STANFORD UNIVERSITY BULLETINS

[Entered, January 22, 1920, at Palo Alto, California, as second-class matter, under Act of Congress of August 24, 1912. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917. Authorized on August 23, 1918. Issued once a month in January, April, October, November, and December; twice a month in February, March, June, and August; and three times in May.]

Published annually in

INFORMATION .......................................................... January
SUMMER QUARTER ....................................................... February
HOPKINS MARINE STATION ........................................... March
GRADUATE SCHOOL OF BUSINESS .................................... April
SCHOOL OF LAW .......................................................... May
COURSES AND DEGREES ............................................... May
SCHOOL OF NURSING .................................................... June
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THE REGISTRAR
STANFORD UNIVERSITY, STANFORD, CALIFORNIA

STANFORD ENGINEERING NEWS. Published in December, March, and June.
[Registrar’s Office. No charge.]

STANFORD TODAY. Published in February, May, August, and November.
[Registrar’s Office. No charge.]

UNIVERSITY DIRECTORY. Published in October (50 cents); with supplements in January and April (10 cents each). [On sale at the Cashier’s Office.]

TIME SCHEDULE OF LECTURES AND LABORATORY WORK. Printed in September, December, March, and May, for the next succeeding quarter. [Registrar’s Office. No charge.]

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STANFORD UNIVERSITY PRESS
STANFORD, CALIFORNIA
Stanford University

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1958-59

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(Continued overleaf)
UNIVERSITY CALENDAR
1958
Autumn Quarter
Sept. 29-30 Monday-Tuesday .......... Registration
Oct. 1 Wednesday ................. Instruction begins
Oct. 3 Friday .................. Conferring of degrees
Oct. 5 Sunday .................. Matriculation Sunday
Oct. 21 Tuesday .. .......... Last day for registration
Oct. 28 Tuesday .................. Last day for filing A.M., M.S., and Engineer applications for April degrees
Nov. 4 Tuesday ................. Last day for filing Ph.D. dissertations
Nov. 27-30 Thursday-Sunday .... Thanksgiving Recess
Dec. 1 Monday .................. Last day for filing A.B. and B.S. applications
Dec. 15 Monday .................. Last day for filing theses
Dec. 15-19 Monday-Friday ......... End-quarter examinations

1959
Winter Quarter
Jan. 5 Monday .................. Registration
Jan. 6 Tuesday ................. Instruction begins
Jan. 9 Friday .................. Conferring of degrees
Jan. 26 Monday .................. Last day for registration
Feb. 2 Monday .................. Last day for filing A.M., M.S., and Engineer applications for June degrees
Feb. 9 Monday .................. Last day for filing Ph.D. dissertations
Feb. 16 Monday ................. Last day for filing Fellowship and Graduate Scholarship applications
Feb. 23 Monday ................. Holiday for Washington's Birthday
Mar. 2 Monday .................. Last day for filing A.B. and B.S. applications
Mar. 9 Monday .................. Founders' Day
Mar. 16 Monday .................. Last day for filing theses
Mar. 16-20 Monday-Friday ......... End-quarter examinations

Spring Quarter
Mar. 30 Monday .................. Registration
Mar. 31 Tuesday ................. Instruction begins
Apr. 3 Friday .................. Conferring of degrees
Apr. 15 Wednesday ............... Last day for filing Undergraduate Scholarship applications, matriculated undergraduates
Apr. 20 Monday .................. Last day for registration
Apr. 20 Monday .................. Last day for filing Ph.D. dissertations
Apr. 27 Monday .................. Last day for filing A.M., M.S., and Engineer applications for October degrees
Apr. 28 Tuesday ................. Last day for filing A.B. and B.S. applications
June 4 Thursday ............... Last day for filing theses
June 5-10 Friday-Wednesday .... End-quarter examinations
June 13 Saturday ................ Senior Class Day
June 14 Sunday .................. Baccalaureate Sunday
June 14 Sunday .................. Commencement

Summer Quarter
June 22 Monday ................. Registration
June 23 Tuesday ................. Instruction begins
July 3 Friday ................. Holiday for Independence Day
Aug. 14-15 Friday-Saturday .... Eight-week term examinations
Aug. 15 Saturday .............. Eight-week term closes
Sept. 1 Tuesday ................. Quarter closes
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DEGREES

This section describes requirements for degrees which apply to all students at Stanford University. Special departmental or school requirements are described in the section on the school or department itself.

Candidates may be presented for graduation in January, April, June, and October.

No degree will be conferred upon any person who has not spent at least three quarters in resident study at the University. No honorary degrees are given.

GENERAL STUDIES PROGRAM

The aims of education at Stanford are twofold—to provide a liberal education and to make available the best in specialized study. A liberal education is designed to produce a citizen worthy of a free society and a free university. Specialized study aims to equip a student to take his place in the profession or vocation of his choice. Both are essential to modern life.

The General Studies Program, inaugurated at Stanford in 1956, is directed toward satisfying these aims and is the product of intensive study by faculty committees. Student experience and opinions also contributed to the findings. The General Studies Program is spread over the entire four years of undergraduate work, permitting flexibility in planning individual programs of study. A student may spend much of the first two years in fulfilling General Studies requirements, or he may begin specialization early and carry both his major and General Studies courses for four years.

There is a great deal more in the new Program which is aimed at enriching the undergraduate's career. On the academic side, students may be awarded up to 15 units of graduating credit for superior work done in high school. Such advanced credit will be established on the basis of scores achieved on the College Board Advanced Placement Examinations, subject to University approval, or on advanced placement tests administered after the student arrives on campus. Honors programs are offered in a number of departments, or cooperatively among several departments. These permit further individual study and development for the capable student. Also, development of the student's specialization under the direction of a particular department is an essential part of his undergraduate experience. Of more general application is the fact that good English is expected in all University course work and is a consideration in grading. It is not just an exercise limited to English classes.

On the extracurricular side, the University is anxious to provide adequate opportunities for the cultural and social activities which can add to the student's educational experience in an infinite variety of ways. Much of this is up to the student, although Stanford is concerned that he not forget that the primary purpose of a university education is intellectual growth. To help keep intellectual and other activities in some balance, all students are required to participate during six quarters (two academic years) in supervised activities of recreational or avocational value. Here the goal is in part to help the individual cultivate or keep alive interests which will continue beyond the University and make the increased leisure of modern life more productive. Two of the six quarters must be in some sport or physical activity. The remaining four may be either in physical activity or in work with orchestra, band, choir, dramatic productions, or some other approved group activity. Beyond this lie a host of
activities in student government, organizations, the Stanford Daily, literary endeavors, etc., in which the student may participate if he desires.

Requirements and options are set forth below. Candidates for the degree of Bachelor of Arts complete A, B, and C below. Candidates for the Bachelor of Science Degree complete A (Basic requirements) and B (Area requirements) only. Students majoring in Engineering, Physics, Chemistry, Mineral Sciences, Mathematics, and Statistics are candidates for the Bachelor of Science Degree.

A. BASIC REQUIREMENTS FOR ALL STUDENTS

1. English 1, 2, 3—Freshman English (Composition and Literature)
2. History of Western Civilization, History 10, 11, 12
3. Foreign Language or Mathematics—Students may choose to complete either a foreign language or a mathematics series.

a. Foreign Language
   Acquisition of a reading ability equivalent to that reached in the following courses: Chinese 21, French 23, German 23, Greek 23, Italian 23, Japanese 21, Latin 23, Russian 21, Spanish 23.

b. Mathematics
   Completion of the final course of any of the following sequences or demonstration by examination of comparable achievement:
   1. Mathematics A, C, 10 (or 10a), 11, 21, 22, 23
   2. Mathematics A, C, 41, 42, 43
   4. Mathematics A, C, 41 (or 10 and 11), 62, 63

4. Group Activity
   Students are required to participate in organized activities to a total value of 6 non-credit units. No more than 2 of such units will be counted in any one quarter. During the freshman and sophomore years at least 2 units of this requirement, 1 each year, must be devoted to a physical activity, including varsity teams, supervised intramural sport, organized physical education classes, and other physical activity offerings as listed in the Time Schedule. The remaining 4 units may be fulfilled either in physical activity offerings or in group activities approved by the General Studies Committee. Among these are chorus, band, orchestra, dramatic productions, and some journalistic activities.
   Any student enrolling for one group activity only must count it toward the group activity requirement until this requirement has been fulfilled; if he enrolls in more than one activity, only one need be so counted.
   Enrollment in ROTC will be accepted, quarter for quarter, in satisfaction of all or part of this requirement. Students who have had military service may be exempt from the group activity requirement.

B. AREA REQUIREMENTS FOR ALL STUDENTS

Every student is exempt from the General Studies Area Requirements within that area—humanities, social sciences, natural sciences (including mathematics, applied science, and engineering)—in which he majors. This exemption does not affect the Basic Requirements in mathematics, foreign languages, English, and History of Western Civilization, as listed under "A" above. All students must therefore complete the following requirements in the two areas in which they are not majoring:
1. **Humanities**—A minimum total of 8 units selected from General Studies courses in any two of the following three fields (complete list of approved courses available in Advisers' Handbook).
   a. The Fine Arts (including Music, Art and Architecture, Speech and Drama)
   b. Philosophy, Religion
   c. Literature

2. **Social Sciences**—Two 5-unit General Studies courses selected from the following:
   a. Anthropology 1
   b. Economics 1
   c. Geography 1
   d. Political Science 1
   e. Psychology 1
   f. Sociology 1

3. **Natural Sciences**—Students who have not taken biology in high school will take Biology 1, 2, 3. It is also possible to fulfill this requirement by taking the sequence intended for biology majors—Biology 20, 21. Those who have had biology but not physical science in high school will take one of the following complete series:
   a. Physical Sciences 1, 2, 3 (9 units)
   b. Physics 21, 23, 29 (13 units)*
   c. Physics 51, 53, 55 (15 units)*
   d. Chemistry 1, 2, 3 (13 units)
   e. Mineral Sciences G1, G2
   f. (Geology) (10 units)

* Majors in the physical sciences and engineering normally enroll in the Physics 50-series; other students, including pre-meds, normally enroll in the 20-series.

Students who have taken both biology and a physical science in high school must take either a biology series or one of the complete series above.

C. **ADDITIONAL REQUIREMENTS FOR CANDIDATES FOR THE A.B. DEGREE**

1. **One of the following courses:**
   a. Mathematics 1, Statistics 50, or an advanced mathematics course making use of calculus if mathematics was chosen under “A” above.
   b. Philosophy 1 (Logic)
   c. 4 units of additional reading in the foreign language which the student took under “A.” (This requirement may be fulfilled either in consultation with the student's own major department or by taking a language reading course numbered 100 or higher. Certain courses in Chinese, Japanese, and Russian with lower numbers will be accepted.)

2. **Additional courses in the natural sciences:** That number of units which, when added to the work completed under “B3,” brings the total to 17 units. This additional work must be selected from the following courses in such a way as not to duplicate subject matter covered under “B3.”
   a. Biology 1, 2, 3*
   b. Biology 20, 21*
   c. Chemistry 1, 2, 3 or 4*
   d. Physical Sciences 1, 2, 3*
   e. Physics 21, 23, 29*
   f. Physics 51, 53, 55*
   g. Mineral Sciences G1, G2
   h. Mathematics 10, (or 10a), 11, 21, 22, 23, 24, 41, 42, 43, 52, 53, 62, 63
   i. Philosophy 1 (Logic)
   j. Statistics 50
   k. Psychology 60
   l. Anatomy 114
   m. Physiology 90
   n. Physical Sciences 100

* May be taken without laboratory after the Natural Sciences requirement in B3 above is fulfilled, but should be taken in sequence.
3. Senior Colloquia—Two colloquia of 2 units each, as listed in the *Time Schedule*, under “Senior Colloquia.” The following A.B. candidates are exempt from the Senior Colloquia requirement:

a. Students taking their senior year of undergraduate study as their first year in the Schools of Law or Medicine.

b. Students enrolled in interdepartmental honors programs.

MAJOR REQUIREMENTS

The selection of a major may be made by a student at any time and must be made no later than the beginning of the junior year.

This school or department selected as a major has the authority to prescribe not more than 60 units in the major subject (exclusive of elementary courses which may have been offered for entrance). The school or department shall also recommend such other courses as may be considered desirable, and shall exercise an advisory supervision over the student’s curriculum from quarter to quarter. It shall be considered a general principle of University policy, to be departed from only in exceptional cases, that at least 90 of the 180 units required for the degree be taken outside the major field of study.

In applied science the school may prescribe as much of the entire 180 units as it shall deem essential to the technical or professional requirements of the major subject.

Within these limitations the work is elective, and the student may freely choose any course which his previous studies have prepared him to undertake.

**BACHELOR OF ARTS OR BACHELOR OF SCIENCE**

The degree of Bachelor of Arts (A.B.) or the degree of Bachelor of Science (B.S.) is conferred upon candidates recommended by the Committee on Graduation who, in addition to fulfilling the following requirements, have applied in advance for graduation:

1. The completion of 180 (quarter) units of university work, including the General Studies Requirements.

2. The acquisition of twice as many grade points as there are units registered on the candidate’s record card.

3. The completion of the curriculum requirements as prescribed by a major department. The recommendation of that department is necessary to graduation.

Candidates who fulfill these requirements in the School of Engineering, Nursing, or Mineral Sciences, or Departments of Chemistry and Chemical Engineering, Mathematics, Physical Sciences, Physics, Physiology, or Statistics receive the degree of Bachelor of Science; candidates who fulfill these requirements in other schools or departments receive the degree of Bachelor of Arts.

Forty-five units constitute a normal year’s work. The degree is conferred whenever the requirements are met, provided the candidate has spent three quarters in resident study and completed at least 45 units (including the last 15) in this University. In special cases, students who have obtained at least 135 units in resident work, and who have completed all major requirements, may be exempted from completing the last quarter’s work in this university and be permitted to complete the required number of units elsewhere. In these cases the approval of the Committee on Graduation is necessary.

If graduates of other universities desire to become candidates for the baccalaureate degree in a different field at Stanford University, they may apply for admission as undergraduates. If admitted, they will be given 135 quarter units of advanced standing and will be required to complete at least 45 units (three
quarters) of university work and fulfill all major and minor requirements.

As a recognition of high scholastic attainment the Bachelor's degree may be
granted "With Distinction" or "With Great Distinction."

ADVANCED DEGREES

General University requirements for advanced degrees are stated in terms
of time devoted to graduate study, or registration for graduate study, rather
than in terms of units of credit. In case any of the work done at Stanford is
on a part-time registration, its equivalence to full-time study is determined by
tuition payments.

For any advanced degree there is a minimum requirement of one academic
year (three quarters) of graduate study in residence at Stanford. For successive
advanced degrees at Stanford a minimum of one academic year (three quarters)
of graduate registration is required between the conferring of two degrees. The
final units of credit toward any advanced degree must be earned at Stanford.

Each student should consult his major department and examine its section
in this Bulletin regarding specific departmental requirements for advanced
degrees. All applications or petitions to the University Committee on Graduate
Study must be submitted to the major department for approval before being
filed with the Graduate Study Secretary. Communications should be addressed
to the Graduate Study Secretary, Registrar's Office, Stanford University, Stan-
ford, California.

Candidacy for A.M., M.S., Engineer, and Ph.D. degrees must be approved
by the University Committee on Graduate Study. Candidacy is valid for five
years from date of such approval and may be renewed only by the submission
and approval of a new application.

BACHELOR OF ARCHITECTURE

Upon recommendation to the Academic Council by the faculty of the De-
partment of Art and Architecture and the University Committee on Graduate
Study, the degree of Bachelor of Architecture (B.Archit.) is conferred on can-
didates who have satisfied the requirements laid down by the faculty of the
Department of Art and Architecture and the University. (Full particulars
concerning these requirements will be found elsewhere in this Bulletin.)

MASTER OF ARTS OR MASTER OF SCIENCE

Upon recommendation to the Academic Council by the faculty of the major
department and the University Committee on Graduate Study, the degree of
Master of Arts (A.M.) or Master of Science (M.S.) is conferred on candidates
who have satisfactorily completed at least one academic year (three quarters)
of graduate work at this University, presented an acceptable thesis (unless this
requirement is waived), and fulfilled such other requirements as may be pre-
scribed by the school or department concerned. In no case will the degree be
conferred unless the candidate has been registered at Stanford University for
three full quarters, or the equivalent, as a graduate student. A longer period of
residence will be necessary for students who are inadequately prepared or who
devote less than the normal amount of time to their studies.

The University minimum unit requirement for the A.M. or M.S. is 36
quarter units earned at Stanford as a graduate. Most departments require more.
At the discretion of a major department, this University minimum require-
ment of 36 graduate units at Stanford may be reduced to 30 graduate units at
Stanford on condition that at least 6 more quarter units of credit be validated
by the department and reported as follows: a student who has done graduate
work elsewhere may be permitted by his major department to demonstrate, to the satisfaction of the major department, that he has completed work elsewhere as a graduate student equivalent to specific Stanford courses. Such courses must appear on the application for candidacy, with the name and number of the Stanford course, the number of Stanford units given for this course, and the method of validation. In any case, the minimum residence requirement for the A.M. and M.S. shall remain unchanged—registration at Stanford as a graduate during at least three quarters and the completion of at least three quarters, or the equivalent, of graduate work at Stanford.

Admission to candidacy is granted by the University Committee on Graduate Study on the basis of an application, approved in writing by the school or department in which the candidate proposes to take the degree. This application should be filed with the Graduate Study Secretary not later than the fourth week of the quarter preceding the final quarter of candidacy. (The application should be submitted to the major department early enough to allow for departmental consideration before the University deadline. The required time varies with departments.) When granted, candidacy is valid for five years, after which it may be renewed only by approval of a new application by the major department and the University Committee.

Three bound copies of the thesis, each bearing the approval of the instructor under whose supervision it was prepared, must be submitted to the Graduate Study Secretary on or before the last day of instruction in the final quarter of candidacy. If this date falls on Saturday, the deadline shall be the following Monday. These copies shall be the original and first two carbon copies, typed on paper of standard size and weight, with title and signature pages of the form prescribed by the University Committee on Graduate Study. Upon acceptance, two copies are placed in the University Library, and the third copy is sent to the major department. Directions for the preparation and submission of theses are available in the office of the Graduate Study Secretary, Registrar's Office.

**Master of Business Administration**

Upon recommendation to the Academic Council by the faculty of the Graduate School of Business and the University Committee on Graduate Study, the degree of Master of Business Administration (M.B.A.) is conferred on candidates who have satisfied the requirements laid down by the faculty of the Graduate School of Business and the University. (Full particulars concerning these requirements will be found in the Bulletin of the Graduate School of Business.)

**Educational Specialist**

Upon recommendation to the Academic Council by the faculty of the School of Education and the University Committee on Graduate Study, the degree of Educational Specialist (Ed.S.) is conferred on candidates who have satisfied the requirements laid down by the faculty of the School of Education and the University. Further information concerning these requirements will be found elsewhere in this Bulletin and may be secured from the office of the Dean of the School of Education.

**Engineer**

**General Regulations**—Upon recommendation to the Academic Council by the faculty of the major department and the University Committee on Graduate Study, the degree of Engineer is conferred on candidates who have satis-
DEGREES

factorily completed six quarters of approved graduate work (of which a minimum of three quarters must be in residence at Stanford), presented an acceptable thesis, and fulfilled such other requirements as may be prescribed by the major school or department. A longer period of residence will be necessary for candidates who are inadequately prepared or who devote less than the normal amount of time to their studies.

Admission to Candidacy—Admission to candidacy for the degree of Engineer is granted by the University Committee on Graduate Study on the basis of an application formally approved by the student's major department and filed with the Graduate Study Secretary not later than the fourth week of the quarter preceding the final quarter of candidacy. (The application should be submitted to the major department early enough to allow for departmental consideration before the University deadline. The required time varies with departments.) Candidacy, when granted by the University Committee, is valid for five years and may be renewed only by submission and approval of a new application.

Thesis—Three bound copies of the thesis, bearing the approval of the instructor under whose supervision it was prepared, must be submitted to the Graduate Study Secretary on or before the last day of instruction in the final quarter of candidacy. If this date falls on Saturday, the deadline shall be the following Monday. These copies shall be the original and first two carbon copies, typed on paper of standard size and weight, with a title page of the form prescribed by the University Committee on Graduate Study, and suitably bound. Upon acceptance, two copies are placed in the University Library, and the third copy is sent to the major department. Directions for the preparation and submission of theses are available in the office of the Graduate Study Secretary, Registrar's Office.

DOCTOR OF EDUCATION

Upon recommendation to the Academic Council by the faculty of the School of Education and the University Committee on Graduate Study, the degree of Doctor of Education (Ed.D.) is conferred on candidates who have satisfied the requirements laid down by the faculty of the School of Education and the University. At the announced time in the quarter at the end of which the degree is to be conferred, the candidate must deposit with the School of Education three typewritten copies of the dissertation, three copies of an approved abstract of the dissertation (600 words or fewer in length), and two signed copies of a publication agreement. The candidate will be charged a $40 fee to cover cost of microfilming the dissertation, binding three copies of the dissertation (including one copy for the candidate), and publishing the abstract. This fee is payable at the Cashier's office on or before the last day of instruction in the final quarter of the candidacy.

(Further information concerning these requirements will be found elsewhere in this Bulletin and may be secured from the office of the Dean of the School of Education.)

BACHELOR OF LAWS

Upon recommendation to the Academic Council by the faculty of the School of Law and the University Committee on Graduate Study, the degree of Bachelor of Laws (LL.B.) is conferred on candidates who have received the degree of Bachelor of Arts, or its equivalent, from this University or from some other institution of recognized collegiate rank, and who have satisfactorily completed courses in law aggregating 124 quarter units after devoting not less than nine full quarters thereto, and who otherwise have satisfied the requirements of the University and of the School of Law.
MASTER OF LAWS

Admission to candidacy for the degree of Master of Laws (LL.M.) is granted only to students who are eligible for admission to the School of Law in regular standing and who have completed, with grades acceptable to this faculty, the work for the first degree in law at this University, or at some other university law school of recognized standing in which the work for the first degree in law covers a period of not less than six years of combined academic and law study, and who otherwise satisfy the requirements of the University and of the School of Law.

The degree of Master of Laws is conferred upon students so admitted to candidacy upon completion, with distinction, of one year (39 quarter units) of work in this School in accordance with the rules of the University and of the School of Law. Upon his admission to candidacy, each student must present for the approval of the School of Law Committee on Graduate Study the program which he wishes to pursue for this degree. The major portion of such a program shall be in law and shall include not less than six units of independent research devoted to the preparation of an acceptable thesis.

DOCTOR OF THE SCIENCE OF LAW

Admission to candidacy for the degree of Doctor of the Science of Law (J.S.D.) is granted only to those who have received the degree of Master of Laws at this University, and who have completed the work required for such Master’s degree with marked excellence and have given clear proof of their ability to do legal research of high quality.

The degree of Doctor of the Science of Law is conferred upon applicants so admitted to candidacy who spend one full academic year in independent legal research and as a result thereof present a thesis which is, in the opinion of the faculty of the School of Law, a contribution to knowledge. Such work and thesis shall conform to the rules and regulations of the University and of the School of Law.

DOCTOR OF MEDICINE

Upon recommendation to the Academic Council by the faculty of the School of Medicine and the University Committee on Graduate Study, the degree of Doctor of Medicine (M.D.) is conferred on candidates who have satisfactorily completed the required curriculum in medicine. (Full information concerning requirements for the M.D. degree will be found in the Bulletin of the School of Medicine.)

DOCTOR OF PHILOSOPHY

General Regulations—Upon recommendation to the Academic Council by the faculty of the major department and the University Committee on Graduate Study, the degree of Doctor of Philosophy (Ph.D.) is conferred on candidates who have demonstrated substantial scholarship, high attainment in a particular field of knowledge, and ability to do independent investigation and present the results of such research. A minimum of three years (nine quarters) of graduate study satisfactorily completed is required of each candidate; he must complete at least one of these years (three quarters) and the final units of credit in fulfillment of degree requirements as a registered student at Stanford University. If the candidate has already been awarded an advanced degree by Stanford University, he must register for at least three quarters at Stanford between the conferral of the two degrees.

Admission to Candidacy—When a student has completed the major department’s required preliminary procedures, and has fulfilled at least one of the
two foreign language requirements, the major department certifies him to the University Committee on Graduate Study for admission to candidacy. If the student's program includes a minor, certification by the minor department is also required. If the student offers no minor, his application must show at least three units of work taken as a graduate under each of four or more Stanford faculty members. Application for admission to candidacy is made on Form G34, which must be filed with the Graduate Study Secretary not later than the fourth week of the final three quarters of candidacy. Candidacy, when approved by the University Committee, is valid for five years and may be renewed only by submission and approval of a new application.

**Foreign Language Requirement**—Prior to application for admission to candidacy a certificate must be filed stating that the student possesses a reading knowledge of at least one of the two required languages in addition to English. (In special cases referred to in the next paragraph, a reading knowledge of only one foreign language will be required.) The two languages shall be selected in individual cases by the mutual assent of the student and the major school or department. The languages selected shall be those most likely to be useful in connection with the individual student's program of study for the degree and his predoctoral and postdoctoral research program. The certificates shall be issued by examiners designated by the University Committee on Graduate Study. (Information regarding arrangements for foreign language examinations is published each quarter in the *Time Schedule*.)

A candidate may submit to the University Committee a petition to be allowed to substitute for one of the required languages a program of at least 15 quarter units of courses taken as a graduate student, provided the major department has certified on Form G35 that this program is external to the major and minor departments and an addition to their requirements, that the courses appear to form a coherent group, and that they should contribute more toward the candidate's proficiency in his major field than would a second language. An average grade of B must be earned in the substitute courses.

**University Oral Examination**—When a candidate has been admitted to candidacy, has completed the foreign language requirement, and has shown special ability in his field of study and proved his capacity for independent investigation to the satisfaction of the schools or departments concerned, he may arrange through the Graduate Study Secretary for the University oral examination. This examination shall be approximately three hours in length and shall be held not later than the fourth week of the final quarter of candidacy. The request for an oral examination must be submitted to the Graduate Study Secretary on Form G21 at least three weeks prior to the date proposed for the examination. The purpose of the examination is to test the candidate's command of his fields of study and to confirm his fitness for scholarly pursuits. The examining committee shall be composed of (1) the Dean of the Graduate Division or his delegate, presiding, (2) four or more faculty members appointed by the Dean of the Graduate Division from the major and minor departments, (3) any additional representatives selected by the major and minor departments and the Dean of the Graduate Division, and (4) any members of the Academic Council who may attend. On the favorable vote of three-fourths or more of the examining committee (including the presiding chairman), the candidate shall be certified as having passed the examination.

Five members present and voting, including representatives of both major and minor departments, shall constitute a quorum.

**Dissertation**—Recommendation for the degree shall be made only after the acceptance of a dissertation, which must be a contribution to knowledge and the result of independent work, expressed in satisfactory form. By the close of the fifth week of the final quarter of candidacy in autumn, winter, or summer
quarter, or by the close of the third week in spring quarter, the candidate must submit to the Graduate Study Secretary (1) a minimum of four unbound typewritten copies of the dissertation, including one original copy, each copy bearing at least two department signatures, (2) two copies of an abstract of the dissertation, each copy bearing at least one department signature, and (3) two copies of a publication agreement signed by the candidate. Upon the receipt of the dissertation, the Dean of the Graduate Division shall appoint a special committee of three whose duty it shall be to read the dissertation, conferring with the candidate if it so desires, and to report to the Dean of the Graduate Division whether or not in its opinion the dissertation is of a scope and quality acceptable in fulfillment of this requirement for the degree. After its final acceptance, the dissertation shall be microfilmed and bound at the direction of the Graduate Study Secretary. A negative microfilm copy of the dissertation shall be kept on file by University Microfilms (in Ann Arbor, Michigan), from whom positive microfilm copies may be ordered. When bound, the original copy will be delivered to the author, the first two carbon copies to the Stanford University Library, and the third carbon copy to the major department.

Directions regarding the form of the dissertation, title and signature pages, and the abstract may be obtained from the Graduate Study Secretary. The abstract (600 words or fewer in length) shall be published in Dissertation Abstracts by University Microfilms. The candidate shall be charged a $40 fee to cover the cost of microfilming the dissertation, binding four copies of the dissertation, and publishing the abstract. This fee is payable at the Cashier's office on or before the last day of instruction in the final quarter of candidacy.
COURSES of INSTRUCTION

1958-59

Unless otherwise specified, courses numbered from 1 to 99 inclusive are primarily for first- and second-year undergraduates; from 100 to 199 inclusive, for third- and fourth-year undergraduates; from 200 to 499 inclusive, for graduate students.

The University reserves the right to make any necessary changes in the regulations, fees, and courses outlined herein.

SUMMER QUARTER

The summer quarter of 1959 will be eight weeks in length, except in certain schools which will offer ten-week courses.

This announcement includes, for the summer quarter of 1959, only those courses which can be tentatively scheduled at this time by each department. For the complete list of courses and faculty, request should be made for the special Summer Quarter Bulletin to be issued in February 1959.

GRADUATE SCHOOL of BUSINESS

Emeriti: George William Dowrie, Jacob Hugh Jackson, Edward Kellogg Strong, Jr. (Professors)

Dean: Ernest Comings Arbuckle
Associate Dean: Carlton Anker Pederson
Assistant Dean: Walter Alvin Diehm


Associate Professor: Robert Tyrrell Davis
Assistant Professors: James E. Howell, Lyle E. Jacobsen, Leonard Marks, Jr.
Acting: Lamar Lee, Jr., Gerald Oren Wentworth

Instructor: Rae Olsen Wirtz
Lecturers: Walter Alvin Diehm, Ralph A. Yeo.
The regular program of the Graduate School of Business is described in a separate publication. Courses listed below, while not a part of that program, are offered under the auspices of the Graduate School of Business as a service to interested Stanford undergraduates.

107a. **Shorthand I**—Beginning of Gregg Shorthand theory.
   3 units, autumn, *(Wirtz)*, *MWF 10 or 1*
   or *winter, *(Wirtz)*, *MWF 11*

107b. **Shorthand II**—Completion of Gregg Shorthand theory.
   3 units, *winter, *(Wirtz)*, *MWF 10 or 1*
   or *spring, *(Wirtz)*, *MWF 11*

107c. **Shorthand III**—Dictation.
   3 units, *spring, *(Wirtz)*, *MWF 10 or 1*

108a. **Typing I**—For beginners.
   2 units, autumn, *(Wirtz)*, *MWF 9*
   or *winter, or spring, *(——)*, *MWF 11*

108b. **Typing II**—Typing for business.
   2 units, autumn, *(Wirtz)*, *MWF 11*
   or *winter, or spring, *(Wirtz)*, *MWF 9*

108c. **Typing III**—Advanced secretarial typing.
   2 units, autumn, *(Wirtz)*, *MWF 11*
   or *winter, or spring, *(Wirtz)*, *MWF 9*

**Note:** A maximum of 4 quarter units in Typing may be credited on the college level.
SCHOOL OF EDUCATION

Emeriti: Maud Merrill James, Jesse Brundage Sears, Warren D. Allen (Professors); Ernest Paul Hunt (Associate Professor)

Dean: I. James Quillen
Assistant Professors: Margaret Barr, Elwyn Bugge, Fred S. Cook, Walter M. Garcia, Luell Guthrie, Miriam B. Lidster (on leave 1958-59), Frederick J. McDonald, June K. McFee, Marian S. Ruch, Helen W. Schrader, Ruth Hirsch Weir
Lecturers: Elva F. Brown, Guy H. Browning, Daniel T. Dawson, Margaret Catherine Riassetto, William Henry Strand

Members of the faculties of other divisions of the University giving courses or cooperating in the offerings of the School of Education are Virgil A. Anderson, John D. Black, Jack Curtice, Howard Dallmar, Stanley T. Donner, Margaret P. Duggar, William Paul Fehring, Charles E. Finger, Carroll Gordon, Paul F. Griffin, Thomas G. Haynie, Jr., Payton Jordan, Raymond E. Lunny, Jr., Pamela L. Strathairn, Clifford F. Weigle, C. Langdon White, Georgia R. Williams.

The School of Education is responsible for the preparation of teachers, supervisors, guidance workers, administrators, and other educational specialists. Five degrees with specialization in education are granted by the University: Bachelor of Arts, Master of Arts, Educational Specialist, Doctor of Education, and Doctor of Philosophy. Various teaching and educational service credentials are issued by state departments of education upon certification of the School that properly accredited work has been carried by the student. For California, the University grants credentials under authorization of the State Board of Education.

Acceptance of Work Done Elsewhere—Students transferring with advanced or graduate standing from other universities may have substantially equivalent training accepted in lieu of the courses required at this University in education and in the major and minor fields.

The University offers no correspondence or extension courses.

SUMMER QUARTER

The full summer quarter in the School of Education is for eight weeks. In addition, several one-, two-, three-, and four-week workshops and institutes are offered which make it possible for students to earn credit in shorter periods.
of time. However, those who pursue a program of study for eight weeks may earn a full quarter of residence toward degree and credential programs. The number of units for which a student may register may not exceed 16, unless part of the registration is for thesis or dissertation.

In the listing of courses below, only those which can be reasonably scheduled at this time are listed for the summer quarter. The Summer Quarter Bulletin, issued each year in February, will contain more definite information.

**DEGREES**

**Bachelor of Arts**

The Bachelor of Arts in education is a pre-professional degree and may be obtained only by those who are candidates in good standing for one of the teaching credentials offered through the School of Education or who already hold a valid teaching credential. Normally, candidacy for the Bachelor of Arts degree in education is limited to those completing four years of one of the following five-year credential programs: (1) general elementary, (2) men's physical education, (3) women's physical education, and (4) health and hygiene. In a few special cases, some candidates for the General Secondary Credential are permitted to seek the Bachelor of Arts degree in education while completing requirements in certain academic departments for a teaching major and a minor or for two teaching minors. Students desiring to become candidates for this degree in connection with their preparation for one of the above types of teaching credentials should consult with an adviser from the School of Education as early as possible.

To qualify for the Bachelor of Arts degree in education, the student must meet the following requirements: (1) be approved by a faculty committee as a candidate for one of the five types of teaching credentials named above or be a holder of a valid teaching credential; (2) complete work, with an average grade of C or better, in courses selected from at least four of the following scientific fields: (anthropology, sociology, psychology, health, anatomy, physiology, geology, physical sciences, chemistry, physics, biological sciences, and mathematics); (3) complete 12 units, with an average grade of C or better, from courses in the educational foundations offered within the School; (4) complete the requirements through the senior year of one of the five credential programs named above or be a holder of a valid teaching credential.

Further details covering the general University requirements for the degree of Bachelor of Arts will be found in the section “Degrees” in this Bulletin.

**Graduate Degrees**

*Basis of Acceptance as Candidates for Advanced Degrees in Education*—Students who have been admitted to graduate standing at Stanford University should apply, during their first quarter in residence, for admission to the graduate program in the School of Education. Admission to graduate standing by the University does not in itself constitute admission to candidacy for advanced degrees in the School of Education.

Students working toward graduate degrees should follow the suggestions outlined under each degree. Students applying for the Master's, Educational Specialist, or Doctor's degree will present a preliminary program of study which represents the work to be completed in earning the degree. They will also consult their advisers with regard to organizing their graduate programs within the limits described in this Bulletin.

Students who are candidates for the degree of Master of Arts or Doctor of Philosophy should consult also the University's general requirements described in the section “Degrees” in this Bulletin.
Field of Concentration for Advanced Degrees—Candidates for advanced degrees in education should plan to specialize in the field of their professional interest, preparing for some line of professional activity and at the same time securing mastery of an organized body of knowledge. The choice should be made in light of the professional objective of the student. The program of study for the various fields of concentration is somewhat flexible, allowing a student, in consultation with his adviser, to emphasize certain aspects of the work, depending on his special interests and his professional objective. Each candidate will select a faculty adviser to assist him in planning his program of study and in projecting research plans for his dissertation. Other members of the faculty of the School of Education may also be consulted with regard to the particular field chosen by the student. Each program as finally approved will designate one area of special interest as a major field of concentration.

The fields of concentration for the Doctor of Education and Doctor of Philosophy degrees are listed below. Members of the faculty of the School of Education who are specialists in a particular area serve as advisers to students who have selected that field of concentration.

- General School Administration
- Elementary Education
- Secondary Education
- Higher Education
- Junior College
- Guidance
- Philosophy and/or History of Education
- Overseas and/or Comparative Education
- Psychological Foundations of Education
- Social Foundations of Education
- Health Education
- General Curriculum
- Child Development

Teacher Education, or Secondary Education, or Special Curriculum, with concentrations in any of the following:

- Art
- Business
- Foreign Languages
- Health
- Journalism
- Language Arts or English
- Mathematics
- Music
- Physical Education
- Science
- Social Studies
- Speech and Drama

Candidates who select one of the fields of concentration indented above should identify their fields as in the following examples:

- Teacher Education: Art
- Secondary Education: Science
- Special Curriculum: Journalism

Other possible fields of concentration may be arranged for candidates with the approval of both the student's adviser and the Committee on Advanced Graduate Degrees.

A preliminary interview for all advanced degree candidates is required. Application forms may be obtained at the office of the School of Education.

Master of Arts

The program for the degree of Master of Arts in Education provides for a common core of training for all candidates for the degree, and for specialization in the selected fields of concentration which follow:

- Elementary Education (with specializations, such as Supervision, Administration, Curriculum, Teaching)
- Secondary Education (with specializations, such as Physical Education, Social Studies)
- Student Personnel and Counseling
- Health Education
Other possible fields of concentration may be arranged for individual advanced graduate candidates when approved by both the student's adviser and the Master of Arts Committee of the School. Requirements for the core program are listed for each of the concentrations. Courses presented for core requirements must have been taken within five years of the date of the formal application. The remaining courses are to be determined by the candidate and the adviser. Graduate course work taken seven or more years before the date of formal application will be evaluated by the adviser and the Master of Arts Committee, and additional course work in the foundation fields will be required in certain cases.

General requirements for the completion of the degree of Master of Arts (A.M.) include:

1. Forty-five units of graduate study beyond the Bachelor's degree to be completed at Stanford (30 of which must be in the School of Education). In no case will the degree be granted unless the student has been registered at Stanford University for three full quarters, or the equivalent, after the conferring of the Bachelor's degree. Evaluation of residence is based on tuition payments. One full-time quarter (a minimum of 12 units) is required. The remainder of the work may be carried on a part-time basis.
2. Preliminary application materials, listed below, to be submitted to the Master of Arts secretary in the School of Education two quarters before the conferring of the degree:
   a) Transcripts of all academic work previously taken.
   b) A proposed program of courses for the degree, signed by the adviser.
3. Satisfaction of all requirements for the degree within four years after formal application for the degree has been accepted.
4. Completion of student teaching or other appropriate practicum, or one year of teaching experience.
5. Recommendation from the adviser and the Master of Arts Committee that the degree be granted.

The degree of Master of Arts (A.M.) is conferred by the University, on recommendation of the University Committee on Graduate Study.

Three types of programs are offered leading to the degree of Master of Arts in education:

1. Research type: A thesis is required. Recommended for future doctoral candidates, research workers, and college teachers of education.
2. Internship type: A project carried on during internship is filed with the School of Education at the close of the year of teaching. Planned for elementary and secondary school teachers.
3. School Specialist type: No thesis. Planned for elementary and secondary school teachers, administrators, guidance workers, etc.

List of current advisers, programs of study, and order of procedure should be obtained from the School of Education Credential Secretary during registration day in the first quarter of residence.

Master of Arts in Teaching

The Master of Arts in Teaching is offered jointly by the academic departments and the School of Education. General requirements for the degree include:

1. Evidence of one or more years of successful teaching experience and possession of a valid teaching credential.
2. Three quarters of full-time residence (or its equivalent). This may be satisfied by attending a series of summer sessions.
3. A minimum of 40-45 quarter units, with at least 36 units of this work completed at Stanford.
4. 25-30 units of the work in the academic department of the candidate's teaching major.
5. At least one-fourth of the course requirements shall consist of graduate courses in the School of Education. These shall include recent advanced courses in the following areas:
   a. Curriculum and methods in the candidate's teaching field.
   b. General curriculum in Secondary or Elementary education.
   c. Foundations of Education.
6. Specific course requirements in both the academic and professional education fields will be influenced by the candidate's previous training.
7. Courses required in the teaching major field are determined by the academic department, and the program of professional courses by the School of Education. Both the preliminary and the final application forms for the degree must be signed by a representative of the academic department and of the School of Education.

Educational Specialist

The degree of Educational Specialist (Ed.S.) is conferred, upon recommendation of the faculty of the School of Education and the University Committee on Graduate Study, on students who complete satisfactorily the program of advanced study in education as outlined by the faculty of the School of Education and present a written report of some substantial educational project selected in conference with an adviser. This project will be based on some problem of importance in the candidate's area of specialization and it must be read and approved by the adviser of the candidate. The program involves a minimum of two years of graduate study, one of which must be taken at Stanford.

This degree will provide an intermediate program of specialized training in education between the Master of Arts degree and the Doctor of Education or Doctor of Philosophy degree. When the degree is granted, the diploma will indicate the area of specialization of the candidate.

Encouragement to study for the degree is based upon recommendation by the adviser and approval of the Committee on Advanced Graduate Degrees of the School of Education. This committee will consider all available evidence relative to the candidate's fitness to enter upon the program.

After preliminary admission to candidacy the work of the student progresses under the guidance of an adviser chosen by the student from the representatives of the faculty in the candidate's field of concentration.

Educational Specialist programs are offered only in certain specified fields. For further information regarding fields and requirements for the Ed.S. degree, write to the School of Education.

Doctor of Education

The degree of Doctor of Education (Ed.D.) is a professional degree conferred by the University on recommendation of the faculty of the School of Education and the University Committee on Graduate Study.

Residence—Nine quarters of graduate study (135 units) beyond the baccalaureate degree are required for the doctorate, of which one full quarter (a minimum of 12 quarter units) must be outside the field of education. Evaluation of Stanford residence is based on tuition payments. Candidates for the degree will be required during the course of work to register at Stanford for
a minimum of one academic year (three quarters). Two of these quarters must be in consecutive full-time residence. All requirements for the degree must be completed within four years after the candidate has passed his qualifying examinations. Graduate course work beyond the Master’s degree taken seven or more years ago will not ordinarily be included in the doctoral program. Applicants 45 years of age and over are not admitted to the doctoral program in education.

Organisation of Program—The candidate for the Ed.D. degree will organize his program in conference with an adviser in his field of concentration. The adviser will make recommendations to the Committee on Advanced Graduate Degrees in connection with application for candidacy, will aid in planning, will approve the program of the individual, and will function as adviser on research for dissertation. The adviser will be aided by other members of the faculty in the direction of the research program.

Complete information concerning the organization of this program may be secured from the Office of the Dean of the School of Education.

Doctor of Philosophy

The degree of Doctor of Philosophy (Ph.D.) is conferred by the University on recommendation of the Committee on Graduate Study. Students working toward this degree in the School of Education are ordinarily preparing for the direction of research work in public-school systems or in specialized institutions, or are preparing to conduct research in connection with college teaching.

Residence—Nine quarters of graduate study (135 units) beyond the baccalaureate degree are required for the doctorate, of which 45 units must be in a minor field if the candidate does not hold a Master's degree outside the field of education. Evaluation of Stanford residence is based on tuition payments. Candidates for the degree will be required during the course of work to register at Stanford for a minimum of one academic year (three quarters). Two of these quarters must be in consecutive full-time residence. All requirements for the degree must be completed within five years from the date of admission to Ph.D. candidacy by the University Committee on Graduate Study. Graduate course work beyond the Master's degree taken seven or more years ago will not ordinarily be included in the doctoral program. Applicants 45 years of age and over are not admitted to the doctoral program in education.

Organisation of Program—Considerable flexibility is allowed in projecting a program for the Ph.D. degree. The candidate will be expected to organize his program of work for the degree in conference with an adviser in his field of concentration. All programs require the approval of the School of Education Committee on Advanced Graduate Degrees and the University Committee on Graduate Study.

Complete information concerning the organization of this program may be secured from the Office of the Dean of the School of Education.

Ph.D. Minor in Education—Candidates for the Ph.D. degree in other departments or schools of the University who elect a minor in education will be expected to choose a field of concentration and to have fundamental grounding in certain foundation fields. They will be required to take a minimum of 30 units in graduate courses in education. In the organization of his program, the student who applies for a minor in the School of Education will consult with an adviser in education and the Committee on Ph.D. Minors of the School of Education.

CREDENTIALS FOR PUBLIC SCHOOL SERVICE

The University acts as agent for the State Department of Education in granting credentials for service in the California public schools, and also
SCHOOL OF EDUCATION

recommends to the proper educational authorities in other states that such credentials be issued.

Persons desiring to secure credentials through Stanford University are required, at the beginning of their training program, to present evidence of their qualifications to a committee on credentials. The function of the committee is to encourage those applicants who, in the judgment of the committee, are qualified to pursue the program. The Credential Secretary in the School of Education should be consulted as to the necessary procedure.

A candidate for any type of Stanford credential must complete the equivalent of one full year's work (three quarters) at the University. For the General Elementary, General Secondary, and Junior College Credentials two of the quarters must be devoted to full-time study; for the Administration Credentials one quarter must be devoted to full-time study. The remaining work (to total at least 39 units) may be taken on a part-time basis by those candidates who are eligible for such type of registration. The program carried will depend upon the teaching major and minor and the professional objective of the candidate.

Administration and Supervision Credentials

The Stanford School of Education is authorized to recommend applicants for the following administration credentials:

The General Administration Credential, which authorizes the holder to administer and supervise schools as a superintendent, deputy superintendent, assistant superintendent, principal, vice-principal, supervisor, curriculum co-ordinator, or administrative assistant in elementary or secondary schools.

The Secondary School Administration Credential, which authorizes the holder to administer and supervise a secondary school as superintendent, deputy superintendent, assistant superintendent, principal, vice-principal, supervisor, curriculum co-ordinator, or administrative assistant.

The Elementary School Administration Credential, which authorizes the holder to administer and supervise elementary schools as superintendent, deputy superintendent, assistant superintendent, principal, vice-principal, supervisor, curriculum co-ordinator, or administrative assistant.

The School Supervision Credential, which authorizes the holder to supervise or co-ordinate instruction in the area in which he holds his basic teaching credential.

GENERAL REQUIREMENTS

The following are required of applicants for administration or supervision credentials:

1. A full year of study at Stanford University (a minimum of 39 quarter units).
2. A certificate from a physician that the applicant is physically and mentally fit to engage in school work.
3. A program of study approved by the adviser in the School of Education and filed with the Credential Secretary.
4. Verification of required years of experience at the appropriate level.
5. Qualifications for the basic teaching credential required.

A list of current advisers, programs of study, and order of procedure should be obtained from the Credential Secretary in the School of Education on or shortly after registration day in the first quarter of residence.

Teaching Credentials

The Stanford School of Education is authorized by the State of California to recommend candidates for the following teaching credentials:
The General Elementary Credential, which authorizes the holder to teach any or all subjects in all grades of any elementary school, including kindergarten.

The General Secondary Credential, which authorizes the holder to teach in all grades of any junior college, senior high school, four-year high school, junior high school, or the seventh and eighth grades of elementary schools.

The Junior College Credential, which authorizes the holder to teach in all grades of any junior college.

Common requirements for teaching credentials:

Candidates for teaching credentials must present evidence of meeting standards in the following:

a) Physical Examination. A certificate of mental and physical fitness from the University Health Service.

b) Speech Competency. Approval of candidate's competency in oral expression. The usual method of satisfying this requirement is by enrollment in the course Speech for Teachers (Speech 115).

c) Fulfillment of the Constitution Requirement, either by passing an examination or by taking satisfactory course work. Any one of the following courses at Stanford will satisfy this requirement:

   History 120, 121, 133, 163
   Political Science 1, 10

d) Audio-Visual Requirement—Three quarter units or equivalent. All credential candidates are required to take Education 241a before student teaching.

e) Approval by the Committee on Credentials based on scholarship and other requisites for successful teaching.

The lists of requirements for teaching credentials are available from the School of Education Credential Secretary upon request.

Exemption from Student Teaching (General Secondary and Junior College). Part of the student teaching requirement may be waived for one year of successful teaching or student teaching elsewhere after satisfactorily completing half of the student teaching requirement at Stanford. Such a waiver does not imply granting of credit. Course work must be substituted for exemptions in order to have the required number of education units.

Programs of study and order of procedure should be obtained from the Credential Secretary in the School of Education on registration day in the first quarter of residence.

A brief summary of the three general credentials follows.

GENERAL ELEMENTARY CREDENTIAL

A program of work for the California General Elementary Credential has been arranged whereby students may complete work for this credential at the time of receiving the Master's degree from this University. Students desiring to follow this program should apply in the winter quarter of the sophomore year. A limited number of applications will be considered during the spring quarter of the sophomore year or the autumn quarter of the junior year, provided any vacancies are available after the winter selection. Only a limited number of students (at present, about 40 a year) are accepted into the General Elementary program. The program requires the completion of one year of graduate work.
GENERAL SECONDARY CREDENTIAL

To qualify for the Stanford General Secondary Credential, the candidate must complete the following:

A. Sixty quarter units of general education with a minimum of 9 quarter units in each of the following:
   1. Science and mathematics. (The Stanford General Studies program fulfills this requirement.)
   2. The practical arts and the fine arts, such as music, art, homemaking, health education, physical education, industrial arts, and similar fields. (Courses in art and music are recommended to Stanford undergraduates.)
   3. Social Sciences. (The Stanford General Studies program fulfills this requirement.)
   4. The communicative arts, such as languages, literature, speech. (The Stanford General Studies program fulfills this requirement. Candidates for the credential, however, are required to take also Speech 115.)

B. At least 39 quarter units in the following professional courses (or their equivalent).

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<th>Units</th>
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<tr>
<td>110. Social Foundations of Education</td>
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<td>115. Psychological Foundations of Education</td>
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<td>118. Health Foundations of Education</td>
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<tr>
<td>241a. Audio-Visual Laboratory</td>
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<td>246. The American Secondary School</td>
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<td>247a. Participation and Observation in Secondary Teaching</td>
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<tr>
<td>Curriculum and Instruction in teaching major</td>
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<tr>
<td>Curriculum and Instruction in teaching minor</td>
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<td>247b, c, d. Student Teaching in Secondary Schools</td>
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<td>39</td>
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C. At least a B— academic average in undergraduate and graduate courses.

D. At least 40 quarter units at Stanford in graduate standing. One-third of the units must be in courses numbered 200 or above. For two quarters of this work, the candidate must be enrolled for full-time study.

E. A teaching major and teaching minor, as specified by the California State Department of Education and the Stanford academic department. Candidates are urged to schedule the required course in methods of teaching in their minor subject during the autumn quarter of the senior year. Requirements for specific majors and minors, not listed in this Bulletin by departments, may be obtained from the Credential Secretary of the School of Education, Room 43.

Teaching Major in Social Studies. Because the social studies major includes work in several departments, it is listed here. The requirements for the other teaching majors will be found under the appropriate departmental headings.

Applicants for the secondary teacher's credential in the social studies are required to complete, with a grade average of not less than B—, at least 35 units of history, together with 35 units (divided 15, 10, 10) in three of the other social sciences, namely, political science, anthropology or sociology, economics or geography. Of the history units at least 15 must be in the history of the United States. Irrespective of work done elsewhere, at least 8 units of history must be taken at Stanford University.
Teaching Major in Physical Education. The program for the teaching major in physical education is planned in cooperation with the men's and women's physical education departments. Specialization in dance is possible within the women's program. Students in these programs are required to meet all requirements listed under the General Secondary Credential.

Junior College Credential

A. Completion of professional course requirements, which include a course on the aims and scope of the junior college, practice teaching, Audio-Visual Aids, fulfillment of the Constitution requirement, and a four-unit course in the methods of teaching the major. The methods courses are usually offered only autumn quarter.

B. Completion of the Master of Arts degree in the teaching major.

C. Completion of a teaching major and a teaching minor satisfactory to the departments concerned. For details consult the Credential Secretary of the School of Education, Room 43.

D. Acceptance by the academic department and the School of Education.

Courses in Other Divisions of the University

It is desirable that workers in education have thorough backgrounds in areas outside of professional work. Students are therefore urged to consider the courses offered in other divisions of the University in planning their programs.

Courses in Education

Junior-Senior courses: 100-199; graduate courses: 200-299; courses for experienced teachers or advanced graduates: 300-399; seminars and individual study for advanced graduates: 400-499.

The various fields in education courses are distributed as follows:

- Foundations of Education (Digits 00-19), i.e., 118, Health Foundations of Education
- Administration (Digits 20-29), i.e., 320, Public School Administration
- Guidance and Personnel (Digits 30-39), i.e., 330, Guidance
- General Curriculum and Methods (Digits 40-49), i.e., 244c, Curriculum and Instruction in Elementary Schools
- Testing, Evaluation and Research (Digits 50-54), i.e., 251, Educational Testing and Evaluation
- Physical Education (Digits 55-79), i.e., 155, Elementary Analysis of Body Movement
- Special Curriculum and Instruction in Other Fields (Digits 80-99), i.e., 280, Curriculum and Instruction in Secondary Art

Freshman-Sophomore

1. Introduction to the Study of Education—For future teachers; a general education experience for students in other fields. Surveys field of education but gives particular attention to structure, administration, policies of public school systems.
   
   3 units, winter, (Bartky), MWF 10

Junior-Senior

These courses are also open to graduate students.

110. Social Foundations of Education—For credential and Master of Arts degree candidates. Influence of social structure on schools, school sys-
tems; value determinants in educative process; American national character as a socio-psychological context of education; special problems of ethnic groups in American schools; school system as formal organization in mass society; case studies of teachers, administrators.

5 units, autumn, (Spindler), MTWThF 1
or spring, (Bariky), MTWThF 10
or 4 units, summer, (———), MTWThF 10


3 units, autumn, winter, or spring, (———), M 4–6 and Sunday 10:30–12

115. Psychological Foundations of Education—Introductory course in application of psychological principles to educational practices. (Same as Psychology 115.) Prerequisite: Psychology 1 or equivalent.

5 units, autumn, (McDonald), MTWThF 11
or spring, (McDonald), MTWThF 9
or 4 units, summer, (McDonald), MTWTh 3 and by arrangement


4 units, winter, (———), MWF 10 and hours for observation

118. Health Foundations of Education—Relationship of health and education; nature of a practical school health program.

3 units, autumn, (Byrd), MWF 9
or winter, (Byrd), MWF 11

143. Observation in Elementary Schools—Introduction to modern educational practice in elementary schools, and to study of children in classroom. Four hours observation per week in addition to class hours. Prerequisite: admission to elementary credential program.

4 units, autumn, (P. Sears), M 2, W 2–4, and by arrangement

143a. Participation in School Camping—One week as counselor to group of children in school camp, plus observation of children in their regular classroom.

1 unit, autumn or spring, (P. Sears), by arrangement

143b. Guided Observation in Special Educational Facilities—By permission of instructor only. Opportunities provided for study and work with children in institutional and special settings.

2 to 4 units, autumn, winter or spring, (P. Sears), by arrangement

144a. Curriculum and Instruction in Elementary Schools—Methods of teaching in elementary school; particular emphasis on teaching of reading, related language arts, arithmetic. Prerequisite: admission to the elementary credential program.

8 units, autumn, (Sowards, Iverson), MTWTh 2–4

144b. Curriculum and Instruction in Elementary Schools—Continuation of 144a; particular emphasis on teaching of science, social studies; development of teaching units. Prerequisite: 144a.

8 units, winter, (Shaftel, Hurd), MTWTh 10–12

145. Participation in Elementary Schools—Opportunity for students to observe, participate on limited basis in classroom activities, under guidance of experienced classroom teacher. Prerequisite: 143 and admission to elementary credential program.

6 units, autumn, (———), F 10–12, and by arrangement

180. Art in the Elementary School—Enroll in Art 180. Basic concepts in art education; experiences with art materials, methods. For elementary teachers.

5 units, winter or spring, (McFee), TTh 11, and MWF 1–3

198. Study of Planning Church School Curricula—Individual study, pra-
tice in development of techniques for teachers experienced in church school education. Prerequisite: 114.

3 units, autumn, winter, or spring, (——), by arrangement

GRADUATE

These courses are open to seniors with permission of adviser and instructor of course.

200. History of Education — Foundational course in educational history meeting advanced degree requirements. Survey; emphasis upon European backgrounds, educators, schools, covering period from “Golden Age” of Greece to twentieth century.

3 units, autumn, (Gross), MWF 2

or winter, (Gross), W 7-10 p.m.

or 4 units, summer, (Gross), MTWThF 11

201. History of Education in the United States — Detailed study of American educational history in its cultural setting. Education 200 will provide a helpful background but is not a prerequisite.

3 units, spring, (Gross), MWF 2

204. Philosophy of Education — Philosophical issues in epistemology, value theory, metaphysics of significance to educational policy, practice. No previous study of philosophy assumed.

4 units, winter, (Thomas), MW 2-4

or spring, (Thomas), MTWTh 11

or summer, (Thomas), MTWThF 2

206. Comparative Education — Comparative study of education in several nations, cultural groups.

4 units, summer, (——), MTWThF 2

216. Statistical Analysis in Education — Introduction to statistical description and inference in study and conduct of education. No previous college mathematics necessary. This or equivalent required of all doctoral candidates unless specifically waived by adviser.

4 units, autumn, (Coladarci), MW 2-4

or summer, (Coladarci), MTWThF 9

217. Mental Hygiene — Recent developments in theory and practice leading to understanding of bases for emotional, personality disturbance. Prerequisite: Education 115.

3 units, winter, (P. Sears), W 7-10 p.m.

218. Administration of School Health Program — Significant problems in school health facing school personnel.

3 units, spring, (Byrd), W 7-10 p.m.

or 4 units, summer, (Byrd), MTWThF 9

235a, b, c. Military Seminar — For military students on active duty enrolled at Stanford University.

235a. 3 units, autumn, (MacConnell), by arrangement

235b. 3 units, winter, (MacConnell), by arrangement

235c. 3 units, spring, (MacConnell), by arrangement

239a, b. Observation of Study Skills and Developmental Reading in College, and Directed Teaching of Study Skills and Developmental Reading — Two-quarter practicum, to be taken in sequence. Two-hour weekly seminar plus individual conferences with instructor supplement required observation (239a) and directed teaching (239b) of regular college class in developmental reading, study skills.

4 units, autumn or winter, (Browning), Th 1-3, and by arrangement

or spring, (Browning), M 1-3, and by arrangement
241. Audio-Visual Aids—Theory and laboratory course to acquaint teachers with audio-visual principles, materials, equipment.

3 units, spring, (Cook), M 7–10 p.m.
or 3 units, summer (6 weeks), (Cook), MTWThF 8

241a. Audio-Visual Laboratory—To acquaint student with use of audio-visual equipment. Enrollment limited. Required of all credential candidates before student teaching. Must be taken concurrently with curriculum and instruction course in major field.

1 unit, autumn or winter, (Cook), M 2 or 3, or W 2 or 3

242. Student Teaching in Speech Correction—Supervised teaching in speech therapy and lip reading in public schools in partial fulfillment of requirements for special credential in these fields.

3 units, autumn, winter or spring, (Anderson), by arrangement

243. Guided Observation in the Demonstration School—Guided observation of modern practices in elementary classrooms; problem of curriculum development for entire elementary school; discussion of theories and practices observed.

4 units, summer, (———), by arrangement

244. Survey of Elementary School Curriculum—Theory, practices, issues, trends in designing of total elementary school curriculum and in teaching of the several subjects. Service course for those whose concentration is other than elementary school leadership. (Fulfills requirements for administrative and supervisory credentials.)

3 units, winter, (Shaftel), W 7–10 p.m.
or 4 units, summer, (———), MTWThF 11

244c. Curriculum and Instruction in Elementary Schools—Advanced; curriculum, instruction in elementary school for candidates in 5-year elementary credential program.

2 to 4 units, autumn, (Sowards), TTh 3–4:30
or winter, (Sowards), by arrangement
or spring, (Sowards), MW 4–5:30

245. Elementary Student Teaching — Opportunity to observe, teach in elementary classroom; full day assignment under guidance of experienced classroom teacher. Prerequisites: 145a, and admission to elementary credential program.

16 units, winter, (Sowards, Staff), M 7–9 p.m., and by arrangement

246. The American Secondary School—Orientation to American secondary school, primarily for student teachers; emphasis upon historical development, general curriculum problems. Prerequisites: 110, 115, and approval of Committee on Teaching Credentials.

3 units, autumn or spring, (Iverson), MWF 8

247a. Participation and Observation in Secondary School Teaching—Directed observations in public elementary, secondary schools. Prerequisites: 110, 115, and approval of Committee on Teaching Credentials.

3 units, autumn, winter, or spring, (———), T 8, and by arrangement

247b, c, d. Student Teaching in Secondary Schools—Open only to candidates for Stanford General Secondary Credential. Prerequisites: adequate preparation in teaching major and minor, 246, 247a, and approval of Committee on Teaching Credentials. Prerequisite or parallel: methods course in teaching major. Students register for 9 units (and 22 hours by arrangement).

247b. 5 units, (major), autumn, winter, or spring, (Hurd, Staff), M 5
247c. 4 units, (1st minor), autumn, winter, or spring, (Hurd, Staff), M 5
247d. 5 units, (2d minor), autumn, winter, or spring, (Hurd, Staff), M 5

248. Student Teaching in the Junior College.

9 units, autumn, winter, or spring, (Bartky), by arrangement
251. **Educational Testing and Evaluation**—Introduction to principles of evaluation; emphasis upon application to construction and use of tests in educational practice. Prerequisite: 115 or equivalent.

3 units, winter, (McDonald), Th 7-10 p.m.
or 4 units, summer, (——), MThWF 1

280a. **Curriculum and Instruction in Secondary School Art I**—Lectures on foundations of art education. (Same as Art 280a.)

4 units, autumn, (Mendelowitz, McFee), TTh 4-6

280b. **Curriculum and Instruction in Secondary School Art II**—Curriculum development in art education; exploration of methods and materials. (Same as Art 280b.)

2 units, winter, (McFee), TTh 4-6

281a. **Curriculum and Instruction in Business Education I**—Curriculum, materials, methods in teaching of business subjects.

4 units, autumn, (Cook), TTh 4-6

281b. **Curriculum and Instruction in Business Education II**—Continuation of 281a.

2 units, winter, (Cook), T 4-6

282a. **Curriculum and Instruction in Foreign Languages I**—Methods, techniques of foreign language teaching, testing. Survey of language teaching to the present.

4 units, autumn, (Weir), TTh 4-6

282b. **Curriculum and Instruction in Foreign Languages II**—Materials of foreign language teaching. Use of audio and visual aids in language work.

2 units, winter, (Weir), Th 4-6

284a. **Curriculum and Instruction in Secondary English I**—Evaluation of conflicting views of program of language arts; study of research and recommendations for teaching of composition, critical thinking, semantics, grammar, usage, punctuation, spelling.

4 units, autumn, (——), MW 4-6

284b. **Curriculum and Instruction in Secondary English II**—Study of recommendations for teaching of reading and of the various types of literature.

2 units, winter, (——), W 4-6

284c. **Teaching Adolescents' Literature**—Opportunity to read, discuss 10 to 15 books of interest to adolescents.

2 units, spring, (Grommon), W 4-6, to be given in 1959-60

285. **Curriculum and Instruction in Secondary School Journalistic Writing.**

4 units, any quarter, (Weigle), by arrangement

286a. **Curriculum and Instruction in Secondary School Speech I**—Theory, practice in curriculum and instruction in speech and drama.

4 units, autumn, (Schrader), TTh 4-6

286b. **Curriculum and Instruction in Secondary School Speech II**—Survey of materials for teachers of speech and drama.

2 units, winter, (Schrader), Th 4-6

289. **Curriculum and Instruction in the Junior College**—Curriculum and methods of teaching in student's teaching major. Students will be assigned to the specialist in methods of teaching this subject. See Curriculum and Instruction courses in major field for class hours.

290a. **Curriculum and Instruction in Secondary Mathematics I**—Purpose and program of mathematics in secondary curriculum; teaching materials, methods.

4 units, autumn, (Kinney), WF 4-6

290b. **Curriculum and Instruction in Secondary Mathematics II**—Continuation of 290a.

2 units, spring, (Kinney), T 4-6
293. Applications of Science and Mathematics—Application of science and mathematical methods of research and discoveries to industrial problems, development. Field trips to research and development laboratories; lectures by guest scientists, mathematicians, engineers. Limited to Shell Merit Fellows.

4 units, summer, (Hurd, Staff), MTWTh 11, field trips F 11-5

294a. Curriculum and Instruction in Secondary School Science I—Introduction to objectives of secondary science teaching; selection and organization of teaching units; laboratory and demonstration techniques; tests, evaluation. Prerequisites: major or minor in science and senior or graduate standing.

4 units, autumn, (Hurd), TTh 4-6

294b. Curriculum and Instruction in Secondary School Science II—Continuation of 294a; emphasis upon instructional materials, community resources for science teaching. Special attention to Science Fair, junior academy, field trip, junior research, special programs of scientific societies and industry for high school science students. Prerequisites: major or minor in science and graduate standing.

2 units, winter, (Hurd), T 4-6


4 units, autumn, (Gross), MTWF 3


2 units, winter, (Gross), T 4-6

299L. Children's Literature—General survey of children's literature for both pre-school, elementary school years.

3 units, spring, (Iverson), MTWTh 10

Courses for Experienced Teachers or Advanced Graduate Students


3 units, winter, (Thomas), TTh 2-4

or 4 units, summer, (Thomas), MTWThF 11


4 units, spring, (Cowley), MW 2-4, to be given in 1959-60

310. Social Foundations of Education for Advanced Graduate Students—Analysis of social foundations of education as applied to problems of educational leadership. Assumed that class members have had teaching experience or equivalent. For Ed.S., Ed.D., and Ph.D. candidates.

4 units, winter, (Quillen), MTWTh 10

or summer, (Quillen), MTWThF 10

311. International Understanding and Intergroup Education—Advanced course in social foundations of education for experienced teachers, administrators, curriculum directors. Educational problems in such areas as intercultural, interethnic, interracial, interreligious, international relations.

4 units, summer, (———), MTWThF 10

312. Occupational Trends—Current nature of American labor force, occupational structure; intended for vocational counselors, advanced students of educational sociology. Prerequisite: 110 or 310.

4 units, spring, (McDaniel, Thomas), MW 2-4
314. **Classroom Learning**—Principles of learning and motivation relevant to study of classroom behavior.

4 units, autumn, (McDonald), MW 8–10

315. **Cultural Transmission**—Education in cross-cultural perspective: transmission of values; transmission of covert culture, implicit cultural assumptions; adolescent education; case studies of teachers in American schools. For advanced graduate students in education, anthropology, other behavioral sciences.

3 units, autumn, (Spindler), M 7–10 p.m.

316. **Psychological Assessment of the Individual**—Development of psychometric concepts, principles particularly relevant to development of educational theory, and assessment of evaluation programs, procedures. Emphasis on methodological problems encountered in assessment of learner in various curricular areas. Prerequisites: 115 and 216.

4 units, spring, (Coladarci), MW 8–10


4 units, winter, (Coladarci), TTh 8–10

318. **Social Psychology in Educational Practice**—Application of theories, concepts, research techniques of social psychology to educational process. Prerequisite: 115 or equivalent.

4 units, spring, (McDonald), MW 10–12

320. **Public School Administration**—School district organization for administration; emphasis upon development, function of school superintendency.

3 units, autumn, (Garcia, Strand), Th 7–10 p.m.

or 4 units, summer, (Garcia, Strand), Th 7–10 p.m.

321. **School Staff Personnel Problems**—For experienced teachers, administrators. Recruitment, selection, placement of teachers; orientation of new teachers; administrative responsibilities for in-service education; staff participation in salary scheduling and other aspects of economic welfare of teachers; administrator-teacher relations; codes of ethics; merit rating; certification, tenure.

4 units, summer, (Bush), MTWThF 1

322. **Secondary School Administration**—For experienced teachers and candidates for administrative and supervisory credentials. Systematic treatment of full range of problems of administration of schools that include grades 7–12. Administration viewed mainly from vantage point of principal.

3 units, spring, (Bush), W 7–10 p.m.

or 4 units, summer, (Bush), MTWThF 10

323. **Public School Law**—Nature of legal responsibilities faced by public school administrator; resources available to him for solution of legal problems. Specifically designed to meet requirements for California administrative credentials.

3 units, spring, (———), M 7–10 p.m.

or 4 units, summer, (———), MTWThF 4

324. **Elementary School Administration**—Roles, problems of elementary school principal with focus on administration of single school.

3 units, autumn, (Dawson), M 7–10 p.m.

or 4 units, summer, (Dawson), MTWThF 8

325. **School Planning**—Introductory course in relating educational planning to school plant needs.

3 units, winter, (MacConnell, Staff), Sat. 9–12

3 units, autumn, (———), M 7-10 p.m.

or 4 units, summer, (———), MTWTThF 3

326b. Public School Accounting — Designed to familiarize school administrators with techniques of fund accounting as applied to public school operations; emphasis upon applications consistent with requirements in California.

3 units, winter, (———), M 7-10 p.m.

326c. Public School Purchasing—Basic principles, methods of procurement; related problems in public school administration.

3 units, spring, (———), Th 7-10 p.m.

327. Community Relations—Introductory course in techniques, information essential to interpreting educational needs to lay, professional community groups.

3 units, spring, (MacConnell), Sat. 9-12


4 units, winter, (Cowley), to be given in 1959-60

328b. Government of Higher Education—Control of policy in American colleges and universities.

4 units, winter, (Cowley), to be given in 1959-60

330. Guidance—Basic concepts and practices of guidance services in elementary, secondary schools, junior colleges.

3 units, winter, (McDaniel), M 7-10 p.m.

or 4 units, summer, (———), MTWTThF 3


3 units, spring, (P. Sears), TTh 4-5:30

331. In-service Personnel Training—For those interested in women’s residence programs. Includes philosophy and principles of university residences, selected techniques in personnel work in women’s residences.

2 units, autumn, or winter, (Brown, Staff), Th 2-4

333a. Counseling Techniques: The Interview—Basic concepts, practices of counseling interview. For graduate students who expect to become school counselors.

4 units, winter, (McDonald), MW 2-4

333b. Counseling Techniques: Testing—Study and practice with psychological tests employed in counselor’s study of individual client. Experience in taking tests, administering them, analyzing and interpreting data.

4 units, winter, (McDaniel), TTh 2-4


4 units, spring, (McDaniel), MW 4-6

334. Counseling Center Practicum — Experience in college counseling center operations, including testing and counseling. Placements made through Stanford Counseling and Testing Center. By permission. May be repeated for credit.

3 to 6 units, any quarter, (Black), by arrangement

338. Student Personnel Services in Higher Education—Critical examination of operation of student personnel services in American colleges and universities.

3 units, spring, (———), by arrangement

8 units, summer (1st 4 weeks), (McDaniel), MTWThF 9-4

339b. **Guidance Workshop II**—Opportunity for professional guidance workers to extend technical skills, analyze current problems, plan new activities in guidance testing. Approval of instructor required.

8 units, summer (2d 4 weeks), (McDaniel), MTWThF 9-4

340. **Supervision**—Supervision is defined as face-to-face relationships between teacher, administrator. Emphasizes human relations problems that arise from this relationship.

3 units, spring, (Bartky), Th 7-10 p.m.

or 4 units, summer, (Bartky), MTWThF 11

341. **Non-Commercial Telecasting**—Enroll in Speech and Drama R201.

3 units, summer, (Donner, Staff), by arrangement


4 units, autumn, (Bush), TTh 10-12

or summer, (Bush), MTWThF 9


4 units, summer, (Sowards), MTWThF 11

346. **The Junior High School**—Comprehensive survey of problems, issues confronting modern junior high school.

4 units, summer, (———), MTWThF 11

347. **The Junior College**—Required of all candidates for junior college credential. Philosophy, problems of the junior college.

3 units, winter, (Bartky), Th 7-10 p.m.

or 4 units, summer, (Bartky), MTWThF 1

348. **The Curriculums of Higher Education**—Exploration of the many kinds of curriculums offered by American colleges and universities; current and historical considerations which influence them.

4 units, winter, (Cowley), TTh 2-4, to be given in 1959-60

349. **Professional Education of Teachers**—For doctoral candidates interested in studying programs and procedures for teacher education.

4 units, autumn, (Kinney), MTWTh 9

or summer, (Kinney), MTWTh 10

353. **Research in Business Education**—Review of selected research; investigation of possible research topics in business education.

4 units, summer, (Cook), MTWThF 9

354. **School Surveys**—Introductory course in projecting school populations, analyzing other factors pertinent to determining future needs in school building, personnel.

3 units, autumn, (MacConnell, Staff), Sat. 9-12

380. **Recent Developments in Art Education**—Current contributions of educational foundations to art education. Studio experience adjusted to individual needs. Same as Art 380.

4 units, summer, (McFee), MWF 9 and studio hours by arrangement

381. **Special Problems in Business Education**—Investigation, discussion of problems related to teaching of specialized business subjects.

3 units, winter, (Cook), W 7-10 p.m.
   3 units, spring, (Cook), W 7-10 p.m.
   or 4 units, summer, (Cook), MTWThF 9

383. Recent Developments in Secondary School Foreign Languages—Basic assumptions, findings of scientific study of language as applied to language teaching methods. Adaptation of currently available textbooks to structural approach. Use of audio-visual aids in language class.
   4 units, summer, (Weir), MTWThF 9

384. Recent Developments in Secondary School English—Recent research, materials, methods in secondary school English. For teachers who have had experience teaching English.
   4 units, summer, (——), MTWThF 8

386. Speech for Administrators—Practice in speaking, leading discussions; especially designed to meet administrator’s problems.
   4 units, summer, (Schrader), MTWThF 10

387. Elementary School Language Arts—For experienced teachers, graduate students; reviewing research, curriculum issues, instructional procedures related to language arts in elementary schools.
   4 units, winter, (Iverson), MTWTh 11

   4 units, summer, (Dawson), MTWThF 11

391. Recent Developments in Secondary School Mathematics—Purposes and program of mathematics in secondary curriculum; teaching materials, methods. For experienced teachers only.
   4 units, summer, (enrollment limited to Shell Merit Fellows), (Kinney), MTWThF 2

393. Elementary School Science—Content, methods of elementary school science; emphasis on materials, techniques of instruction, curriculum organization, development of teaching units.
   4 units, summer, (——), MTWThF 8

394. Recent Developments in Secondary School Science—Current problems in enrollments; new types of courses, instructional techniques; curriculum development; guidance materials for science students. Content of course will be varied to consider teaching problems of those enrolled. For experienced teachers only. Prerequisite: major or minor in science and teaching experience in science.
   4 units, summer (enrollment limited to Shell Merit Fellows), (Hurd), MTWThF 2

   4 units, summer, (Gross), MTWThF 9

397. Elementary School Social Studies—Analysis of theories, trends, issues of elementary school social studies curriculum; special emphasis on integrative core program, unit-of-work procedures. For experienced teachers, supervisors, administrators.
   4 units, autumn, (Shaftel), TTh 10-12
   or summer, (Shaftel), MTWThF 9

   4 units, summer, (Iverson), MTWThF 10

399. Reading in Elementary Schools—For experienced teachers, graduate
students reviewing research, curriculum issues, instructional procedures related to program of reading in elementary schools.

4 units, winter, (Iverson), MTWTh 1
or summer, (Iverson), MTWThF 9

Curriculum and Instruction in Secondary School Music — See Music 181a, b, c.

Human Geography — See Geography 1.

Introduction to American Higher Education — See Graduate Division Special Programs 308.

Musicanship for Elementary Teachers — See Music 80.

Teaching Music in the Elementary School — See Music 88.

The Teaching of Geography — See Geography 198.

SEMINARS AND INDIVIDUAL STUDY FOR ADVANCED GRADUATE STUDENTS

400i. Individual Study in the History of Education.

(Gross)

404. Seminar in the Philosophy of Education — Intensive study of student-selected topics in comparative philosophies of education. Prerequisite: 204 or consent of instructor.

3 units, spring, (Thomas), M 7-10 p.m.

404i. Individual Study in the Philosophy of Education.

(Gross)

410i. Individual Study in Social Foundations of Education.

(Quillen, Spindler)


3 units, spring, (Quillen, Gross), MW 4-5:30

415. Seminar in Educational Psychology and Guidance — Topical seminar for advanced majors in educational psychology, guidance, psychology. Admission by permission of instructor.

4 units, autumn, (Coladarci), by arrangement

415i. Individual Study in Educational Psychology.

(Coladarci, McDonald)

416. Seminar in Social Anthropology in Education — Seminar on cross-cultural data on cultural transmission. Prerequisite: 315 or permission of instructor.

3 units, winter, (Spindler), F 3-6

419. Seminar in Human Relations in the School — Problems, issues involved in relationships among pupils, teachers, administrators, parents and other persons in the community as they work together in schools. Academic disciplines of anthropology, psychiatry, psychology, social psychology, sociology will be drawn upon. Reasonable familiarity with basic concepts in these fields assumed. Emphasis on case studies of teachers, administrators, students interacting in school setting.

4 units, autumn, (Bush), TTh 2-4

422. Seminar in Administration — Primarily for assistants, interns in general school administration. Theory of administrative organization, practices.

3 units, autumn, (Garcia, Strand, Staff), W 7-10 p.m.
or winter, or spring, (Odel, Garcia, Strand, Staff), W 7-10 p.m.
or 4 units, summer, (Odel, Garcia, Strand), MTWThF 1

422i. Individual Study in Administration.

(Staff)
425. Field Practice in Elementary School Supervision and Administration—Field experience in elementary school administration and supervision that will meet requirements for California Elementary School Administration Credential and California Elementary School Supervision Credential.

3 to 6 units, autumn, winter, or spring, (———, Shaftel, Staff), Sat. 9-11 and by arrangement

427. Field Practice in Secondary Schools—Field practice in secondary school administration that will meet requirements for California Secondary School Administration Credential.

3 to 6 units, autumn, winter, or spring, (———, Staff), Sat. 9-11 and by arrangement

428. Seminar in School Planning—For advanced students who have had considerable experience in school planning or who have completed 325, 327, and 354. Preparation of educational specifications in school planning.

3 units, autumn, winter, or spring, (MacConnell), Th 7-10 p.m.

430i. Individual Study in Educational and Vocational Guidance—Study program planned by student and instructor to strengthen student's preparation for effective guidance work.

(McDaniel)

440. Seminar in Curriculum Development—Designed for advanced graduate students preparing for leadership positions in curriculum either as college instructors or as school administrators. Prerequisites: Completed courses in the foundations and preferably completion of the qualifying examinations for the doctorate.

4 units, winter, (Sowards), TTh 2-4
or summer, (Sowards), TTh 2-4 and 1 hour by arrangement

441i. Individual Study in Audio-Visual Education.

(Cook)

443. Educational Leadership—Consideration of leadership problems of school administration. Leadership as a theory and a practice; specific emphasis on theory of group and individual leadership in a democracy.

2 units, winter, (Bartky), M 7-9 p.m.

443i. Individual Study in Educational Leadership.

(Bartky)

444. Seminar in Elementary Education for Doctoral Candidates—Limited to advanced graduate students preparing for careers in this field of concentration.

2 to 10 units, autumn, (Shaftel), MW 2-4
or 2 to 10 units, winter, (Hanna), MW 2-4
or 2 to 10 units, spring, (Hanna), MW 2-4
or 2 to 10 units, summer, (Hanna), MW 2-4

444i. Individual Study in Elementary Education.

(Hanna, Shaftel, P. Sears, Sowards)


3 units, spring, (Bush), MW 4-5:30
or 4 units, summer, (Bush), MW 2-4

446i. Individual Study in Secondary Education.

(Staff)

447. Practicum in Secondary Education—For doctoral students only. Opportunity, under direct supervision of member of regular staff, for work in teacher, supervisor, and administrator education program of the University. May be taken during more than one quarter for maximum of 15 units. Required
of all majors in Secondary Education, Teacher Education (Secondary), and special fields in Secondary Curriculum, such as English, Science, Mathematics.

3 to 5 units, autumn, winter, or spring, (Bush, Staff), by arrangement

448. Seminar in Higher Education—Chiefly gives attention to methods of gathering, organizing facts and concepts bearing upon higher education.

4 units, autumn, (Cowley), by arrangement

448i. Individual Study in Higher Education.

(Cowley)

449. Seminar in Teacher Education—For doctoral candidates interested in studying special problems in preparation of teachers.

4 units, spring, (Kinney, Sowards), M 7-10 p.m. and by arrangement

449i. Individual Study in Teacher Education.

(Kinney)

450c. Advanced Graduate Students' Seminar—Informal seminar. Three quarters required of all doctoral candidates.

No credit, autumn or winter, (Staff), W 4-6
No credit, spring, (McDaniel), T 12-2
No credit, summer, (McDaniel), M 7-9 p.m.


1 to 10 units, any quarter, (Staff)

452. Educational Specialist Research.

1 to 10 units, any quarter, (Staff)


1 to 30 units, any quarter, (Staff)

454. Research Methodology—Introduction to nature of scientific thinking in education, various methodological approaches relevant to educational problems. Consideration given to particular concerns relating to doctoral dissertations.

4 units, winter, or spring, (Coladarci), TTh 2-4

480i. Individual Study in Curriculum and Instruction in Art. (Same as Art 480i.)

(Mendelowitz)

481. Cooperative Work-Education—To give business teacher opportunity to secure work experience, plus understanding of procedures for developing similar program for his school.

8 to 12 units, summer, (Cook), by arrangement

481i. Individual Study in Business Education.

(Cook)

482i. Individual Study in Curriculum and Instruction in Modern Languages.

(Weir)

484i. Individual Study in Curriculum and Instruction in English.

(Grommon)

486i. Individual Study in Curriculum and Instruction in Speech and Drama.

(Schrader)

490i. Individual Study in Curriculum and Instruction in Mathematics.

(Kinney)

494i. Individual Study in Curriculum and Instruction in Science.

(Hurd)

496i. Individual Study in Curriculum and Instruction in Social Science.

(Gross)

499i. Individual Study in Reading in the Elementary School.

(Iverson)
**SCHOOL OF EDUCATION**

**PHYSICAL EDUCATION**

150. *Introduction to Physical Education*—Survey of field, its relation to areas of education, recreation, health education. Types of service and employment possibilities.
   2 units, autumn, (Knapp, Nixon), MW 8

153. *Curriculum and Instruction in Dance (Folk, Square, Social)*—Methods of teaching social, folk, square dance; place, relationship to school recreation.
   3 units, winter, (Staff), TTh 8-10, F 9

   2 units, autumn or spring, (Ruch), TTh 8

156. *Foundations of Physical Education*—Historical, biological, psychological, sociological, educational bases of physical education. Prerequisite: 155.
   3 units, autumn, (Knapp), MWF 9

157. *The Elementary School Program in Physical Education*—Educational bases, types of physical education activities included in elementary school program. Demonstration lessons in elementary school, experience in teaching activities to classmates.
   4 units, winter, (PE Majors), (Knapp), M 1-3, TTh 10-12
   or 3 units, spring, (Elem. Ed. Majors. Prerequisites: Col4 and 15), (Knapp, Staff), MTWTh 2 and TTh 1

   3 units, autumn, (Nixon), MWF 9

159. *Tests and Measurements in Physical Education*—Development and availability of evaluative criteria useful in physical education. Instruction in basic statistical methods.
   3 units, winter, (Nixon), MWF 8

161. *Curriculum and Instruction*—Prerequisite for all teaching progressions; 155 may be taken concurrently. Experience in the activity.
   161a. *General Methods: Basketball, Badminton*—Basic methods, procedures relating to all physical education curriculum, instruction courses.
   Techniques, procedures, teaching methods in basketball, badminton.
   4 units, winter, (Strathairn, Williams), MTWTh 9

161b. *Archery, Tennis*—Methods of presenting target archery, tennis to individuals of a group.
   2 units, spring, (Barr, Guthrie), MW 10, to be given in 1959-60

   3 units, autumn, (Barr), MTWTh 10, to be given in 1959-60

161d. *Softball, Swimming*—Techniques, procedures, methods of teaching. Prerequisite: Senior Life Saving (may be taken concurrently).
   3 units, spring, (Strathairn, Williams), T 10, T 3; lab. Th 10, 2 hours by arrangement

161e. *Golf*—Methods in group instruction, fundamental strokes, shot making.
   1 unit, spring, (Gordon), M 9

   2 units, spring, (Barr), M 3, W 3-6

163. *Curriculum and Instruction in Dance (Modern)*—Teaching of dance technique, elements of choreography and program production, dance ac-
3 units, autumn, (Duggar), TTh 1-3 and F1 or 2

164a. Posture and Orthopedic Problems—Bases and methods of teaching posture and other motor skills of daily living; adapting physical education for handicapped child. Prerequisites: Anatomy 114 and Education 169 and Physiology 90.

3 units, autumn, (Ruch), TTh 9, lab. MW 1

164b. Posture and Orthopedic Problems—Practice in teaching posture. For physical education majors.

2 units, winter, (Ruch), one conference, 2 or 3 hours lab. by arrangement

165. Choreography—Fundamentals.
2 units, autumn or spring, (Duggar), TTh 1 and by arrangement

166. Choreography—Dance Forms. Prerequisite: 165.
2 units, winter, (Duggar), WF 1 and by arrangement

167. Choreography—Production, accompaniment. Prerequisites: 165 and 166 or consent of instructor.

2 units, (Duggar), by arrangement

168. The Elementary School Program in Physical Education—Teaching physical education in an elementary school. Prerequisite: 157.

2 units, spring, (Knapp), by arrangement


4 units, spring, (Ruch), MWF 1-3

171. Curriculum and Instruction—Methods, techniques of applied physical education; open only to students enrolled for degrees or teaching credentials in physical education. Each course planned, given by director of activity involved, with assistance of staff. Classroom presentations; graphic illustrations; field, court, floor demonstrations. Admission only by permission of instructor. Not open to freshmen.

2 units, winter, (Fehring), TTh 11 and by arrangement

171b. Basketball.
2 units, autumn, (Dallmar), MWF 9

171c. Football.
2 units, spring, (Staff), TTh 10 and by arrangement

171d. Track and Field.
2 units, winter, (Jordan), MW 10 and by arrangement

171f. Special Physical Education Methods—Apprenticeship teaching experiences prior to regular student teaching. Open to physical education majors of junior, senior, graduate standing.
1 to 3 units, autumn, winter, or spring, (Staff)

171g. Athletic Conditioning.
2 units, autumn, (Staff), by arrangement

171h. Adapted Physical Education.
1 unit, spring, (Ruff), T 1

171j. Combatives.
2 units, autumn, (Lunny, Ruff), MWF 2

171k. Volleyball, Soccer, Speedball.
2 units, spring, (Ruff), TTh 2 and by arrangement

171m. Golf.
2 units, winter, (Finger), MF 11 and by arrangement

171n. Aquatics.
2 units, spring, (Haynie), TTh 11 and by arrangement

2 units, winter, (Ruff), by arrangement
171r. **Gymnastics.**
   2 units, winter, (Ruff), MW 5 and by arrangement

171s. **Tennis.**
   2 units, spring, (Bugge), WF 11 and by arrangement

173. **Athletic Officiating Methods Courses for Men**—Each course planned, conducted by director of sport involved, with assistance of staff. Admission by permission of instructor. Not open to freshmen.

173a. **Football.**
   1 unit, autumn, (Staff), TTh 11

173b. **Basketball.**
   1 unit, winter, (Dallmar), W 11

173c. **Baseball and Track and Field.**
   1 unit, spring, (Fehring, Jordan), by arrangement

175. **Administration of Men's Physical Education**—Procurement, efficient utilization of staff, facilities, equipment. Problems of finance, budget, liability, scheduling peculiar to physical education and athletics.

   3 units, spring, (Nixon), MWF 9

176. **Intramural Programs**—Administration of intramural sports programs: scope, medium of competition, scheduling, awards, point systems, equipment, finance, personnel problems.

   3 units, spring, (Bugge), TTh 9

256. **Physiological Bases of Physical Education**—Recent developments in physiology of neuromuscular activity. For experienced physical education teachers.

   4 units, summer, (Ruch), by arrangement

258. **Trends and Practices in Recreation**—Recent trends, current practices in all phases of recreation, uses of leisure time. Junior, senior, graduate students.

   3 units, spring, (Guthrie), TThF 11

260. **History of Dance**—The many forms, styles of dance, primitive time to present; how dance has influenced or been influenced by changing civilizations.

   3 units, autumn, (Lidster), TWF 11, to be given in 1959–60

263. **Methods in Officiating.**

   263a. **Hockey (Women)**—Instruction in, practice of umpiring field hockey games. Official ratings may be earned.

      1 unit, autumn, (Barr), by arrangement

   263b. **Basketball (Women)**—Instruction in, practice of officiating basketball games under women's rules. Local, national ratings may be earned.

      1 unit, winter, (Barr), by arrangement

   263c. **Tennis**—Official U.S.L.T.A. rules, regulations for umpiring; practice in umpiring; leading to official United States Lawn Tennis Umpire certificate.

      1 unit, spring, (Guthrie), by arrangement

264. **Analysis of Body Movement (Advanced)**—Review of kinesiology; emphasis on recent developments. For experienced physical education teachers.

   4 units, summer, (Ruch), by arrangement

265. **Administration of Women's Physical Education**—Planning a program in physical education considering student needs in relation to school, community resources. Facility needs, preparation of budgets, purchase of equipment, ways of establishing good public relations.

   4 units, winter, (Knapp), TThF 2–4

266. **Teaching Dance**—For experienced teachers who desire to concentrate on some phase of curriculum, instruction in dance.

   2 to 3 units, (Duggar, Staff), by arrangement

267. **Curriculum and Instruction in Individual Sports (Advanced)**—
Advanced techniques, strategy, tactics. Prerequisite: Above average in playing ability and/or teaching experience in selected activities.

1 to 4 units, spring or summer, (Staff), by arrangement

268. Curriculum and Instruction in Team Sports (Advanced)—Advanced techniques, strategy, tactics. Prerequisite: Above average in playing ability and/or teaching experience in selected activities.

1 to 4 units, spring or summer, (Staff), by arrangement


2 units, winter or summer, (Barr), by arrangement

270. Research Methods in Physical Education—Research methodology utilized in education; emphasis on methods most often found useful in physical education.

3 units, winter, (Nixon)

271. Curriculum and Instruction in Men's Physical Education—Development of plans, procedures for organization, conduct of physical education programs. Includes survey of State courses of study.

4 units, autumn, (Ruff), MTWF 1


3 units, autumn, (Nixon), MWF 10

or 4 units, summer, (Nixon), MTWTThF 8

359. Philosophy of Physical Education—Terminal course for men A.M. candidates. Current philosophies analyzed with regard to ultimate effect on profession. Prerequisite: 156 or equivalent, or consent of instructor.

3 units, spring, (Nixon), M 7-10 p.m.

365. Administrative Problems in Women's Physical Education—Pertinent problems within the field; individual research on related topics. For experienced teachers.

4 units, winter, (Knapp), by arrangement

370. Special Assignments, Men's Physical Education.

1 to 5 units, any quarter, (Nixon, Ruff), by arrangement

460. Seminar in Physical Education—Current problems, research. For advanced graduate students.

3 to 9 units, (Knapp), by arrangement

461. Individual Study in Women's Physical Education.

2 to 6 units, (Knapp), by arrangement

470. Individual Study in Men's Physical Education.

2 to 6 units, any quarter, (Nixon), by arrangement

HEALTH EDUCATION

Emeriti: Walter H. Brown, George Sparr Luckett (Professors)

Executive Head: Oliver Erasmus Byrd
Professor: Oliver Erasmus Byrd
Assistant Professors: John F. Eckert, Robert D. Russell, Lois Pendleton Todd
Instructor: Gilbert M. Shimmel
Lecturer: Margaret Riassetto

The undergraduate courses in health education are based upon the philosophy that knowledge of the factors that influence health should be the possession of every cultured individual and that an understanding of the principles of healthful living requires training in the application of the scientific facts of the various fundamental sciences which are related to health.
The graduate courses in health education are designed for the training of teachers and school administrators who desire special competence in the field of school health.

**Teaching Credentials**

Students in the Department of Health Education may follow a major or minor sequence of study leading to teaching credentials for the State of California. For the details of these requirements, the student is referred to the Credential Secretary of the School of Education.

**Degrees**

Through the School of Education, the Department of Health Education offers the A.B., A.M., Ed.S., and Ed.D. degrees with specialization in health education. Candidates not interested in the field of education may secure the A.B. and A.M. degrees through the Department of Health Education. A minimum of 30 units from the curriculum of the Department of Health Education plus 15 units in certain basic sciences is required for the A.B. degree. Candidates for the Master of Arts degree must complete at least 36 units of graduate work in the Department of Health Education. The degree of Doctor of Education may be recommended for those candidates who satisfy the requirements of the School of Education and who devote approximately one-half of their course work on the graduate level to certain offerings from the Department of Health Education. Complete information on this degree may be secured from the office of the Dean of the School of Education.

**Undergraduate Courses**

**H50. Constructive Hygiene**—Basic principles of personal hygiene. Family health, nutrition, public health, exercise are considered.
- 3 units, autumn, (Shimmel), MWF 10
- or spring, (Shimmel), MWF 11

**H51. Defensive Hygiene**—Individual, community action in prevention of communicable and chronic disease. Safety, habit-forming substances, international health are additional units.
- 3 units, winter, (Staff), MWF 9
- or spring, (Russell), MWF 9

**H60. Personal and Community Health**—Combines all areas offered in H50 and H51.
- 4 units, summer, (Shimmel), MTWThF 10

**H75. First Aid**—Prevention, immediate care of injuries, sudden illnesses.
- 2 units, any quarter, (Riassetto), MW 2-4, Th 7-9 p.m.

**H101. Family Health**—Introduction to family living, including preparation for marriage, health of family members, prevention of disease, child care, nutrition of family.
- 3 units, autumn, (Shimmel), MWF 1

**H103. Nutrition**—Basic food needs; nutritional deficiencies; recent findings in vitamin, protein, mineral research; hazards of eating out, school feeding programs.
- 3 units, winter, (Russell), MWF 1

**H106. Personal Mental Health**—Group discussions of the specific personal mental health problems of students enrolled in the class.
- 3 units, autumn, (Byrd), MWF 11

**H108. Problems in Medical Care**—Consideration of types of care for ill
health, methods of payment, comparison of U.S. with other countries, and changes which have taken place in this phase of health.

3 units, winter, (Russell), MWF 10

H121. Marriage and Family—Preparation for marriage. Speakers, readings, field trips and discussion of all aspects of courtship, marriage, pregnancy, and child care.

4 units, winter, (Shimmel), MTWTh 4

GRADUATE COURSES

H200. Source Materials I—A professional course for health education, with emphasis on recent research and writing in the various fields of health and on varied teaching methods.

4 units, autumn, (Russell), MTWTh 9
or summer, (Shimmel), MTWThF 8

H201. Source Materials II—Complementary to Source Materials I; may be taken either before or after latter course.

4 units, spring (Shimmel), MTWTh 9

H214. School Hygiene Programs—Survey of functions of school health programs as related to instruction, healthful school environment, school health services. For education majors only.

4 units, winter, (Byrd), MTWTh 9
or summer, (Russell), MTWThF 10

H215. Teaching Units—Preparation of teaching materials in health education; designed to supplement preparation of teachers, prospective teachers. For education majors only.

4 to 16 units, any quarter, (Staff), by arrangement

H220. Safety Education—Educational approach to leading safety problems: traffic safety, home accidents, fire prevention, school safety, civil defense.

3 units, winter, (Shimmel), W 7-10 p.m.

H222. Family Life Education—Development of instructional programs in preparation for family living.

4 units, summer, (Russell), MTWThF 9

H302. Community Health—To facilitate investigation, analysis, evaluation of community programs for promotion of health; to provide understanding of interrelationships existing among school, health department, voluntary health organizations.

3 units, spring, (Russell), M 7-10 p.m.

H304. International Health—Health practices of other national or ethnic groups; a consideration of certain health problems which occur in various parts of the world with the varying attempts at solution.

3 units, autumn, (Russell), W 7-10 p.m.

H305. Practicum in School Nursing—Participation in work of school nurse under supervision of school district and University Department.

4 to 12 units, any quarter, (Byrd), by arrangement


4 units, summer, (Byrd), MTWThF 11

H400. Individual Study in Health Education.

3 to 15 units, any quarter, (Staff), by arrangement
SCHOOL of ENGINEERING

Dean: Frederick Emmons Terman
Associate Deans: Ray Keyes Linsley, Leroy Farrell McGhie, Joseph Mayo Pettit
Secretary of the Faculty: James Monroe Gere

The School of Engineering includes the Departments of Civil Engineering, Electrical Engineering, Industrial Engineering, and Mechanical Engineering; and the Divisions of Aeronautical Engineering and Engineering Mechanics.

The School offers undergraduate curricula permitting specialization in the major fields of engineering, leading to the degree of Bachelor of Science, and various graduate curricula, administered by the departments of the School, leading to the degrees of Master of Science, Engineer, and Doctor of Philosophy. Requirements for the degree of Bachelor of Science may normally be completed in twelve quarters. Instruction in engineering is offered in each of the four quarters of the academic year, but only basic courses required of all engineering students are offered in the summer quarter.

UNDERGRADUATE DIVISION

Admission

Students admitted to the University are permitted to major in the School of Engineering if they elect to do so; there are no additional procedures, course requirements, or examinations for admission to the School.

Preparation Recommended for Freshmen

Students who enter as freshmen should have taken high school English and mathematics through trigonometry. High school courses in physics, chemistry, machine drawing, biological science (biology, botany, or zoology), and more advanced mathematics are recommended but are not required.

Deficiencies in high school English or mathematics are remedied in the following manner: English R, Remedial English, is required of students who have special difficulties in reading or writing, as shown by a Departmental examination. Mathematics A, Algebra, or Mathematics C, Trigonometry, are required of engineering students who do not pass the placement tests in algebra and trigonometry respectively. These tests are given by the Mathematics Department before final enrollment in more advanced mathematics courses. Those who obtain marginal scores on the placement tests may take Mathematics 10a (5 units) instead of Mathematics 10 (3 units).

Preparation Recommended for Transfer Students

Students who do the early part of their college work elsewhere and then transfer to Stanford to complete their engineering programs should follow an engineering or pre-engineering program at the first school, or should select courses applicable to the requirements of the School of Engineering; otherwise a total of more than four years may be required to obtain the B.S. degree.

Transfer credit will be applied to School of Engineering requirements whenever the courses are equivalent or substantially similar. Transfer credits for courses not required of Stanford engineering students will be substituted for requirements when the over-all program is not reduced in value. The policy of the School is to study each transfer student's preparation and make a reasonable evaluation of his status. Substitution of transfer credit for courses required
by the University is administered by the University Committee on General Studies.

The great flexibility allowed in planning and scheduling individual programs makes it possible for transfer students having wide variations in preparation to plan full programs for each quarter and to progress normally toward graduation.

Undergraduate Engineering Curricula

One objective of the School is to provide a suitable course of study for each student of engineering. This is done by maintaining a number of curricula, as listed below, and allowing modification (within limits) to fit individual needs.

In four professional fields, Civil, Electrical, Industrial, and Mechanical Engineering, curricula accredited by the Engineer’s Council for Professional Development are offered. A curriculum in Engineering Science allows emphasis on the basic sciences and mathematics of engineering; this program will lead, in most cases, to graduate study and research work, and is available only to students of demonstrated competence. A curriculum leading to the B.S. degree in Engineering without specification of a major field, is also available. Courses common to all curricula appear in the first table below. Supplementary lists for each of these curricula will be found in the tables following. A student who satisfactorily completes the courses taken by all students of engineering, together with one of these supplementary lists, will be recommended by the School of Engineering for the degree of Bachelor of Science. (For Chemical Engineering see the section on Chemistry and Chemical Engineering; for Mining, Metallurgical, and Petroleum Engineering, see the section on the School of Mineral Sciences.)

These listed programs are not to be interpreted as rigorous requirements. Substitution of other courses for those indicated, particularly in the supplementary lists, may be allowed with approval of the Registration Committee of the School of Engineering and the Dean. Every student is urged to discuss with his faculty adviser any substitution that would improve the curriculum for his personal needs.

Courses Taken by All Engineering Students

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 51, 53, 55, Engineering Physics</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Math. 10, 11, 21, 22, 23, 24, Analytic Geometry and Calculus (Note 1)</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Chemistry 1, 2, 4, General Chemistry</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>English 1, 2, 3, Freshman English</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>History 10, 11, 12, History of Western Civilization</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>M.E. 9, Engineering Drawing</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 99, Engineering Mechanics (Statics)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 100, Engineering Mechanics (Dynamics)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 101, Engineering Mechanics (Dynamics)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 106, Mechanics of Fluids</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 110, Mechanics of Materials</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 112, Properties of Materials</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>E.E. 100, Principles of Circuits</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 102, Electromechanics I</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>E.E. 102L, Electrical Machinery Laboratory (Note 3)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>I.E. 130, Engineering Economy</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>M.E. 131, Elementary Engineering Thermodynamics</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>General Studies Social Sciences</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>
General Studies Humanities .................................................. 5
Speech 20, Public Speaking (Note 4) ..................................... 3
English 129 (or 131), Scientific Writing (or Exposition) .......... 3

125

Note 1. Math. 41, 42, and 43 may be substituted for Math. 10, 11, 21, 22, and 23.
Note 2. Courses listed above the dashed line are most advantageously completed during the first two years. So, also, are the following: For students of civil engineering: C.E. 20 and 126; for students of electrical engineering: E.E. 100, 102, and 103; for students of industrial engineering: I.E. 100; for students of mechanical engineering: M.E. 50. Other technical and laboratory courses may well be taken in the first two years.
Note 3. Students of electrical engineering will substitute E.E. 155 for E.E. 102L.
Note 4. The General Studies Humanities requirement is for at least 8 units selected from the list of courses given in the section on the General Studies Program. Speech 20 is a requirement of the School of Engineering, and may also be offered as partial fulfillment of the University requirement. For the remaining 5 units at least one of the courses chosen must be selected from the approved list of courses in philosophy, religion, and literature.

Supplementary Requirements

1. CIVIL ENGINEERING

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S. Gla (or 1), Geology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>M.E. 1, Forging and Welding</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>C.E. 20, Surveying</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 107, Mechanics of Fluids</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>C.E. 114, Mechanics of Materials</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 116, Plain Concrete</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 126, Advanced Surveying</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 138, Specifications and Contracts</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 150, Transportation Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 160, Hydrology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 161, Hydraulic Structures</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 180, Elementary Structural Analysis</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 181, Structural Design</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 182, Structural Design</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 190, Soil Mechanics and Foundations</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 198, Senior Report</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Elective Courses as below</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>

The elective courses normally will be selected from undergraduate offerings in civil engineering or closely allied subjects. With permission some courses designated as primarily for graduate students may be included. Suggested use of these units by students with well-defined interests in construction, highway, hydraulic, or structural engineering, or public works administration are listed below.

Construction: C.E. 134, Construction Estimates and Costs (3 units); C.E. 135, Construction Equipment and Methods (3 units); I.E. 133, Industrial Accounting (3 units); Law 101, Business Law (5 units).
Highways: C.E. 151, Highway Engineering (3 units) plus 11 or more units among: C.E. 134, Construction Estimates and Costs (3 units); C.E. 135, Construction Equipment and Methods (3 units); C.E. 162, Hydraulic Engineering (3 units); C.E. 166, Sanitary Engineering (3 units); C.E. 183, Structural Design (2 units); C.E. 230, Civil Engineering Economy (2 units); E.E. 143, Introduction to Electronics (3 units).

Hydraulics: C.E. 162, Hydraulic Engineering (3 units); C.E. 163, Hydraulic Machinery (2 units); C.E. 166, Sanitary Engineering (3 units); Statistics 110, Statistical Methods (4 units); and Mathematics 130, Differential Equations (3 units).

Structures: C.E. 183, Structural Design (2 units); C.E. 184, Statically Indeterminate Structures (3 units); C.E. 162, Hydraulic Engineering (3 units); C.E. 166, Sanitary Engineering (3 units) and Mathematics 130, Differential Equations (3 units).

Public Works Administration: Political Science 100, Public Administration (5 units); C.E. 166, Sanitary Engineering (3 units); I.E. 133, Industrial Accounting (3 units); and one other course selected from civil engineering electives or: Political Science 103, State and Local Government (5 units); Political Science 105, Public Personnel Administration (5 units); Law 101, Business Law (5 units); Psychology 192, Industrial Relations (4 units).

Strict adherence to one of these programs is not required. Students whose interests lie primarily in engineering administration may select industrial engineering courses. Students preparing for graduate study in engineering mechanics should include Mathematics 130 and M.E. 160 as part of their undergraduate programs in Civil Engineering. Students preparing to take graduate work in sanitary engineering at another university should include Biology 1 and 2 (6 units) or Biology 20 (5 units), Bacteriology 101 (5 units) and C.E. 166, Sanitary Engineering (3 units) among their electives.

2. ELECTRICAL ENGINEERING

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. 3</td>
<td>Machine Shop</td>
<td>2</td>
</tr>
<tr>
<td>Phys. 57</td>
<td>Engineering (Atomic) Physics</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 103</td>
<td>Principles of Fields</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 104, 105, 106, Circuits</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>E.E. 116, Circuits: Transients</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>E.E. 117, Circuits: Transmission Lines</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 124, Electromechanics II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 150, 151, 152, Electronics</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>E.E. 155, 156, 157, Laboratory</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>E.E. 160, Electronic Circuits</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Optional program A, B, or C as below</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

Note: Students in electrical engineering may, with their advisor’s approval, omit from the list “Courses Taken by All Students of Engineering” the course Met.E. 104 and substitute a course of at least equal credit in engineering, physical science, or mathematics. Engrg. 150, Introductory Science of Materials, is particularly recommended for this purpose.

Courses to complete the undergraduate program will be selected according to the student’s interest. The following three lists of courses are suggested. These are arranged for three general types of interest in electrical engineering,
and students who wish variations or intermediate arrangements should see their faculty advisers.

List A is for students with a primary interest in the business and administrative aspects of electrical engineering such as plant management, contracting, selling, and application engineering. Students who like to deal with people, and prefer committee work to laboratory work, may wish to choose this list.

At least 17 units of work are to be taken from the following list or from the courses listed for industrial engineering (either the required or substitute list except E.E. 143).

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psych. 1, General Psychology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>E.E. 108, Illumination</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 125, 126, Electrical Machinery</td>
<td>3, 3</td>
<td></td>
</tr>
<tr>
<td>E.E. 128, Control Systems</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 135, Machinery Laboratory</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>E.E. 138, Servomechanisms Laboratory</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>E.E. 161, 162, Electronic Circuits, Radio Engineering</td>
<td>3, 3</td>
<td></td>
</tr>
<tr>
<td>E.E. 170, 171, 172, Electronic Measurements</td>
<td>3, 3, 3</td>
<td></td>
</tr>
<tr>
<td>E.E. 200, Seminar</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

List B is for students who expect to engage in technical electrical engineering work such as design or operation of apparatus, circuits, or systems. This is the standard preparation for the professional electrical engineer. Graduate study leading to the Master of Science or Engineer degree is recommended to follow this program.

At least 17 units of work are to be taken from the following list. The first course, Mathematics 130, is required; others are optional, depending on interest.

Substitution of Physics 87, 89, and a 3-unit course elected from mathematics or physics in place of C.E. 99, 100, and 101 is suggested for consideration by the student. Such substitution requires a petition.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 130, Ordinary Differential Equations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 128, Control Systems</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 161, 162, Electronic Circuits, Radio Engineering</td>
<td>3, 3</td>
<td></td>
</tr>
<tr>
<td>E.E. 170, 171, 172, Electronic Measurements</td>
<td>3, 3, 3</td>
<td></td>
</tr>
<tr>
<td>E.E. 270, Elementary Electromagnetic Theory</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 220, Advanced Electronic Circuits</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 231, Electron Devices</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 235, Network Analysis</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 125, 126, Electrical Machinery</td>
<td>3, 3</td>
<td></td>
</tr>
<tr>
<td>E.E. 135, Electrical Machinery Laboratory</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>E.E. 138, Control Systems Laboratory</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>E.E. 108, 109, Illumination</td>
<td>3, 3</td>
<td></td>
</tr>
<tr>
<td>E.E. 200, Seminar</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

List C is for students interested in science and mathematics, preparing for life work in electrical engineering research or teaching. This course should be followed by graduate study, possibly to the Ph.D. degree, in preparation for such positions.

The following courses are to be taken, and also 7 units are to be elected from reasonably advanced courses in electrical engineering, physics, mathematics, and chemistry.
To allow time for these courses, the following will be omitted from the list of “Courses Taken by All Students of Engineering”: C.E. 99, 100, 101, 110, 112, and Met.E. 104 (total, 17 units). Note, however, that these C.E. courses may be omitted only if the student is taking all the following List C courses with the expectation of pursuing graduate study. (In this program, Physics 87 replaces C.E. 100 as a prerequisite for C.E. 106.)

### Course No. Subject Units

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phys. 87, 89, Mechanics</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Math. 130, Ordinary Differential Equations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Mathematics, any suitable mathematics courses</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>E.E. 161, Electronic Circuits</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 170, 171, Electronic Measurements</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>E.E. 270, Elementary Electromagnetic Theory</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Electives, restricted as above</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Omissions as above</td>
<td>(—17)</td>
<td></td>
</tr>
</tbody>
</table>

3. **INDUSTRIAL ENGINEERING**

### Course No. Subject Units

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. 1, 2, 3, Engineering Shops</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>M.E. 50, Engineering Kinematics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>E.E. 143, Electronics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I.E. 100, Industrial Organization and Management</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>I.E. 108, Motion and Time Study</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I.E. 109, Production Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I.E. 110, Production Control</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I.E. 118, Motion and Time Study Laboratory</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>I.E. 119, Production Engineering Laboratory</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>I.E. 120, Statistical Quality Control</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>I.E. 133a, Industrial Accounting</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>I.E. 161, Introduction to Data Processing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I.E. 190, Seminar</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>M.E. 103, Advanced Machine Shop</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Stat. 27, Introduction to Theory of Probability</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Stat. 110, Statistical Methods</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Law 101, Business Law</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Psych. 192, Industrial Relations</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Industrial engineering students may, with the adviser’s approval, substitute as many as 15 units of junior, senior, or graduate engineering courses or courses listed below for an equal number of units from the above list. They may also substitute such work for Mathematics 24.

M.E. 110, Algebraic Methods in Engineering (2 units); Econ. 145, Labor Economics (5 units); Law 102, Business Law (5 units); Math. 123, Theory of Probability (4 units); Psych. 113, Industrial Psychology (3 units); Stat. 119, Elementary Statistical Inference (3 units); Stat. 120, Statistical Inference (3 units); Stat. 214, Experimental Statistics (3 units); Stat. 216, Sampling Inspection (3 units).

4. **MECHANICAL ENGINEERING**

### Course No. Subject Units

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. 1, 2, 3, Engineering Shops</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>M.E. 50, Kinematics</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
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M.E. 110, Algebraic Methods in Engineering ........................................... 2
M.E. 114a, b, Mechanical Engineering Design ....................................... 7
M.E. 118 (or Math. 130), Differential Equations in Engineering ............. 3
M.E. 122, Mechanical Engineering Laboratory ...................................... 3
M.E. 123, Heat and Power Laboratory ............................................... 4
M.E. 133, Engineering Thermodynamics ............................................. 3
M.E. 160, Engineering Dynamics ........................................................ 3
C.E. 107, Mechanics of Fluids ........................................................... 2
C.E. 114, Mechanics of Materials ..................................................... 3
E.E. 143, Introduction to Electronics ................................................ 3
Restricted Electives, as below ............................................................. 11 or 12

53 or 54

Students who do not plan to do graduate work should take M.E. 118, and may take Mathematics 130 also as a restricted elective. Students who are planning to do graduate work may substitute Mathematics 130 for M.E. 118, but those who do so may not count Mathematics 130 as one of their "restricted electives."

Each student is required to select one or more of the following groups of courses according to his major interests.

Aeronautics: M.E. 145, Elementary Airplane Structures (2 units); M.E. 146, Introduction to Aerodynamics (2 units); plus 8 units from: C.E. 180, Elementary Structural Analysis (4 units); M.E. 135, Heat Transmission (2 units); M.E. 136, Gas Dynamics (2 units); M.E. 161, Dynamics of Machinery (3 units); Mathematics 106, Introduction to Functions of a Complex Variable (3 units); Mathematics 130, Ordinary Differential Equations (3 units); Mathematics 131, Partial Differential Equations I (3 units); total 12 units.

Mechanical Engineering Design: M.E. 114c, Mechanical Engineering Design (3 units); M.E. 161, Dynamics of Machinery (3 units); plus 5 units from: M.E. 103, Advanced Machine Shop Practice (2 units); M.E. 135, Heat Transmission (2 units); C.E. 180, Elementary Structural Analysis (4 units); E.E. 128, Servomechanisms (3 units); E.E. 151, Electronics (1 unit*); E.E. 152, Electronics (2 units); Mathematics 130, Ordinary Differential Equations (3 units); Mathematics 131, Partial Differential Equations I (3 units); total 11 units.

Heat and Power: Any three of M.E. 134, Thermodynamics (2 units); M.E. 135, Heat Transmission (2 units); M.E. 136, Gas Dynamics (2 units); M.E. 137, Combustion (2 units); plus 5 units from: the one remaining course not already chosen from the preceding four (2 units); C.E. 163, Hydraulic Machinery (2 units); Mathematics 130, Ordinary Differential Equations (3 units); Mathematics 131, Partial Differential Equations I (3 units); Physics 57, Atomic Physics (3 units); M.E. 161, Dynamics of Machinery (3 units); M.E. 171, Introduction to Nuclear Engineering (3 units); total 11 units.

Engineering Mechanics: M.E. 161, Dynamics of Machinery (3 units); C.E. 180, Elementary Structural Analysis (4 units); plus 6 units from: M.E. 136, Gas Dynamics (2 units); M.E. 145, Elementary Airplane Structures (2 units); E.E. 128, Servomechanisms (3 units); Mathematics 106, Introduction to Functions of a Complex Variable (3 units); Mathematics 113, Vector Analysis (3 units); Mathematics 130, Ordinary Differential Equations (3 units); Mathematics 131, Partial Differential Equations I (3 units); total 12 units.

* Students electing this group may substitute E.E. 150 (2 units) and one unit of E.E. 151 (2 units) for E.E. 143. The other unit of E.E. 151 can then be counted as a restricted elective.
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**Nuclear Engineering:** Physics 57, Atomic Physics (3 units); M.E. 171, Introduction to Nuclear Engineering (3 units); plus 5 units from: M.E. 134, Thermodynamics (2 units); M.E. 135, Heat Transmission (2 units); Met.E. 124, Physical Metallurgy I (4 units); Mathematics 130, Ordinary Differential Equations (3 units); Mathematics 131, Partial Differential Equations I (3 units); total 11 units.

**5. ENGINEERING SCIENCE**

This curriculum is a program of applied science, leading in most cases to further study at the graduate level, and designed for those individuals whose interests extend outside the area covered by any one of the departmental engineering programs. Emphasis is placed on developing the ability to approach new problems, both those which are purely technical and those which involve consideration of social, economic, and human values. Thus applied science and General Studies courses are given precedence over those which deal primarily with standard methods in engineering practice.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 130</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
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<tr>
<td>Math. 131</td>
<td>Partial Differential Equations I</td>
<td>3</td>
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<tr>
<td>Physics 57</td>
<td>Atomic Physics</td>
<td>3</td>
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<tr>
<td>Restricted Electives as listed below</td>
<td>27</td>
<td></td>
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<tr>
<td>Unrestricted electives to bring total units to</td>
<td>180</td>
<td></td>
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In order to provide time for these courses, any or all of the following courses may be omitted from the list of “Courses Taken by All Engineering Students”: C.E. 110, C.E. 112, E.E. 102, E.E. 102L, Met.E. 104 (total 11 units). In addition the following substitutions may be made: Physics 87, 89, and 3 additional units of restricted electives for C.E. 99, 100, and 101.

**Restricted Electives:** A total of 30 units (or 27 if C.E. 99, 100, and 101 are chosen) selected from the following list of technical courses. Of these, a minimum of 3 units are to be in laboratory work chosen from the first five courses listed: M.E. 122, Mechanical Engineering Laboratory (3 units); E.E. 155, 156, 157, Electrical Engineering Laboratory (6 units); E.E. 170, 171, 172, Electronic Measurements (9 units); E.E. 138, Servomechanisms Laboratory (2 units); E.M. 205, Experimental Stress Analysis (3 units); C.E. 107, Mechanics of Fluids (2 units); C.E. 114, Mechanics of Materials (3 units); C.E. 180, Elementary Structural Analysis (4 units); C.E. 292, Statically Indeterminate Structures (3 units); E.E. 103, Principles of Fields (3 units); E.E. 104, 105, 106, Electric Circuits (9 units); E.E. 116, Transients (2 units); E.E. 124, Electromechanics II (3 units); E.E. 128, Control Systems (3 units); E.E. 150, 151, 152, Electronics (6 units); E.E. 160, Electronic Circuits (3 units); E.E. 235, Network Analysis (3 units); E.E. 270, Elementary Magnetic Theory (3 units); E.M. 200, Theory of Structures (3 units); E.M. 221*, 222*, 223*, Advanced Dynamics (6 units); M.E. 118, Differential Equations in Engineering (3 units); M.E. 133, 134, 135, 136, 137, Engineering Thermodynamics (11 units); M.E. 160, 161, Engineering Dynamics (6 units); Mathematics 100, Advanced Calculus (3 units); Mathematics 106, Functions of a Complex Variable (3 units); Mathematics 113, Vector Analysis (3 units); Mathematics 132, Partial Differential Equations II (3 units); Mathematics 137, 138, Numerical Methods (6 units); Stat. 110, Statistical Methods in Engineering (4 units); Stat. 27, Introduction to Theory of Probability (3 units); Physics 111, 113, 115, Intro-

*Undergraduates registering for these courses should have completed Mathematics 130 and Physics 89 or C.E. 101.
duction to Theoretical Physics (9 units); Physics 173, Thermodynamics (3 units); Physics 175, Introduction to Statistical Mechanics (3 units); Engrg. 150, Introductory Science of Materials (3 units); Engrg. 152, Electric and Magnetic Properties of Materials (3 units).

Unrestricted Electives: A possible 30 (or more) units of unrestricted electives allows considerable freedom in adapting this program to individual needs and interests. These elective units may be used for further studies in basic engineering science, or for more specialized engineering courses, or for additional General Studies courses in which the student encounters social and human value considerations.

To be eligible for admission to the Engineering Science program, the student must have a good record, including not less than a B average in both mathematics and physics. Each student’s schedule of electives must be approved by the Engineering Science Committee of the School of Engineering at the time of his admission to the program.

6. ENGINEERING WITHOUT SPECIFICATION OF A MAJOR FIELD

The Bachelor of Science degree in Engineering without specification of a major field is intended to prepare students for some definite objective involving engineering. It is for those who desire an engineering education as preparation for a business career, or who are going into the commercial aspects of engineering, or who wish to complete an engineering program with ROTC in four years, etc. It is also for students who desire a background involving unusual combinations in engineering that do not fit into the existing accredited curricula.

Students who wish to obtain a Bachelor of Science degree in Engineering without specification of a major field must submit a petition to the Dean of Engineering outlining their program and plans. Such petitions will be examined by the Registration and Graduation Committee of the School of Engineering and approved only if they provide for a coherent plan and are adequate in quantity and quality of work. These petitions should be filed not later than the end of the third quarter preceding graduation. Petitions received later than this will be acted upon favorably only if there is a special justification for doing so. All petitions must be approved by a faculty adviser before they will be considered by the Committee.

The requirements for the Bachelor of Science degree in Engineering without specification of a major field are as follows:

a) “Courses Taken by All Engineering Students” as listed early in this section.

b) An additional 59 units, constituting a coherent program. At least 20 of these units must be School of Engineering courses.

Students considering a Bachelor of Science degree in Engineering without specification of a major field should recognize that this degree is not accredited by the Engineer’s Council for Professional Development, and therefore may not be recognized by state boards of registration of engineers. Also, students graduating with this degree who later wish to carry on graduate work at Stanford or elsewhere will require more than one academic year to complete the program for the Master of Science degree in a particular field of engineering.

ROTC

Reserve Officers’ Training Corps are maintained at Stanford by the Army, the Navy, and the Air Force (see Air, Military, and Naval Science in this Bulletin). Students following a curriculum to obtain a Bachelor of Science
degree in Engineering, without specification of a major field, will be able to graduate in four years while pursuing an ROTC program. Students following an accredited engineering curriculum will usually require more than four academic years (twelve quarters) in the University to obtain a baccalaureate degree. Since the Air, Military, and Naval Science programs require 36 units of specialized work, and since the additional units of the accredited engineering programs will vary, this will normally require from one to three extra quarters of study depending upon individual circumstances. ROTC students staying for more than one extra quarter can often arrange their programs to include one or even two sequences of graduate courses in their major field while working for their baccalaureate degrees.*

Comprehensive Five-Year Programs

For students who desire a broader training than any included in one of the regular four-year programs of the School of Engineering, comprehensive five-year programs leading to the degree of Bachelor of Science in Engineering are offered. These programs are worked out in cooperation with the students concerned, and can usually include one or two sequences of graduate courses in the student's field of major interest.

Dual Degree Programs

Stanford University cooperates with certain liberal arts colleges (presently Claremont Men's College, the College of Idaho, Hastings College, Knox College, Pacific Lutheran College, George Pepperdine College, The University of Redlands, Whittier College, and Willamette University) in providing a program that leads to concurrent award of the A.B. degree by the college and the B.S. degree by Stanford. These programs comprise three years of study at the college, with some emphasis on mathematics and science, followed by two years of study of engineering at Stanford. Inquiries may be addressed to the Dean of Engineering at Stanford, or to the above listed colleges. Superior students with an A.B. or B.S. in physical sciences may also be eligible to earn an M.S. at Stanford by taking two years of graduate work.

GRADUATE DIVISION

Admission

Application for admission with graduate standing in the School should be made to the Director of Admissions of the University; applications are reviewed by the appropriate department of the School before admission is authorized. Inquiries may be addressed to the Dean of Engineering or to the Executive Head of the department.

Registration

New graduate students should consult the faculty member who acts as adviser in the student's field (or departmental secretary) on registration day of his first quarter for advice in planning his program and for instruction on departmental procedures.

Graduate Engineering Curricula

Departments and Divisions of the School offer graduate curricula, as follows:

* Residence credit toward an advanced degree, however, cannot be obtained until the baccalaureate degree program has been completed.
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<tr>
<th>AERONAUTICAL ENGINEERING</th>
<th>MECHANICAL ENGINEERING</th>
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<tr>
<td>Aircraft Design</td>
<td>Thermodynamics</td>
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<td>Aircraft Structures</td>
<td>Heat Transfer</td>
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<td>Aerodynamics</td>
<td>Fluid Mechanics</td>
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<td>Physical Aspects of Aeronautics</td>
<td>Design</td>
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<td>Nuclear Power</td>
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<tr>
<th>CIVIL ENGINEERING</th>
<th>ELECTRICAL ENGINEERING</th>
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<tr>
<td>Civil Engineering Admin.</td>
<td>Administration</td>
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<tr>
<td>Hydraulic Engineering</td>
<td>Communication Theory</td>
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<tr>
<td>Structural Engineering</td>
<td>Computers</td>
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<tr>
<td>Construction Engineering</td>
<td>Control Systems</td>
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<tr>
<td>Public Works Admin.</td>
<td>Electron Tubes</td>
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| ENGINEERING MECHANICS     | |
|---------------------------| |
| Engineering Statistics    | |
| Engineering Economy      | |
| Data Processing           | |

| ENGINEERING SCIENCE       | |
|---------------------------| |
| Engineering Statistics    | |
| Engineering Economy      | |
| Data Processing           | |

| INDUSTRIAL ENGINEERING    | |
|---------------------------| |
| Engineering Statistics    | |
| Engineering Economy      | |
| Data Processing           | |

For further details see the department sections following.

**Fellowships and Assistantships**

Each department and division of the School of Engineering awards a number of fellowships, research assistantships, and teaching assistantships each year. Information and application blanks may be obtained from the head of the appropriate department or division.

**Master of Science**

The degree of Master of Science (M.S.) is conferred on graduate students in engineering according to the University regulations stated elsewhere. However the presentation of a thesis is not required for the Master of Science degree in Engineering.

**Four-two program**: Superior students who have completed a four-year B.A. or B.S. in physical science with adequate physics and mathematics may complete the requirements for an M.S. in engineering at Stanford in two academic years (six quarters). Programs will be worked out in consultation with an adviser from the department in which the student wishes to study. Further information may be obtained from the Dean of Engineering.

**Engineering Science**: The degree of Master of Science is available to those who wish to follow a program of study emphasizing the scientific background of some aspect of engineering, and which does not conform to a normal graduate program in a department. Such programs usually combine work in several engineering departments, or contain an unusual amount of mathematics, physics, chemistry, statistics, etc. Application for candidacy for the Master of Science in Engineering Science should be made to the Dean of Engineering. Only students with superior academic records will be accepted for this type of program.

**Engineer**

The degree of Engineer is awarded at the completion of a comprehensive two-year program of graduate study. It is intended for those who desire more graduate training than can be obtained in a Master of Science program but who do not wish to undertake a Ph.D. program. The program of study must satisfy the student's department and include 90 units of which at least 60 must
be devoted to advanced or graduate study in the major subject or intimately allied subjects. The presentation of a thesis is required. The University regulations for the Engineer degree are stated in the section "Degrees" in this Bulletin, and further information will be found in the department sections following.

Doctor of Philosophy

Programs leading to the degree of Doctor of Philosophy are offered in each of the departments and divisions of the School. University regulations are given in the section "Degrees" in this Bulletin, and further information will be found in the department sections following.

DIVISION OF AERONAUTICAL ENGINEERING

Emeritus: William Frederick Durand (Professor)

Executive Head: Nicholas John Hoff
Associate Professor: Daniel Bershadner
Research Supervisor and Lecturer: Irmgard Flügge-Lotz

Offerings and Facilities

The work offered by this Division is intended to prepare the student for a professional career in aeronautical design, research, or teaching, and may lead to the degree of Master of Science, Engineer, or Doctor of Philosophy in Aeronautical Engineering. The requirements for all three degrees include training in the fields of aerodynamics, aircraft structures, and mathematics.

Facilities for Instruction and Research

The work of the Division is centered in the Daniel Guggenheim Aeronautical Laboratory and the Aeroscience Laboratory.

The Guggenheim Laboratory houses classrooms, library, aerodynamic laboratory, and offices. The library contains a collection of text and reference books, reports of the principal aeronautical research organizations, and files of scientific journals and technical periodicals. In the laboratory are a 7.5-foot subsonic wind tunnel (with six-component balance, propeller dynamometer, pressure manometers, etc.) and a portable 1-foot subsonic tunnel used for demonstration and calibration.

The Aeroscience Laboratory houses research laboratories for structures and gas dynamics, a laboratory for student instruction in experimental aerodynamics, a machine shop, and faculty offices. The structures laboratory is set up with particular emphasis on equipment suitable for the study of structural behavior at high temperatures. Quartz-lamp heaters are used to produce rapid changes of temperature both spacewise and timewise. Ovens capable of maintaining temperatures of 1,000 degrees Fahrenheit are also used to investigate the effects of creep on stress distribution and structural stability. The facilities
AERONAUTICAL ENGINEERING

in the student-instruction laboratory, which are also available for research projects, include a supersonic jet; a small, low-turbulence stream; a shock tube; optical equipment, including schlieren and interferometer apparatus; equipment for studying magnetic effects in fluid flow; and associated control and recording devices. In the gas-dynamics laboratory, hypersonic wind tunnels are under construction for the investigation of high-temperature gas flows with regard to both their aerodynamic and structural effects.

The Division also sponsors a student branch of the Institute of Aeronautical Sciences which conducts periodic meetings and visits to nearby research, military, and industrial establishments.

Admission and Registration

To be eligible for registration in the Division a student must have received the Bachelor's degree in engineering, or an acceptable equivalent, and will be expected to have had either the undergraduate courses M.E. 118, Differential Equations in Engineering, 3 units, M.E. 145, Elementary Airplane Structures, 2 units, M.E. 146, Introduction to Aerodynamics, 2 units, and M.E. 160, Engineering Dynamics, 3 units, or their substantial equivalents. Students with this preparation should be able to qualify for the Master's degree in Aeronautical Engineering in three quarters of work at Stanford. Students with Bachelor's degrees in physical science may find it preferable to enter the two-year program leading to the Master's degree referred to under "Graduate Division" above. Registration is carried out in accordance with the general rules outlined under "Graduate Division" above.

Master of Science

The University's basic requirements for the Master's degree are outlined in the section "Degrees" in this Bulletin. The following are Divisional requirements.

To secure the recommendation of the Division for the Master's degree, a candidate must complete a minimum of 6 graduate units in each of the following fields, (1) Aerodynamics, (2) Structures, and (3) Mathematics. In addition to these 18 units of Restricted Electives, the program calls for a minimum of 18 units of Approved Electives and 9 units of Free Electives, making in all 45 units of course work. A list of the courses from which the 18 units of Restricted Electives must be chosen, together with a list of courses currently accepted as Approved Electives, can be obtained by application to the Division. No thesis is required. In this work a minimum grade point average of 2.75 in engineering courses is expected.

Engineer

The University's basic requirements for the Engineer's degrees are outlined in the section "Degrees" in this Bulletin. The following are Divisional requirements. In addition to satisfying the Division's requirements for the Master's degree, the candidate must complete: (a) 24 units of Approved Electives, of which 15 will usually be taken in one of the following fields; (1) Aircraft Design, (2) Aircraft Structures, (3) Aerodynamics, or (4) Physical Aspects of Aeronautics, and 9 units will be in Mathematics, (b) 15 units of Engineer's Thesis, and (c) 6 units of Free Electives. A list of courses currently accepted as Approved Electives can be obtained by application to the Division. Candidates for the degree of Engineer will be expected to have a minimum scholastic average of 3.00 for work in engineering courses beyond those required for the Master's degree.
Doctor of Philosophy

The University's basic requirements for the Ph.D. degree are outlined in the section "Degrees" in this Bulletin. The requirements of the Division include one or more qualifying oral examinations early in the second year of graduate study, and the presentation of a satisfactory program after consultation with the faculty member who will direct the dissertation research. The requirements for the M.S. degree (see above) must be satisfied.

Undergraduate Courses in the Aeronautical Engineering Program

Elementary Airplane Structures—See Mechanical Engineering 145.
Introduction to Aerodynamics—See Mechanical Engineering 146.

Courses Primarily for Graduate Students

200a. Wing Theory—Primarily, theory of lift and resistance of monoplane and multiplane. Prefaced by fundamental hydrodynamics, followed by applications to wind tunnel boundary influence, ground effect, downwash, etc.; includes wing pitching moments, elementary profile theory. (Formerly 240a.) Prerequisites: C.E. 100 and 106, and (or concurrent registration in) C.E. 107 and M.E. 146.
3 units, autumn, (Reid), MWF 9

200b. Aerodynamics of the Airplane—Span load distribution; viscosity; boundary layer and skin friction; boundary layer control and effects on drag and separation; control and lift augmenting devices; (subsonic) compressibility effects; mutual interference; aerodynamic characteristics of complete airplane; static and elementary dynamic stability; controllability. (Formerly 240b.) Prerequisite: 200a.
3 units, winter, (Reid), MWF 9

200c. Airplane Performance—Generalized drag and power equations; rigorous methods of predicting performance for propeller-driven and turbojet airplanes; special problems of range, endurance, take-off, landing; estimation of performance characteristics by use of formulae and charts. (Formerly 240c.) Prerequisites: 200b and 201.
3 units, spring, (Reid), MWF 9

201. Aircraft Propellers—Modern screw propulsion theory developed and correlated with experimental results to enable the intelligent selection of propellers for, and prediction of performance of, aircraft powered by reciprocating and turbo-prop engines. Influences of design and operating parameters upon characteristics of controllable, constant speed, and dual rotation propellers are examined in some detail. (Formerly 243.) Prerequisite: 200a.
2 units, winter, (Reid), TTh 9

203. Aerodynamic Laboratory—Demonstrations and experiments to familiarize students with operating characteristics of a wind tunnel; with use of associated equipment for measuring pressures, velocities, forces; with aerodynamic properties of wings and bodies of simple geometric form; with principal characteristics of boundary layer. (Formerly 245.) Prerequisite: 200b.
3 units, spring, (Reid), by arrangement

205a, b. Aerodynamic Design—Layout, general design of an airplane for a specific duty, including analysis and prediction of stability, controllability, performance. (Formerly 248a, b.) Prerequisites: 200a, b, c.

205a. 5 units, autumn, (Reid), by arrangement
205b. 2 units, winter, (Reid), by arrangement

210a. Fundamentals of Gas Dynamics—Fundamentals of continuum compressible flow from the standpoint of the aeronautical engineer: basic thermodynamics; steady and unsteady one-dimensional flow; shock waves; simple
expansion waves. (Formerly 250a.) Prerequisites: M.E. 118 (or Mathematics 130), M.E. 133 and 146. (The Mathematics 130 and/or M.E. 146 may be taken concurrently.) Students planning to continue with A.E. 210b should note the additional prerequisites for that course.

3 units, autumn, (Vincenti), MWF 10

210b. Fundamentals of Gas Dynamics—continuation of 210a: Airfoils in two-dimensional supersonic flow; general equations and principles of three-dimensional steady flow; exact solutions; small-disturbance approximation. (Formerly 250b.) Prerequisites: 210a and E.M. 242, and concurrent registration in Mathematics 131 or E.M. 251.

3 units, winter, (Vincenti), MWF 11

210c. Fundamentals of Gas Dynamics—continuation of 210b: Slender-body theory; similarity rules for subsonic, transonic, supersonic, and hypersonic flow; method of characteristics; effects of viscosity, including aerodynamic heating and shock-wave boundary-layer interaction. (Formerly 250c.) Prerequisite: 210b.

3 units, spring, (Vincenti), MWF 8

214. Transonic Flow Theory—Subsonic, transonic, and supersonic flows from the unifying viewpoint of the transonic small-disturbance theory: physical description of flow fields; fundamental equations; exact solutions; hodograph method; approximate methods; applications to thin airfoils and slender bodies; equivalence and area rules. Prerequisite: 210c.

2 units, autumn, (Spreiter), TTh 8

215. Supersonic Flow Theory—Linearized theory of flow at supersonic speeds: three-dimensional wings in steady flight; two-dimensional wings in unsteady flight with applications to flutter and gust response; wing-body interference problems with emphasis on minimum-drag configurations. Prerequisite: 210c.

2 units, winter, (Lomax), TTh 8

216. Hypersonic Flow Theory—Aerodynamics at supersonic speeds so great that nonlinearities are essential: improvements on linearized theory; Newtonian, shock-layer, and other methods for blunt bodies; blast-wave theory and self-similar solutions; viscous interaction; numerical methods. Prerequisite: 210c.

2 units, spring, (Van Dyke), TTh 8

220. Aerodynamic Physical Measurements—Lecture-laboratory course on experimental aerodynamics emphasizing compressible flow; analysis of pressure, velocity, Mach number, density, heat transfer, turbulence measurement problems, with reference both to standard methods and current research techniques; general treatment of dynamic response; experiments involving use of schlieren, interferometry, hot-wire anemometry, supersonic jet apparatus, and associated electronics. (Formerly 255.) Prerequisite: 210a.

3 units, spring, (Bershader), by arrangement

221. Experimental Aerophysics—Lecture-laboratory course on advanced physical measurements in gas dynamics with emphasis on recent developments; simulation of high altitude, hypervelocity phenomena; problems of experimental high-temperature gas dynamics; principle and applications of the shock tube; modern aeroballistic investigations; procedures in low-density gas dynamics; study of atom/molecular effects in flows; experimental magnetohydrodynamics. Prerequisite: 220.

2 units, autumn, (Bershader), by arrangement

229a. Physics of High-Speed Gas Flow—Introduction to the physical principles underlying the flow of gases at high speeds and temperatures: outline of relative concepts from kinetic theory, atomic physics, and statistical mechanics; application to study of chemical equilibrium, transport properties, and rate
processes; aerodynamics of ionized and radiating gases; flow of conducting gases in magnetic and electric fields. Prerequisite: 210c or permission of instructor.

2 units, winter, (Smelt, Griffith), by arrangement


2 units, spring, (Smelt, Griffith), by arrangement

230. Principles of Helicopter Design—Background of helicopter development, selection of parameters, general helicopter design considerations, performance methods, structural criteria. (Formerly 260a.) Prerequisite: M.E. 146.

2 units, winter, (Wiesner), M 7:30–9:30 p.m., alternate years, to be given in 1958–59

231. Principles of Helicopter Design—Discussion of stability and control, helicopter power and rotor systems, airworthiness and operational requirements. (Formerly 260b.) Prerequisite: 230.

2 units, spring, (Stuart), M 7:30–9:30 p.m., alternate years, to be given in 1958–59


3 units, autumn, (Niles), MWF 8

241n. Thin-Walled Beams and Columns—Bending and torsion of thin-walled shells, columns, and compression panels, incomplete tension field beams. (Formerly 241b.) Prerequisites: 240n and M.E. 145.

3 units, winter, (Niles), MWF 10

242. Airplane Structural Theory—Combined stresses, connections, beam-columns, rings, weight-strength analysis, shear lag. (Formerly 241c.) Prerequisite: 240n.

3 units, spring, (Niles), MWF 10

245n. Advanced Aircraft Structures—Problems of aircraft stress analysis: pressure cabins; testing of aircraft structures and their elements; sandwich plates. (Formerly 246a.) Prerequisites: 242, or E.M. 202 and 206.

2 units, winter, (Flügge), by arrangement

246n. Aircraft Structural Dynamics—Impact on landing gears; aeroelastic problems; flutter. (Formerly 246b.) Prerequisite: 242 or E.M. 202.

2 units, spring, (Flügge), by arrangement

249a, b. Airplane Structural Design—Civil Aeronautics Authority structural design requirements, preparation of partial stress analysis and detail design of airplane developed in 205; study of recent literature with application of various proposed methods of stress analysis to that design. Prerequisites: 205a, 241n, and 242.

249a. 3 units, winter, (Niles), by arrangement

249b. 3 units, spring, (Niles), by arrangement

250n. Thermal Effects in Structures—Heat transfer from boundary layer to surface of structure in supersonic airflow, analysis of distribution of temperature in structure. (Formerly 271.) Prerequisite: E.M. 200.

2 units, winter, (Hoff), TTh 10

251n. Thermal Effects in Structures—Calculation of thermal stresses, buckling of rods, plates, shells under action of thermal stresses, reduction in rigidity of structure in consequence of thermal buckling. (Formerly 272.) Prerequisite: E.M. 200.

2 units, spring, (Hoff), TTh 10

255n. Creep Effects in Structures—Phenomenon of creep; its effect on distribution of stresses in structural elements; buckling caused by creep; con-
cept of structural safety in presence of creep. (Formerly 275.) Prerequisite: E.M. 200.

2 units, autumn, (Hoff), TTh 10

290. Aeronautic Problems—Investigation, experimental or otherwise, of problems in aeronautics. Offers opportunity to students to work in any field of aeronautics of special interest.
1 to 5 units, any quarter, (Staff), by arrangement

295. Seminar in Solid Mechanics—Problems in all branches of solid mechanics. Credit given to students presenting oral reports.
1 unit, autumn, winter, and spring, (Goodier), Th 3:15

296. Seminar in Fluid Mechanics—Problems in all branches of fluid mechanics. Credit given to students presenting oral reports.
1 unit, autumn, winter, and spring, (Flügge-Lötz, Vincenti), T 4:00 alternate weeks

2 to 15 units, any quarter, (Staff), by arrangement

Autumn, winter, and spring, (Staff), by arrangement

CIVIL ENGINEERING

Emeriti: John Charles Lounsbury Fish, Charles Moser, Stephen P. Timoshenko, James Bertrand Wells, (Professors); Eugene Valentine Ward, (Lecturer)

Executive Head: Ray K. Linsley

Professors: Wilhelm Flügge, Eugene Lodewick Grant, Ray K. Linsley, Alfred Salem Niles, Clarkson Hill Oglesby, John King Vennard, Harry A. Williams, Donovan Harold Young

Associate Professors: Jack R. Benjamin, Joseph B. Franzini, James Monroe Gere

Assistant Professors: John Walker Fondahl, Byrne Perry, Cedric W. Richards. Acting: Leonard Bush Baldwin

Lecturers: John A. Blume, Nathaniel J. Kendall, Richard R. Kennedy, Leon D. Luck, Robert R. Matheu, Samuel B. Morris

Offerings and Facilities

The undergraduate Civil Engineering program provides a well-balanced program stressing the fundamentals common to all special fields of civil engineering. Elective units permit the student to make a further selection of general courses or, if his interests are well defined, to specialize slightly in a definite branch, such as construction, highways, hydraulics, public works administration, or structures. Well-equipped laboratories are available to supplement the lecture courses.

The Civil Engineering Department, in collaboration with other departments of the University, offers graduate programs with particular strength in Structural Engineering
Hydraulic Engineering (Hydrology and Fluid Mechanics)
Civil Engineering Administration
Public Works Administration
Construction Engineering
Water Resources Studies
Bachelor of Science

In addition to the basic University requirements for the B.S. degree, students in civil engineering must complete the specific course requirements for all engineers and for Civil Engineering.

Master of Science

Programs are available leading to the degree of M.S. in civil engineering with special designation on the diploma as follows: Civil Engineering Administration, Construction, Hydraulic Engineering, Structural Engineering, and Public Works Administration. A general M.S. in civil engineering without special designation is also given. Detailed statements of the general requirements for all Master's degrees and the specific course requirements for a degree with special designation may be secured by request to the Civil Engineering Department.

Students having undergraduate degrees in civil engineering normally can satisfy requirements for the M.S. degree with three quarters of graduate work of satisfactory quality. Students with undergraduate degrees in other fields may need longer residence for the M.S. degree as they will be required to make up any deficiencies in basic undergraduate civil engineering subjects.

Engineer

A minimum of six quarters of graduate work including a thesis is required for the degree of Engineer in Civil Engineering. The student normally should start his thesis early in the fourth quarter of graduate work. Programs leading to the degree of Engineer are offered in the fields of specialization mentioned above.

Doctor of Philosophy

The degree of Doctor of Philosophy is offered under the general regulations of the University. This program requires a minimum of three years (nine quarters) of graduate study, at least one year of which must be at Stanford. The first year is represented by the M.S. program described above. The second year will be devoted partly to additional courses of graduate study and partly to the preliminary work toward a dissertation. The third year will be applied almost entirely to the completion of an acceptable dissertation.

The program of study will be arranged by the candidate with the advice of a faculty committee of three and having as chairman the faculty member who will direct work on the dissertation. The final program must be approved by the Department and the University Committee on Graduate Study.

Undergraduate Courses

20. Elementary Surveying—Care and use of instruments; leveling; transit-tape and stadia traverses; topographic surveying, triangulation; plotting and adjusting of field data; computing of areas and topographic mapping. (Limited to 36 students per section.)

3 units, autumn, (Baldwin, Luck), MW 1-5; TTh 1-5
or spring, (Baldwin), MW 1-5


3 units, autumn, (Staff), MWF 9, 2
or winter, (Staff), MWF 9, 2
or spring, (Staff), MWF 9, 2
or summer, (——), MTThF 8
100. Engineering Mechanics (Dynamics)—Principles of dynamics, application to typical mechanical problems; mainly dynamics of a particle. Prerequisites: 99, and Mathematics 23.

3 units, autumn, (Staff), MWF 11, 2
or winter, (Staff), MWF 11, 2
or spring, (Staff), MWF 11, 2
or summer, (——), MTThF 8

101. Engineering Mechanics (Dynamics)—Continuation of Course 100; mainly dynamics of rigid bodies. Prerequisites: 100 and 110.

3 units, winter, (Staff), MWF 8, 12
or spring, (Staff), MWF 8, 12
or summer, (——), MTThF 10

106. Mechanics of Fluids—Statics and dynamics of incompressible fluids; viscosity, fluid friction, laminar and turbulent flow; flow in pipes; measuring devices. Prerequisite: 100.

4 units, autumn, (Staff), MWF 9 or 12; T or W 1-4
or winter, (Staff), MWF 9; T, W, or Th 1-4
or spring, (Staff), MWF 9; T, W, or Th 1-4
or summer, (——), MTThF 8; F 2-5

107. Mechanics of Fluids—Open channel flow, resistance of immersed objects, similitude and dimensional analysis, hydrodynamics. Prerequisite: 106.

2 units, autumn, (Staff), TTh 9
or winter, (Staff), TTh 10
or spring, (Staff), TTh 10


4 units, autumn, (Staff), MTThF 10
or winter, (Staff), MTThF 10, 11
or spring, (Staff), MTThF 10
or summer, (——), MTWThF 10

112. Properties of Materials—Structure of solid engineering materials. Elastic and inelastic behavior; notch sensitivity; fatigue; creep; other physical properties. Laboratory investigations. Must be taken concurrently with 110.

1 unit, autumn, (Staff), W 10 and T or Th 1-3 or 3-5
or winter, (Staff), W 10, 11 and M, T, or Th 1-3 or 3-5
or spring, (Staff), W 10 and T or Th 1-3 or 3-5
or summer, (——), W 2-5

114. Mechanics of Materials—Continuation of 110; combined stresses, combined bending and twist in circular shafts, beams of two materials, statically indeterminate beams, strain energy, special problems. Prerequisites: 110 and 112.

3 units, autumn, (Staff), MWF 8
or spring, (Staff), MWF 11

116. Plain Concrete—Physical properties of concrete and its constituents. (Limited to 20 students per section.)

3 units, autumn, (Staff), T 1-5, Th 1-4; W 1-5, F 1-4
or winter (Staff), W 1-5, F 1-4


3 units, winter, (Richards), TTh 11, W 1-4
126. Advanced Surveying—Highway reconnaissance and location, horizontal and vertical curves, earthwork computations, photogrammetry, construction surveys, adjustment of instruments, city and land surveying, plane table, engineering astronomy. Prerequisite: 20.

4 units, spring, (Luck), TTh 11, TTh 1-4

134. Construction Estimates and Costs—Estimates, costs from viewpoint of contractor, construction engineer; details of estimating, emphasis on labor, material, equipment, overhead costs.

3 units, autumn, (Oglesby), MWF 8
or winter, (Fondahl), MWF 9

135. Construction Equipment and Methods—Construction procedures, equipment used; job planning and scheduling, equipment selection, related problems. (May be taken concurrently with 150 or 151.)

3 units, autumn, (Fondahl), TTh 8, M1-4
or spring, (Fondahl), TTh 9, M1-4

138. Specifications and Contracts—Contract principles, as applied to engineering practice; varieties of construction contracts; specification writing; composition, arrangement of typical sets of specifications; engineering ethics, practice. Prerequisite: junior standing.

3 units, autumn, (Oglesby), MWF 11
or winter, (Fondahl), MWF 11

150. Transportation Engineering—Highway, railroad, airport finance, planning, design, construction; introduction to traffic engineering. Open to engineering students having 90 quarter units of credit, to others by permission.

3 units, autumn, (Oglesby), TTh 11, M1-4
or spring, (Oglesby), TTh 10, M1-4

151. Highway Engineering—Continuation of 150, particular emphasis on highway problems. Prerequisite: 150.

3 units, spring, (Oglesby), TTh 8, M1-4

160. Hydrology—Introduction to hydrologic measurements, runoff computations, ground water, water law, reservoir design, frequency analysis.

3 units, autumn, (Linsley), MWF 10

161. Hydraulic Structures—Dams, spillways, pipe lines, canals, hydraulic machinery, economy in hydraulic design, water purification, sewage treatment. Prerequisites: 107 and 160.

3 units, winter, (Linsley), MWF 8

162. Hydraulic Engineering—Continuation of 160, 161; discussion of applications in irrigation, water supply, hydroelectric power, navigation, flood control, drainage, sewerage. Prerequisite: 161.

3 units, spring, (Linsley), MWF 11


2 units, winter, (Vennard), TTh 11

166. Elements of Sanitary Engineering—Water purification, sewage treatment, refuse disposal. Open to senior, graduate engineering students; others by permission.

3 units, winter, (Fransini), TTh 8, M1-4

180. Elementary Structural Analysis—Stresses in beams, trusses, frames; influence lines; moving loads; introduction to statically indeterminate structures, moment distribution. Prerequisite: 110.

3 units, autumn, (Young), MWF 12
4 units, spring, (Gere), MTTh 8

181. Structural Design—Steel beams, columns, other members; analysis, de-
sign of riveted, bolted, welded joints; design of simple beam connections, moment resistant connections, column base plates. Prerequisite: 110.

3 units, autumn, (Benjamin, Williams), MWF 9


4 units, winter, (Benjamin, Gere), MWF 10, T or Th 1-4

183. Structural Design — Elements of timber structures, including connection design. Prerequisites 180 and 181.

2 units, spring, (Gere), TTh 10


3 units, spring, (Benjamin), MWF 11

190. Soil Mechanics and Foundations — Soil as an engineering material; application of soil mechanics to foundation design; design of simple footings, retaining walls; various types of foundations. Prerequisite: 182.

4 units, spring, (Williams), MWF 9, T or W 1-4

198. Senior Report — Practice in execution of a simple engineering investigation, preparation of a written report on the investigation. Required of all candidates for the Bachelor's degree during either of the last two quarters before graduation.

1 unit, winter or spring, (Staff), by arrangement

199. Directed Reading and Special Studies in Civil Engineering — Open to senior students by permission.

1 or more units, any quarter, (Staff), by arrangement

Courses Primarily for Graduate Students

206. Advanced Fluid Mechanics — Similitude and dimensional analysis; fluid friction for incompressible fluids in tubes, boundary layers, and through granular media; lubrication theory; cavitation. (Same as E.M. 241.) Prerequisite: 107.

3 units, autumn, (Vennard), MWF 10

207. Advanced Hydraulic Laboratory — Prerequisite: 107.

2 units, spring, (Vennard), by arrangement


3 units, winter, (Baldwin), MWF 11

209. Hydraulics of Open Channels — Varied flow, hydraulic jump, hydraulics of open-flow structures; intakes, transitions, measuring flumes, spillways, culverts, etc. Prerequisite: 107.

3 units, spring, (Vennard), MWF 8

214. Experimental Stress Analysis — Introduction to some common experimental methods of investigating stress distribution. Photoelasticity; static, dynamic strain gage methods; brittle lacquers. (Same as E.M. 205.)

3 units, winter, (Williams), TTh 8 and one lab. by arrangement


3 units, spring, (Richards), TTh 10 and one lab. by arrangement

218. Engineering Diagrams — Design, construction of nomographic charts; individual work for qualified graduate students. By permission of instructor.

2 units, any quarter, (Niles), by arrangement
228. Special Engineering Surveys—Individual investigation to meet needs of students who have had considerable experience in engineering surveys. (Field work can be done only when two or more students pursue the same work.) By permission only.
1 or more units, any quarter, (Fondahl), by arrangement

230. Civil Engineering Economy—Review of fundamentals of engineering economy; applications to problems of regulated public utilities; benefit-cost studies, other types of economic analysis of public works. (See also I.E. 230.)
Prerequisite: I.E. 130.
2 units, winter, (Grant), TTh 10

236. Construction Administration—Organization, management, business problems of construction industry; management, control of construction companies, individual projects; financing, bonding, insurance problems. Prerequisites 134, 135, and 138—concurrent registration in these courses or permission of instructor.
3 units, autumn, (Fondahl), TTh 10 and one evening by arrangement

237. Advanced Construction Equipment and Methods—Procedures, equipment employed in heavy and building construction work; emphasis on methods for analyzing, improving present-day methods, techniques. Prerequisites: 134 and 135.
3 units, winter, (Oglesby), M 10 and Th 11 and one evening by arrangement

238. Construction Problems—Analysis of individually selected problem in construction techniques, equipment, or management, followed by preparation of oral and written report. Students are expected to consult specialists from construction industry as well as make use of University facilities. Prerequisites: 236 and 237.
3 units, spring, (Oglesby), by arrangement

239. Concrete Construction—Economy and procedures in plant and equipment selection, form design, and field operations. Special techniques in forming and handling.
3 units, spring, (Fondahl), MW 9 and one evening by arrangement

257. Transportation Problems—Individual investigation. Prerequisites: 150, and consent of instructor.
2 or more units, autumn or winter, (Oglesby), by arrangement

260, 261, 262. Advanced Hydraulic Engineering—Techniques of applied hydrology; unit hydrographs, runoff relationships, flood routing, frequency studies, measurement of stream flow, sediment sampling; a case problem in project design.
260. 4 units, autumn, (Linsley), MWF 9 and T 1-4
261. 4 units, winter, (Linsley), MWF 10 and Th 1-4
262. 4 units, spring, (Linsley), TTh 10 and two afternoons by arrangement

269. Hydraulic Engineering Seminar—Discussions on all phases of hydraulic engineering.
1 unit, all quarters, (Staff), alternate W 3

3 units, autumn, (Niles), MWF 8

282. Statically Indeterminate Structures—Continuation of statically indeterminate structures, including moment distribution, members of variable cross section, secondary stresses in trusses, column analogy, panel method, miscellaneous topics. Prerequisite: 281.
3 units, winter, (Gere), MWF 9
283. **Advanced Structural Analysis**—Membrane stresses in tank, roof shells; discontinuity stresses in domes, tanks; barrel shell roofs; introduction to plate theory. Prerequisite: 281.

*4 units, spring, (Flügge), TTh 11 and two afternoons by arrangement*

285. **Advanced Structural Design**—Structural geometry; analysis of structures by deflected structures, statics; structural models; bridge analysis, design; bridge types, characteristics; large bridge design problem.

*4 units, autumn, (Benjamin), TTh 8, W 1–4*


*4 units, winter, (Benjamin), TTh 9, W 1–4*

287. **Advanced Structural Design**—Continuation of 286. Design of buildings in steel, timber; lateral load analysis, design; shear walls; diagonal sheathing; framing problems. Prerequisites: 282, 285, and 286.

*4 units, spring, (Benjamin), TTh 8, W 1–4*

288. **Structural Engineering Seminar**—Problems in all phases of structural engineering.

*1 unit, autumn, winter, and spring, (Staff), alternate W 4*

290. **Advanced Soil Mechanics**—A brief review of elementary soil mechanics followed by discussion of selected subjects in this field.

*2 units, autumn, (Williams), TTh 9*

293. **Advanced Foundation Design**—Design, construction of foundations for buildings, bridges. Prerequisite: 190.

*3 units, autumn, (Williams), TTh 11*

295. **Harbor Structures**—Wharves; piers of timber, concrete; sea walls, bulkhead walls; factors affecting design, life of marine structures. Prerequisite: 190.

*3 units, spring, (Williams), TTh 9*

296. **Structural Dynamics**—Vibration theory, particular reference to structures; behavior of structures under shock, impulse loads. Prerequisites: 100 and 281.

*3 units, winter, (Young), MWF 11*

299. **Directed Reading and Special Studies in Civil Engineering**—Graduate students by special permission.

*Autumn, winter, or spring, (Staff), by arrangement*

300. **Thesis**—Investigation of some engineering problem; required of candidates for degree of Engineer.

*Autumn, winter, or spring, (Staff), by arrangement*

301. **Thesis**—Dissertation; required of candidates for degree of Doctor of Philosophy.

*Autumn, winter, or spring, (Staff), by arrangement*

**Seminar in Water Resources**—See Graduate Division Special Programs 360.

The following courses in Engineering Mechanics are of special interest to civil engineering students. For descriptions, see the section on the Division of Engineering Mechanics which follows.

**E.M. 201. Advanced Mechanics of Materials.**

**E.M. 205. Theory of Elastic Stability.**

**E.M. 207. Theory of Plates.**

**E.M. 211. Plasticity.**

**E.M. 224. Dynamics of Structures.**
ELECTRICAL ENGINEERING

Emeriti: Joseph Snyder Carroll, Ward B. Kindy (Professors)

Executive Head: Hugh Hildreth Skilling
Associate Executive Head: Leland Hermon Brown
Graduate Instruction: Karl Rudolph Spangenberg
Undergraduate Instruction: Willis Walter Harman
Honors Cooperative Program: Joseph Mayo Pettit
Fellowships and Assistantships: Robert Arthur Helliwell
Associate Professors: Ronald Newbold Bracewell, Robert Rumsey Buss, Milton Dixon Hare, Hubert Heffner, Malcolm Myers McWhorter, Laurence Albert Manning, John Lewis Moll, Allen Montgomery Peterson, Glen Wade, Alan Tower Waterman, Jr.
Lecturers: Byron Jirden Bennett, Donald I. Cone, Donald Allen Dunn, Harold Farley Elliott, Donald John Grace, William Redington Hewlett, William Rodgers Johnson, William Robertson Kincheloe, Jr., Walter Heinrich Kohl, Norman Hallam Moore, Theodore Moreno, Jerre Donald Noe, Bernard More Oliver, William B. Shockley, George Allan Smith, Horace Myrl Stearns

Undergraduate Program

Students desiring to specialize in electrical engineering during their undergraduate period may do so by following the curriculum given earlier in the general discussion of the School of Engineering. Variations of this curriculum are encouraged if there is good reason for change. Attention is also called to the Engineering Science curriculum in the same general section.

Graduate Curricula

The practice of the profession of electrical engineering requires broad ability in both scientific thinking and the art of working with men. As education for those who wish to engage in this profession with competence, four years of undergraduate study and at least one year of postgraduate study are strongly recommended. The undergraduate and graduate curricula at Stanford are planned to offer as much as possible of the breadth of education needed for leadership in the profession as well as knowledge of the physical sciences and the basic professional techniques.
The Electrical Engineering Department offers graduate work in the following fields:

- Administration
- Communication Theory
- Computers
- Control Systems
- Electron Tubes
- High Voltage
- Illumination
- Microwaves
- Network Theory
- Radio Propagation
- Transistor Electronics

Most student programs include courses in several of the above-listed fields. Descriptions of courses will be found in the following pages.

A one-year program of graduate study in electrical engineering may lead to the degree of Master of Science.

An alternative fuller program, giving wider selection of engineering course work, more opportunity for study in the related fields of physics, mathematics, and engineering, and in particular more independent work and individual guidance, may lead to the degree of Engineer. This program is reserved for students of demonstrated ability. A considerable part of the six academic quarters required for this program is usually devoted to research in collaboration with other students and faculty of the department, and to individual study.

The degree of Doctor of Philosophy is offered under the general regulations of the University. The doctoral program, requiring a minimum of three years (nine quarters) of graduate study, is recommended for those with the desire and ability to make a life work of research or teaching.

GRADUATE PROGRAMS

Master of Science and Engineer Degrees

Graduate admission and registration are described under "Graduate Division" above. In preparing a program of graduate study the following four basic requirements should ordinarily be satisfied.

1. Preparation: Certain studies, ordinarily included in the undergraduate program, are necessary for proper understanding of advanced work. These include physics, mathematics (through integral calculus), mechanics (C.E. 99, 100, 110, 112, and if possible 106), electrical circuits (E.E. 104, 105, 106), electronics (E.E. 150, 151, 152), electromechanics and fields (E.E. 102, 103), and electrical laboratory work (E.E. 155, 156, 157). If these courses, or their reasonable equivalent, have not previously been completed they should be taken as soon as possible, and the time needed to obtain an advanced degree may be increased.

2. Fundamental Courses: If the following courses or reasonable equivalents have not been taken previously, they should be included in the graduate program: ordinary differential equations (Mathematics 130), atomic physics (Physics 57), circuits: transmission lines (E.E. 117), control systems (E.E. 128), electronic circuits (E.E. 160), and elementary electromagnetic theory (E.E. 270). Since these courses may be part of the graduate program of study, they will not ordinarily increase the time needed to obtain an advanced degree.

The faculty does not prescribe courses to be taken, other than those listed in paragraphs 1 and 2 above. Each student prepares his own proposed program and submits it to the faculty for approval. This is done in the first academic quarter of graduate study (modifications may be made later). The average course of study is about 16 or 17 units per quarter. In planning his program, the student will normally include E.E. 200 (Seminar) each quarter, and any courses in paragraphs 1 and 2, above, not previously taken. He should then review, for possible inclusion in his program, all courses offered by the Elec-
trical Engineering Department, considering their relation to his major and minor objectives.

3. **Major:** The student should normally have a major objective in electrical engineering, related to the field in which he expects to earn his living immediately upon leaving college. It is not well to attempt to define this major objective too narrowly, but distinction may be made between an interest in: research and teaching; technical engineering (communication or power); engineering administration and sales.

4. **Minor:** Those working for advanced degrees are normally expected to take an average of at least one course per quarter outside of the Electrical Engineering Department. This outside work should be planned with a specific objective in mind, and can be thought of as representing a minor subject.

A student must file in the department office: (1) Application for candidacy for the Master's degree before the end of the first academic quarter of graduate study. (2) Application of candidacy for the Engineer's degree before the end of the first academic quarter of graduate study after the Master's degree has been received.

General regulations governing the degrees of Master of Science and Engineer will be found in the section "Degrees" in this Bulletin.

**Doctor of Philosophy Degree**

A complete statement regarding the degree of Doctor of Philosophy will be found in the section "Degrees" in this Bulletin. The requirements are administered by the University Committee on Graduate Study.

A student should file in the Department office: (1) Not later than the first autumn quarter after receiving the Master of Science degree, an application to take the Departmental qualifying examination (given each winter quarter) for the degree of Doctor of Philosophy. (2) Application for candidacy for the degree of Doctor of Philosophy as soon as he has satisfied one of the language requirements by passing the necessary examination, and has passed the Departmental qualifying examination.

Requirements may be summarized as follows: The student is to complete successfully (1) a minimum of three years of residence with graduate standing, one year of which must be in residence at Stanford; (2) one or more qualifying examinations given by the faculty of the Electrical Engineering Department, beginning in the second year of graduate study; (3) an examination to show reading knowledge of a foreign language (usually French or German, although another language may be substituted if it is of greater value in the student's research);* (4) an approved program of courses in electrical engineering and allied subjects; (5) an oral examination near the completion of the doctoral program; (6) a dissertation, based on research, which must be a contribution to knowledge.

About one-fourth of the program of graduate study should be in departments other than Electrical Engineering. Courses shall be selected to form

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* The University requirement of a second foreign language is waived by the University Committee on Graduate Study if a satisfactory program of advanced study is offered as a substitute. The substitute program must comprise not less than 15 units of coherent work taken in schools or departments other than the student's major and minor departments, and the work must be done while the student has graduate standing. (See the University requirements in the section "Degrees" in this Bulletin.)

Thus, a student of electrical engineering with no formal minor department may satisfy the requirement by taking additional work in physics, mathematics, etc.
an integrated program, to be approved by the Department. A student wishing to fulfill the requirements for a formal minor may elect to do so.

**Special Programs**

*Electronic Science Program*—Master's and Doctor's degrees carrying the designation "Electrical Engineering: Electronic Science" on the diploma may be conferred upon students who combine exceptional competence in electrical physics and mathematics with an electronics program in the Department of Electrical Engineering.

It is recognized that there is a professional place for engineers whose work is the application of science in the field of electronics. The proper education for such men emphasizes the development of scientific and mathematical analysis as well as engineering competence.

A student who wishes to be a candidate for a degree with the designation "Electrical Engineering: Electronic Science" should so indicate when he submits his application for candidacy for the degree (see "Graduate Programs," given earlier in the general discussion of the School of Engineering). He should plan a program of study to include physics and mathematics courses well beyond the minimum required for an electrical engineering degree. The candidate for such a degree will be expected to show adequate ability in mathematics, physics, field and circuit theory, and electronics; he will not, however, be required to show professional competence in electrical power engineering. This program is particularly called to the attention of those who have Bachelor's degrees in science or mathematics, or in engineering science, as well as graduates of professional electrical engineering curricula.

*Electrical Engineering Administration*—By a special arrangement, graduate students of engineering are enabled to take courses in the Graduate School of Business. This may be done to an extent that depends on the interests of the student, and three arrangements may be distinguished.

While working toward the degree of Master of Science in electrical engineering, it is possible to take about one course each term in the School of Business without interfering with completion of the technical studies necessary for the degree. Industrial engineering courses are also useful.

The Master's degree carrying the distinction "Electrical Engineering: Administration" on the diploma is conferred upon students who combine not less than 30 units of study in technical electrical engineering with 30 or more units of study in industrial engineering or business. Four or five academic quarters are required to complete this program, which combines the technical education that is represented by the Master's degree in electrical engineering with a substantial amount of work in industrial engineering or business.

The degree of Engineer is offered for an administration program. Six academic quarters are required, and a thesis is to be written. Work toward this degree is usually divided about evenly between business and engineering. The thesis may be in either department, with proper approval.

Students wishing a degree with the designation "Electrical Engineering: Administration" should so indicate on the application for candidacy for the degree.

*Postgraduate Electronics Program*—Students who have graduated from a department other than electrical engineering may obtain a Master's degree with specialization in electronics by pursuing the following postgraduate course of study. The student may have graduated in any field, and may hold either a B.S. or an A.B. degree. The postgraduate program leading to the M.S. degree requires two academic years (six quarters) if the student has studied mathematics (through calculus) and general college physics (including electricity) in his undergraduate program. If he has not, the time is somewhat longer.
This two-year postgraduate program is highly concentrated in science and electronics; it is a difficult course that should be undertaken only by serious, competent, and mature students. It is of special interest to two classes of young men:

1. Those who graduate from liberal arts colleges, or from curricula in humanities and sciences at Stanford or elsewhere, with the expectation of pursuing this electronics program after graduation.

2. Those who have graduated in some non-electrical curriculum and have later found a need for professional education in electronics, perhaps as a result of experience in industry or the armed forces.

The program is outlined below for the student well prepared in mathematics and physics. A possible schedule is suggested.

A student needing review of mathematics may include a review course (possibly Mathematics 24) by rearranging the schedule and adding to the total number of units. If more extensive reviewing is required it will be necessary to add a quarter (possibly a summer quarter) to the six shown. A student who has had neither calculus nor physics may nevertheless pursue this post-graduate course, but three years (nine quarters) will be necessary.

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<th>First year</th>
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<td>E.E. 100, 104, 105, Circuits</td>
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<td>E.E. 116, 117, 106, 235, Circuits, networks</td>
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<td>E.E. 103, Fields</td>
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<td>E.E. 102, 124, Electromechanics I and II</td>
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<td>E.E. 150, 151, 152, 160, 161, Electronics</td>
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<td>E.E. 155, 156, 157, 170, 171, Laboratory</td>
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<td>E.E. 200, Seminar</td>
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<td>E.E. 220, Pulse and timing circuits</td>
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<td>E.E. 270, Electromagnetic theory</td>
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<td>Mathematics 130, Differential equations</td>
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<td>Physics 57, 87, 89, Atomics, mechanics</td>
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<td>Optional courses selected from the following list</td>
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<td>Totals</td>
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List from which optional courses are selected (this list will be adjusted from time to time):

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<th>Autumn</th>
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<td>E.E. 128, 138, Control systems</td>
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<td>E.E. 162, Electronic circuits</td>
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<td>E.E. 172, Electronic measurements</td>
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<td>E.E. 221, 222, Amplifier circuit theory</td>
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<td>E.E. 226, 227, 228, Transistor electronics</td>
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<td>E.E. 231, 232, Electron devices</td>
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<td>E.E. 236, 237, Network synthesis</td>
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<td>E.E. 251, 252, Theory of communication</td>
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<td>E.E. 271, 272, Applied electromagnetic theory</td>
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<td>Mathematics 106, Complex variable</td>
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**Laboratories**

Facilities for instruction and research include:

- Electrical Machinery Laboratory
- Harris J. Ryan High-Voltage Laboratory
ELECTRICAL ENGINEERING

Illumination Laboratory
Electronics Laboratory (for class instruction)
Electronics Research Laboratory
Microwave Laboratory (in co-operation with Physics)
Radio Propagation Laboratory
Servomechanisms Laboratory
Digital and analog electronic computers
Radio Club (W6YX)

The Hansen Microwave Laboratory provides opportunity for study and research in the rapidly advancing fields of investigation that combine the scientific aspects of electrical engineering with physics. The Laboratory is administered by a committee of faculty men from the Departments of Electrical Engineering and Physics. Students are accepted from the Departments of Electrical Engineering and Physics to take part in the work of the Laboratory. The Microwave Laboratory work is additional and complementary to the courses in the Department of Electrical Engineering and to the research in the Electronics Research Laboratory of the Department of Electrical Engineering. It offers an important opportunity for electrical engineering students interested in ultra-high-frequency problems. (See the section on Physics.)

FELLOWSHIPS, SCHOLARSHIPS, AND ASSISTANTSHIPS

The Department each year awards a number of fellowships, scholarships, and assistantships which are available to graduate students. Detailed information concerning these may be obtained by addressing the Assistantship Committee of the Electrical Engineering Department.

COURSES PRIMARILY FOR UNDERGRADUATES

100. Principles of Circuits—Analysis of electrical networks; circuit constants, natural and forced behavior, impedance and admittance, power and polyphase networks; emphasis on formulation of network equations, their solution, interpretation. Complex algebra is used. Prerequisites: Mathematics 22 or 42, and Physics 53 (Mathematics 22 may be taken concurrently).

3 units, autumn, or winter, (——–), MWF 8 or 11
or spring, (——–), MWF 10 or 11
or summer, (——–), MTWTh 11

102. Electromechanics I—Physical principles of operation of electric motors, generators, and other electromechanical devices; the application of these principles in devices of engineering importance. Prerequisite: 100. To be followed by laboratory work in either 102L or 155.

2 units, autumn, or winter, or spring, (——–), TTh 8 or 11
or summer, (——–), MWTh 10

102L. Electrical Machinery Laboratory—To follow 102; best taken in following quarter. (Students in Electrical Engineering will cover this work in 155 and should not register for 102L.)

1 unit, winter, or spring, or summer, (——–), day by arrangement, 1–4

103. Principles of Fields—Introduction to electric and magnetic fields in engineering; static field problems, magnetic circuits, and applications in electromechanical devices. Prerequisite: 100.

3 units, autumn, (——–), TThS 9
or spring, (——–), TThS 9 or 10

104, 105, 106. Circuits—Analysis of networks, mainly in the steady state; impedance, admittance, use of complex algebra; application of Kirchhoff's laws in mesh and node equations; equivalent circuits; network theorems. Resonant circuits, coupled circuits, polyphase circuits, Fourier analysis, wave
filters. Prerequisites: Mathematics 22, and Physics 53, and E.E.100, and a C+ average in analytic geometry, calculus, physics, and electrical engineering courses taken. E.E.116 should be taken concurrently with 104 or 105. 105 and 106 may be taken concurrently.

104. 3 units, autumn, (———), MWF 8 or 10
    or winter, (———), MWF 8

105. 3 units, winter, (———), MWF 8 or 10
    or spring, (———), MWF 9

106. 3 units, spring, (———), MWF 8 or 10

108. Illumination — Production of light; characteristics of light sources; methods of measuring, controlling and applying light; home, school, commercial and industrial lighting. Prerequisite: 100.
    3 units, autumn, (———), MWF 8

108a. Architectural Illumination—Light and color, light sources, light control, design of lighting systems for homes, schools, commercial and industrial buildings. Primarily for pre-architectural and education majors.
    3 units, autumn, (———), MWF 8

109. Illumination Laboratory—Theory, design, operation of photometers, reflectometers, illuminometers, etc.; measurement of light sources, lighting fixtures, levels of illumination, reflection factors, transmission factors, etc. Prerequisite: 108, or 108a.
    3 units, winter, (———), MW 1-4

116. Circuits: Transients—Analysis of simple linear networks under transient condition. Prerequisite: 100. Should be taken concurrently with 104 or 105.
    2 units, autumn, (———), TTh 8 or 10
    or winter, (———), TTh 10

117. Circuits: Transmission Lines—Differential equations of transmission lines and circuits with distributed constants; traveling wave solution; standing wave solution; trigonometric, hyperbolic functions of complex arguments; typical characteristics of lines in power, telephone, radio practice; impedance matching; approximations valid at high frequency; lines as circuit elements. Prerequisite: 104, and preferably 103.
    3 units, autumn, (———), MWF 9 or TThS 10
    or winter, (———), MWF 9

124. Electromechanics II—Theory of electromechanical energy conversion in such devices as electromagnets, loudspeakers, microphones, vibration pickups, control system components, motors, generators. Prerequisites: 102, and 103, and 116.
    3 units, autumn, (———), MWF 9 or 10
    or winter, (———), MWF 9

125, 126. Electrical Machinery—Theory, operation of electrical machines. Emphasis on alternating-current machinery. Includes also direct-current generators and motors, and rectifiers. Prerequisites: 103, and 105 and 124.
    125. 3 units, winter, (———), MWF 9
    126. 3 units, spring, (———), MWF 9

    3 units, autumn, (———), TThS 8
    or spring, (———), TThS 10

135. Electrical Machinery Laboratory—Emphasis on more common machines, including transformers, induction motors, etc. 125 should either precede or be taken concurrently.
    2 units, winter, (———), Th 1-4
138. Control Systems Laboratory—128 should either precede or be taken concurrently.

2 units, winter or spring, (——), M or W 1-4

143. Elements of Electronics—Use of electronic equipment; emphasis on common, simple, typical devices for communication and power applications. Primarily for other than Electrical Engineering students. Prerequisite: 100.

3 units, autumn, or winter, (——), TTh 9; lab. M, W, or F 1-4

144. Elements of Control Systems—Servomechanisms; analysis of feedback control systems containing electronic, electromechanical, hydraulic components. (Electrical Engineering majors should take 128 rather than 144.) Prerequisites: 102, and 143.

3 units, spring, (——), TThS 9

150, 151, 152. Electronics—Electronic elements, simple systems basic to all communication, industrial applications. Vacuum tubes, gas-filled tubes, phototubes, transistors, their application in rectifiers, amplifiers, oscillators, modulators, etc. Prerequisites: 100 and previous or concurrent registration in 104, or Physics 101.

2 units, autumn, winter, and spring, (——), TTh 8 or 10

153, 154. Electronics—The material of 150, 151, 152 presented in two quarters. Primarily for students who were unable to take 100 before the beginning of their third year.

3 units, winter and spring, (——), MW F 11

155, 156, 157. Laboratory—Circuits, fields, electronic and electromechanical devices, supplementing lectures in 102, 103, 150, 151, 152. Normally taken by electrical engineering students in third year. Prerequisites: 102, and previous or concurrent registration in the series of courses 150, 151, 152.

2 units, autumn, (——), Th 1, one 3-hour lab. weekly
and winter, and spring, (——), T 1, one 3-hour lab. weekly

159. Electronics Review—Rapid review of material prerequisite for 160. To be taken concurrently with 160 by students who need refreshing, reviewing, or minor strengthening of previous electronics course work. Two lectures per week for five weeks only. Grade given will be same as grade in 160. Prerequisite: concurrent registration in 160.

1 unit, autumn, (——), by arrangement

160, 161. Electronic Circuits—Comprehensive coverage of electron-tube and transistor circuits; emphasis on engineering applications and considerations; continuation of 152, with additional material on amplifiers, detectors, oscillators, modulators, etc.; also wave-shaping circuits, generation of special waveforms, etc. Prerequisites: 152, and 106, or equivalent background in electronics and circuit analysis.

3 units, autumn, and winter, (——), MWF 11 or 1

162. Radio Engineering—Applications of electronic circuits to systems of radio engineering; propagation of radio waves, antennas, waveguides, transmitters, receivers, television, radar, special applications. Prerequisites: 117 and 161.

3 units, spring, (——), MWF 11 or 1

170, 171, 172. Electronic Measurements—Primarily laboratory, 1 or 2 lectures a week; principles, methods of electronic measurement. Prerequisites: 157; previous or concurrent registration in the series of courses 160, 161; and 117 should precede or be taken concurrently with 171.

3 units, autumn, winter, and spring, (——), TTh 9, one 3-hour lab. weekly

Courses Primarily for Graduate Students

200. Seminar—Weekly discussion of special topics of current interest in electrical engineering. Normally taken each quarter by graduate students.

1 unit, autumn, winter, and spring, (Villard), Th 11
201. Power Systems—Power-system computation under transient and unbalanced conditions: characteristics of machines, lines, transformers; system faults. Method of symmetrical components applied. Prerequisites: 105, 125, and knowledge of simple transients. 135 desirable, but may follow 201.

3 units, winter, (Hoover)

208. Illumination Seminar—Discussions on current literature, research, developments in all branches of illumination engineering. Students desiring to do special research in illumination should register under this number.

2 or more units, (Brown)

For description of Courses 209p–216p, see Physics 209–216.


3 units, winter, (Jaynes)


3 units, spring, (Jaynes)

211p. Microwave Electronics I—Enroll in Physics 211.

3 units, autumn, (Chodorow)

212p. Microwave Electronics II—Enroll in Physics 212.

3 units, winter, (Chodorow)


2 units, autumn, (Ginston)


3 units, autumn, (Ginston)


2 units, winter, (Ginston)

216p. Microwave Measurements Laboratory II—Enroll in Physics 216.

2 units, winter, (Ginston)


3 units, autumn or spring, (Pettit, McWhorter)

221. Amplifier Circuit Theory I—Tube, transistor amplifier analysis, design based on transient performance. Prerequisite: 231, and 235, or equivalent.

3 units, winter, (McWhorter, Scarlett)


3 units, spring, (McWhorter, Scarlett)

223. Electronic Circuits Laboratory—Advanced experimental techniques. Prerequisite: concurrent or previous enrollment in 220, 221, or 222 or equivalent.

223a. 2 units, autumn, (McWhorter and Staff)

223b. 2 units, winter, (McWhorter and Staff)

223c. 2 units, spring, (McWhorter and Staff)


3 units, autumn, or winter, (Linvill, Gibbons)

227, 228. Transistor Electronics—Transistor operation; possibilities, limitations stemming from physical principles. Functional representation of transistors. Design of linear amplifiers employing transistors. Use of transistors as low-frequency switches; regenerative pulse circuits. Special studies of
synthesis of networks. Prerequisites: For Course 227—226 and 231 and familiarity with mathematics of complex variables; for Course 228—227.

227. 3 units, winter or spring, (Linvill, Gibbons)
228. 3 units, spring, (Linvill), given again autumn, 1959 (Gibbons)

230. Transistor Electronics Seminar—Discussion by faculty, students, and guest specialists of research topics and current literature in the circuit and device aspects of transistor electronics.

1 unit, autumn, winter, and spring, (Linvill, Pettit, Staff), by arrangement

231. Electron Devices I—Internal operation of transistors. Study of semiconductors, junction effects, emission over boundaries, space charge, ion motion in solids, diffusion effects; low- and high-frequency characteristics of transistors. Equivalent networks of active four-terminal devices.

3 units, autumn, (Spangenberg)


3 units, winter, (Spangenberg, Scarlett)

235. Network Analysis—Formulation of integro-differential equations of linear, lumped-constant systems (primarily electric networks, but also mechanical, acoustical, thermal systems). Solution, interpretation of these equations, with aid of complex frequency variable and Laplace transformation. Prerequisites: 116, and Mathematics 24.

3 units, autumn or spring, (Pantell, Staff)


236. 3 units, autumn or winter, (Tuttle, Pantell)
237. 3 units, winter or spring, (Tuttle, Pantell)

238. Active-Network Theory—General theory of linear systems containing active elements (particularly servomechanisms, feedback amplifiers); appropriate theorems, principles of mathematical analysis. Stability, related questions. Examples of uses of such systems, introduction to their synthesis. Prerequisites: 128 and 237.

3 units, spring, (Tuttle)

240. High-Voltage Laboratory—Characteristics of sphere-gaps, point-gaps, transmission line insulators with application of high-voltage at power and high frequencies, impulse voltages; fundamentals of corona formation about conductors; some properties of insulating oils, other insulating materials. Two lectures per week, six laboratory periods per quarter. Prerequisite: 103.

3 units, autumn, (Hoover)

243. Protection of Power Systems—Fundamental principles of operation, general design practice of systems for protection of equipment, maintenance of service. Prerequisites: 105 and 201.

3 units, spring, (Hoover)


3 units, winter, (Franklin)
    3 units, spring, (Franklin)

    3 units, (Franklin), to be given autumn 1959

251, 252. Theory of Communication—Statistical theory of communication systems. Methods of describing random signals, analysis of circuits with random signals, information measure and channel capacity, statistically optimum systems. Prerequisites: 161 or equivalent and Statistics 27 or equivalent.
    3 units, winter and spring, (Abramson)

266. Digital Computer Circuitry—Arithmetic operations in digital computers. Survey of storage, switching, input-output devices finding applications in computing, data processing, control systems, communication systems. Prerequisites: 143 or 152, and Mathematics 24.
    3 units, spring, (Peterson)

    2 units, winter, (Peterson)

270. Elementary Electromagnetic Theory—Introduction to field theory: elements of vector analysis, Maxwell’s equations, plane and spherical waves, electrodynamic potentials, radiation, simple antennas, waveguides. Prerequisites: Physics 53, Mathematics 24, normally senior or graduate standing.
    3 units, autumn or spring, (Heffner, Staff)

271, 272. Electromagnetic Theory—Solutions to static field problems, Maxwell’s equations, field basis for circuit concepts, skin effect and circuit impedance, guided waves, common waveguides and transmission lines, resonant cavities, microwave networks, radiation theory, antennas. Prerequisite: 270.
    271. 3 units, autumn or winter, (Watkins, Heffner)
    272. 3 units, winter or spring, (Watkins, Heffner)

    3 units, spring, (Watkins)

274. Seminar on Magnetic Phenomena at Microwave Frequencies—Physical understanding of the various types of magnetism, with emphasis upon microwave phenomena such as paramagnetic and ferrimagnetic resonance. Applications to solid-state masers, ferrite devices, variable-parameter amplifiers. Related aspects of atomic and quantum physics, crystallography, microwave circuit theory, etc. Prerequisites: 270–272, and introduction to quantum mechanics.
    2 units, autumn, (Siegman)

275. Electromagnetic Waves in Ionized Media—Transmission, reflection of radio waves in isotropic dielectric, ionized media. Relation between oblique,
vertical-incidence transmission in ionosphere. Introduction to magnetic-ionic theory. Applications to communications, including measurement techniques. Prerequisite: 270 or equivalent.

3 units, winter, (Helliwell)


3 units, spring, (Bracewell)

280. Radio Propagation Seminar—Student-faculty discussion of research problems in general field of radio propagation, ionospheric physics.

1 or more units each quarter, (Bracewell)

287. Materials and Techniques for Electron Devices—Physics of materials entering into the construction of electron devices, and principles which govern their selection: glass, ceramics, mica, metals and alloys. Fabrication of components and process techniques: cathodes, heaters, getters, phosphors; glass-to-metal and ceramic-to-metal sealing, joining of metals by brazing; high-vacuum technique; tube reliability in critical environments.

2 units, winter, (Kohl), to be given in 1959–60

288. Electron Device Techniques Laboratory—Practical training in the execution of techniques described under 287, and special research in this area. (Kohl), by arrangement

290. Special Studies in Electrical Engineering—Special studies, under direction of faculty member, for which academic credit may properly be allowed. (This course number is used to give credit for laboratory work, directed reading, etc. A grade of + indicates satisfactory work; no letter grade will be assigned.)

By arrangement

291. Reports and Papers in Electrical Engineering—Special studies, under direction of faculty member, leading to written report or end-quarter examination. Letter grade indicates quality of written work; if letter grade based on written work is not applicable, student should enroll in 290.

By arrangement

295. Electrical Engineering Instruction—Open to a very limited number of electrical engineering students who plan to make teaching their career. (Harman), by arrangement

296. Electrical Engineering Instruction Seminar—Weekly discussions of problems for guidance of those who intend to make a profession of engineering teaching. Open to all.

1 unit, winter, (Skilling)

297. Special Seminar—Discussion meetings arranged by certain faculty members.

1 unit, by invitation

300. Thesis and Thesis Research—A grade of + indicates satisfactory work; no letter grade is assigned.

By arrangement

Numerical Methods and Theory and Operation of Computing Machines—See Mathematics 137, 138, 139, 239.

Elementary Nuclear Physics, Quantum Mechanics and Atomic Physics, and Solid State Physics—See Physics 107, 108, 135, 176, 177

Introduction to Nuclear Engineering—See M.E. 171.

The Engineering courses deal with subject areas within the basic science of engineering which are, in their essential nature, broader than the confines of any particular branches of engineering.

**Courses**

**150. Introductory Science of Materials**—Atomic basis of the mechanical, electrical, magnetic, and thermal behavior of solids. Introduction to free electron, band theories of solids; applications to structure-insensitive properties. Crystals, crystalline imperfections, structures of multi-component systems. Solid state reactions. (Same as Metallurgical Engineering 150.) Prerequisites: Physics 55, and Chemistry 3 or 4, and Mathematics 24.

3 units, winter, (Huggins)

**152. Electric and Magnetic Properties of Materials**—Introduction to the physical basis of conduction of electricity, dielectric and magnetic properties. Review of atomic theory, molecular and atomic polarization, metallic conduction, band theory, semiconductors, physical processes in transistors, magnetic materials, magnetic resonance phenomena. (Same as Metallurgical Engineering 152.) Prerequisites: Physics 57, and Engineering 150.

3 units, spring, (Heffner)

**DIVISION OF ENGINEERING MECHANICS**

Emeritus: Stephen Prokofievich Timoshenko (Professor)

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Executive Committee: James Norman Goodier (Chairman), Wilhelm Flügge, Nicholas John Hoff, Lydik Siegumfeldt Jacobsen, Karl Klotter, Donovan Harold Young (Professors)

Professors: John King Vennard, Harry A. Williams

Associate Professor: James Monroe Gere

Assistant Professor: Cedric W. Richards

Research Supervisor and Lecturer: Irmgard Flügge-Lotz

**Offerings and Facilities**

The Division provides one, two, or three years of advanced training in solid and fluid mechanics leading to abundant career opportunities in industrial and governmental research establishments, in technical development in industry, and in the universities and institutes of technology. It also offers programs of study for mechanical, aeronautical, and civil engineers who find that their work involves them in advanced mechanics, and necessitates a year or more of graduate study to acquire a deeper grasp of fundamental concepts and advanced methods.

The Timoshenko Laboratory of Engineering Mechanics provides facilities for special experimentation in conjunction with the laboratories of the Departments of Civil and Mechanical Engineering. Individual accommodation is provided for the work of each research student. Weekly seminar meetings acquaint the students with a great variety of subjects in their field, and give opportunity to practice speaking on a selected topic.
The Division also conducts government-sponsored research projects. Qualified students participate in these as research assistants, engaged on thesis research, in close working association with the faculty director and fellow students. The projects include original experimental and theoretical investigations in the strength and deformability of elastic and plastic elements of machines and structures, vibrations and non-linear dynamics, and the flow dynamics of liquids and gases.

DEGREES

Master of Science

The University's basic requirements for the Master's degree are discussed in the section “Degrees” in this Bulletin. The following are Divisional requirements.

To secure the recommendation of the Division for the Master's degree, a candidate must include a minimum of 6 graduate units in each of the four subdivisions: (1) Advanced Dynamics, (2) Elasticity and Plasticity, (3) Fluid Mechanics, and (4) Mathematics. In addition to these 24 units of required courses, the program calls for a minimum of 12 units in approved electives and 9 units in free electives, making in all 45 units of course work. No thesis is required. In all of this work a minimum grade-point average of 2.75 is expected.

The program assumes that the student is adequately prepared to undertake graduate study in engineering mechanics and that he has already had the equivalent of the following Stanford courses: C.E. 114 (Mechanics of Materials), Mathematics 130 (Ordinary Differential Equations), M.E. 160 and 161 (Engineering Dynamics and Dynamics of Machinery). A student who, at the time of admission, is deficient in any or all of these 12 units will be required to make them up during his graduate study; in which case, more than the three quarters of residence normally required to complete the program may be necessary.

Engineer

The University's basic requirements for the degree of Engineer are discussed in the section “Degrees” in this Bulletin. The program of courses and thesis are arranged in consultation with the student's adviser, and require the approval of the Executive Committee of this Division. The requirements for the M.S. degree (see above) must be included.

Doctor of Philosophy

The University's basic requirements for the Ph.D. degree are discussed in the section “Degrees” in this Bulletin. The requirements of the Division include one or more qualifying oral examinations early in the second year of graduate study, and the presentation of a satisfactory program after consultation with the faculty member who will direct the dissertation research. The requirements for the M.S. degree (see above) must be included.

COURSES


3 units, autumn, (Niles), MWF 8
   2 units, autumn, (Goodier), TTh 11

   3 units, winter, (Goodier), MWF 10

   3 units, spring, (Goodier), MWF 10

205. Experimental Stress Analysis—Introduction to some common experimental methods of investigating stress distribution. Photoelasticity; static, dynamic strain gage techniques; brittle lacquers, membrane analogy. (Same as C.E. 214.)
   3 units, winter, (Williams), TTh 8, one lab. by arrangement

206a. Theory of Elastic Stability—Stability analysis of bars under separate or combined axial, lateral, torsional loading, by solution of differential equations, energy approximations. Prerequisites: C.E. 114, and M.E. 118.
   2 units, winter, (Goodier), TTh 11

   2 units, spring, (Goodier), TTh 11

   3 units, winter, (Flügge), MWF 9

   3 units, spring, (Flügge), MWF 9

   3 units, autumn, (Flügge), by arrangement

   3 units, autumn, (Flügge), by arrangement

   3 units, winter, (Flügge), by arrangement

   3 units, spring, (Richards), TTh 10, one lab. by arrangement

221. Advanced Dynamics—Dynamics of a particle. Differential equations
of motion, their solution for various particular cases including free and forced vibrations, exterior ballistics, relative motion. Prerequisite: C.E. 100.

2 units, autumn, (Klotter), TTh 9

222. Advanced Dynamics — Dynamics of a system of particles. General theorems of momentum, energy; applications to variable mass systems, impact, vibration problems, etc., particularly to motion of gyroscope. Prerequisites: M.E. 118 (or Math. 130), and M.E. 160 (or E.M. 221).

2 units, winter, (Klotter), TTh 9

223. Advanced Dynamics—Generalized co-ordinates, Lagrangian equations, Hamilton’s Principle, with applications particularly in field of vibration problems. Prerequisite: 222.

2 units, spring, (Klotter), TTh 9

224. Dynamics of Structures—Behavior of elastic structures subjected to dynamic loads. Vibrations of buildings, bridges, ships, dams excited by earthquakes, wind, traffic. Prerequisite: 160.

3 units, spring, (Jacobsen), by arrangement


2 units, winter, (Klotter), TTh 2

232. Non-Linear Oscillations—Special features: subharmonics, superharmonics, frequency multiplication and demultiplication, entrainment of frequency, parametric excitation, retarded action. Systems of multiple degrees of freedom. Prerequisite: 231.

2 units, spring, (Klotter), TTh 2


3 units, autumn, (Vennard), MWF 10


3 units, autumn, (Flügge-Lots), MWF 1


3 units, winter, (Flügge-Lots), MWF 11


3 units, spring, (Flügge-Lots), MWF 11

250. Mathematical Methods in Engineering Mechanics—Introduction to Fourier series, complex variables, by solution of selected illustrative problems in solid, fluid mechanics, e.g., vibrations of taut wires, stress waves in rods, streamline patterns. Prerequisite: M.E. 118 or equivalent.

3 units, autumn, (Goodier), MWF 11

251. Mathematical Methods in Engineering Mechanics — Continuation of 250. Selected problems, such as vibration of membranes, heat flow in cylinders, illustrating properties, use of Bessel functions, other transcendental functions. Variational methods, principles.

3 units, winter, (Klotter), MWF 8
3 units, spring. (Flügge), M 1, TTh 8

270. Special Problems in Engineering Mechanics — Directed study for graduate students on subject of mutual interest to student and a staff member. Student must find faculty sponsor before registering.
1 to 5 units, any quarter. (Staff), by arrangement

295. Seminar in Solid Mechanics—Problems in all branches of solid mechanics. Credit given to students presenting oral reports.
1 unit, autumn, winter, and spring. (Goodier), Th 3:15

296. Seminar in Fluid Mechanics—Problems in all branches of fluid mechanics. Credit given to students presenting oral reports.
1 unit, autumn, winter, and spring. (Flügge-Lotz, Vincenti), T 4, alternate weeks

Autumn, winter, and spring. (Staff), by arrangement

Autumn, winter, and spring. (Staff), by arrangement

INDUSTRIAL ENGINEERING

Executive Head: William Grant Ireson
Professors: Eugene Lodewick Grant, William Grant Ireson
Associate Professors: Gerald J. Lieberman, Robert Vernon Oakford
Assistant Professor: Harvey M. Wagner
Acting Assistant Professor: David Van Driest Heebink, David Alfred Thompson
Acting Instructor: Sam Less Carrell

Degrees

Bachelor of Science
The program leading to the degree of Bachelor of Science in Industrial Engineering is given earlier under School of Engineering. This curriculum is planned to serve those students whose long-run objective is administrative work in enterprises where a scientific and engineering background is necessary or desirable. The fundamentals of engineering are stressed; 69 per cent of the program is common to all of the engineering curricula and an additional 13 per cent is of technical nature in engineering, mathematics, and statistics. The remaining 18 per cent consists of courses in a number of fields that are important as preparation for management activities.

Many of the courses listed under Industrial Engineering are introductory courses in management subjects. These are appropriate electives for students in the more technical fields of engineering as well as in certain other departments of the University.

Graduate Program
The Industrial Engineering Department, in collaboration with other departments of the University, offers programs leading to the degrees of Master of Science and Doctor of Philosophy in Industrial Engineering. The programs emphasize the analytical approach to industrial engineering problems using quantitative measures. Specialized work is available in engineering statistics (including quality control) and data processing; this includes a number of courses in the Departments of Statistics and Mathematics. Special emphasis may also be given to engineering economy and related fields.
Other graduate programs that appropriately may follow undergraduate work in industrial engineering include the Graduate School of Business and Department of Statistics.

Master of Science

Programs are available leading to the degree of M.S. in industrial engineering either with or without a special designation on the diploma as follows: Engineering Economy, Engineering Statistics, Data Processing. Detailed statements of the general requirements for the Master's degree and the specific course requirements for the special designations may be secured by request to the Industrial Engineering Department.

Students having Bachelor's degrees in industrial engineering normally can satisfy requirements for the M.S. degree in a year of graduate work of satisfactory quality. Those students who have the Bachelor's degree in some other field of engineering will be required to make up certain basic undergraduate industrial engineering courses.

Doctor of Philosophy

The degree of Doctor of Philosophy is offered under the general regulations of the University. The program requires a minimum of three years (nine quarters) of graduate study, at least one year of which must be at Stanford. The first year is represented by the M.S. program. The completion of an acceptable dissertation may occupy most of the third year of study.

The program of study will be arranged by the candidate with the advice of a Faculty Committee of three appointed by the Department head and having as chairman the faculty member who will direct the thesis work. The final program must be approved by the Department.

Assistantships and Scholarships

A limited number of assistantships with stipends of $750 or more a year are awarded each year. Application forms and detailed information may be obtained by writing the Department of Industrial Engineering. Applications normally should be made by February 15 preceding the start of the academic year for which the award is to be made.

The University Information Bulletin should be consulted for a description of available scholarships and fellowships and for a description of the procedure for making application.

Undergraduate Courses

100. Industrial Organization and Management—Concepts of manufacturing management, i.e., organizational principles, industrial engineering techniques, relationship of organizational functions.

4 units, autumn, (Heebink), MTWF 8
or winter, (Ireson), MTWF 10
or spring, (Heebink), MTWF 10
or summer, ( ), MTWThF 9


3 units, autumn, (Thompson), MWF 9
or spring, ( ), MWF 11
or summer, ( ), MTWTh 11

3 units, autumn, (Ireson), MWF 9
or winter, (—), MWF 9


3 units, winter, (Heebink), MWF 9
or spring, (Heebink), MWF 11

118. Motion and Time Study Laboratory—Practice, projects in techniques, applications. Prerequisite: 108.

1 unit, autumn, (Staff), T 1-4 or W or F 2-5
or winter, (Staff), M, W, or F 1-4

119. Production Engineering Laboratory—Production tooling, layout design practice. Plant visits. Prerequisite: 109 and 118.

1 unit, winter, (Staff), W or F 1-4
or spring, (Staff), M, T, or F 1-4

120. Quality Control by Statistical Methods—Use of statistical techniques in control of quality of manufactured product. Basic statistical concepts. Shewhart control charts. Introduction to probability theory with applications to sampling acceptance procedures.

4 units, autumn, (Wagner), MTWF 8
or winter, (Ireson), MTWF 11
or spring, (Thompson), MTWF 10

130. Engineering Economy—Comparison of relative economy of engineering alternatives. Open to those who have 90 units of credit and to others by permission.

3 units, autumn, (Carrell, Heebink), MWF 10 or 12
or winter, (Carrell, Thompson), MWF 8 or 12
or spring, (Carrell, Thompson), MWF 9 or 12
or summer, (Grant), MTWFTh 1

133. Industrial Accounting—Brief introduction to general accounting, cost accounting; particular emphasis on cost accounting. (Students who have taken or are taking a University course in elementary accounting are admitted only by special permission of instructor.)

3 units, spring, (Grant), MWF 8
4 units, summer, (Grant), MTWFThF 10

133a. Industrial Accounting—Alternative to 133. More attention to such matters as use of standard costs in cost accounting, fixed capital accounting and depreciation, budgetary control, interpretation of financial statements.

5 units, autumn, (Heebink), MTWFThF 11
or winter, (Grant), MTWFThF 8

152. Introduction to Operations Research—Application of mathematical models to industrial problems; linear programming, queueing, games theory, inventory. Discussion, solution of actual problems encountered in management, production, economics of industry. (Same as Statistics 152.) Prerequisite: Statistics 110.

3 units, autumn, (Lieberman), MWF 10
or winter, (Wagner), MTW 4:15

161. Introduction to Data Processing—Use of data processing equipment, applications to industrial problems. Includes laboratory application of IBM-650, auxiliary equipment.

3 units, autumn, (Oakford), MWF 8
190. Seminar—Special topics by guest speakers. Students prepare a formal engineering report on approved subject.
   1 unit, winter, (Staff), Th 11

COURSES PRIMARILY FOR GRADUATE STUDENTS

202. Job Evaluation—Methods, techniques employed in job analysis, job descriptions, evaluation, merit rating systems. Job evaluation in collective bargaining, establishment, control of wages and salaries. Prerequisites: 108, Psychology 192, or equivalents. Psychology 192 may be taken concurrently. 3 units, autumn, (——), TTh 8 and T1-4

208. Advanced Motion and Time Study—Current problems of technique, application. Statistical time standards. Predetermined time systems. Group projects. Prerequisites: 108, 118, and Statistics 110 or equivalent. 4 units, winter, (——), TTh 8 and TTh 1-4

220. Quality Control Applications—Current practices in industrial quality control. Problems of application of statistical quality control methods in various industries. Prerequisite: 120. 4 units, spring, (Ireson), MWF 8 and Th 1-4

230. Advanced Engineering Economy—Application of engineering economy to problems of competitive industry. Income tax aspects of economy studies. Relationship between accounting and engineering economy. MAPI formula; other approaches to replacement economy. Discounted cash flow method. Capital budgeting. (See also Civil Engineering 230.) Prerequisite: 130. 2 units, winter, (Grant), WF 10 or spring, (Grant), TTh 8

231. Problems in Engineering Economy—Independent study of selected problem in engineering economy. Prerequisites: 130 and consent of instructor. 1 or more units, (Staff), by arrangement

234. Depreciation—Mortality studies for physical property. Accounting, income tax aspects of depreciation. Appraisal aspects of depreciation. Prerequisite: a course in accounting. 3 units, spring, (Grant), MWF 11

247. Advanced Production Engineering—Advanced problems in factory planning, materials handling, production-line techniques, automation, plant facilities. Prerequisite: 109 (I.E. 109 may be taken concurrently.) 3 units, autumn, (——), TTh 9 and Th 1-4

249. Engineering Climatology—Effects of weather on engineering operations and the use of climatic data as an aid in engineering design and operations. 2 units, spring, (Linsley), TTh 11

252. Operations Research—A rigorous treatment of linear programming, queuing, inventory theory, and other mathematical techniques used in operations research. (Same as Statistics 252.) Prerequisite: 152. 3 units, spring, (Lieberman), MTW 4:15

253. Operations Research—A continuation of 252. Emphasis on inventory problem, including static and dynamic programming models. (Same as Statistics 253.) Prerequisite: 252. 3 units, autumn, to be given in 1959-60

261. Data Processing Seminar—Case studies, selected topics, laboratory applications. Prerequisite: 161, or Mathematics 139. 3 units, winter, (Oakford), MWF 8; lab. by arrangement

263. Data Processing Laboratory—Application of IBM Type 650 electronic data processing machine to problem of business management or opera-
tions research. Student will choose problem, program solution, test program, prepare data input, obtain and analyze output. Prerequisite: 261.
1 or more units, any quarter, (Oakford), by arrangement

291. Industrial Engineering Problems — Directed study on subject of mutual interest to student and staff member. Student must find a faculty sponsor.
1 or more units, (Staff), by arrangement

301. Dissertation—Required for degree of Doctor of Philosophy.
Autumn, winter, and spring, (Staff), by arrangement

MECHANICAL ENGINEERING

Emeriti: Hans Frederick Birnie, William Frederick Durand, Boynton Morris Green, Stephen P. Timoshenko (Professors)

Executive Head: Lydik Siegumfeldt Jacobsen
Associate Professors: Frank Robert Arnold, Robert H. Eustis, Stephen Jay Kline, George Leppert
Assistant Professors: William Craig Reynolds, Albert Abbe Rowe
Acting Assistant Professor: Wayne Samuel Brown
Research Supervisor and Lecturer: Irmgard Flügge-Lotz
Lecturer: Carl George Arthur Rosen
Instructor: Peter Zane Bulkeley
Teaching Technicians: Gordon John McKenzie, Robert Simpson

OFFERINGS AND FACILITIES

The Department gives specialized work leading to careers in many mechanical engineering fields, such as power generation, process industries, engineering design development, instrumentation and controls, public utilities, thermodynamic processes including nuclear energy problems, production control, and last, but not least, in mechanical engineering research and development.

In collaboration with other departments of the University, there is offered specialized graduate work with particular strengths in the fields of:

- Thermodynamics and heat transfer
- Elastic and plastic analysis of design elements
- Dynamic problems of machine design
- Fluid mechanics and gas dynamics
- Comprehensive design and systems engineering
- Aircraft power plants and internal combustion engines
- Nuclear engineering

Most graduate programs will include courses in several of the above fields.

Laboratory Facilities—The Mechanical Engineering Laboratory is well equipped with representative hydraulic, steam, internal combustion, refrigeration, air conditioning, and pneumatic machinery for undergraduate testing. Modern examples of aircraft engines, rockets, gas turbines, and other machinery components are set up as demonstrations. Research facilities include adequate instrumentation, CFR engine test units, dynamometer facilities, a supersonic flow system for gas dynamic investigations, air duct flow systems for heat and mass transfer studies, and ample supplies of compressed air, electricity, steam,
and water utilities. There is a laboratory for instruction in the utilization of radioisotopes, and a subcritical nuclear assembly has been installed for use in the nuclear engineering program. Machine shop equipment is available for student construction of research apparatus in the William Roberts Eckart Room. The Mechanical Engineering Shops have facilities for experimental investigations in the fields of melting, heat-treatment, forming, and machining of metals. The Timoshenko Laboratory of Engineering Mechanics and the Vibration Research Laboratory are equipped to accommodate a number of graduate students doing experimental research in the fields of mechanics and mechanical engineering.

**Degrees**

**Bachelor of Science**

Students desiring to specialize in mechanical engineering during their undergraduate period may do so by following the curriculum outlined earlier under School of Engineering. The University’s basic requirements for the Bachelor’s degree are discussed in the section “Degrees” in this Bulletin.

**Master of Science**

*Admission and Registration*—The University’s basic requirements for the Master’s degree are discussed in the section “Degrees” in this Bulletin. To be eligible for registration as a graduate student in the Department, one must have received the Bachelor’s degree in engineering, or an acceptable equivalent, and normally will be expected to have had all the Stanford courses listed under Mechanical Engineering requirements for a Bachelor of Science degree, or their equivalents. When circumstances make it advisable certain substitutions will be allowed.

*Graduate Program*—The graduate work offered in this Department is intended to prepare the student for a professional career in the broad aspects of mechanical engineering with especial emphasis placed on the analytical approach. Flexibility in the selection of courses is allowed provided that a certain minimum of fundamentally important courses is included. Ordinarily the Master’s degree, requiring one year of graduate work, will not include a thesis and will not allow a great deal of specialization, since approximately three-fifths of the required 45 units will consist of courses designed to broaden the scientific and technical outlook of the student. If more technical specialization is desired, the professional degree of Engineer, representing two years of graduate work and including a thesis, or the academic degree of Doctor of Philosophy, normally requiring three years of graduate work, should be considered.

The requirements which must be met for the degree of Master of Science in Mechanical Engineering are:

1. **6 units** of mathematics selected from E.M. 250, 251, 252, Math. 131, 132.
2. **6 units** in each of two of the following four categories, plus fulfillment of minimum indicated units in one of the two remaining categories.
   a) **Design or Materials** (4 units minimum) from:
      - M.E. 214a, b, 260, E.M. 201, 202a, b, 215, 221, 222, 223, E.E. 128, 235, 245, 246, Engr. 150
   b) **Fluid Mechanics** (3 units minimum) from:
      - M.E. 238a, b, c; E.M. 241, 242, 243, 244; A.E. 210a, b, c
   c) **Thermodynamics and Heat Transfer** (3 units minimum) from:
      - M.E. 231a, b, 233a, b, 236
   d) **Nuclear Science** (3 units minimum) from:
      - M.E. 271a, b; Physics 107, 108
3. **18 units** of approved electives.
4. **5 or 6 units** of free electives, preferably outside engineering, making up a total of 45 units.

It should be noted that students who have not fulfilled the Mechanical Engineering requirements for the Bachelor's degree will have to take additional units in undergraduate courses.

Candidates for the degree of Master of Science will be expected to have a minimum scholastic average of 2.75 in engineering courses to secure the Department's recommendation for the degree.

**Degree of Engineer**

The University's basic requirements for the degree of Engineer are discussed in the section "Degrees" in this Bulletin. The Department requirements for the degree of Engineer in Mechanical Engineering include an acceptable thesis for which as much as 15 units will be allowed. The thesis should be started not later than the second week of the last academic year of residence, and ordinarily will involve some experimental work. In addition to the thesis, 30 units of approved advanced course work are expected beyond the requirements for the Master of Science degree in Mechanical Engineering.

All candidates for the degree of Engineer in Mechanical Engineering will be expected to have a minimum scholastic grade point average of 3.0 for work in engineering courses beyond those required for the Master's degree.

**Prize**—The income of the William Roberts Eckart Research Fund is available as an annual prize for the best Engineer's Thesis offered by a student in the Department.

**Doctor of Philosophy**

The University's basic requirements are discussed in the section "Degrees" in this Bulletin. The Department will allow a minor field of study but does not require one. However, if a minor is waived, the candidate must show breadth of training in engineering or in adjacent fields. In lieu of a second foreign language a group of courses, centering around an additional field of competence, may be offered; for instance, 15 units of junior, senior, or graduate mathematics and physics courses (taken as a graduate student) may constitute an acceptable substitute for the second foreign language, but the same courses cannot be used to substitute for both the minor and the second foreign language.

All candidates for the degree of Doctor of Philosophy in Mechanical Engineering will be expected to have a minimum scholastic grade point average of 3.0 for work in engineering courses beyond those required for the Master's degree.

**Undergraduate Courses**

Note—Laboratory sections in experimental engineering will be assigned in groups. Insofar as the laboratory schedule permits, students will be allowed, with due regard to priority of application, to arrange their own sections and laboratory periods. Enrollment with the instructor concerned, on registration day or the first day of University instruction, is essential in order that the laboratory schedule may be prepared. Enrollment later than the first week will not be permitted under any circumstances.

1. **Forging and Welding**—Four-hour laboratory period, one-hour lecture per week. Approximately one-third of term devoted to forging, practical heat treating; remainder devoted to oxyacetylene, electric welding processes. Enrollment limited.

2 units, autumn, (Simpson), T 9 or Th 8; lab. M, T, W, Th, or F 1-5
or winter, (Simpson), T 8 or Th 9; lab. M, T, W, Th, or F 1-5
or spring, (Simpson), T 9 or Th 8; lab. M, T, W, Th, or F 1-5
2. Foundry Practice—Four-hour laboratory period per week. One additional hour per week devoted to lecture, by arrangement with instructor. Enrollment limited.

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3. Machine Shop Practice—Four-hour laboratory per week; student operates lathe, shaper, milling machine, drill press; also performs bench operations including filing, lay-out, tapping. One additional hour per week devoted to lecture, by arrangement with instructor. Enrollment limited.

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9. Engineering Drawing—Study, application of descriptive geometry to solution of space problems in various engineering fields, graphical representation of structural or mechanical components, assemblies. Enrollment limited.

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50. Engineering Kinematics—Application of graphical, mechanical, analytic methods of kinematics to solution of real engineering problems of interest; student exercises powers of analysis, synthesis in cases requiring precisely prescribed motions of components. Enrollment limited. Prerequisite: 9.

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102. Advanced Foundry—Pattern design, pattern making, special molding problems. Minimum enrollment five, maximum ten. Prerequisite: 2.

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103. Advanced Machine Shop Practice—Special work in setup, operation of production machine tools. Minimum enrollment five, maximum ten. Prerequisite: 3.

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110. Algebraic Methods in Engineering—Study and practice in use of various aids for numerical solution of engineering problems, such as synthetic division, functional coordinate papers, nomographic charts, electronic and mechanical computers, systematic recording of numerical calculations. Development of empirical equations. Elementary applications of probability theory in experimental work. Prerequisite: C.E. 110.

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112. Advanced Engineering Drawing—Advanced work in descriptive geometry, engineering drawing, etc., according to need of student. Prerequisite: 9.

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114a. Mechanical Engineering Design—Design of machine elements, stressing a rational approach; their incorporation in mechanical, electromechanical devices arising from synthesis problems primarily of kinematic character where stress analysis is of secondary importance. Introduction to electromechanical computer elements. Enrollment limited. Prerequisites: 3, 50, and C.E. 114.

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114c. Mechanical Engineering Design—Continuation of 114b. Enrollment limited. Prerequisite: 114b.
3 units, spring, (J. Arnold), Th 1; lab. T 1-4, Th 2-5

118. Differential Equations in Engineering—Special attention to setting up differential equations; problems drawn from various fields of engineering. Prerequisites: Mathematics 24, C.E. 106 and 110.
3 units, spring, (Jacobsen), MWF 8

122. Mechanical Engineering Laboratory — Laboratory experiments on commercial hydraulic, thermal power apparatus designed: (1) to introduce student to experimental methods in field of mechanical engineering, (2) to demonstrate validity of principles, techniques described in 131, 133, (3) to give student experience of analyzing own experimental work, presenting results in acceptable engineering report, and (4) to provide experience in joint group effort. Prerequisite: 131, and preferably 133.
3 units, autumn, winter, and spring, (Staff), one afternoon by arrangement

123. Mechanical Engineering Laboratory — Continuation of 122. Work with experimental systems designed to illustrate individual principles, and with examples of commercial equipment. Prerequisites: 122 and 133.
4 units, winter, and spring, (Staff), one afternoon by arrangement

131. Elementary Engineering Thermodynamics — Introduction to principles of thermodynamics; application to thermal power systems. One afternoon in laboratory per week, but no formal laboratory report writing. Prerequisites: Physics 55, and Mathematics 23.
5 units, autumn, (Staff), MTWF 8 or 11; lab. M, T, W, or Th 1-4
or winter, (Staff), MTWF 11 or 12; lab. M, T, W, or Th 1-4
or spring, (Staff), MTWF 8; lab. M, T, W, or Th 1-4

133. Engineering Thermodynamics—Thorough review of basic principles of thermodynamics; applications to problems of engineering interest, such as analysis of heat, power, refrigeration systems; problems of more advanced nature than covered in 131. Prerequisite: 131.
3 units, autumn, (Kline, Eustis), MWF 10
or winter, (Kays, London), MWF 10

134. Thermodynamics—Continuation of 133; further work on availability, chemical thermodynamics, properties of substances. Prerequisite: 133.
2 units, spring, (Staff), MW 10

135. Heat Transmission—Introduction to mechanisms of conduction, convection, radiation; emphasis on engineering design applications. Prerequisite: 131.
2 units, autumn, and winter, (Staff), TTh 11

136. Gas Dynamics—Introduction to effects of compressibility through one-dimensional analysis. One-dimensional treatment of integral theorems, isentropic flow, shock waves, choking effects. Prerequisite: 133.
2 units, spring, (Staff), MW 11

137. Combustion—Applications of first, second laws of thermodynamics to combustion reactions, reaction mechanisms, flame propagation theories; discussion of various combustion systems. Prerequisite: 133.
2 units, winter, (Staff), MW 10

2 units, spring, (Niles), TTh 11

146. Introduction to Aerodynamics—Explanation of principles of flight; prefaced by resumé of aeronautical history, consideration of aircraft classification and atmospheric characteristics. Properties of airfoils, parasitic bodies studied in light of basic aerodynamic principles, synthesized in discussions of
performance, stability, controllability of airplanes. Prerequisites: C.E. 106 and (or concurrent registration in) 107.

2 units, autumn, (Reid), TTh 8

160. Engineering Dynamics—Engineering applications of d'Alembert's Principle. Practice in considering dynamic problems from point of view of differential equations; emphasis on physical interpretation of results. Vibration problems of one degree of freedom will be studied in detail. Prerequisites: 118, or Mathematics 130.

3 units, autumn, (Jacobsen), MWF 11

161. Dynamics of Machinery—Problems involving several degrees of freedom with application to torsional as well as to linear vibrations of machinery. Practical considerations of design problems. Prerequisite: M.E. 160.

3 units, winter, (Jacobsen), MWF 11

171. Introduction to Nuclear Engineering—Nuclear fission and the chain reaction. Nuclear reactor design principles. Radiation hazards, shielding. Prerequisite: M.E. 160.

3 units, autumn, (Brown), MWF 12

Engineering Mechanics (Statics)—See Civil Engineering 99.
Engineering Mechanics (Dynamics)—See Civil Engineering 100.
Mechanics of Materials—See Civil Engineering 110.
Properties of Materials—See Civil Engineering 112.

Courses Primarily for Graduates

214a. Philosophy of Design—An introduction to the philosophy of comprehensive design. A discussion of the attitudes and viewpoints of the designer and a thorough investigation of the techniques of analysis, synthesis and evaluation that he uses. Emphasis will be placed on understanding of the creative process and the factors that influence it. Limited registration. Prerequisite: Permission of Instructor.

3 units, autumn, (J. Arnold), W 1-4

214b. Human Factors in Design.—A study of Man's strength and weaknesses in opposition to and/or in cooperation with machines. The problems associated with the transfer of information, energy, and matter between man and machine will be investigated. Limited registration. Prerequisite: M.E. 214a.

3 units, winter, (J. Arnold), W 1-4

214c. Comprehensive Design—Seminar discussions and actual design practice in the solving of complex and comprehensive engineering problems. Imagination tempered with sound engineering analysis and judgment will be stressed. Limited registration. Prerequisite: M.E. 214b.

3 units, spring, (J. Arnold), W 1-4

231a. Heat Transmission—Application of principles of heat transfer, thermodynamics to solution of transient, steady state heat transfer problems. Methods of dimensional analysis and model experimentation, as well as strictly analytical procedures, emphasized. Prerequisite: graduate standing and concurrent registration in differential equations.

3 units, autumn, (London), MWF 9


3 units, winter, (Kays), MWF 9

232. Experimental Problems in Heat Transmission—Laboratory for investigation of problems of heat transmission. Approximately five problems involving analytical prediction of performance of an idealized heat transfer sys-
tem, experimental determination of behavior of actual system, rationalization of difference. No formal laboratory reports required. Prerequisite: 231b.

2 units, autumn or spring, (Kays), by arrangement

233a. Advanced Thermodynamics—Fundamentals of thermodynamics. Review of First Law, Second Law, relations among properties of systems. Different treatments of principles are studied, compared. Applications given to engineering problems, including development of availability concept.

2 units, autumn, (———), TTh 10

233b. Advanced Thermodynamics—Continuation of 233a. Further study on relationships among properties of systems. Introduction to chemical thermodynamics; theorems of Onsager, Prigogine.

2 units, spring, (Kline), WF 1

236. Combustion—Study of chemistry, thermodynamics, and fluid mechanics of combustion in flowing systems. Includes stoichiometry, equilibrium considerations, flame propagation theories, theories of droplet combustion and flame stabilization. Prerequisite: M.E. 133.

2 units, spring, (Eustis), TTh 9

237a. Thermodynamics of Propulsion Systems—Analysis of the performance of propulsion prime movers from a thermodynamic and dynamic point of view, including rocket, ramjet and turbojet systems as well as piston, gas turbine, and compound piston-turbine type engines. Thermodynamics and kinetics of combustion reactions as applied to internal combustion engine systems. Prerequisites: M.E. 133 and graduate standing.

4 units, spring, (London), MWF 11 and one hour by arrangement

237b. Special Problems in Internal Combustion Engine Systems—A laboratory and directed study course concerned with the special problems associated with internal combustion engine components including cooling, carburetion, fuel injection, combustion, and control problems. Prerequisite: M.E. 237a or concurrent registration.

2 units, spring, (Rosen), by arrangement


3 units, autumn, (Eustis), MWF 8


3 units, winter, (Kline), TTh 10, F 12


3 units, spring, (Kline), MWF 9

260. Advanced Dynamics of Machinery—Transient and steady state behavior of linear and of some non-linear systems in mechanical engineering. Problems involving many degrees of freedom. Prerequisite: M.E. 161 or its equivalent.

2 units, spring, (Jacobsen), TTh 8

271a. Nuclear Reactor Theory—Nuclear reactor physics, design theory. Prerequisite: E.M. 251 or Mathematics 131 (or concurrent registration), Physics 107.

3 units, winter, (Leppert), MWF 11
3 units, spring, (Leppert), MWF 8

3 units, spring, (Leppert, Brown), by arrangement

2 units, spring, (Leppert), TTh 10

SPECIAL RESEARCH

291. Engineering Problems—Directed study for graduate engineering students on subject of mutual interest to student and staff member. May be used to prepare for experimental research during a later quarter under 292. Student must find faculty sponsor.
1 to 5 units, any quarter, (Staff), by arrangement

292. Experimental Investigation of Engineering Problems—Graduate engineering student may undertake experimental investigation under guidance of staff member. Previous work under 291 may be required to provide background for experimental program. Student must find a faculty sponsor.
1 to 5 units, any quarter, (Staff), by arrangement

296. Seminar in Fluid Mechanics—Problems in all branches of fluid mechanics. Credit given to students presenting oral reports.
1 unit, autumn, winter, and spring, (Flügge-Lotz, Vincenti), T 4, alternate weeks

2 to 15 units, any quarter, (Staff), by arrangement

2 to 15 units, any quarter, (Staff), by arrangement

AERONAUTICAL ENGINEERING

Courses of special interest to mechanical engineers

A.E. 200a, b, c. Aerodynamics and Wing Theory.
A.E. 210a, b, c. Fundamentals of Gas Dynamics.
A.E. 241n. Thin-Walled Beams and Columns.

ENGINEERING MECHANICS

Courses of special interest to mechanical engineers

E.M. 207. Theory of Plates.
E.M. 211. Plasticity.
E.M. 221, 222, 223. Advanced Dynamics.
E.M. 242, 243, 244. Mathematical Hydro- and Aerodynamics.
SCHOOL of HUMANITIES and SCIENCES

Dean: Philip H. Rhinelander
Associate Dean: Ray Nelson Faulkner
Assistant Dean: William Maxwell McCord

ORGANIZATION

The School of Humanities and Sciences includes all members with the rank of instructor or above of the Departments of Anthropology, Art and Architecture, Asian Languages, Biological Sciences, Chemistry and Chemical Engineering, Classics, Communication and Journalism, Economics, English, Geography, Modern European Languages, History, Humanities, Mathematics, Music, Philosophy, Physics, Political Science, Psychology, Sociology, Speech and Drama, Statistics, together with appointees to the Faculty at Large.

Members of the School of Humanities and Sciences are listed under their respective departments, or under the staff for Special Interdepartmental Programs.

UNDERGRADUATE PROGRAMS

A student wishing to take a departmental major leading to the degree of Bachelor of Arts should consult appropriate sections of the announcements following. Further information concerning requirements may be obtained from the department concerned.

A student desiring to fulfill the requirements for the degree of Bachelor of Arts or Bachelor of Science in one of the special interdepartmental programs (see Humanities Special Programs, Physical Sciences General Program, and Social Sciences Special Programs in following sections of this Bulletin) should consult the Director of Special Programs in the Humanities, the Chairman of the General Program in the Physical Sciences, or the chairmen of interdepartmental programs in the Social Sciences. For general statements of the requirements for the degree of Bachelor of Arts or Bachelor of Science in these programs, students should see appropriate sections of the announcements following.

ROTC—Reserve Officers' Training Corps are maintained at Stanford by the Army, the Navy, and the Air Force (see Air, Military, and Naval Science in this Bulletin). Students enrolled in chemical engineering, chemistry, or physics who are also enrolled in an ROTC program will usually require more than the usual four years (twelve quarters) in the University to obtain a baccalaureate degree. Because of the 36 units of credit required for the Air, Military, and Naval Sciences, the Chemical Engineering, Chemistry, or Physics courses require additional time for graduation which will vary from one to three quarters depending upon the circumstances in each case.

GRADUATE PROGRAMS

Candidates for the degree of Master of Arts, Master of Science, or Doctor of Philosophy should consult appropriate sections of the announcements fol-
lowing and should also consult the department in which they intend to speciali-

Programs of study have also been established in the interdepartmental program in International Relations. Information regarding enrollment for the degree of Master of Arts in International Relations will be found in the section “International Relations Program” in this Bulletin.

ANTHROPOLOGY

Executive Head: Felix Maxwell Keesing
Associate Professors: Bert Alfred Gerow, George Dearborn Spindler
Assistant Professors: Alan Robin Beals, Antone Kimball Romney

OFFERINGS AND FACILITIES

The courses offered by the Department of Anthropology are designed: (1) to provide undergraduate students who wish to add to their general education, or to supplement collaterally their major field, with instruction in this discipline which deals with man from the broadest viewpoints of biological heritage, culture, society, and personality; (2) to provide undergraduate majors in anthropology with a program of work leading to the Bachelor's degree, and (3) to prepare candidates for advanced degrees in anthropology.

Undergraduate students wishing to enroll as majors in anthropology should apply to the Executive Head of the Department, who will assign them an adviser. Students wishing to change their majors to anthropology will be accepted if they have an average grade of C or higher in all courses counting toward a major in the field. Graduate students should apply formally through the Admissions Office, which will submit their names to the Department for approval when application requirements are completed. Initial inquiries may also be addressed directly to the Department.

DEGREES

Bachelor of Arts

For the Bachelor's degree in anthropology, 45 units of work in the Department are a requirement. The program of courses can be arranged in consultation with the adviser to meet the special needs and interests of the student. The following basic course requirements will be included in the 45 units, unless specifically excepted: Anthropology 1; Anthropology 5; Sociology 1; Psychology 1. The Senior Seminar will also be normally taken in the senior year. To be recommended for the Bachelor's degree, the student must have an average grade of C or higher for work in the major field. An honors program may be arranged by majors with superior records. This will include an honors thesis for which 3 units of credit will be granted (see 190—Directed Individual Study).

Students majoring in other social science fields or in education, and interested in taking an undergraduate minor or co-ordinated program in anthropology, may wish to consider a choice from the following courses as being particularly relevant: 1 (General Anthropology); 20 (Cultural Perspectives); 120 (The Growth of Cultures); 130 (Social Anthropology); 140 (Comparative Social Systems); 163 (Cultural Dynamics); 164 (Culture and Personality).
For majors in humanities fields the following anthropology courses are correspondingly brought to special attention: 1 (General Anthropology); 5 (Development of Man); 20 (Cultural Perspectives); 120 (The Growth of Cultures); 141 (Anthropological Approaches to Religion and Philosophy); 144 (Mythology and Folklore); 145 (Anthropological Approaches to Art); 170 (Prehistoric Archaeology); 176 (Language and Culture).

For students in the biological sciences the most relevant courses are: 5 (Development of Man); 175 (Physical Anthropology).

It will also be noted that regional courses are given, especially in fields where Stanford has integrated "area" programs: Latin America, Pacific and Asia.

Interested students may take part in field work on local archaeological sites. They may also obtain training in museum methods by doing directed work relating to the Stanford Museum anthropological collections (see Anthropology 180, 182).

**Master of Arts**

To undertake a program of study for the degree of Master of Arts in anthropology a student is required to have a Bachelor's degree, or evidence of equivalent training, in anthropology. In addition he must complete an introductory course in statistics.

To be recommended for the Master's degree a candidate must complete an approved course of graduate study at this University amounting to not less than 45 units of credit, normally the equivalent of three quarters of work. It must include one of the following plans: (a) With the approval of the Department and the acceptance of a member of the staff as director, a candidate may complete a thesis which may be submitted for a maximum of 12 units of the 45 units required; or (b) the candidate may obtain his training in research by participating in one of the formal research programs within the Department for a maximum of 12 units. In the approved course of graduate study no units will count which do not have a grade of C or higher, and the candidate must receive an average grade of B or higher. Candidates must have completed the following courses or equivalent work: Anthropology 120, 130, 170, 175, 176. They will also take approved graduate seminar work.

**Doctor of Philosophy**

To be recommended by the Executive Head of the Department to the University Committee on Graduate Study for admission to candidacy for the degree of Doctor of Philosophy in anthropology, the student must satisfy the following requirements:

(1) He must have demonstrated in his initial graduate work an ability and preparedness to pursue advanced studies to the professional level; (2) he must present, ordinarily by the beginning of his second quarter of doctoral work, a comprehensive plan of study, including an area of interest for his dissertation; and (3) he must demonstrate to the appropriate examiners, ordinarily before the close of the second year of graduate study, his knowledge of two languages other than English, these languages to be elected in collaboration with representatives of the Department; or if the Department and the University Committee on Graduate Study approve, he may demonstrate his knowledge of one language other than English and, in addition, complete satisfactorily a program of study of at least 15 units giving greater control of behavioral science methodology in some field other than anthropology.

The degree of Doctor of Philosophy in anthropology is offered at present for candidates intending to specialize professionally in cultural anthropology. But a general competence in other recognized fields of anthropology is also required: physical anthropology, prehistoric archaeology (prehistory), and
linguistics. To be recommended for this degree the candidate must (a) demonstrate in Departmental written examinations and in the University oral examination his scholarly proficiency in cultural anthropology; and (b) complete an acceptable doctoral dissertation, which will include evidence of adequate field work training and experience. The Departmental written examinations and the University oral examination will cover the following fields:

1. History and Modern Viewpoints (Ethnology and Ethnography, Social Anthropology);
2. At least three approved areas of specialization, including both topical interests (e.g., Social Organization, Folklore, Culture and Personality Studies, Cultural Dynamics, Cultural Basis of Mental Health) and regional interests (as the Far East, Pacific Islands, North America, Latin America).

The approved program will ordinarily consist of:

A. History and Modern Viewpoints, four areas of specialization, and a course of study of at least 15 units of graduate work in some other department, the work to be related directly to the elected fields of specialization, or

B. History and Modern Viewpoints, three areas of specialization, and a minor in some other department.

Comprehensive written examinations in the candidate's selected fields will be arranged by the Executive Head of the Department. They must be passed satisfactorily by the candidate before he may be certified for the University oral examination for the degree. Ordinarily the written and oral examinations will be taken several weeks apart, and in the same quarter.

In the case of students wishing to include the Cultural Basis of Mental Health as one of their areas of specialization, it may be possible to arrange for relevant work to be done at a local hospital.

Candidates for the degree of Doctor of Philosophy who wish to offer anthropology for their minor must have completed at Stanford or elsewhere courses in anthropology amounting to not less than 35 units of credit as a general background before working in their special minor fields. In order to satisfy the Department that they are properly qualified to undertake this work, candidates may be required to submit to brief qualifying oral examinations by designated staff members.

To be recommended for the degree of Doctor of Philosophy with anthropology as the minor subject, a candidate must acquire scholarly proficiency in two of the recognized fields of the minor. The selection of these fields is subject to the approval of the Department. When the candidate has passed a written examination in each of the two fields chosen, the Department will recommend to the University Committee on Graduate Study that he be permitted to take the University oral examination. Ordinarily the written and oral examinations will be taken within the same quarter.

A special minor is offered in social anthropology, with a study program concentrated in those anthropological fields of greatest relevance to the behavioral sciences. Choice of fields, to be worked out in consultation with the Departmental adviser, might cover such areas of specialization as Culture and Personality Studies, Social Organization, Cultural Dynamics, Anthropology and Education. For the graduate student electing to take a co-ordinated program in social anthropology as alternative to a minor such courses as 120, 130, 140, 163, 164, and 176 are suggested; at least one approved graduate seminar should also be taken.

TEACHING ASSISTANTSHIPS AND FELLOWSHIPS

The Department annually nominates graduate students for appointment as teaching assistants. The service expected consists for the most part of con-
ducting sections of 1 (General Anthropology). A teaching assistant devotes approximately a third of his time to the work, and receives $1,080 for the year, plus a tuition scholarship of $376. Research assistantships may also be available in connection with research programs in the Department, with stipends depending on the amount of work involved. Applicants for these appointments should address their requests to the Executive Head of the Department. Where students not already working in the Department wish to be considered, the application should be accompanied by a transcript of the academic record (graduate and undergraduate) and should name several persons qualified to speak of the applicant’s fitness for the appointment.

The University has a number of fellowships and scholarships available, including an Honors Fellowship assigned to the Department. Particulars are to be found in the annual Information Bulletin distributed from the Registrar’s Office.

COURSES PRIMARILY FOR UNDERGRADUATES

(Except where prerequisites are specified, courses are open to all students. With consent of the instructor, an extra unit may be added to 4-unit courses by undertaking special project work.)

1. General Anthropology—Anthropological approaches and perspectives relating to man, his culture, and his society. Emphasis on fields of cultural anthropology.
   5 units, autumn, (Keesing), MTWThF 1
   or winter, (Siegel), MTWThF 1
   or spring, (Spindler), MTWThF 10
   or summer, (———), MTWThFS 9

5. The Development of Man—Human evolution; early man; racial and other differences in modern man; early development and differentiation of culture. Introduction to physical anthropology and prehistory.
   5 units, winter, (Keesing), MTWThF 10

20. Cultural Perspectives—Analysis of selected social issues in terms of understandings about the nature of culture. Anthropological insights relating to such problems as technological development, education, health improvement, overpopulation, national movements.
   4 units, autumn, (Siegel), MTW Th 10

COURSES OPEN TO UNDERGRADUATES AND GRADUATES

120. The Growth of Cultures—Varieties, historical development, and distribution of world cultures and civilizations.
   4 units, winter, (Beals), MTWTh 9

130. Social Anthropology—Theories and schools in social anthropology, including contemporary functional, psychological, interactional studies. Prerequisite: Anthropology 1, or Sociology 1, or Psychology 1, or permission of instructor.
   4 units, autumn, (Keesing), MTWTh 10

140. Comparative Social Systems—Analysis of social structure, including kinship, community, other principles of organizing social life; comparison of non-Western with Western societies. Prerequisite: Anthropology 1, or Sociology 1, or permission of instructor.
   4 units, winter, (Siegel), MTWTh 10

141. Anthropological Approaches to Religion and Philosophy—Examination of anthropological theories relating to the origin and nature of religion; these fields of creativity and experience looked at cross-culturally, and in relation to the total social and cultural life.
   4 units, autumn, (Beals), MTWTh 1
144. Mythology and Folklore — Anthropological contributions to understanding of these fields of human creativity; comparisons with Western literature.

4 units, spring, (Gerow), MTWTh 11

145. Anthropological Approaches to Art — Emphasis on forms, meaning, and functioning of visual arts within the context of social and cultural life; some materials on music, the dance, and drama; opportunities for special work in chosen fields.

4 units, spring, (———), MTWTh 1

150. Peoples of the Pacific — Racial, linguistic, cultural backgrounds and characteristics of Malaysian and Oceanic islanders; opportunities to read on special areas.

4 units, autumn, (Keesing), alternate years, to be given in 1959-60

152. Peoples of the Far East — Racial, linguistic, cultural backgrounds and characteristics; opportunities to read on special areas.

4 units, spring, alternate years, to be given in 1959-60

153. Community and Society in India — Anthropological contributions to understanding of peoples and cultural traditions of India. Special attention to recent "village" studies.

4 units, autumn, (Beals), MTWTh 11

155. Indians of North America — Racial, linguistic, cultural backgrounds and characteristics; cultural relationships with "nuclear" America.

4 units, winter, (Spindler), alternate years, to be given in 1959-60

159. Early Civilizations of Middle America — Anthropological perspectives relating to Mexican, Peruvian, other "nuclear" American cultures prior to the Spanish Conquest.

4 units, autumn, (Siegel), alternate years, to be given in 1959-60

161. Indians of Mexico — Survey of cultural development of the Indians of Mexico during the last 3,000 years. Special emphasis is placed upon modern Indian village studies.

4 units, winter, (Romney), MTWTh 9

163. Cultural Dynamics — Interrelations between cultural, social, psychological processes in dynamics of cultural growth and change, including acculturation. Prerequisite: Anthropology 1, or Sociology 1, or Psychology 1, or permission of instructor.

4 units, spring, (Siegel), by arrangement

164. Culture and Personality — Anthropological contributions to understanding the role of culture in personality development; comparative studies; present status of problem. Prerequisite: Anthropology 1, or Sociology 1, or Psychology 1, or permission of instructor.

4 units, winter, (Spindler), MTWTh 11

165. Problems of Administration in Pacific Territories — Examination from the anthropological viewpoint of some outstanding problems of government, development, and welfare, and of varied national policies and administrative methods involved in handling them.

4 units, spring, (Keesing), MTWTh 10

170. Prehistoric Archaeology — Methods, findings in this field; correlations of prehistory of Europe and Near East with that of other zones over the world. Prerequisite: Anthropology 5, or Classics A100, or permission of instructor.

4 units, autumn, (Gerow), MTWTh 9

175. Physical Anthropology — Methods, findings relating to human evolution, racial differences, bodily growth; includes laboratory exercises. Prerequisite: Anthropology 5, or Biology 1, 2, 3, or permission of instructor.

4 units, spring, (Gerow), MTWTh 9
176. Language and Culture—Contributions of anthropology to study of linguistics; symbolic nature of language; structural and comparative studies; metalinguistic theory. Designed for students in language and other departments as well as in anthropology.

4 units, winter, (Gerow), MTWTh 1

180. Archaeological Field Methods—Studies, excavations of local archaeological sites, and related work in the Department archaeological laboratory. Prerequisite: consent of instructor.

3 or 4 units, autumn, (Gerow), by arrangement

182. Museum Methods—Directed work on anthropological collections in Stanford Museum. Prerequisite: consent of instructor.

2 or 3 units, winter, (Gerow), by arrangement

190. Directed Individual Study—For undergraduate students with special needs, and showing capacity to do independent or honors work. Prerequisite: consent of instructor.

Any quarter, (Staff), by arrangement

191. Senior Seminar—For undergraduate majors, to give experience in seminar techniques and afford opportunity to undertake special project work.

4 units, spring, (Keesing), by arrangement

Social Foundations of Education (Spindler)—See Education 110.
Cultural Transmission (Spindler)—See Education 315.

COURSES PRIMARILY FOR GRADUATES

210. History and Modern Viewpoints in Anthropological Theory—Seminar or directed individual work. Prerequisite: graduate standing or permission of instructor.

4 units, autumn, (Siegel), by arrangement

220. Advanced Ethnology—Seminar or directed individual work, oriented topically or toward intensive study of chosen areas, e.g., North America, Latin America, Southeast Asia, Africa, Soviet Union. Prerequisite: graduate standing or permission of instructor.

Any quarter, (Staff), by arrangement

233. Advanced Social Organization—Seminar or directed individual work, following up that given in Anthropology 140. Prerequisite: graduate standing or permission of instructor.

Autumn, (Romney), W 2-5

236. Advanced Cultural Dynamics—Seminar covering selected problems, especially at the community level. Prerequisite: graduate standing or permission of instructor.

4 units, spring, (Staff), by arrangement

237. Advanced Personality and Culture—Seminar work, following up Anthropology 164. Prerequisite: graduate standing or permission of instructor.

4 units, spring, (Spindler), by arrangement

251. Research in Cultural Anthropology—Seminar, analyzing selected studies for guidance and training in research; field work, thesis projects. Prerequisite: graduate standing or permission of instructor.

4 units, winter, (Keesing), M 2-5

253. Linguistic Field Methods—Seminar or directed individual work, following up Anthropology 176. Use of one or more informants and selected linguistic materials to demonstrate field methods and procedures for analysis of a language. Prerequisite: graduate standing or permission of instructor.

Any quarter, (Gerow), by arrangement

255. Psychologically Oriented Techniques in Field Work—Analysis and evaluation of use of psychological techniques (Rorschach, TAT, auto-
biographies, etc.) in cross-cultural and culture change contexts. Prerequisite: graduate standing or permission of instructor.

4 units, spring, (Spindler), alternate years, to be given in 1959-60

257. Communication Theory and Culture—Seminar, analyzing selected case materials, testing significant hypotheses. Prerequisite: graduate standing or permission of instructor.

3 units, winter, (Bateson), W 8 p.m.

300. Directed Project Work—Special research projects undertaken for course credit.

Any quarter, (Staff), by arrangement


Any quarter, (Staff), by arrangement


Any quarter, (Staff), by arrangement

Seminar in Social Anthropology in Education (Spindler)—See Education 416.

Cultural Dynamics—See Graduate Division Special Programs 322.

Graduate courses offered in other departments and institutes within the University, such as in Anatomy, Paleontology, Sociology, Psychology, and the Hoover Research Institute, may also be elected for graduate credit provided the course concerned is approved by the adviser as fitting into the student’s program. Graduates working for the Master of Arts degree are recommended to take Sociology 255, Methods of Social Research. For the graduate statistics requirement in anthropology, Statistics 50, Psychology 60, or Education 216 may be taken.

See also Senior Colloquia.

ART and ARCHITECTURE

Executive Head: Ray Nelson Faulkner
Professors: Edward McNeil Farmer, Ray Nelson Faulkner, Daniel Marcus Mendelowitz, Victor King Thompson
Assistant Professors: Victor Mikhail Arnautoff, Matthew Kahn, June King McFee. Acting: John-David Paul La Plante
Instructor: Raymond E. Brose. Acting: George J. Young
Lecturers: Birge M. Clark, James Fessenden, Henry Hill, Ernest J. Kump, Eldridge T. Spencer, James Storm, Arthur B. Sweetser (Architecture); Dwight A. Coddington (Mechanical Engineering); Isadore Thompson, Cecil Wells, Jr. (Structural Engineering)

The art program is presented in three areas: the courses of instruction, the Art Gallery exhibits, and the Museum with its collections and opportunities for research work.

The lecture and laboratory courses are open to the general student and afford a means of increasing his appreciation of art and an opportunity to try out his abilities.

DEGREES

Bachelor of Arts

A freshman or sophomore student intending to major in art will confer with the art adviser at the beginning of each quarter to plan his course of study.
A prospective art major should plan to complete about 20 units of art work during his freshman and sophomore years.

Two undergraduate curricula are open to the student majoring in art or architecture. Completion of one of these curricula with an average grade of not less than B minus is prerequisite to recommendation for graduate or professional work:

1. The Art Curriculum, a four-year program leading to the Bachelor of Arts degree in art, is made up of courses in drawing and painting, design, and history and theory which are basic to any further specialization.

   Required courses:
   - Painting: Art 3, 4, 101, 105, 203, 206, 209, Architecture 41 19 units
   - Design: Art 24, 26, 31, 124, 125, 128 18 units
   - History and Theory: Art 60, 61, 62, 166 17 units
   - Art Electives 16 units

2. The Pre-Architecture Curriculum provides the opportunity for a liberal education with pre-professional training in architecture. Upon satisfactory completion of this program the student receives the degree Bachelor of Arts in pre-architecture. (See graduate program below for the professional degree Bachelor of Architecture.) Required courses:

   Architecture: 41, 42, 43, 51, 52, 53, 141, 142, 143, 144, 145, 146, 151, 152, 153, 156, 157 49 units
   - Art: 3, 24, 26, 61, 124, 128, 166, 175 27 units
   - Other: Mathematics 10, C.E. 20, 116, E.E. 108a 12 units
   - Apprentice Training: Architecture 160, 6 units or 240 hours experience in an architect’s office.

Special Major Program for Honors Candidates in Humanities—Students who are planning to take the special Honors Program in Humanities may fulfill the requirements for their major in art by satisfactorily completing the following courses: Art 3, 4, 24, 26, 61, 62, 101, 105, 124, 166, 203, and 206.

If the major field of emphasis is architecture, satisfactory completion of the following courses is required: Architecture 41, 42, 43, 51, 52, 53; Art 3, 4, 24, 26, 61, 166. The Honors Program is described in the section “Humanities (Special Programs)” in this Bulletin.

Master of Arts

Graduate work leading to the Master’s degree may be undertaken by students who wish to engage in advanced creative work or art education. Only such students will be accepted whose ability is evident and whose study will lie within the fields in which the members of the faculty are working.

No degree is offered beyond the Master’s degree, but work for a minor in art will be provided for properly qualified students when such work forms an essential part of the student’s requirement for an advanced degree in another department.

Admission to candidacy for the degree of Master of Arts with specialization in creative work is based on:

1. The equivalent of a Bachelor of Arts degree in art at this University.
2. A grade-point average of B in at least 70 units of undergraduate work in art.
3. Formal admission to candidacy granted by the University Committee on Graduate Study.
The requirements for the degree of Master of Arts in creative work are:

1. Completion of a minimum of three full quarters of graduate work in residence at this University.

2. Completion of the equivalent of 45 units of selected third- and fourth-year undergraduate and graduate courses. At least 30 units of this work must be in art with a grade of B or above and distributed as follows:
   a) 8 units of drawing and painting
   b) 8 units of design
   c) 8 units of history and theory
   d) 6 units of thesis or individual creative project accompanied by written report.

3. Periodic evaluation of creative work.

Bachelor of Architecture

The professional degree of Bachelor of Architecture is offered at the graduate level and it is intended for the student who plans to become a practicing architect.

The requirement for admission is:

A Bachelor of Arts degree in pre-architecture from this University or its equivalent.

Requirements for degree:

1. Completion of a minimum of three full quarters of graduate work in residence.

2. Completion of 45 units of graduate work at Stanford which must include the following courses:
   Architecture 241, 242, 246, 248, 301 .......................... 22 units
   Law 101, Geography 270, C.E. 134, 138, Art 261 ............... 17 units

Doctor of Education and Doctor of Philosophy in Education

In cooperation with the School of Education the Department offers work leading to the Ed.D. and Ph.D. degrees with a concentration in Art Education. Specialization may be made in Teacher Education in Art, Secondary Education in Art, and Special Curriculum in Art.

TEACHING CREDENTIALS

Requirements for the Stanford General Secondary School Credential are:

one graduate year at this University of not less than 39 units of third- and fourth-year undergraduate and graduate courses, including at least 9 units of work in each of the candidate's teaching fields and at least 9 units in education; completion of the teaching-major in art and of a teaching-major or -minor in at least one other subject. (For further information consult the section of this Bulletin on Credentials, listed under the School of Education, and the Credential Secretary of the School of Education.)

COURSES

Elementary courses of both lecture and laboratory type are numbered below 100. No elementary course may be repeated for credit. Advanced courses are numbered 100 or above and, with the approval of the instructor, may be repeated indefinitely for credit.
DRAWING AND PAINTING

1. **Exploratory Course in Art**—Exploration of individual potential in art; variety of media. No prerequisites.
   - 3 units, autumn, (McPee)

2. **Representational Drawing**—Drawing with various media to gain facility in objective representation.
   - 3 units, autumn, winter, or spring, (Faculty)

3. **Expressive Drawing**—Problems in the organization of the elements of pictorial expression.
   - 2 units, autumn, winter, or spring, (Faculty)

4. **Introduction to Painting**—Basic practice in oil and watercolor. Prerequisites: 3 and 26.
   - 3 units, autumn or winter, (Brose)

5. **Life Drawing**—Stressing form, structure, action of human figure. Prerequisite: 3.
   - 2 units, autumn, winter, or spring, (Faculty)

6. **Print Methods**—Linoleum cutting, wood engraving, lithography, etching. Prerequisite: 105.
   - 3 or more units, winter, (Arnautoff)

7. **Individual Work: Drawing and Painting**—Individual work, weekly criticisms. Prerequisites: Previous related course work with instructor and his permission.
   - Any quarter, (Faculty), by arrangement

8. **Watercolor Painting**—Mostly landscape; techniques and stylistic approach varying with instructor. Prerequisite: 101.
   - 3 to 5 units, spring, (Faculty)

9. **Oil Painting**—Various subject matter; techniques and stylistic approach varying with instructor. Prerequisite: 101.
   - 3 to 5 units, autumn or winter, (Faculty)

10. **Painting Methods**—Advanced practice in using various oil, watercolor media. Prerequisites: 203 and 206.
    - 3 or more units, winter, (Brose)

DESIGN

11. **Elementary Design**—Laboratory problems emphasizing work with the art elements.
    - 3 units, autumn, winter, or spring, (Kahn)

12. **Color**—Theory, practical problems to learn visual characteristics and use of color.
    - 3 units, autumn or spring, (Faculty)

13. **Lettering**—Design, study of letter styles; exercises in their application to commercial art. Prerequisites: 3 and 24.
    - 3 units, autumn or winter, (Brose)

14. **Craft Techniques**—Introduction to ceramics, work in metal, wood, leather, other popular craft materials.
    - 3 units, autumn, (——)

    - 3 to 6 units, autumn and winter, (Kahn)

16. **Advanced Design**—Varied comprehensive problems in design. Prerequisite: 124.
    - 4 units, spring, (Kahn)

17. **Sculpture**—Carving, construction in various materials. Prerequisite: 124.
    - 2 or more units, spring, (Kahn)
220. Individual Work: Design—Individual work, weekly criticisms. Pre-requisites: Previous related course work with instructor and his permission. Any quarter, (Faculty), by arrangement

229. Textile Design—Problems in textile design, emphasis on printed cloth. Prerequisite: 125.
5 units, autumn (Kahn)

3 or more units, autumn, (Brose)

237. Product Design—Designing furniture, other articles for craft and industrial production. Prerequisite: 124.
3 units, winter, (Kahn)

The Theory of Costume—See Speech and Drama 71.
History of Costume—See Speech and Drama 171.
Introductory Costume Design—See Speech and Drama 172.
Introduction to Stage Design—See Speech and Drama 175.
Techniques of Stage Design—See Speech and Drama 178.
Projects in Stage Costume—See Speech and Drama 272.

ART HISTORY AND THEORY

60. Introduction to Art—Orientation to contemporary and historic art forms and principles to increase understanding, enjoyment of art. Illustrated lectures.
2 units, winter, (Faulkner)

5 units, spring, (——)

5 units, winter (Mendelowitz)

63. The Modern House—Functional, social, aesthetic problems in house design. Illustrated lectures.
2 units, autumn, (Faulkner)

5 units, winter, (——)

168. American Art—Colonial to modern times. Illustrated lectures.
5 units, spring, (Mendelowitz)

175. Oriental Art—Art from earliest times in China, India, and Japan and its development through major formative periods.
3 units, autumn, (LaPlante)

3 or more units, winter, (——)

3 or more units, autumn, (Mendelowitz)

266. Seminar: Modern Arts.
3 or more units, spring, (Farmer)

270. Individual Work: Art History—Individual work, weekly conferences. Prerequisites: Previous related course work with instructor and his permission.
Any quarter, (Faculty), by arrangement

300. Master's Thesis.
Any quarter, (Faculty), by arrangement

301. Master's Project.
Any quarter, (Faculty), by arrangement
SCHOOL OF HUMANITIES AND SCIENCES

Introduction to Greek Art—See Classics A120.
Early Greek Art—See Classics A125.
Anthropological Approaches to Art—See Anthropology 145.

INTERDEPARTMENTAL SEMINAR

Senior Seminar in Humanities: The Relationship between the Arts—See Humanities 192.

ART EDUCATION

180. Art in the Elementary School—(Same as Education 180.)
   5 units, winter or spring, (McFee)

280a. Curriculum and Instruction in Secondary School Art I—Lectures
   on foundations of art education. (Enroll in Education 280a.)
   4 units, autumn, (Mendelowitz, McFee)

280b. Curriculum and Instruction in Secondary School Art II—Curriculum
   development in art education; exploration of methods and materials.
   (Enroll in Education 280b.)
   2 units, winter, (McFee)

286. Seminar in Art Education—For advanced graduate students or
   experienced teachers. Exploration of problem areas in art education; application
   of foundations to art education. Prerequisite: 280a or 380.
   2 to 5 units, winter, (McFee)

380. Recent Developments in Art Education—Current contributions of
   educational foundations in art education. Studio experience adjusted to individual
   needs. (Enroll in Education 380.)
   4 units, summer, (McFee)

480i. Individual Instruction in Curriculum and Instruction in Art—
   (Enroll in Education 480i.)
   (Mendelowitz), by arrangement

ARCHITECTURE

41. Introduction to Architecture—A survey of architecture today. Lec.
   and lab. Open.
   2 units, autumn, (V. Thompson, Staff)

42. Design Fundamentals—Basic design problems. Structures. Representa-
   tion.
   2 units, winter, (Young)

43. Design Fundamentals—Continuation of Architecture 42.
   2 units, spring, (Thompson)

51. Elementary Design—Design of the modern house. Prerequisite: Arch.
   3 units, autumn, (Faulkner, Young)

52. Elementary Design—Interior design.
   3 units, winter, (Kahn)

53. Elementary Design—Site planning and garden design.
   3 units, spring, (— — —)

141. Intermediate Design—Architectural problems existing in the community.
   3 units, autumn, (Young, Wells)

142. Intermediate Design—Continuation of Arch. 141.
   3 units, winter, (Thompson, Wells)

143. Intermediate Design—Continuation of Arch. 142.
   3 units, spring, (Young, Wells)
144. Structures I—Mechanics, strength of materials, steel design.  
2 units, autumn, (Wells)
2 units, winter, (Wells)
146. Structures III—Lateral force analysis and design of structures.  
2 units, spring, (Wells)
5 units, autumn, (Thompson, Wells)
152. Advanced Design—Continuation of Arch. 151.  
5 units, winter, (Young, Wells)
153. Advanced Design—Continuation of Arch. 152.  
5 units, spring, (Kump, Sweetser, Fessenden, Storm, Wells)
156. Mechanical Equipment I—Plumbing, heating and air conditioning systems.  
2 units, winter, (Coddington)
2 units, spring, (Coddington)
160. Apprentice Training—Office internship sponsored by Coast Valleys Chapter AIA.  
1 to 2 units, any quarter.
241. Advanced Design—Large scale architectural projects involving planning.  
5 units, autumn, (Hill)
242. Practice Seminar—Discussion of procedures of practice.  
1 unit, winter, (Thompson)
246. Contemporary Structures Seminar—Discussion of modern structural techniques.  
1 unit, spring, (I. Thompson)
248. Building Materials—Lectures and field trips. Offered alternate years.  
2 units, autumn, (B. Clark)
Any quarter, by arrangement
301. Terminal Project—Individual projects. Fifth-year students only.  
1 unit, autumn, (Thompson)
4 units, winter, (Staff)
8 units, spring, (Spencer, Staff)

ASIAN LANGUAGES

Executive Head: Shau Wing Chan
Professor: Shau Wing Chan
Associate Professors: Robert Hopkins Brower, Frederic Spiegelberg
Assistant Professor of Philosophy and Chinese: ———
Acting Instructors: ———

OFFERINGS

The Department offers work in the languages, literatures, and civilizations of Asia. At present the languages offered are Chinese and Japanese; the literatures and civilizations include also those of India.

An Honors Program in Humanities is offered for majors in the Department who wish to supplement their Departmental major by a related and carefully
guided program of studies. The Honors Program is described in the section "Humanities (Special Programs)" in this Bulletin.

Bachelor of Arts

The Bachelor of Arts degree is granted in Chinese and Japanese. Majors may fulfill Departmental requirements for the degree by completing one of the two following programs. Whichever alternative is chosen, all majors are required to take the Senior Seminar (C191 or J191) in their respective fields, and to write a senior paper on a subject approved by the Departmental faculty.

Program A. Three years of Chinese or Japanese, plus at least 21 units from Departmental course offerings in the literature and civilization of the country whose language is being studied.

Program B. Two years of Chinese or Japanese, plus at least 15 units from Departmental course offerings in the literature and civilization of the country whose language is being studied, and at least 21 units in appropriate work in related fields such as anthropology, art, geography, history, and political science. The choice of such related courses must be approved by the Departmental adviser.

I. CHINA

C1, C2, C3. First-Year Modern Chinese—Grammar, reading, conversation, elementary composition.

5 units, autumn, winter, and spring, (Chan, ———), MTWThF 9

C5. Intensive Modern Chinese—Equivalent to C1, C2, and C3 combined. Consent of instructor necessary.

15 units, summer, (—— ———) MTWThF 9-12

C21, C22, C23. Second-Year Modern Chinese—Further study in grammar, reading, conversation, composition. Prerequisites: C3, C5, or equivalent.

5 units, autumn, winter, and spring, (Chan, ———), MTWThF 1

C91. Chinese Civilization—Development of Chinese civilization, with special emphasis on achievements in religion, philosophy, literature, art. Open to all students except freshmen.

3 units, winter, (Chan), MWF 10

C100. Directed Reading in English—For students with special interests in Chinese literature or culture. Consent of instructor necessary.

1 to 3 units, (Chan), by arrangement

C101, C102, C103. Third-Year Modern Chinese—Intensive reading in works of modern Chinese authors. Prerequisite: C23 or equivalent.

5 units, autumn, winter, and spring, (Chan, ———), by arrangement

C131, C132, C133. Introduction to Classical Chinese—Grammar and syntax; reading of representative texts; composition. Prerequisite: C23, or equivalent, or by permission of instructor.

3 units, autumn, winter, and spring, (—— ———), by arrangement

C141. Chinese Philosophical Literature—Selected works of representative philosophers in English translation.

3 units, autumn, (Chan), MWF 10

C145. Masterpieces of Chinese Literature—Selected literary works in English translation. Open to all students except freshmen.

3 units, autumn, (Chan), to be given in 1959-60

C161. Contemporary China—Political, social, economic, cultural problems. Open to all students except freshmen.

3 units, spring, (Chan), to be given in 1959-60

C191. Senior Seminar—Open to undergraduate majors only.

2 units, (Chan), by arrangement
**ASIAN LANGUAGES**

**C200. Directed Reading in Chinese**—For advanced students who wish to prepare for specialized research in their major field of interest. Consent of instructor necessary.

1 to 3 units, autumn, winter, (Chan), and spring, (———), by arrangement

See also Senior Colloquia.

**II. JAPAN**

**J1, J2, J3. First-Year Modern Japanese**—Conversation, grammar, reading, elementary composition.

5 units, autumn, winter, and spring, (Brower, ———), MTWThF 9

**J21, J22, J23. Second-Year Modern Japanese**—Further instruction, practice in conversation, grammar, reading. Prerequisite: J3 or equivalent.

5 units, autumn, winter, and spring, (Brower, ———), MTWThF 1

**J91. Japanese Civilization**—Development of Japanese civilization from ancient times to present; special attention to balance between native traditions and foreign influences in religion, literature, the arts. Open to all students except freshmen.

4 units, spring, (Brower, ———), to be given in 1959-60

**J100. Directed Reading in English**—For students with special interests in Japanese literature or culture. Consent of instructor necessary.

1 to 3 units, (Brower), by arrangement

**J101, J102. Third-Year Japanese**—Intensive reading in texts representative of various modern written styles. Prerequisite: J23 or equivalent.

5 units, autumn and winter, (Brower, ———), by arrangement

**J103. Third-Year Japanese**—Introduction to classical Japanese through close analysis of representative texts.

5 units, spring, (Brower, ———), by arrangement

**J145. Classical Japanese Literature**—Japanese literature in English translation from eighth to late sixteenth century. Lectures, readings, discussions of major examples of the novel, essay, no drama, classical poetry. Open to all students except freshmen. May be taken independently of J145.

3 units, autumn, (Brower), MWF 11

**J146. Modern Japanese Literature**—Japanese literature in English translation from seventeenth century to present, including popular drama, haiku poetry, contemporary novel and short story. Open to all students except freshmen. May be taken independently of J145.

3 units, winter, (Brower), MWF 11

**J191. Senior Seminar.** Open to undergraduate majors only.

2 units, (Brower), by arrangement

**J200. Directed Reading in Japanese**—For advanced students who wish to prepare for specialized research in their major field of interest. Consent of instructor necessary.

1 to 3 units, (Brower), by arrangement

See also Senior Colloquia.

**III. INDIA**

**E91. Indian Civilization**—Basic attitudes toward life underlying Indian society patterns, religion and art. The changing picture under Western influence.

5 units, autumn, (Spiegelberg), MTWTh 11

**E100. Directed Reading**—For students with special interests in Indian literature and culture. Consent of instructor necessary.

1 to 3 units, any quarter, (Spiegelberg), by arrangement
E145. Epics and Dramas of India—The great heritage of India's antiquity. Its literary form. The importance of oral tradition. Special problems of plots and character design, based on philosophy of life.
5 units, autumn, (Spiegelberg), WF 2-4

E146. Contemporary Indian Literature—The English writings of Tagore, Gandhi, and Aurobindo, and the modern novel.
5 units, winter, (Spiegelberg), WF 2-4

E147. Tagore—A discussion on his novels, dramas and poems; his philosophy and political ideas; the background of his thinking; the influence of his personality and his school on contemporary India.
3 units, spring, (Spiegelberg), M 2-4

E161. Bhagavadgita—A study of this central document of Indian philosophy in English translation.
5 units, spring, (Spiegelberg), WF 2-4, to be given in 1959-60

5 units, winter, (Spiegelberg), MTWTh 11

E163. Indian Philosophical Literature—The great systems of philosophy and the forms of their transmission. Their practical emphasis.
5 units, winter, (Spiegelberg), WF 2-4, to be given in 1959-60

Seminar on the Bhagavadgita—See Graduate Division Special Programs 334.

BEHAVIORAL SCIENCES (HONORS PROGRAM IN QUANTITATIVE METHODS)

Committee in charge: Patrick Suppes (Chairman), Kenneth J. Arrow, Albert H. Bowker, James E. Brinton, Douglas H. Lawrence

General Statement of Purpose
The Honors Program in Quantitative Methods is designed to supplement the curricula of able students in the behavioral sciences with an integrated program of quantitatively oriented work. It is intended that students participating in the Program will acquire a firm mastery of certain mathematical tools and also become familiar with substantive theoretical developments in the behavioral sciences which require mathematical methods.

Admission to the Program
A University average of B is required for admission to, and continuation in, the Program. Because many of the courses require specific mathematical background, candidates are urged to apply for admission not later than their sophomore year. Any member of the Committee may be consulted on admission. Information may also be obtained from the Program secretary in Serra House.

Requirements of the Program
1. The Honors Program supplements rather than replaces a regular Departmental major. Consequently a major in one of the following four participating departments is required: Communication and Journalism, Economics, Philosophy, Psychology. It is possible to combine this Honors Program with Departmental Honors Programs.
2. The following required courses totaling approximately 47 units in addition to the elementary calculus sequence are listed according to the year in which it is recommended they be taken.

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Units</th>
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<tbody>
<tr>
<td><strong>FIRST YEAR</strong></td>
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<tr>
<td>Mathematics 41, 62, 63. Differential and integral calculus</td>
<td>5, 5, 5</td>
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<tr>
<td>Philosophy 1. Introduction to Logic</td>
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<tr>
<td><strong>SECOND YEAR</strong></td>
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<tr>
<td>Mathematics 64. Partial derivatives, multiple integrals, infinite series</td>
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<tr>
<td>Course in Matrix Theory</td>
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<tr>
<td>Statistics 50, Psychology 60, or Economics 7</td>
<td>5</td>
<td></td>
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<tr>
<td><strong>THIRD YEAR</strong></td>
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<tr>
<td>Statistics 116. Theory of Probability</td>
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<tr>
<td>Statistics 119. Statistical Inference</td>
<td>3</td>
<td></td>
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<tr>
<td>Behavioral Sciences 151, 152, 153. Mathematical models in the Behavioral Sciences</td>
<td>10</td>
<td></td>
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<tr>
<td><strong>FOURTH YEAR</strong></td>
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<tr>
<td>Economics 199, Psychology 104, or Behavioral Sciences 199</td>
<td>5</td>
<td></td>
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<tr>
<td>Three of the following:</td>
<td>9</td>
<td></td>
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<tr>
<td>Economics 272. Statistical Inference in Economics</td>
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<td></td>
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<tr>
<td>Mathematics 115. Fundamental Concepts of Analysis</td>
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<td></td>
</tr>
<tr>
<td>Mathematics 116. Fundamental Concepts of Analysis</td>
<td></td>
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<tr>
<td>Mathematics 120. Modern Algebra</td>
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<td>Mathematics 137. Numerical Methods</td>
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<tr>
<td>Philosophy 161. Set Theory</td>
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<tr>
<td>Statistics 117a. Introduction to Stochastic Processes</td>
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<tr>
<td>Statistics 117b. Stochastic Processes and Distribution Theory</td>
<td></td>
<td></td>
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<tr>
<td>Statistics 122. Analysis of Variance</td>
<td></td>
<td></td>
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<tr>
<td>Statistics 124. Experimental Design</td>
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</tbody>
</table>

3. The Senior Thesis will be written under supervision of a designated faculty adviser. It may properly be concerned with empirical or experimental problems whose investigation requires use of mathematical techniques. The Thesis may be written as part of a Departmental Honors Program.

4. Each student will be required to take three courses designated by the Department in which he is majoring. In general these three courses will exemplify the application of mathematics to the student's major subject.

**Courses of Instruction**

151, 152, 153. **Mathematical Models in Behavioral Sciences**—The concentration will be on mathematical models which have been empirically tested: stimulus sampling and linear models for learning and social interaction; models for utility and subjective probability; and models of demand for consumption goods. There will also be some discussion of models relevant to normative problems: n-person game theory, arbitration schemes, existence of a social
welfare function. These courses are open to students not in the Honors Program. Prerequisite: Mathematics 63 or equivalent. Statistics 116 recommended.

151. 4 units, autumn, (Suppes), to be given in 1959-60
152. 3 units, winter, (Suppes), MW 4-5:30
153. 3 units, spring, (Suppes), MW 4-5:30

199. Senior Thesis in Quantitative Methods.
1 to 5 units, each quarter, (Staff), by arrangement

251, 252, 253. Graduate Seminar: Mathematical Methods in Behavioral Sciences—Selected topics in mathematical economics, decision theory, and learning theory.
1 or 2 units, autumn, winter, spring, (Arrow, Karlin, Scarf, Suppes), W 4

BIOLOGICAL SCIENCES

Emeriti: Gordon Floyd Ferris, Willis Horton Rich, Gilbert Morgan Smith, Harry Beal Torrey (Professors)

Executive Head: Victor Chandler Twitty
Professors: Lawrence Rogers Blinks, Rolf Ling Bolin, Arthur Charles Giese, Clifford Grobstein, George Sprague Myers, Cornelis Bernardus van Niel, Joseph Frederick Oliphant, Victor Chandler Twitty, Ira Loren Wiggins
Professors by Courtesy: Jens Christian Clausen, Charles Stacey French, William McKinley Hiesey
Associate Professors: Donald Putnam Abbott, Richard William Holm, Robert Meredith Page, David Dexter Perkins, David Cook Regnery, Donald Eugene Wohlschlag, Charles Yanofsky
Assistant Professor: Winslow Russell Briggs
Research Biologists: Dorothy Newmeyer, Patricia St. Lawrence
Lecturers: Laurence Monroe Klauber, Oswald Hope Robertson, Robert R. Rofen, Allen Cowie Taft

ORGANIZATION

The Department of Biological Sciences comprises the following divisions of teaching and research: (a) General and Experimental Biology, (b) Natural History, and (c) Marine Biology and Oceanography. The laboratories, museums, and libraries of these divisions are housed in Jordan Hall and the Natural History Museum on the campus, and in the Hopkins Marine Station in Pacific Grove on Monterey Bay. They provide excellent facilities and equipment for instruction and research in the various biological fields represented by members of the Department. Land, marine, fresh-water, and brine plants and animals are abundant nearby in nature at all times of the year.

The Department provides: (1) informative courses for the general student, (2) programs of study leading to the degree of Bachelor of Arts, and (3) programs of graduate study and research leading to the degrees of Master of Arts and Doctor of Philosophy.

In addition to broad offerings in pure science, the Department provides programs of study leading to specialized professional outlets. Among these are the premedical and teacher's programs, and special programs in entomology and fisheries biology. Additional programs may be arranged by consultation.
BIOLOGICAL SCIENCES

BIOLOGICAL LIBRARIES

The working libraries of the Department afford access to books and to current numbers and recent volumes of journals representative of the major biological fields. In addition to the Biological Library in Jordan Hall, there are also libraries in the Natural History Museum and in the Hopkins Marine Station. The latter includes an extensive collection of books, journals, and reprints especially on marine biology. In addition to the main University Library, the libraries of the Departments of Anatomy, Medical Microbiology, Chemistry and Chemical Engineering, Physics, and Geology (including Paleontology), as well as the Lane Medical Library in San Francisco, are open to qualified students in the Department of Biological Sciences.

UNDERGRADUATE PROGRAM

Bachelor of Arts

Candidates for the Bachelor of Arts degree must complete: (1) a group of specified courses in biology, or their equivalents, with certain options (see below) in keeping with the intended field of specialization; (2) 24 units of cognate studies in the physical sciences; and (3) 12 units of elective courses in biological sciences. Electives may be courses in biological sciences, anatomy, bacteriology, physiology, or any of the following courses in mineral sciences: G114, Elementary Paleontology; G115, Systematic Invertebrate Paleontology I; and G116, Systematic Invertebrate Paleontology II. Courses included under 1 and 3 must be completed with an average grade of not less than C.

Required Courses in Biology:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 20</td>
<td>Introduction to Botany</td>
<td>5</td>
</tr>
<tr>
<td>Biology 21</td>
<td>Introduction to Invertebrate Zoology</td>
<td>5</td>
</tr>
<tr>
<td>Biology 22</td>
<td>Comparative Vertebrate Anatomy</td>
<td>5</td>
</tr>
<tr>
<td>Biology 24</td>
<td>Cellular Physiology</td>
<td>5</td>
</tr>
<tr>
<td>Biology 25</td>
<td>Genetics</td>
<td>3</td>
</tr>
</tbody>
</table>

and one of the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 23</td>
<td>Introductory Embryology</td>
<td>5</td>
</tr>
<tr>
<td>Biology 30</td>
<td>The Plant Kingdom: Algae and Fungi</td>
<td>4</td>
</tr>
<tr>
<td>Biology 31</td>
<td>The Plant Kingdom: Mosses and Ferns</td>
<td>4</td>
</tr>
<tr>
<td>Biology 32</td>
<td>The Plant Kingdom: Seed Plants</td>
<td>4</td>
</tr>
</tbody>
</table>

Biology 1, 2, 3 (General Biology) may be substituted for Biology 20 and 21 (transfer from one sequence to another is not encouraged; students enrolling in Biology 1 will ordinarily complete Biology 2 and 3, and those electing Biology 20 will continue with Biology 21; Biology 111h or 112h (Marine Zoology) for 21; Biology 164h (Physiology of Algae) for 24.

Required Cognate Courses in the Physical Sciences:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 1, 2, 3, or equivalent</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Organic Chemistry 121, 123, or equivalent</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Physics, geology, or mathematics</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

In all cases the program of study must be approved each quarter by the Departmental Adviser for Graduation. The degree is conferred only upon recommendation of the Department. A student transferring from another institution should file a statement of credits promptly with the Adviser for Graduation. These credits will be evaluated and the student will be advised in regard to his remaining program.

Students wishing additional training in any of the special fields of botany...
or zoology in anticipation of attaining professional competence should consult with advisers of the Department regarding the elective units in their programs and additional courses which should be taken. (For botany, see Professor R. M. Page.)

Fishery Biology

Students who intend to become professional fishery biologists should plan to obtain the degree of Master of Arts and, if possible, the degree of Doctor of Philosophy. In planning programs of course work in the field of biology and in other fields allied to their research interests, they should consult members of the Fishery Advisory Committee (Bolin, Harry, Myers, Wohlschlag).

Senior Honors Program

(See Biology 200 under Courses.) This program is open to students of superior scholarship (grade average of B+ or better) or of outstanding interest and ability in biology. The aim of the program is to aid superior students in gaining greater independence of thought and a more professional approach to biological problems. Emphasis will be placed on the importance of original ideas in research rather than on the mastery of established facts. Satisfactory completion of the program will lead to graduation “With Departmental Honors.”

Premedical Students

It is recommended that premedical students take the following courses:

- Biology 20. Introduction to Botany ....................... 5 units
- Biology 21. Introduction to Invertebrate Zoology ............ 5 units
- Biology 1, 2, 3 (General Biology), 9 units, may be substituted for Biology 20 and 21
- Biology 22. Comparative Vertebrate Anatomy ............... 5 units
- Biology 23. Comparative Vertebrate Embryology ............ 5 units

These courses fulfill the biology requirements for admission to the Stanford University School of Medicine (see School of Medicine Bulletin) and for most other medical schools. For specific requirements of other medical schools consult the premedical advisers of the Department.

Predental Students

The Council on Dental Education has fixed as the minimum basis for admission to an approved dental school the successful completion of two full academic years of work in an accredited college of liberal arts and science. The college course must include at least a year’s credit in English, in biology, in physics, and in inorganic chemistry, and a half-year’s credit in organic chemistry. All courses in science should include both class and laboratory instruction.

The predental requirement in biology may be fulfilled by taking either Biology 20, 21, and 22, or Biology 1, 2, and 3.

The Teacher’s Recommendation

Programs are provided for candidates seeking either (a) the General Secondary Credential, with a teaching major or a teaching minor in biology, or (b) the Junior College Credential. Candidates holding the A.B. degree may satisfy the requirements for a General Secondary Credential by completing approved courses of study in biology and education in a minimum of three quarters of graduate study. Candidates who hold the degree of Master of Arts or
Doctor of Philosophy may qualify for a Junior College Credential in Biological Sciences with a teaching major or minor in biological sciences, botany, or zoology. In satisfying the requirements for a teaching credential the candidate may offer units transferred from other institutions, but at least one course of advanced character should be taken in this Department. Some substitutions may be made for Biology 23, 24, and 25 with the approval of the adviser on teaching credentials of the Department of Biological Sciences. For the details of these programs the prospective candidate should consult the statement on credentials in the section “School of Education” in this Bulletin, his adviser in the Department of Biological Sciences, and the Credential Secretary in the School of Education.

ADVANCED STUDY AND RESEARCH

Advanced courses and research are offered to qualified students in the following disciplines of the biological sciences which are represented on the campus and at the Hopkins Marine Station: (a) plant systematics, animal systematics, related interests (entomology, herpetology, ichthyology, marine invertebrates); (b) plant morphology, cytotaxonomy, invertebrate and vertebrate morphology; (c) experimental morphology, experimental embryology; (d) genetics, biochemical genetics; (e) marine and fresh-water ecology, oceanography, experimental ecology, fisheries biology; (f) plant physiology, general physiology, photobiology, comparative physiology; (g) microbiology, mycology, parasitology.

The disciplines listed above are among those commonly pursued in universities by students looking toward teaching and research, and medicine. They may also serve, however, as an essential background and basic training toward desirable positions in various branches of applied science, especially in agricultural and industrial fields, and in governmental agencies. Students interested in such pursuits should confer with the head of the Department, who may refer them to an appropriate adviser for assistance in the selection of courses in the Department and adjacent fields best suited for training toward a chosen objective. Students whose field of special interest is not listed above should correspond with the Department head before applying for admission.

ADVANCED DEGREES

Graduate study and research leading to the degrees of Master of Arts and Doctor of Philosophy may be carried on in the biological laboratories on the campus or at the Hopkins Marine Station on Monterey Bay. Students properly qualified for enrollment in any of the advanced and research courses previously noted may find available exceptional facilities for research and adequate reference literature in the biological libraries.

A student who has fulfilled the requirements for the degree of Bachelor of Arts, or their approximate equivalent as determined by the Department, may apply for admission to the Graduate Division. Before admission to candidacy for an advanced degree, a prospective candidate must conform to the regulations of the Department as stated below and of the University as outlined in the section “Degrees” in this Bulletin.

Doctor of Philosophy

Preparation for graduate study. In addition to courses equivalent to those required for a Bachelor's degree in biology at Stanford, it is recommended that wherever possible preparation for graduate work include courses in general physics, mathematics through intermediate algebra and if possible calculus, and foreign languages (preferably German and/or French, at least 2 years).
The Graduate Record Examination (Aptitude Test and Advanced Test in Biology) is recommended but not required of applicants.

The Master's degree is not required in order to proceed for a doctorate, although it may be recommended in specific cases.

The Ph.D. Qualifying Examination. Before being recommended for admission to candidacy for the degree of Doctor of Philosophy, the prospective candidate will be required to pass a qualifying examination, normally during the fourth quarter of registration as a graduate student. The qualifying examination is given once a year near the end of the autumn quarter. The status of the student remains probationary until this examination is completed, at which time his eligibility to continue work toward the Ph.D. degree is determined on the basis of his total academic performance during the first four quarters of graduate study.

Courses required of all Ph.D. candidates. It is expected that graduate students will fulfill the undergraduate requirements for a Biology major at Stanford by the time of entrance to graduate work, or as soon thereafter as possible. This includes credit for general inorganic chemistry (one year), organic chemistry, and some training in both botany and zoology. The Department also requires a minimum of 15 units of advanced biology courses (beyond Biology 25 and exclusive of special problems and research courses) taken in graduate standing. Specific course training beyond this point will be determined in each individual case by the special needs of the student, in consultation with his research adviser and sponsor.

Graduate Seminars, devoted to the discussion of current literature and research in particular fields of biology, are an important means of attaining professional perspective and competence.

Language Examinations. Proficiency in reading scientific literature in two foreign languages, normally German (required of all candidates) and French. Additional work in another scientific field (e.g. Physical Sciences or Mathematics) may in special circumstances be substituted for the second language.


The Oral Examination. Normally a three-hour examination, taken when the dissertation is at or near completion, the oral examination is conducted by a committee composed of members of the Department and others appointed by the Chairman of the University Graduate Study Committee. A candidate is expected to demonstrate a knowledge of the factual basis and theoretical implications of his thesis and an adequate mastery of his field of research. He must also show a grasp of the fundamental principles of biology and be able to show how these apply to his field of specialization. More detailed information concerning the oral examination and thesis will be found in the section "Degrees" in this Bulletin. Additional information and a suggested schedule for completion of requirements may be obtained from the secretary of the Department.

Master of Arts

Admission to graduate status and prospective A.M. candidacy of students who have been Stanford undergraduates requires prior agreement by a member of the Biology faculty to act as the candidate's sponsor and thesis adviser. Qualified applicants from other institutions will be assigned a tentative sponsor when they are admitted, and should make their choice of sponsor and thesis adviser definite as soon as they are prepared to do so. The student should discuss his program with his faculty sponsor to plan the training most useful for his professional development.
Permission to continue graduate work may be denied by the Department as the result of deficiencies in scholastic performance. A consistent B average is ordinarily expected of A.M. candidates.

The requirements for the A.M. degree in Biology are as follows:

One year (three quarters) of registration at Stanford in graduate status, totaling 45 units, of which 30 must be in advanced courses (including registration for research).

Courses Biology 20 through 25 or their equivalents (during either collegiate or graduate years). These undergraduate courses cover the following fields: introductory botany, introductory zoology, comparative vertebrate anatomy, embryology, cellular physiology, and genetics, respectively. Courses from the botany group Biology 30, 31, 32 may be substituted for comparative anatomy and/or embryology. These cover algae and fungi, mosses and ferns, and seed plants, respectively. An introductory general biology course such as Biology 1, 2, 3 is acceptable in lieu of the separate introductory botany and zoology courses (20 and 21).

A minimum of 15 units of advanced biology courses taken in graduate standing, excluding special-problems courses, seminars and research. Not more than 5 of these 15 units may be elected from courses offered by the departments of Anatomy, Bacteriology, Biochemistry, Geology (Paleontology) and Physiology.

A minimum of 10 units each in plant and animal biology (during either collegiate or graduate years). An introductory botany or zoology course may apply toward one of these. Bacteriology or microbiology do not apply toward this requirement for plant biology.

A minimum of 22 units in physical sciences (during either collegiate or graduate years), consisting of a year's course in general chemistry, and 10 additional units in chemistry and/or mathematics, physics, or geology.

A written A.M. thesis, based either on the results of an original investigation, or on a survey of the literature, in a special field agreed upon with the faculty sponsor.

Students originally admitted to the Department as A.M. candidates may subsequently transfer to Ph.D. candidacy only by written petition to the Department.

COMBINED SCHOLARSHIP AND TEACHING ASSISTANTSHIP PROGRAM

Qualified graduate students who wish to combine graduate study with part-time teaching, may apply for a tuition scholarship covering up to halftime tuition and fees ($564), together with a Teaching Assistantship carrying a stipend up to $1,620 annually for half-time teaching. Graduate students may apply for a Teaching Assistantship without a scholarship, if they are not subject to tuition charges or if they do not require scholarship aid.

The Department of Biological Sciences makes the majority of the Teaching Assistantship awards on or before April 1 for the coming year, and for these awards, and for half-tuition scholarships to accompany them, application forms (Application for Fellowship, Scholarship, or Assistantship) should be submitted to the Office of Admissions not later than February 15. However, assistantships occasionally become vacant at other times of the year, and applicants who desire to be considered for such vacancies may apply at any time by completing the regular forms and in addition addressing a letter of application to the Executive Head of the Department, Professor V. C. Twitty.

Predoctoral Fellowships. Qualified applicants are urged to take the initiative in applying for predoctoral fellowships from the National Science Foundation (for forms and information write: National Science Foundation Fellowship Office, National Research Council, 2101 Constitution Avenue, N.W.,
Washington 25, D.C. Deadline: early January) and the U.S. Public Health Service (for forms and information write: Research Fellowships Branch, Division of Research Grants, National Institutes of Health, Bethesda 14, Maryland. No deadline, but 3 to 4 months required between application and decision.). These attractive awards provide full tuition and generous stipends. Application may be made by college seniors planning to work for a higher degree after graduation, as well as by students at any level of graduate work. Competition is with other applicants at the same level of advancement.

Application for these fellowships does not preclude application for a teaching assistantship at Stanford; if both are granted one may be declined in favor of the other.

**BIOLOGY SEMINAR**

The Biology Seminar meets on Monday afternoons at 4:15. Topics of current biological interest are presented by speakers from Stanford and from other institutions, and are announced in the weekly University calendar. Students are urged to attend.

**SEMINAR IN TECHNIQUES OF BIOLOGICAL RESEARCH**

To acquaint beginning graduate students with the types of research represented in the Department, and with the principal techniques involved, visits to the laboratories of individual staff members will be arranged on dates announced at the beginning of each quarter. The Seminar is intended primarily for candidates for the Ph.D. degree, and attendance is voluntary.

**COURSES**

The letter h following a number indicates that the course is given at the Hopkins Marine Station.

1, 2, 3. General Biology—Functional mechanisms in plants and animals; major biological concepts, including historical development, logical or experimental bases. Structure, function, interrelationships of representative plants and animals are considered in the first two quarters; special attention to physiology of higher plants, vertebrate animals. Third quarter deals with principles of reproduction, development, inheritance, evolution.

Primarily for students who do not intend to major in biology, but may serve as a prerequisite to Biology 22 and subsequent courses leading to fulfillment of degree or premedical requirements. Lectures, laboratory, demonstrations. Enrollment only by signing class lists.

1. 3 units, autumn, (Regnery, ——), WF 11; lab. (I) T 9-12, (II) T 2-5, (III) W 8-11, (IV) W 2-5, (V) Th 9-12, (VI) Th 2-5; also offered summer quarter.
2. 3 units, winter, (Regnery, ——), WF 11; lab. (I) T 9-12, (II) T 2-5, (III) W 8-11, (IV) W 2-5, (V) Th 9-12, (VI) Th 2-5.
3. 3 units, spring, (Regnery, ——), WF 11; lab. (I) T 9-12, (II) T 2-5, (III) W 8-11, (IV) W 2-5, (V) Th 9-12, (VI) Th 2-5.

20. Introduction to Botany—Structure, function, relationships of plants. 5 units, autumn, (Page), MWF 8; lab. (I) TTh 2-5, (II) WF 2-5.

21. Introduction to Invertebrate Zoology—Structure, function, relationships of invertebrate animals. Prerequisite: Biology 20. 5 units, winter, (Oliphant), MWF 10; lab. (I) TTh 1-4, (II) WF 1-4.

22. Comparative Vertebrate Anatomy—Structure, relationships of vertebrate animals. Prerequisites: Biology 1, 2, 3, or 21.

5 units, spring, (Bolin), TWF 12; lab. (I) TTh 9-12, (II) TTh 2-5, (III) WF 2-5.
23. **Introductory Embryology**—An introductory study of development, particularly of amphibians, birds and mammals. Prerequisites: Biology 22, or equivalent.

5 units, autumn, (Grobstein), MWF 9; lab. (I) TTh 9-12, (II) TTh 2-5, (III) WF 2-5

24. **Cellular Physiology**—Fundamental activities of animals, plants, microorganisms. Prerequisites: Biology 1, 2, 3, or 20, 21, or equivalents, and elementary chemistry and physics. Preferred that students take organic chemistry before registering, or concurrently.

5 units, winter, (Giese), MWF 9; lab. (I) TTh 1-3:30, (II) WF 1-3:30; discussion (I) T 9, (II) Th 9

25. **Genetics**—Prerequisites: Biology 1, 2, 3, or 20, 21.

3 units, autumn, (Perkins), MWF

28. **Classification of Flowering Plants**—Lectures, laboratory, field studies. Prerequisite: General Biology or equivalent.

4 units, spring, (Holm, Wiggins), MWF 2-5: S 9-12

29. **Fungi**—Prerequisite: Biology 20 or Biology 1, 2, 3, or equivalents.

4 units, winter, (Page), TTh 9; lab. TTh 10-12 and 2 hours by arrangement

30. **The Plant Kingdom: Algae and Fungi**—Structure, development, evolutionary relationships of algae, fungi. Lectures, laboratory, field trips. Prerequisite: Biology 20 or equivalent.

4 units, spring, (Page), TTh 1; lab. TTh 2-5

31. **The Plant Kingdom: Mosses and Ferns**—Structure, development, evolutionary relationships of liverworts, mosses, the seedless vascular plant. Lectures, laboratory, field trips. Prerequisite: Biology 20 or equivalent.

4 units, winter (Briggs), TTh 1; lab. TTh 2-5

32. **The Plant Kingdom: Seed Plants**—Structure, development, evolutionary relationships of seed plants. Lectures, laboratory, field trips. Prerequisite: Biology 20 or equivalent.

4 units, autumn, (Holm), TTh 1; lab. TTh 2-5

36. **Plants in Human Affairs**—Lectures, reading on significance of plants in development of our civilization; special emphasis on economic importance.

3 units, autumn, (Wiggins), MWF 8, alternate years, to be given in 1958-59

40. **Ecology of Plants**—Lectures, assigned readings, field excursions. Prerequisite: General Biology or equivalent.

3 units, autumn, (Wiggins), MWF 8, alternate years, to be given in 1958-59

43. **Forest Botany and Geographical Distribution**—Lectures, herbarium, field study of classification, distribution of woody plants. Prerequisite: Biology 28 or equivalent.

3 units, autumn, (Wiggins), TTh 8; alternate Saturdays 8-4, alternate years, to be given in 1959-60

100h. **Marine Algae**—Lectures, laboratory, field work on various classes of algae. Open to elementary students.

5 units, summer (first half), (———), TThS

101h. **Natural History of Marine Animals**—Lectures, laboratory, field work stressing adaptive adjustments of marine animals. Prerequisites: General Biology or Zoology (or concurrent registration in Course 111h).

5 units, summer (first half), (Bolin), MWF, alternate years, to be given in 1958-59

103. **Comparative Histology**—Microscopic structure of animal tissues; special reference to vertebrates. Prerequisite: Biology 22 or equivalent.

3 units, autumn, (Oliphant), TTh 10; lab, W 1-4

105. **Immunobiology**—Principles of immunology as related to certain problems in biology.

2 units, winter, (Regnery), TTh, alternate years, to be given in 1958-59

109h. **Marine Ecology**—Ecological principles applied to marine habitats,
communities. Prerequisite: General Biology or Zoology (or concurrent registration in Course 111h.)

5 units, summer (first half), (Bolin), MWF, alternate years, to be given in 1959–60

110h. Marine Ecology—Continuation of 109h; some time on independent research. While the two courses form a continuous sequence, either half may be taken with profit. Prerequisite: General Biology or Zoology, preferably also Course 109h (or concurrent registration in Course 112h).

5 units, summer (second half), (Bolin), MWF, alternate years, to be given in 1959–60

111h. Marine Invertebrates—Structure, classification, biology of lower marine invertebrates, echinoderms, protochordates. Prerequisite: an elementary zoology course.

5 units, summer (first half), (Abbott), TThS

112h. Marine Invertebrates—Continuation of Course 111h, covering molluscs, annelids, arthropods, allied minor phyla. While the two courses form a continuous sequence, either half may be taken with profit. Prerequisite: elementary zoology, preferably also Course 111h.

5 units, summer (second half), (Abbott), TThS

113. Invertebrate Biology—Lectures, laboratory, field studies in ecology, biology of terrestrial, fresh-water, marine invertebrates. Prerequisite: Biology 21 or equivalent.

4 units, spring, (Abbott), TTh 10; lab. TTh 2–5; few Saturday field trips

124. Comparative Parasitology: Protozoa, Helminths—Principal attention to forms parasitic in man, animals, plants of importance in human economy.

4 units, spring, (Oliphant), TTh 10; lab. TTh 1–4

134. Vertebrate Evolution—Development of vertebrate animals through time. Prerequisites: Biology 1, 2, 3, or equivalent, or Historical Geology. Enrollment by permission.

3 units, winter, (Myers), TTh 11; lab. W 2–5

136h. General Ichthyology—Fishes, including elements of morphology, taxonomy, embryology, natural history, principles and techniques of conservation. Prerequisite: Biology 22 or equivalent.

5 units, summer (second half), (Bolin), MWF, alternate years, to be given in 1958–59

138. Systematic Herpetology—Lecture, laboratory survey of living amphibians, reptiles of the world.

4 units, spring, (Myers), by arrangement, alternate years, to be given in 1959–60

142. Experimental Embryology—Lectures on experimental analysis of embryonic development by microsurgical methods, related techniques. Prerequisite: Biology 23.

3 units, autumn, (Twitty), MWF 10

143. Analysis of Development—Lectures and class discussion of the experimental analysis of development, with emphasis on the behavior of cells and tissues and its integration in the development of the whole organism. Prerequisites: Biology 23, 24, 25, 142, or equivalents.

3 units, winter, (Grobstein), MWF


3 units, spring, (Briggs), TTh 9 and one hour by arrangement

147. Cytology—Plant, animal cells in reproduction, growth, differentiation. Prerequisites: Biology 1, 2, 3, or 20, 21, or equivalents.

4 units, winter, (Holm), MWF 11; lab. F 2–5, alternate years, to be given in 1959–60
2 units, winter, (Perkins), TTh, alternate years, to be given in 1958–59

2 units, spring, (Yanofsky), TTh, alternate years, to be given in 1958–59

149. Cytogenetics—Critical study of important experiments selected from the literature. Prerequisite: Biology 25.
2 units, winter, (Perkins), TTh, alternate years, to be given in 1959–60

2 units, winter, (Perkins), by arrangement, alternate years, to be given in 1959–60

151. Evolutionary Genetics—Application of genetics to study of evolution. Prerequisite: Biology 25.
2 units, winter, (Regnery), TTh, alternate years, to be given in 1959–60

153h. General Microbiology—Culture, morphology, general physiology, ecology of representative types of microorganisms. Prerequisites: elementary chemistry, biology. Organic chemistry desirable, but not a prerequisite. Courses 153 and 154 form an integrated sequence, but either section may be taken separately.
6 units, summer (first half), (van Niel), MWF

154h. General Microbiology—Continuation of 153h. Biochemical properties of microorganisms. Prerequisites: Biology 153h, or an introductory course in general bacteriology; and organic chemistry (e.g., Chemistry 121 and 123).
6 units, summer (second half), (van Niel), MWF

156. Introductory Plant Physiology—Principal functions of organs of higher plants; growth, mineral nutrition, water relations, movement of materials, respiration, nitrogen relations, photosynthesis. Prerequisites: Biology 20 or equivalent, Inorganic Chemistry.
5 units, autumn, (Briggs), MWF 9; lab. WF 2–5

164h. Physiology of Algae—Prerequisites: elementary physics, chemistry, biology.
5 units, summer (second half), (Blinks), TThS

165. Advanced Plant Physiology—Selected topics. Reading, conferences, lectures. Prerequisites: Biology 20, 24, and preferably 156.
2 units, winter, (Blinks), M 2–4, alternate years, to be given in 1959–60

168. Comparative Animal Physiology—Response, nutrition, reproduction of animals; special emphasis on invertebrates. Prerequisites: Biology 21, 22, 24, or equivalents. Laboratory work may be undertaken during summer at Hopkins Marine Station.
5 units, spring, (Giese), MTWThF 9

169h. Ecological Physiology—Physiological responses of animals to variation in environmental factors and to organisms. Most work will deal with marine invertebrates. Prerequisite: general zoology and elementary chemistry.
5 units, summer (first half), (Giese), TThS

170. Paleobotany—Structure, evolutionary relationships of fossil plants. Prerequisite: Biology 31, or 32, or permission of instructor.
4 units, winter, (Holm), WF 1; lab. WF 2–5, alternate years, to be given in 1958–59

2 units, spring, (Myers, with co-operation of the Natural History Museum Staff), alternate years, to be given in 1959–60
176. Limnology—Ecology of fresh waters. Lectures, laboratories, field trips. Prerequisites: 9–10 units General Biology.
   4 units, spring, (Wohlschlag), TTh 9; lab. TTh 2–5

178. Principles of Conservation—Biological problems involved in utilization, maintenance of renewable natural resources. Prerequisite: General Biology.
   3 units, winter, (Wohlschlag), MWF 8

179. Conservation Practices—Special study, written report on selected topic for students in Course 178. By permission.
   2 units, winter, (Wohlschlag), by arrangement

182. Special Problems in Fishery Biology—Literature or field problem elected for one or more quarters by qualified students. Prerequisites: Junior or more advanced standing.
   (Wohlschlag), by arrangement

189. Quantitative Methods in Biology—Design, analysis, interpretation of biological experiments. Rationale, application of techniques of analysis of variance, regression and correlation, covariance; techniques utilizing chi-square, binomial, and Poisson distributions. Prerequisites: Statistics 50 or equivalent.
   4 units, autumn, (Wohlschlag), TTh 9; lab TTh 2–5

193. Studies in the Historical Development of Natural History—Directed readings, discussions. By permission. May be elected for two quarters.
   2 units, autumn, (Myers), by arrangement

194. Special Problems in Taxonomic Botany—Juniors, seniors, or graduate students on permission of instructor.
   (Holm, Wiggins), by arrangement

196. Seminar in Fishery Biology—Special topics in current fishery research.
   1 unit, autumn, winter, spring, (Wohlschlag), by arrangement

199. Special Problems.
   (Staff), by arrangement

199h. Special Problems.
   (Hopkins Marine Station Staff) by arrangement

200. Senior Honors Program—Readings or research in some phase of biology of especial interest to the individual. Satisfactory completion leads to Departmental recommendation for graduation with honors in biology. Open only to seniors (or students in the last quarter of their junior year) who have maintained an average grade of B+ or better. Not more than six units of honors work may be applied toward the 12 units of electives required for graduation in biology.
   (Staff), by arrangement

210. Advanced Plant Morphology.
   (Staff), by arrangement

212. Phylogeny of the Angiosperms I—Critical study of selected families of flowering plants; particular attention to evolutionary relationships. Prerequisite: Biology 28 or equivalent.
   4 units, winter, (Wiggins), TTh 11 and 2 laboratory periods by arrangement, alternate years, to be given in 1958–59

213. Phylogeny of the Angiosperms II—Continuation of Biology 212.
   4 units, winter, (Wiggins), TTh 11 and 2 laboratory periods by arrangement, alternate years, to be given in 1959–60

214. Biosystematics—Some major relationships of cytology, genetics, morphology to systematics. Prerequisite: Biology 25 or equivalent.
   3 or 4 units, spring, (Holm), MWF 11; lab. by arrangement, alternate years, to be given in 1958–59

216. Field Problems in Geographical Distribution—Student must be
prepared to devote his whole time to the problem during the quarter selected, furnish his own transportation to, from, and in the field, and his own camping equipment when necessary.

15 units, autumn, spring, summer, (Staff), by arrangement

230. Advanced Systematic Ichthyology I—Intensive lecture, laboratory course extending through two quarters. Open only to especially qualified advanced students upon permission of instructor.

4 units, autumn, (Myers), by arrangement

231. Advanced Systematic Ichthyology II—Continuation of Biology 230.

4 units, winter, (Myers), by arrangement

240. Graduate Seminar in Microbiology—Discussion of current literature and research. May be repeated for credit.

1 unit, autumn and winter, (Yanofsky), alternate weeks, by arrangement

241. Graduate Seminar in Genetics—Literature, research. May be repeated for credit.

1 unit, winter and spring, (Perkins), alternate weeks, by arrangement

245. Electrophysiology—Bio-electric phenomena in plants, animals.

2 units, winter, (Blinks), M 2-4, alternate years, to be given in 1958-59

247. Advanced Cellular and Comparative Physiology—Discussion of a selected topic. Prerequisites: Biology 24, and 168, or equivalents. By permission.

2 units, autumn, (Giese), M 1-3

255. Museum Methods in Natural History (Zoology)—Practical work in handling, care of zoological research collections; discussions on organization, administration of natural history museums. Open to juniors, seniors, graduate students in biology, with permission of instructor.

2 to 4 units, (Myers, with assistance of Museum Staff), by arrangement

256. Herbarium Methods in Natural History—Practical work in preparation, care, identification of botanical research collections. Open to juniors, seniors, graduate students in biology after consultation with instructor.

2 to 4 units, any quarter, (Holm and Herbarium Staff), by arrangement

300. Research

(Staff), by arrangement

300a. Research

(Hopkins Marine Station Staff), by arrangement

See also Senior Colloquia.

DIVISION OF MARINE BIOLOGY AND OCEANOGRAPHY

HOPKINS MARINE STATION

Director: Lawrence Rogers Blinks
Assistant Director: Rolf Ling Bolin
Professors: Lawrence Rogers Blinks, Rolf Ling Bolin, Arthur Charles Giese, Cornelis Bernardus van Niel
Associate Professor: Donald Putnam Abbott

The Hopkins Marine Station is situated at Pacific Grove, on the south side of Monterey Bay, 90 miles from the main University campus at Palo Alto. The ground area comprises seven and a half acres, consisting of the main portion of Cabrillo Point, with complete control of the coast line of the Point and including an excellent sheltered landing place and harbor for boats. There are two well-equipped buildings, the Alexander Agassiz Laboratory and the Jacques Loeb Laboratory. The library is especially endowed, and subscribes to about fifty journals. Its collections are especially rich in marine biology, oceanography, and microbiology.

The Station is open during the entire year and maintains a permanent staff of resident investigators and technical assistants; this staff is increased by
visiting faculty members, especially during the summer. There are facilities for visiting investigators and for elementary and advanced instruction in biology. For further information, see the Hopkins Marine Station Bulletin issued in March.

Admission and Fees

Candidates for admission should make application to the Director, Hopkins Marine Station, Pacific Grove. The application should state whether admission to the freshman, sophomore, junior, senior, or graduate level as a matriculated student is desired; or whether the student wishes to register on the non-matriculated basis (available in summer quarter only).

Matriculated Basis—Students who have been admitted to the University and wish to receive credit toward a degree should register as matriculated students.

Non-matriculated Basis—Students from institutions which have agreed to accept work completed at the Station in fulfillment of their requirements and other students not expecting degree credit at Stanford should register as non-matriculated students (summer quarter only).

(For detailed information regarding procedure and credentials necessary for admission, see the Hopkins Marine Station Bulletin).

The tuition and required fees for all students at the Hopkins Marine Station are $335 per quarter. In the summer, half-quarter registration (two courses, ten units) will be at the rate of $188. (This does not apply to the full quarter, for which 8 units constitute half-time.)

Visiting investigators will be charged a minimum fee of $50 per quarter or fraction thereof; and for the use of larger or more expensive equipment, upward of $100 per quarter. Very little such space is available.

Autumn, Winter, and Spring Quarter Courses

Although formal courses will not be offered, the staff will welcome the opportunity to direct work of graduate and undergraduate students in the fields indicated. Owing to superior conditions of tides and weather, the autumn and spring quarters are especially recommended for research involving marine organisms.

199h. Special Problems—Properly qualified Upper Division students may undertake individual work in fields indicated under 300h. Such studies are intended to introduce the serious student to methods of research. Arrangements must be made by consultation or correspondence.

(Staff), by arrangement

300h. Research—Problems involving original work may be undertaken with members of the staff in the following fields:

Marine Zoology—Problems connected with anatomy, taxonomy, natural history of oceanic invertebrates. Invertebrate ecology.

(Abbott)

Physiology—Problems of general and cellular physiology, especially of marine plants. Permeability, photosynthesis, bio-electric phenomena emphasized.

(Blinks)

Marine Fishes—Morphology, taxonomy, embryology, ecology of marine fishes.

(Bolm)

Physiology—Problems on physiology of invertebrate animals; photobiology, especially effects of ultra-violet light.

(Giese)
Microbiology—Morphology, taxonomy, biochemistry of various groups of microorganisms.
(van Niel)

Summer Quarter Courses

The summer quarter is divided into two half-quarters of about five weeks each. Those courses requiring the lower tides of early summer are scheduled in the first half. It is possible to register for either half, or for the full quarter.

The regular five-unit laboratory courses are scheduled for three alternate days per week, an average of 20 hours per week being required. It is possible to obtain ten units in each half-quarter, but registration for more than fifteen units in the full quarter is not ordinarily advisable, owing to the intensive schedule.

For detailed descriptions of courses, see listings above under Biological Sciences; also the Hopkins Marine Station Bulletin (issued in March).

First Half

100h. Marine Algae.
5 units, (———), TThS
101h. Natural History of Marine Animals.
5 units, (Bolin), MWF
111h. Marine Invertebrates.
5 units, (Abbott), TThS
153h. General Microbiology.
6 units, (van Niel), MWF
169h. Ecological Physiology.
5 units, (Giese), TThS
199h. Special Problems—(See autumn, winter, spring quarters, above.)
(Staff), by arrangement
300h. Research—(See autumn, winter, spring quarters, above.)
(Staff), by arrangement

Second Half

136h. General Ichthyology.
5 units, (Bolin), MWF
112h. Marine Invertebrates (continued).
5 units, (Abbott), TThS
154h. General Microbiology (continued).
6 units, (van Niel), MWF
164h. Physiology of Algae.
5 units, (Blinks), TThS
199h. Special Problems—(See under First Half.)
(Staff), by arrangement
300h. Research—(See under First Half.)
(Staff), by arrangement

Division of Natural History

NATURAL HISTORY MUSEUM

Emeriti: Gordon Floyd Ferris, Willis Horton Rich (Professors), Albert W. C. T. Herre (Curator)

Director: Ira Loren Wiggins
Curators: Richard William Holm (Dudley Herbarium), George Sprague Myers (Ichthyological and Herpetological Collections)
The Natural History Museum has for its general purpose the maintenance of provisions (1) for proper housing and care of the systematic collections of animals and plants; (2) for furthering the growth and development of the collections through explorations; (3) for instruction, investigation, and research in systematics, geographical distribution, ecology, and the general field of natural history. It is housed in the west wing of the Museum Building, where instruction and research utilizing the collections are conducted. Facilities are available for a limited number of graduate students and qualified investigators to carry forward research programs.

Advanced courses and research leading to the degrees of Master of Arts and Doctor of Philosophy, in compliance with University and Department of Biological Sciences requirements, are offered at the Museum in the following fields: (a) botany (morphology, distribution, and taxonomy of vascular plants); (b) entomology (morphology, life histories, and taxonomy of insects); (c) zoology (fisheries biology, ichthyology, and herpetology, including taxonomy, morphology, ecology, and distribution).

Dudley Herbarium

The Dudley Herbarium, named in honor of Professor William Russel Dudley, is especially rich in material from western North America and offers unusual facilities for critical systematic and distributional studies of the floras of that region. The Harvey Herbarium, comprising about 65,000 sheets, and the herbarium of the late Dr. Herman Knoche, containing over 125,000 sheets, furnish authentic material from Europe and the Mediterranean regions. They contain many historical, frequently cited specimens and are of great value to investigators studying plants recently introduced into North America or those closely related to Old World species. The collections of cryptogamic and phanerogamic plants in the Dudley Herbarium now number about 557,050 sheets.

Botanical exploration is carried on each season by one or more members of the Herbarium staff, and properly qualified students are encouraged to participate in this work. This field work may be carried on partially in connection with Biology 216 by properly prepared students.

Entomological Collections

The entomological collections are rich in material suitable as a basis for research in certain groups. The collections of Mallophaga and Anoplura are almost unrivaled and that of Coccidae is one of the most important in existence, while smaller groups of ectoparasites are well represented. All of these collections contain large numbers of types and other important material. Much material of other insect orders, especially from the western United States, is available to the research student.

Zoological Collections

The collection of fishes is one of the largest and most important in the world, its basis being the material collected by Dr. David Starr Jordan, his associates, and his students. The marine and fresh water fishes of both eastern and western North America, the West Indies, Central America, Japan, eastern China, the Philippines, the Malay Peninsula, Hawaii, and Polynesia are well represented. In addition, there are large bathyal collections from the North Pacific and other parts of the world, as well as extensive series of fishes of
Peru, Colombia, the Galapagos Islands, Venezuela, British Guiana, the Amazon, Cameroon, South and East Africa, India, the Malay Archipelago, and Australia.

The herpetological collections contain an extensive representation of the amphibians and reptiles of the West and considerable material from southeastern Asia and tropical America. The Museum also has a fine representation of the birds and mammals of the western states. The collection of marine invertebrates is rich in echinoderms, crustaceans, and cephalopods, and contains good working nuclei in other groups. The series of deep-sea forms is especially good.

George Vanderbilt Foundation

The George Vanderbilt Foundation is an independently endowed, semi-autonomous, nonprofit organization occupying quarters on the ground floor of the Natural History Museum. Its main purpose at present is to carry on research dealing with the fish fauna of tropical Pacific Ocean waters from ecological, systematic, and zoogeographic approaches, and to promote these researches by providing for publication of the results obtained. Substantial parts of the collections of fishes obtained by the Foundation's field operators will be incorporated into, and will enrich, the ichthyological collections of the Natural History Museum. Such collections will be available for study by staff members and qualified students of Stanford University, and by visiting scientists.

Dr. Robert R. Rofen, Lecturer in Ichthyology, is Director of the Foundation, and a member of its Board of Trustees.

CHEMISTRY and CHEMICAL ENGINEERING

Emeriti: John Pearce Mitchell, Robert Eckles Swain (Professors)

Executive Head: George Sutton Parks

CHEMISTRY

Professors: Claudio Alvarez-Tostado, Frederick Otto Koenig, Philip Albert Leighton, Hubert Scott Loring, James Murray Luck, Harry Stone Mosher, Carl Robert Noller, Richard Andrew Ogg, Jr., George S. Parks, James Hollingsworth Clemmer Smith (by courtesy)

Associate Professors: William Andrew Bonner, Richard Hallenbeck Eastman, Stuart Wood Grinnell, Eric Hutchinson, Douglas Arvid Skoog

Assistant Professor: ———. Acting: Eugene Russell Hardwick

Lecturers: Frank R. Mayo, Pierre Van Rysselberghe

[With the co-operation of Arthur Furst, Associate Professor of Pharmacology and Thomas Reed Tuttle, Jr., Acting Assistant Professor of Chemical Physics]

CHEMICAL ENGINEERING

Associate Professor: David Malcolm Mason

Assistant Professors: Cornelius John Pings, William Herman Schwarz

Lecturers: George Anton Agoston, Jack James Gordon, Nevin Kay Hiester

Entrance Preparation

Students who intend to major in chemistry or chemical engineering are expected to offer entrance credit in the preparatory subjects of chemistry,
physics, and mathematics (including trigonometry and solid geometry). Those who do not have entrance credit or equivalent training in the foregoing subjects, especially mathematics, may experience some difficulty in meeting the Departmental requirements for graduation in four years.

Chemistry Curricula

*Requirements for Graduation in Chemistry*—Candidates for graduation with chemistry as the major subject are required to have received an average grade of at least C in their chemistry courses. They must offer the equivalent of at least 18 units of college work in German, or 12 units of German and 12 units of French or Russian. Students should complete the courses listed under Curricula A or B to meet the requirements for the degree of Bachelor of Science. Unless entrance deficiencies or other factors require important changes, it is recommended that a curriculum be followed rather closely as given. The requirement in physics may be satisfied by completing either of the series of Courses 21, 23, 29, or 51, 53, 55, 57, although the second series is recommended. The required work in advanced chemistry courses noted below may include any lecture courses not previously listed among the required courses in the curriculum chosen. Elective courses of interest are listed under Curricula A and B.

### A. General Chemistry

[Recommended for those students preparing for graduate work and teaching as well as for careers in industry such as chemical development, production, product control, technical sales, and industrial research.]

*Requirements:* General Studies requirement; foreign language; English 129; Mathematics 10, 11, 21, 22, 23 or 41, 42, 43; Physics; Chemistry 1, 2, 3, 20, 112, 113, 114, 115, 121, 122, 123, 124, 125, 126, 171, 173, 175, 176, 190 (at least 6 units), and approved advanced courses in chemistry (at least 6 units).

1. **Four-Year General Chemistry Program**

#### First Year

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#### Second Year

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### Third Year

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<th>Course</th>
<th>Autumn</th>
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<tbody>
<tr>
<td>Chem. 121, 123, 125. Organic Chemistry</td>
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<td>Chem. 122, 124. Organic Preparations</td>
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<td>Math. 22, 23. Analytic Geometry and Calculus</td>
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### Fourth Year

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<td>Chem. 176. Physico-chemical Measurements</td>
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<td>Chem. 190. Methods of Investigation</td>
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<td>Chem. 126. Organic Qualitative Analysis</td>
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Note 1. Courses which may be used to satisfy the requirement for advanced course work in Chemistry include Chem. 130, 131, 138, 139, 141, 143, 163, 177, 216, 218, 221, 223, 225, 231, 280, 281.

Note 2. Elective courses may be chosen from any offered by the Chemistry Department or by other departments of the University. Courses offered by other departments which may be of particular interest to chemistry majors include: Economics 1; Mathematics 24, 130, 131, 132; Physics 111, 113, 115; Statistics 110; Geology 1, 25, 170; Met.E. 104, Met.E. 107; Microbiology 101; Biology 25, 153, 154.

### 2. Four-Year Chemistry Program Which Completes Premedical Requirements in Three Years

#### First Year

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<th>Course</th>
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<th>Spring</th>
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<tbody>
<tr>
<td>Chem. 1, 2, 3. General Chemistry</td>
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<tr>
<td>Biology 20, 21, 22. Introduction to Botany and Zoology; Comparative Anatomy</td>
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<td>English 1, 2, 3. Freshman English</td>
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<tr>
<td>History 10, 11, 12. History of Western Civilization</td>
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#### Second Year

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<td>Chem. 20, 112, 113, 114, 115. Qual. and Quant. Analysis</td>
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<td>Biology 23. Embryology</td>
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### Third Year

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<tr>
<td>Chem. 121, 122, 123, 124, 125. Organic Chemistry</td>
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<td>German G22, G23a. Second-Year Reading</td>
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<td>English 129. Scientific Writing</td>
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<td>Physics 55, 57. Light and Heat; Atomics</td>
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| Total | 17 | 15 | 14 |

### Fourth Year

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<tr>
<td>Chem. 171, 173, 175. Physical Chemistry</td>
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<td>Chem. 176. Physico-chemical Measurements</td>
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<tr>
<td>Electives</td>
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</tbody>
</table>

| Total | 15 | 17 | 15 |

### B. Biological Chemistry

[Particularly adapted to students who are looking forward to work in medicine or entrance into biochemical practice and research.]

**Requirements:** General Studies requirements; foreign language; English 129; Mathematics 10, 11, 21, 22, 23 or 41, 42, 43; Physics; Chemistry 1, 2, 3, 20, 112, 113, 114, 115, 121, 122, 123, 124, 125, 126, 141, 142, 143, 144, 171, 173, 175, 176, 190 (at least 6 units).

The Four-Year Biological Chemistry program is the same as in Curriculum A for the first, second, and third years. It is the same as the fourth year of Curriculum A with the exception that biochemistry lectures and laboratory, Chemistry 141, 142, 143, and 144, must be taken as the advanced course work. Electives may be those listed under Note 2, Curriculum I.

### Teaching Credentials

The requirements for certification to teach chemistry in the secondary schools and junior colleges of California may be ascertained by consulting the section on credentials under “School of Education” in this Bulletin and the Credential Secretary of the School of Education.

### Advanced Degrees in Chemistry

The general University regulations for advanced degrees are stated in the section “Degrees” in this Bulletin. All candidates for advanced degrees are required to have received an average grade of at least B in all course work (and also a B average in thesis and seminar work) taken during graduate study. During the period in which a thesis is being read by members of the staff, candidates are required to be available in person until the thesis has had final Departmental approval.
Master of Science in Chemistry—Applicants for the degree of Master of Science in chemistry will be expected to complete, in addition to the requirements for the Bachelor's degree, the equivalent of 45 units of work in the University, of which approximately two-thirds must be in the Department. This work will include a thesis based on laboratory work. A minimum of 15 units of advanced course work (exclusive of Chem. 200, 219, 240, 248, and 297) in chemistry and allied sciences is required. It is expected that in addition the candidate will participate continually during residence in at least one of the Department seminars (Chemistry 219, 240, 248, or 297). Medical Microbiology 101, or 225 and 226, or Biology 153h and 154h also must be taken by all students who are majoring in biochemistry. All requirements are subject to the general University regulations described in the section "Advanced Degrees" in this Bulletin.

Doctor of Philosophy in Chemistry—The graduate student does not become a formal candidate for the Ph.D. degree until he has passed the Departmental preliminary qualifying examinations. These differ in the various fields as indicated below. Doctorate candidates will follow such courses as are approved by the Department, subject to general University rules as stated under "Advanced Degrees" in this Bulletin. They will be considered responsible for an integrated knowledge of their field of specialization which will not be limited to the content of related advanced courses offered by the Department. Normally they will register for at least 15 units of such advanced course work. If a formal minor subject in another department is not chosen, candidates are required to present a minimum of 20 units of advanced course work in fields of chemistry or chemical engineering other than the field of specialization, in allied sciences and engineering subjects, or in both. In any event 15 to 18 units of mathematics (analytic geometry and calculus) and 15 to 18 units of physics (including atomic physics), ordinarily completed during undergraduate work, must be presented. If the Ph.D. degree is not obtained within a period of six years from the date of enrollment in graduate school, it will be necessary for the student to repeat and pass the qualifying examinations before the degree will be granted. The foreign language requirement for the Ph.D. in chemistry will ordinarily be met in German and in French or Russian. However, proposals to substitute another language or a program of course work for French or Russian will be considered on petition of the candidate.

In addition to the requirements of the University Committee on Graduate Study governing the University oral examination, candidates are required, at least three weeks before this examination, to arrange an informal private conference with each member of the chemistry staff in residence at the time. Admission to the oral examination will be contingent upon a satisfactory report from the staff members thus interviewed. Three research propositions must be submitted at the time of these pre-oral interviews. The University oral examination may not be taken during the summer quarter except after favorable action on special petition filed not later than the third week of the spring quarter.

Candidates for the Doctor of Philosophy degree in other departments who wish to minor in chemistry should have completed at least 30 quarter units in chemistry, including General Chemistry, and those advanced courses most directly related to the major subject. A brief oral or written examination may be required.

It is the policy of the Department to encourage and support in every possible way the pursuit of research and of other work along advanced lines by qualified students. A list of the published papers, and other information in regard to the research work carried on in the Department during the past academic year, will be sent upon application.
Qualifying Examinations in Chemistry—All new regular graduate students are required to take qualifying examinations during the first week of autumn quarter. These examinations consist of four written examinations of two hours duration each and will be given on October 1, 2, 3, and 4 in 1958. All four examinations must be taken during this period. These four examinations will be in the fields of inorganic, analytical, organic, and physical chemistry and will cover such material as is ordinarily given in a one-year undergraduate course in each of these subjects.

Qualifying Examinations in Biochemistry—For students majoring in biochemistry, four qualifying examinations must be taken. One of these examinations will be in organic chemistry. The remaining three may be selected from inorganic chemistry, analytical chemistry, physical chemistry, and microbiology or physiology. The examinations in chemistry must be taken during the first week of autumn quarter as indicated above. Those students electing to take examinations in microbiology or physiology must declare their intention of doing so at the time they register for autumn quarter. Otherwise they will be expected to take the four examinations in chemistry. In addition, a comprehensive written examination in biochemistry must be passed in the final year of candidacy for the Ph.D. in this subject. This examination is offered regularly on the third Monday of January.

Chemical Engineering Curricula

The chemical engineering curriculum leading to the B.S. degree in chemical engineering is designed for those students who desire the broad training in the physical sciences and engineering necessary for the design, development, or operation of plants and processes of the chemical and petroleum industry; or training necessary in solving research problems in these industries or in specialized fields such as jet propulsion and nuclear engineering. Those students who have the ability and desire to engage in chemical engineering research are encouraged to pursue advanced studies and research leading to the M.S. or Ph.D. degrees in chemical engineering.

Requirements for Graduation in Chemical Engineering—Candidates for graduation with chemical engineering as the major subject are required to have received an average grade of at least C in required chemistry, chemical engineering, mathematics, physics, and engineering courses. Major students in chemical engineering should complete the courses listed in the four-year curriculum below. Because of the interrelation of the subjects in the chemical engineering program, it is recommended that the curriculum as given be followed as closely as possible. Particularly it should be noted that the required chemical engineering courses beginning with Ch.E. 110 are given only once in any academic year, and the sequence of courses requires six quarters for completion.

Students who are planning eventually on obtaining the degree of Doctor of Philosophy in Chemical Engineering will be required to have a reading knowledge of at least one foreign language, and may therefore desire to take an approved foreign language as an elective.

Bachelor of Science Curriculum in Chemical Engineering

Requirements: General Studies requirements; Chemistry 1, 2, 3, 20, 112, 113, 114, 115, 121, 122, 123, 125, 171, 173, 175, 176; Ch.E. 110, 115, 120a, 120b, 123a, 125b, 127a, 127b; Civil Engineering 99, 110, 112; Electrical Engineering 100 and either 102 and 102L or 143; Mathematics 10, 11, 12, 22, 23 and 24 or 41, 42, 43, and 24; Physics 51, 53, 55; Speech and Drama 20; Economics 1.
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<th>First Year</th>
<th>Autumn</th>
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<tr>
<td>Chem. 1, 2, 3. General Chemistry</td>
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<td>Math. 10, 11, 21. Analytic Geometry and Calculus</td>
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<td>Ch.E. 115. Industrial Chemical Calculations</td>
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<tr>
<td>Ch.E. 120b. Chemical Engineering Thermodynamics</td>
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<td>C.E. 99, 100. Engineering Mechanics (Statics) and (Dynamics)</td>
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E.E. 102 and 102L or 143. Principles of Machines or Introduction to Electronics. ................. 3 3
Humanities. Approved Electives ................................. 5 3
Social Sciences ...................................................... 3
Group Activity or Approved Electives (Note 1) .... (3) (3) (3)

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<td>13(16)</td>
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Note 1. Among courses recommended as electives are the following: Chemistry 124, 126, 130, 131, 139, 179, 218, 280, 281; Mathematics 130, 131, 132; Physics 57; Industrial Engineering 130; Mechanical Engineering 9, 171, 271a, 271b; Mineral Sciences, Met.E. 104, Met.E. 123, Met.E. 124, Met.E. 125. Students enrolled in one of the R.O.T.C. programs must take an intensive schedule which may not permit electives.

ADVANCED DEGREES IN CHEMICAL ENGINEERING

Programs leading to the M.S. and Ph.D. degrees are offered in chemical engineering. The general University regulations for these advanced degrees are described in the section "Degrees" in this Bulletin. In addition, the following Departmental requirements must be met: All candidates for an advanced degree must have received an average grade of B in all course work (as well as Ch.E. 290) taken while in residence in the Graduate Division. A student shall be expected to present his thesis in final form and have it approved during or before his last quarter of residence in the Graduate Division.

Candidates for advanced degrees are required to show proficiency expected of the better undergraduate chemical engineering students by passing written qualifying examinations. Examinations on those subjects substantially completed as an undergraduate must be taken during the first quarter of residence in the Graduate Division. Thus the student should have prepared for these examinations prior to enrollment in the Graduate Division.

For the M.S. degree written examinations are required in the fields of (1) general engineering; (2) basic chemical engineering (given October 1); (3) physical chemistry (October 4). In addition, the Ph.D. candidate is required to take one of the following written examinations: inorganic chemistry (October 1); analytical chemistry (October 3) or organic chemistry (October 2) and an oral examination in general engineering and basic chemical engineering at a date and hour to be arranged with each student.

Master of Science in Chemical Engineering—Candidates for the M.S. degree in chemical engineering are required to complete a total of 45 units of approved graduate courses in addition to the courses listed under the curriculum immediately below. These 45 units shall include a thesis based on advanced research of at least 15 units in Ch.E. 290 in the field of chemical engineering or applied chemistry. A successful research program may require more than the minimum required units so that a student should be prepared to devote at least a summer or other full quarter to his research program. The curriculum as given below should be followed. The remaining units may be devoted to further technical courses given in either the School of Engineering or the School of Humanities and Sciences, or for those so desiring may be chosen from approved courses given in the Graduate School of Business or in the School of Humanities and Sciences. A suggested first-year graduate course is shown below.

MASTER OF SCIENCE CURRICULUM IN CHEMICAL ENGINEERING

1. Leading to M.S. degree in Chemical Engineering

Requirements: Ch.E. 210, 215, 220, Math. 130 and 131, Math. 132, or 106, or Stat. 110; minimum of 15 units of Ch.E. 290 leading to a successful thesis.
### CHEMISTRY AND CHEMICAL ENGINEERING

<table>
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<tr>
<td>Ch.E. 215</td>
<td>Chemical Engineering Kinetics</td>
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<td>Ch.E. 220</td>
<td>Introduction to Transport Processes</td>
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<td>Ch.E. 290</td>
<td>Chemical Engineering Research</td>
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<td>Math. 130, 131</td>
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<tr>
<td>Mathematics or Statistics Elective (Note 1)</td>
<td>-</td>
<td>3 or 4</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Approved Electives</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

| Total | 15 | 15 | 15 or 16 |

**Note 1.** Mathematics or Statistics elective must be chosen from the following: Mathematics 132, 106; Statistics 110.

### 2. Leading to M.S. degree in Chemical Engineering Nuclear Reactor Technology

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch.E. 210</td>
<td>Thermodynamics of Multicomponent Systems</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 215</td>
<td>Chemical Engineering Kinetics</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 220</td>
<td>Introduction to Transport Processes</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Ch.E. 290</td>
<td>Chemical Engineering Research</td>
<td>4</td>
<td>2</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Chem. 139</td>
<td>Radiochemistry</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>( ) Nuclear Physics for Engineers</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>E.M. 250, 251, 252. Advanced Mathematics</td>
<td>3</td>
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<tr>
<td>M.E. 271a, b. Nuclear Reactor Theory</td>
<td>3</td>
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</tr>
<tr>
<td>M.E. 272. Nuclear Engineering Laboratory</td>
<td>-</td>
<td>-</td>
<td>3</td>
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<tr>
<td>Met.E. 231. Nuclear Reactor Metallurgy</td>
<td>-</td>
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<td>Approved Electives</td>
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</tr>
</tbody>
</table>

| Total | 15 | 18 | 20 | 15 |

**Doctor of Philosophy in Chemical Engineering** — During the first year qualified Ph.D. candidates should pursue the course of study listed for M.S. candidates above. Candidates will then follow courses approved by their faculty adviser subject to general University regulations described in the section “Degrees” in this Bulletin. A total of 20 units of advanced work in the fields of chemistry or chemical engineering must be presented. A total of 20 units of advanced work in allied sciences and engineering subjects must also be presented. Elective courses may be chosen from broad technical fields such as chemistry, physics, engineering, and mathematics, or from fields of interest in the School of Humanities and Sciences or in the Graduate School of Business. The candidate will be considered responsible for an integrated knowledge of his field of specialization. The thesis must be based on successful advanced research on fundamental chemical engineering or applied chemical problems. If the Ph.D. is not obtained within a period of six years from the date of enrollment, it will be necessary for the student to repeat and pass the qualifying examinations before the degree will be granted.

Candidates are required, at least three weeks before the University oral examination, to arrange a private interview with each member of the Department of Chemistry and Chemical Engineering Staff, and admission to the oral
examination will be contingent upon a satisfactory report from staff members interviewed.

FELLOWSHIPS AND SCHOLARSHIPS

In addition to the University fellowships and scholarships which are open to properly qualified students, there are at present a number of Departmental fellowships in chemistry and chemical engineering. The Dow Chemical Company Fellowship, Edward Curtis Franklin Fellowship, James W. McBain Memorial Fellowship, Parke, Davis Research Fellowship, Stauffer Chemical Company Fellowship, and Frederick P. Whitaker Fellowship are granted only to graduate students. The William H. Nichols Scholarships, David L. and Lavinia E. Sloan Memorial Scholarship, John Maxson Stillman Scholarship, Ephraim and Amelia Weiss Scholarship, and Henry Windt Junior Memorial Scholarship are open to graduates and undergraduates; the American Cyanamid Company Scholarship, Robert M. and Katherine F. Loeser Scholarship, Frank Gard Scholarship, and Standard Oil Company of California Scholarship are available to undergraduates only.

There are also numerous teaching assistantships and research assistantships open to advanced students. The DuPont Teaching Assistantship is available for a student who has been a teaching assistant for two years. Application forms for fellowships, scholarships, and teaching assistantships may be obtained from the office of the Department of Chemistry and Chemical Engineering.

COURSES

Deposits required in laboratory courses, against which charges are made for breakage, loss of apparatus, chemicals, etc., are from $5 to $30 per quarter.

GENERAL AND INORGANIC CHEMISTRY

1. General Chemistry—Prerequisite: high school algebra or Mathematics A.
   4 units, autumn, (Hardwick, Hutchinson, Koenig, ————); lec. (I) MWF 8, (II) MWF 9, (III) TThS 8, (IV) TThS 9; lab. (I) T 9-12, (II) Th 9-12, (III) T 2-5, (IV) W 2-5, (V) Th 2-5, (VI) F 2-5

2. General Chemistry—Continuation of Chemistry 1.
   4 units, winter (Hardwick, Hutchinson, Koenig, ————); lec. and lab. sections same as under Chemistry 1

3. General Chemistry—Continuation of Chemistry 2. For all students except those majoring in the School of Engineering.
   5 units, spring, (Hardwick, Hutchinson, Koenig, ————); lec. (I) MWF 8, (II) MWF 9; lab. (I) TTh 9-12, (II) TTh 2-5, (III) WF 2-5

4. General Chemistry—Continuation of Chemistry 2. For students majoring in the School of Engineering.
   3 units, spring, (———), TThS 8

130. Inorganic Chemistry—Survey of descriptive inorganic chemistry. Prerequisite: Chemistry 3.
   2 units, winter, (Ogg), TTh 11

131. Inorganic Chemistry—Continuation of Chemistry 130.
   2 units, spring, (Ogg), TTh 11

138. Radiochemistry—Properties of radio-isotopes and their application to chemistry. Methods of detection and measurement of activity; methods of preparation and handling radio-isotopes; methods of introducing such isotopes into certain types of compounds and some uses for which tracer atoms have been employed. Prerequisites: Chemistry 3 and Mathematics 24, and Physics 57 or equivalent.
   2 units, winter, (Hutchinson), TTh 9
139. Radiochemistry Laboratory — Laboratory techniques of handling, preparation, isolation and detection of radio-isotopes and the use of such isotopes in typical chemical problems, e.g., solubility studies and reaction rates will be covered. Laboratory space is restricted and registration is by permission of the instructor only. Prerequisite: Chemistry 138.

2 units, spring, (Hutchinson), by arrangement

231. The Ammonia System of Compounds — Compounds related to ammonia as oxygen acids, bases, salts, etc., are related to water; includes chemistry of organic nitrogen compounds. Prerequisite: Chemistry 123.

3 units, autumn, (Ogg), MWF 9, alternate years, to be given in 1959–60

**Analytical Chemistry**

20. Qualitative Analysis — Inorganic substances. Prerequisite: Chemistry 3 or 4.

4 units, autumn, (Ogg) TTh 11; lab. MW or TTh 2–5

110. Elementary Quantitative Analysis — For other than chemistry majors. Concurrent registration in Chemistry 111 required. Prerequisite: Chemistry 3 or 4.

2 units, autumn, (Skoog), TTh 10
or winter, (Tuttle), TTh 11

111. Elementary Quantitative Analysis Laboratory — Concurrent registration in Chemistry 110 required.

3 units, autumn, (Skoog), MWF 1–4
or winter, (Tuttle), MWF 1–4 (Registration limited to 35)

112. Quantitative Analysis — For chemistry majors. Concurrent registration in Chemistry 113 required. Prerequisites: Chemistry 3 and 20.

2 units, winter, (Skoog), TTh 10

113. Quantitative Analysis Laboratory — Concurrent registration in Chemistry 112 required.

3 units, winter, (Skoog), MWF 1–4

114. Quantitative Analysis — Continuation of Chemistry 112. Concurrent registration in Chemistry 115 required.

2 units, spring, (Skoog), TTh 11

115. Quantitative Analysis Laboratory — Concurrent registration in Chemistry 114 required.

2 or 3 units, spring, (Skoog), 2 or 3 afternoons

216. Advanced Analytical Chemistry — Selected topics in quantitative analysis. Prerequisites: Chemistry 114 and 123.

3 units, autumn, (Skoog), MWF 10, alternate years, to be given in 1958–59

218. Instrumental Analysis — Theory, application. Prerequisites: Chemistry 114, 123, and concurrent or previous registration in 171.

3 units, autumn, (Skoog), MWF 10, alternate years, to be given in 1959–60

219. Analytical Chemistry Seminar — May be repeated for credit.

1 unit, autumn, winter, and spring, (Skoog), by arrangement

**Biochemistry**

141. Biochemistry — Carbohydrates, lipids, proteins, enzymes, digestion, absorption, intestinal putrefaction, general aspects of metabolism, composition and function of blood and urine. Prerequisites: Chemistry 110, 111 (or 112, 113), 121 and 123, or equivalents, are required for nonmedical students.

3 units, autumn, (Loring), TTh 8

142. Biochemistry — Laboratory course which, for medical students, will include: pH and buffers; qualitative chemistry of carbohydrates, lipids, proteins; enzyme reactions, digestion; composition, properties of milk, blood,
142 SCHOOL OF HUMANITIES AND SCIENCES

urine. For nonmedical students second half of quarter will be devoted to group experiments, quantitative in character, on living organisms. Prerequisites: Same as Chemistry 141.

2 units, autumn, I, (———), MT 1–4 (Medical students only)  
 II, (Luck), ThF 1–4 (Nonmedical students only)

143. Biochemistry—Continuation of 141; particular reference to intermediary carbohydrate, lipid, protein metabolisms; chemistry and function of vitamins and hormones; nutrition.

3 units, winter, (Loring), TThS 8

144. Biochemistry—Medical students: continuation of 142, emphasis on quantitative analysis of blood, urine by colorimetric, photometric procedures.

2 units, winter, I (———), MT 1–4 (Medical students only)

245. Biochemistry of Cancer—Recent advances in biochemical cancer research, including discussion of methods used in producing experimental cancer; enzymatic, dietary, and nutritional studies; other aspects of oncology. Prerequisite: Organic Chemistry.

2 units, winter, (Furst), WTh 4

246. Nucleoproteins and Nucleic Acids—Lectures on preparation and properties of certain nucleoproteins; chemistry, metabolism of ribo- and deoxyribonucleic acids. (Primarily for graduate students in chemistry.)

2 units, spring, (Loring), TTh 9, alternate years, to be given in 1958-59

247. Biochemistry of Water-Soluble Vitamins—Chemistry, functions of water-soluble vitamins. (Primarily for graduate students in chemistry.)

2 units, spring, (Loring), TTh 9, alternate years, to be given in 1959-60

248. Biochemistry Seminar—May be repeated for credit.

1 unit, autumn, winter, and spring, (Staff), F 4

CHEMICAL ENGINEERING

Ch.E. 110. Mathematics Applied to Chemical Engineering—Differential equations in problems from fields including instrument response; chemical reaction kinetics; mass, heat, momentum transfer with emphasis on setting up ordinary and partial differential equations, solving ordinary differential equations. Prerequisite: Mathematics 24.

3 units, autumn, (Agoston), MWF 1

Ch.E. 115. Industrial Chemical Calculations—Application of principles of stoichiometry and material, energy, and economic balances to solutions of some problems of inorganic and organic process industries; description of representative examples of these industries. Prerequisites: Mathematics 24, Physics 55, and Ch.E. 110.

3 units, winter, (Schwarz), MWF 9

Ch.E. 120a. Chemical Engineering Thermodynamics—First, second laws of thermodynamics in relation to important physical, chemical processes of chemical industry; general application of thermodynamic laws to physical processes occurring in both static, flowing systems. Prerequisites: Chemistry 173, and Ch.E. 110, and 115.

3 units, spring, (Pings), MWF 9 and Th 4

Ch.E. 120b. Chemical Engineering Thermodynamics—Continuation of 120a. Thermodynamic analysis of specific practical systems such as engines, turbines, compressors, refrigeration; application of phase equilibria, chemical reaction equilibria data to industrial processes.

3 units, autumn, (Pings), MWF 10 and Th 4

Ch.E. 125a. Chemical Engineering Unit Operations—Application of mathematical, physical chemical principles in determining scale of equipment used in various unit operations of chemical engineering; study of fluid mechan-
ics, transportation of fluids, size reduction, handling of solids, mixing and mechanical separations; quantitative application of principles to determining rates at which operations occur, size of equipment required. Prerequisites: Ch.E. 120a and 120b.

5 units, winter, (Mason), MTWThF 11

Ch.E. 125b. Chemical Engineering Unit Operations — Continuation of Ch.E. 125a. Unit operations of heat transfer, evaporation, mass transfer, gas absorption, distillation, leaching, extraction, crystallization, air-water-contact operations, drying.

5 units, spring, (Mason), MTWThF 11

Ch.E. 127a. Chemical Engineering Unit Operations Laboratory—Study of instruments of measurement and control used in chemical industry; measurement of temperature by thermoelectric, resistance, fluid expansion thermometers; response of such instruments; measurement of pressure, vacuum; flow measurement. Laboratory exercises to illustrate primarily principles of unit operations in Ch.E. 125a; a few selected experiments on industrial equipment.

3 units, winter, (Mason, Schwarz), MW 1–5

Ch.E. 127b. Chemical Engineering Unit Operations Laboratory—To accompany lecture course Ch.E. 125b. Able students will be permitted to work on an individual research project in chemical engineering.

3 units, spring, (Mason, Schwarz), MW 1–5

Ch.E. 190. Chemical Engineering Research—Laboratory work or directed reading for undergraduate students on assigned chemical engineering problems.

(Staff), by arrangement

Ch.E. 210. Thermodynamics of Multi-component Systems—Engineering thermodynamics of multi-component open systems; volumetric and phase behavior; chemical equilibria; steady state thermodynamics; applications of principles to industrial chemical problems.

5 units, autumn, (Pings), by arrangement


5 units, spring, (Mason), by arrangement

Ch.E. 220. Introduction to Transport Processes—Molecular and turbulent momentum, heat and mass transfer; some solutions of the Navier-Stokes equations; boundary layer theory; introduction to the turbulence theories. Prerequisite: Ch.E. 215.

5 units, spring, (Schwarz), by arrangement

Ch.E. 225a, 225b, 225c. Advanced Chemical Engineering Theory—Selected topics from among the following: momentum, heat, and mass transfer; irreversible thermodynamics; molecular theory of fluids; chemical kinetics; theory of turbulence.

5 units, autumn, winter, spring, (Staff), by arrangement

Ch.E. 240. Distillation—Vapor-liquid equilibria, two-component and multi-component rectification, extractive distillation. Prerequisite: Ch.E. 125a, b.

3 units, spring, (Gordon), by arrangement, alternate years, to be given in 1958–59

Ch.E. 290. Chemical Engineering Advanced Research—Laboratory work for graduate students on specific, approved, advanced chemical engineering basic or applied problems. Experimental work leading to partial fulfillment of requirements for M.S. or Ph.D. degrees.

(Staff), by arrangement
120. **Organic Chemistry** — Aliphatic, aromatic compounds. For students other than chemistry, chemical engineering majors. Prerequisite: Chemistry 3.  
5 units, summer (Mosher), MTWThFS 9

121. **Organic Chemistry** — Carbon compounds. Prerequisite: Chemistry 3.  
3 units, autumn, (Noller), MWF 11

122. **Organic Preparations** — Laboratory course for students in biology, chemistry, medicine. Prerequisites: Previous or concurrent registration in Chemistry 123 or Chemistry 120.  
3 units, winter, (Bonner), MT 1-5 or WTh 1-5 (Limited to 90 students.)  
or spring, (Bonner), MWF 1-4

123. **Organic Chemistry** — Continuation of Chemistry 121.  
3 units, winter, (Noller), MWF 11

124. **Organic Preparations** — Continuation of Chemistry 122.  
3 units, spring, (Bonner), MWF 1-4

125. **Organic Chemistry** — Continuation of Chemistry 123.  
3 units, spring, (Noller), MWF 11

126. **Qualitative Organic Analysis** — Prerequisites: Chemistry 122 and 125.  
3 units, autumn, (Mosher), MWF 1-4

163. **Industrial Organic Chemistry** — Lectures on applied organic chemistry. Prerequisite: Chemistry 125.  
3 units, autumn, (Mosher), MWF 10

221. **Advanced Organic Chemistry** — Lectures on advanced organic reactions. Prerequisite: Chemistry 125.  
3 units, autumn, (Bonner), MWF 9

223. **Advanced Organic Chemistry** — Lectures on elementary theory, stereochemistry. Prerequisite: Chemistry 125.  
3 units, winter, (Mosher), MWF 9

225. **Advanced Organic Chemistry** — Lectures on chemistry of natural products. Prerequisite: Chemistry 125.  
3 units, spring, (Noller), MWF 9

227. **Theoretical Organic Chemistry** — Interpretation of properties, reactions of organic compounds on the basis of organic chemical theory.  
3 units, autumn, (Eastman), MWF 10, alternate years, to be given in 1960-61

229. **Selected Topics in Theoretical Organic Chemistry** — Prerequisites: Chemistry 225, 175, differential and integral calculus.  
2 units, autumn, (Eastman), WF 10, alternate years, to be given in 1959-60

240. **Organic Chemistry Seminar** — May be repeated for credit.  
1 unit, autumn, winter, and spring, (Staff), M 4

171. **Physical Chemistry** — Properties of matter in the various states. Prerequisites: Chemistry 3, Physics 51, 53, 55 (or equivalent), and Mathematics 10, 11, 21 (or equivalent).  
3 units, autumn, (Parks), MWF 8

173. **Physical Chemistry** — Introduction to chemical thermodynamics. Prerequisites: same as for Chemistry 171.  
3 units, winter, (Parks), MWF 8

175. **Physical Chemistry** — Chemical kinetics, electrochemistry. Prerequisite: Chemistry 173.  
3 units, spring, (Parks), MWF 8

176. **Physico-chemical Measurements** — Prerequisites: Chemistry 110 or 112 and Physics 23 or 55; concurrent or previous enrollment in Chemistry 175 required.  
3 units, spring, (Tuttle), TTh 1-5
177. Surface Chemistry—Descriptive lectures on physics, chemistry of various surfaces such as liquid-gas, liquid-liquid, or solid-liquid, and properties of films formed on such surfaces. Prerequisites: Chemistry 3; concurrent or previous enrollment in Chemistry 171 or Physics 51 is desirable.

2 units, autumn, (Hutchinson), MW 11

271. Chemical Kinetics—Survey of experimental methods of studying reaction velocity, fitting of rate expressions, determination of reaction mechanism. Prerequisite: Chemistry 175.

3 units, winter, (Ogg), MWF 9

275a. Electrochemical Thermodynamics and Kinetics—Thermodynamic treatment of reversible cells, electrodes; irreversible phenomena in electrochemical systems, kinetics of electrode processes, polarization and overvoltage, Tafel law, etc.; electrochemical procedures in physical, analytical chemistry. Prerequisite: Chem. 175.

2 units, winter, (Van Rysselberghe), by arrangement, alternate years; given in 1958–59

275b. Electrochemical Thermodynamics and Kinetics—Continuation of Chemistry 275a.

2 units, spring, (Van Rysselberghe), by arrangement, alternate years; given in 1958–59

276. Electrochemical Concepts and Conventions—A survey of the fundamentals of electrochemistry, sign conventions, etc. Prerequisite: Chemistry 175.

1 unit, winter, (Van Rysselberghe), by arrangement, alternate years, to be given in 1959–60

277a. Elements of Statistical Mechanics and Statistical Thermodynamics—Derivation of distribution laws in classical and quantum statistics, calculation of partition functions and of corresponding thermodynamic functions, physical chemical applications. Prerequisite: Chemistry 175.

2 units, winter, (Van Rysselberghe), by arrangement, alternate years, to be given in 1959–60

277b. Elements of Statistical Mechanics and Statistical Thermodynamics—Continuation of Chemistry 277a.

2 units, spring, (Van Rysselberghe), by arrangement, alternate years, to be given in 1959–60

278. Photochemistry—Elementary spectroscopy from a chemical viewpoint, photokinetics, reaction mechanisms and free radicals produced photochemically.

3 units, spring, (Hardwick), by arrangement

280. Electrical Aids to Experimental Research—Application of principles of electrical measurement, control to instrumentation problems connected with chemical research, chemical engineering operations.

2 units, winter, (Grinnell), MW 11

281. Electronic Aids to Experimental Research—Continuation of Chemistry 280.

2 units, spring, (Grinnell), MW 11

289a. Chemical Thermodynamics—Systematic exposition of thermodynamics from the Gibbsian point of view. Principal topics are: fundamental concepts, Gibbsian equations, general conditions for chemical equilibrium, phase rule, systematic deduction of thermodynamic formulas, monovariant systems, azeotropic systems, perfect gases, absolute temperature, imperfect gases, ideal solutions, law of mass action. Lectures, problems.

3 units, autumn, (Koenig), MWF 11, alternate years, to be given in 1958–59

289b. Chemical Thermodynamics—Continuation of 289a. Non-ideal solutions, systematic deduction of the thermodynamic solution laws, chemical affinity and standard free energy, charged components, electrochemical potential, electric potential, electromotive force, galvanic cells, without liquid junction.

3 units, winter, (Koenig), MWF 11, alternate years, to be given in 1958–59
289c. Chemical Thermodynamics—Continuation of 289b. Galvanic cells with liquid junction, pH, gravitational field, radiation, irreversible processes.

3 units, spring, (Koenig), MWF 11, alternate years, to be given in 1958–59


1 unit, spring, (Koenig), by arrangement, alternate years, to be given 1958–59

291. Introduction to Quantum Mechanics—Principles of quantum mechanics, their application to chemistry. Lectures, problems. Prerequisites: Chemistry 175 and Calculus.

3 units, spring, (Ogg), MWF 10, alternate years, to be given in 1959–60

297. Physical Chemistry Seminar—Recent publications from the chemical journals are reviewed. Attendance is required of all graduate students in physical chemistry. May be repeated for credit.

1 unit, autumn, winter, and spring, (Staff), M 4

RESEARCH AND SPECIAL ADVANCED WORK

190. Introduction to Methods of Investigation—For general character and scope, see Chemistry 200, below. Primarily for advanced undergraduates. (Staff), by arrangement

200. Research and Special Advanced Work—Properly qualified students are encouraged to undertake work of research, or other advanced laboratory work along lines not covered by courses already listed, under direction of any member of teaching staff with whom arrangement is made. For all such research and special work, students will register for Course 200 (or Course 190 if in undergraduate standing), giving name of staff member under whom work is carried on and number of units agreed upon. Prerequisite for 190 or 200 in organic or biochemistry: Chemistry 126.

(Staff), by arrangement

See also Senior Colloquia.

CLASSICS

Emeriti: Hermann Ferdinand Fränkel, Raymond Davis Harriman (Professors)

Executive Head: Brooks Otis
Professors: Hazel Dorothy Hansen, Philip Whaley Harsh, Brooks Otis, Lionel I. C. Pearson
Instructors: George John Sullwold, Jr., Richard La Prentice Trapp

The Department of Classics is concerned with the Greek and Latin languages and the literature and civilization of the ancient world. It hopes to develop in its students not only a competence in the classical languages but a critical appreciation and enjoyment of the literature. The Department is interested not only in students who elect to become majors in Classics but also in those who wish to study the languages and literature as a supplement to their work in another major department—for example, English, Philosophy, History, or one of the modern languages.

ADMISSION TO THE DEPARTMENT

In order to be accepted as majors in the Department students should complete the beginning work in Latin or Greek (L23 or G23) or have reached
an equivalent standard through work done in high school. Prospective majors in archaeology may be accepted if they have completed their beginning work in a modern language.

Students who are planning to be majors in Latin or Greek (alternative B) and who have had no training in the language before entering the University should begin their study of Latin (or Greek) in their freshman year or at the very latest in autumn quarter of their sophomore year; such students should consult the Department at the earliest possible moment about arranging a suitable program.

DEGREES

Bachelor of Arts

The Department offers work leading to the degree of Bachelor of Arts in Classics with the following fields of concentration: A, Latin and Greek; B, Latin or Greek; C, Greek Archaeology.

A student’s program of study should be prepared in advance in consultation with a Department adviser and approved by the Department. Major students must register each quarter for at least one course in the major subject.

A. Major in Classics: Latin and Greek—Fifteen units in Latin and 15 in Greek; in one language all units must be in third-year or advanced courses. Ten units in other courses related to the student’s program, including at least one course in Roman history and one in Greek history. A satisfactory knowledge of the history of Greek and Latin literature.

B. Major in Classics: Latin or Greek—Thirty units in third-year or advanced courses in Latin (or Greek). Six units in other courses related to the student’s program, including one course in Roman history (if Greek major, Greek history). A satisfactory knowledge of the history of Latin literature (if Greek major, Greek literature).

C. Major in Classics: Greek Archaeology—Eighteen units (two years) in Greek. Twenty-two units in courses in archaeology. One course in Greek history.

Honors Program in Humanities

For acceptable majors in Classics, an Honors Program in Humanities is offered, a description of which will be found under “Humanities (Special Programs).”

General Secondary Teaching Credential in Latin

Students who wish to be certified as teachers of Latin in California high schools should consult the section on credentials under “School of Education” in this Bulletin or the Credential Secretary of the School of Education for general requirements. The Department may recommend majors and other students in the Department who fulfill the state requirements by taking the following courses:

Teaching Major

| Section II (Latin language) | 36 units, of which 18 must be in courses numbered 100 or above; a course in Latin Composition (L105) and the Teachers' Course (L200) | 36 |
| Section V (Ancient History) | One course | 4 |

One of the following courses in Section III (Linguistics): GL200 or 210 (or approved equivalent) | 3 |

Other courses in the Department in any section except Section II | 11 |

Total units 54
Teaching Minor

Section II (Latin language): 21 units, of which 12 must be in courses numbered 100 or above; the Teachers' Course must be included. 21
Section V (Ancient History): One course 4
Other courses in the Department, in any section except Section II. 6

Total units 31

These are minimum requirements. Students should consult a member of the Department about arranging their programs.

Master of Arts

In order to qualify for the degree of Master of Arts a student is expected to reach a standard of scholarship, in range and exactitude, such as might be expected if he completed three quarters of study in the Department after fulfilling the requirements for an undergraduate major in the Classics Department. The Department may accept as graduate students some whose attainments are less than those of an undergraduate major in Classics, but they will need more than three quarters of residence in order to obtain the degree. A student's complete program of study should be settled in consultation with a senior member of the Department as soon as the Department is satisfied that he is a suitable candidate (early in the second quarter of graduate work).

The precise requirements will vary according to the candidate's special field of interest (i.e., Latin, Greek, Latin and Greek, or Greek Archaeology) but all students will be urged to do some work in both languages. The following will be required of all students:

A thesis showing some critical ability with the use of original sources.
A written examination in prose composition (Latin or Greek) and translation at sight (from Latin or Greek).
An acquaintance with ancient history and literature (Latin or Greek), which will be tested in a short oral examination.

COURSES

I. Greek

First- and Second-Year Courses

The General Studies language requirement may be met by completing the third course of the second year. Students may complete the work of the first year by taking either G1, 2, and 3, or G1a and 2a.

G1. First-Year Greek—For beginners.
   3 units, autumn, (Otis), MWF 10
G2. First-Year Greek—Continuation of G1.
   3 units, winter, (Otis), MWF 10
G3. First-Year Greek—Continuation of G2.
   3 units, spring, (Otis), MWF 10
G1a. First-Year Greek—For beginners.
    4 units, winter, (Trapp), TWThF 10
G2a. First-Year Greek—Continuation of G1a.
    4 units, spring, (Trapp), TWThF 10
G21. Second-Year Greek—Continuation of G3 or 2a. Plato or Xenophon.
    3 units, autumn, (Hansen), MWF 10
    3 units, winter, (Hansen), MWF 10
    3 units, spring, (Hansen), MWF 10
  1 or 2 units, by arrangement

Third-Year Courses

G101. Introduction to Greek Tragedy—One play of Euripides will be read.
  3 units, autumn, (Harsh), MWF 9 or by arrangement

G102. Reading in Greek Poetry—Tragedy and comedy.
  3 units, winter, (Otis), MWF 9 or by arrangement

G103. Reading in Greek Prose—According to the needs of the student.
  3 units, spring, (Harsh), MWF 9 or by arrangement

G105. Greek Prose Composition—May be taken separately or in conjunction with a second- or third-year course. May be repeated for credit.
  2 units, spring, (Pearson), by arrangement

Advanced and Graduate Courses

For students who have completed two or more third-year courses, work at a more advanced level will be offered on an individual basis:

G113 or 213. Individual Work—Reading in Greek suited to the needs of the individual. May include Homer, Hesiod, Greek lyric poets, tragedy, comedy, Hellenistic poetry, Herodotus, Thucydides, Xenophon, Plato, Aristotle, Greek orators, New Testament.
  1 to 5 units, by arrangement


II. LATIN

The General Studies language requirement may be met by completing L23 or L100. A placement test will be given to determine with which course a student should begin. It is generally expected that students who have taken two years of high school Latin will be able to start with L3 or L21; those with three years, with L22; students with four years of high school Latin may complete requirements by taking L23 or one more advanced course.

The following table shows the sequence of first-, second-, and third-year courses offered each year:

<table>
<thead>
<tr>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
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L1. First-Year Latin—For beginners (see also L5).
  3 units, autumn, (Sullwold), MWF 1

L2. First-Year Latin—Continuation of L1.
  3 units, winter, (Sullwold), MWF 1

L3. First-Year Latin—Continuation of L2 or equivalent.
  3 units, autumn, (Trapp), TTh 1 and one hour by arrangement or spring, (Sullwold), MWF 1

L5. Accelerated Course in Elementary Latin—Intended especially for graduate students in other departments.
  4 units, winter, (Pearson), TWThF 8
3 units, autumn, (Pearson), MWF 1
or winter, (Trapp), TTh 1 and one hour by arrangement

L22. Second-Year Latin—Continuation of L21 or equivalent. Vergil or Ovid.
3 units, winter, (Trapp), MWF 1
or spring, (Otis), MWF 1

L23. Second-Year Latin—Continuation of L22 or equivalent. Vergil: Selections from Aeneid VII-XII.
3 units, autumn or spring, (Trapp), MWF 1

L30. Readings in Latin—Continuation of L5.
4 units, spring, (Pearson), TWThF 8

Third-Year Courses

L101. Catullus—Continuation of L23 or equivalent.
3 units, autumn, (Otis), MWF 9

L102. Terence—One or two comedies will be read.
3 units, winter, (Harsh), MWF 9

L103. Horace—Selections from the Odes and Epodes.
3 units, spring, (Harsh), MWF 9

L105. Latin Prose Composition—May be taken separately or in conjunction with a second- or third-year course. May be repeated for credit.
2 units, winter, (Harsh), by arrangement

Advanced and Graduate Courses

One of the following will generally be offered each quarter, carrying 3 units or more:

L113 or 213. Individual Work—Reading in Latin suited to needs of individual. Work may include reading in authors not listed for 1958–59 or 1959–60.
L150. Latin Comedy—(a) Plautus, (b) Terence.
3 units, to be given in 1959–60

L151. Lucretius.
3 units, winter, to be given in 1959–60

L154. Cicero—(a) Orations, (b) Letters, (c) Philosophical Works.
(b) 3 units, spring, to be given in 1959–60

L155. Roman Historians—(a) Caesar, (b) Sallust, (c) Livy, (d) Tacitus.
(a) 3 units, autumn, to be given in 1959–60

L157. Senior Reading Course—The Oxford Book of Latin Verse.
3 units, spring, to be given in 1959–60

161, 162, 163. Vergil—Eclogues, Georgics, and Aeneid. This course will consider Vergil at a relatively advanced level with emphasis on his literary value and his representative value as an Augustan.
161. 3 units, autumn, (Otis), MWF 11
162. 3 units, winter, (Otis), MWF 11
163. 3 units, spring, (Otis), MWF 11

L200. Teachers’ Course—Lectures and conferences on methods of teaching Latin.
3 units, spring, (Trapp), MWF 9

L205. Advanced Latin Prose Composition—May be repeated for credit.

III. LINGUISTICS

One or more of the following courses will be offered each quarter:

GL50. Latin Elements in English—To increase English vocabulary; study of formation, development of Latin words in English.
2 units, winter, to be given in 1959–60
GL51. Greek Elements in English—To increase English vocabulary; study of formation, development of Greek words in English.
   2 units, autumn, to be given in 1959-60

GL129. Greek and Latin Scientific Terminology.
   3 units, spring, to be given in 1959-60

Note: Students enrolling in GL50, GL51, or GL129 are not expected to have previous knowledge of Greek or Latin.

GL200. Introduction to Linguistics—Principles of linguistic development, illustrated chiefly from Greek, Latin, English, Romanic languages.
   3 units, winter, to be given in 1959-60

   3 units, spring, to be given in 1959-60

IV. GREEK AND ROMAN AUTHORS IN TRANSLATION

One or more of the following courses will be offered each quarter:

World Literature and the History of Ideas: Classical Literature—(See Humanities 61).

T74. Greek Comedy: Aristophanes—The eleven comedies; origins of comedy; structure and purpose of Aristophanic comedy.
   3 units, winter, (Harsh), MWF11

T160. The Classical Epic—Reading of the Odyssey and the Aeneid; some discussion of minor epics. Emphasis on formal structure, concept of the hero, cultural implications.
   3 units, winter, (Sullwold), T 2-4 and Th 2-3

T170. Greek and Roman Tragedy—Most extant Greek tragedies, some plays of Seneca will be read, discussed. Open to undergraduates and graduates, but a substantial essay demonstrating ability to compile a bibliography on some phase of the subject will be required for graduate credit.
   4 units, spring, (Harsh), TWTThF 11

T188. Greek and Roman Myths—Stories of the gods and heroes, some reference to their anthropological, religious, literary, psychological aspects.
   2 units, spring, (Sullwold), TTh 1

See also Senior Colloquia.

V. ANCIENT HISTORY

The following courses form a sequence, as a general survey of the Greek and Roman world, but they may be taken separately. Prerequisite: History 10, or equivalent.

H100. Greek History: The City States.
   4 to 5 units, autumn, (Pearson), MTWTh 2

   4 to 5 units, winter, (Pearson), MTWTh 2

H102. The Roman Republic.
   4 units, autumn, (Pearson), to be given in 1959-60

H103. The Roman Empire.
   4 units, winter, (Pearson), to be given in 1959-60

For more advanced students—especially majors and graduate students in Classics or History—work will be offered on an individual basis:

H200. Independent Reading in Greek History—Assigned readings, reports, discussions.
   4 to 5 units, spring, (Pearson), MTWTh 2 or by arrangement
H205. Independent Reading in Roman History.  
3 or more units (Pearson), to be given in 1959–60

VI. GREEK ARCHAEOLOGY

One or more of the following courses will be offered each quarter:

A100. Introduction to Archaeology — Illustrated lectures on various branches of archaeology; special emphasis on processes of discovery and methods by which our present knowledge of ancient civilization has been acquired.  
3 units, autumn, (Hansen), MWF 11

A113. Individual Work—Suited to needs of individual.  
1 to 3 units, (Hansen), by arrangement

A120. Introduction to Greek Art—Evolution of art in classical Greek lands; interpretation of works of art, chiefly sculpture.  
3 units, winter, (Hansen), MWF 11

A125. Early Greek Art—Art from Cretan and Mycenaean sites.  
3 units, spring, (Hansen), MWF 11

A130. Later Greek Art—Illustrated lectures, art of Hellenistic World.  
3 units, spring, (Hansen), to be given in 1959–60

A160. Archaeological Laboratory—Open to qualified students with permission of instructor. Classics A100 a useful preparation for this course. Practical work in restoration, study and classification of archaeological material. The Stanford Museum has a collection of several thousand objects from Greece, including vases, coins, figurines, lamps, etc., which afford excellent material for study.  
2 or 3 units, winter (Hansen), M and/or Th 1–4, Museum

A161. Archaeological Laboratory—A continuation of A160. Students who have not had A160 may enroll with the consent of the instructor.  
2 or 3 units, spring, (Hansen), M and/or Th 1–4, Museum

A162. Advanced Archaeological Laboratory — Prerequisite: A160 or A161 and the consent of the instructor.  
2 units, autumn, (Hansen), by arrangement, Museum

See also Senior Colloquia.

COMMUNICATION and JOURNALISM

Executive Head: Chilton R. Bush  
Professors: Chilton R. Bush, Wilbur Schramm, Clifford Francis Weigle  
Associate Professors: James Everett Brinton, Henry Lloyd Churchill  
Acting Assistant Professor: (——)  
Lecturer: Bruce Bliven  
Research Associates in the Institute for Communication Research: J. Stacy Adams, Richard F. Carter, Ralph N. Haber, Norman McKown

The Department of Communication and Journalism engages in research in communication and offers a curriculum which prepares its students for careers in journalism and communication research.

The main objectives of the curriculum in journalism are to equip the prospective journalist with an adequate set of professional values; to provide a broad program in the social and literary studies; and to present courses in the processes and effects of communication.

A secondary objective is to provide that amount of training in journalistic
skills and techniques that will sustain the student's interest in his chosen pro-
ession while he is in college and will assist him in beginning his career. The
strictly technical courses are about eight per cent of the student's program.
The technical courses provide not only practice but a content that is an
application of some of the principles of the behavioral sciences. The tech-
nical curriculum in this sense is like the curricula of Schools of Medicine and
Engineering which apply the principles of the biological and physical sciences.

ADMISSION

Undergraduate students who have been admitted by the University are
accepted as majors provisionally for one quarter. Thereafter, the student's
record is reviewed quarterly by the Department.

Prospective graduate students should write to: Executive Head, Depart-
ment of Communication and Journalism, Stanford University, Stanford, Cali-
ifornia.

Prospective undergraduate students should write the Office of Admissions.

Placement of Women—It should be noted by prospective women majors
that the proportion of positions on newspapers open to women is limited and
that the number of magazines on the Pacific Coast is limited. The Department
will take these facts into consideration in the acceptance of women majors.

DEGREES

Bachelor of Arts

The requirements for the degree of Bachelor of Arts are as follows:

1. Two courses in general or English literature; Psychology 1; Economics 1,
and 5 or 10; Political Science 1, and 10 or 20; Sociology 1 or Anthropology 1;
and Business 108a (except when the student can demonstrate adequate pro-
ficiency in typewriting).

2. One field (two advanced courses—i.e., courses numbered 100 or higher—
normally constitute a field) in any two of the following groups:
   I. Economics: Price and Allocation Theory, Money, Income and Employ-
   ment, Economic History and Comparative Systems, Public Finance, Labor
   Problems, Economics of Industry, International Trade and Finance, Account-
   ing, Economic Statistics.
   II. History: Medieval and Renaissance Europe, Modern Europe, the
   British Empire, the United States, Latin America, and the Far East.
   III. Political Science: Public Administration, Comparative Government,
   International Law and Relations, Political Theory, Politics, and Public Law.
   IV. Psychology: courses to be designated.
   V. Sociology: courses to be designated.
   VI. Anthropology: courses to be designated.
   VII. Geography: courses to be designated.
   VIII. Business Law I and II.

   The undergraduate student must achieve a grade of C or higher in any
   course offered in fulfillment of field requirements.

3. Twenty-five to thirty units in communication and journalism, of which
   the following courses are required: 50, 51, 103, 107, 120, and 140.

   In addition, the student preparing for newspaper or press association edi-
torial work or radio-TV journalism, will take Courses 109, 169, and 175; the
student preparing for advertising work will take Courses 115, 116, and 156
or 217a or 217b; the student interested primarily in writing for consumer
magazines and industrial publications will take Courses 109, 150, and 169.
The undergraduate must average not lower than 2.5 grade points in the courses in communication and journalism.

After fulfilling all of the requirements specified by the Department and the University, the student normally has up to 35 units of his program available for electives during his junior and senior years.

While the Department offers no courses in public relations, it assumes that the best preparation for a career in that field is the completion of the usual courses in the Department's curriculum, a few additional courses in the humanities and social sciences, and practical experience in journalism or advertising.

The student who is interested in certain aspects of radio and television may elect some of the courses offered by the Department of Speech and Drama during the regular academic year or in the Summer Radio and Television Institute.

Students interested in communication research may apply to participate in the Honors Program in Quantitative Methods in the Behavioral Sciences.

Master of Arts

The Department will recommend to the University Committee on Graduate Study for the degree of Master of Arts students who have completed the following:

1. Four fields in the social sciences, selected from two or more of the groups listed above under requirements for the degree of Bachelor of Arts.
2. Approximately 40 units in communication and journalism, of which two shall be graduate courses in communication and journalism, and shall include Courses 211 or 220.
3. Either an acceptable thesis or the methodological courses (217a and 217b and Psychology 60). The Department decides this option after evaluating the student's preparation. Most students will be held for the thesis requirement. The candidate must earn an average grade of B on his entire program of study during the graduate year.

Candidates for the degree of Master of Arts entering the Department from another institution, or from Stanford with the Bachelor's degree in a subject other than communication and journalism, will follow individually arranged programs of study. In planning such programs the following factors will be taken into account: (1) previous training in the social sciences; (2) previous academic training in communication and journalism; and (3) practical journalistic experience. Where the student's previous work in the social sciences and in communication and journalism has been limited, the requirements for the degree cannot be met in three quarters of residence.

The Ph.D. Degree in Mass Communications Research

Unusually well-qualified students who wish to become candidates for the Ph.D. degree in Mass Communications Research may present, through the Department of Communication and Journalism in co-operation with appropriate other departments, a well-defined program to the University Committee on Graduate Study and petition to become candidates for the degree. (See "Graduate Division Special Programs.")

This program, which is designed to train the student for research in communication, includes courses in several of the departments which offer work in statistics, learning, perception, social psychology, personality theory, social organization, social structure, and the methodology of the behavioral sciences.

The Department of Communication and Journalism sponsors for this degree only those applicants who present a superior academic record and who have demonstrated that they have the motivation for completing a program of this nature. The applicant is first accepted for admission to the University by the
Department. In his first two quarters of residence he must achieve a superior record in the courses taken with sponsoring professors in the several departments. When he does this he may request those professors to recommend him to the University Committee on Graduate Study, first for permission to pursue study toward such a degree, and later for admission to candidacy for the degree.

The Institute for Communication Research

The Institute for Communication Research operates as an office of project research for the faculties of the Department of Communication and Journalism and other departments on grants from foundations, communication media, and other agencies, on government contracts, and on its own funds. A few research assistantships are available to qualified graduate students. Among the qualifications which will be highly valued in applicants are high scholarship, training in the behavioral sciences (preferably psychology and sociology, including training in statistics and research methodology), and training for or experience with the mass media.

Sophomore Courses

50. Editorial Techniques I—Theory of news communication for newspaper and radio; analysis of journalist's audience; representative media; journalistic vocations. Prerequisite: third quarter freshman standing
3 units, autumn or spring, (Brinton), MWF 9

51. Editorial Techniques I Laboratory—Practice in news writing. Weekly conferences, laboratory, outside assignments. To be taken concurrently with Journalism 50. Prerequisite: third quarter freshman standing.
1 unit, autumn or spring, (Brinton), by arrangement

Junior, Senior, and Graduate Courses

3 units, winter, (Brinton), TTh 9; lab. by arrangement

107. Editorial Techniques II—Copy editing, headline writing, news display, illustration, newspaper library reference methods. In laboratory, class edits daily teleprinter report of Associated Press or United Press. To be taken concurrently with Journalism 103. Prerequisite: 50-51, junior standing.
3 units, winter, (Weigle), MW 9; lab. by arrangement

109. Editorial Techniques III—Advanced news writing for newspapers, radio-TV. Prerequisites: 50-51, junior standing. Majors only. Conducted in co-operation with the Palo Alto Times.
2 units, spring, (Weigle, Brinton), by arrangement

115. Advertising I—Fundamentals of marketing, consumer research, media, copy, layout.
3 units, autumn, (———), MWF 11

3 units, winter, (———), MWF 11

120. The Media of Mass Communication I—Development of social systems, political philosophies of mass communication; communicators, their organizations; audiences, content, effects of mass media; developing patterns, problems of ethics and responsibility within the media.
3 units, autumn, (Schramm), MWF 10
140. **History of Anglo-American Journalism.**
   3 units, spring, (Weigle), TTh 9
   4 units, summer, (———), by arrangement

150. **Forms of Journalistic Writing**—Practice in writing magazine articles, editorials, critical essays; emphasis on marketing manuscripts. Conferences. Prerequisites: senior standing and 50-51 or consent of instructor.
   3 units, autumn, (Weigle), TTh 11
   4 units, summer, (———), TTh 10

152. **Magazine Editorial Techniques**—Planning, writing, production studied with local magazine editors, correspondents; industrial editing. Prerequisite: 150, consent of instructor.
   3 units, spring, (———), by arrangement

156. **Media Management**—Principles of business operation of newspapers, magazines, radio-TV; emphasis on revenue factors. Nonmajor students require consent of instructor.
   3 units, spring, (———), by arrangement

159. **Legal Aspects of Journalism**—Libel, contempt, constitutional guarantees, privacy, copyright, inspection of public records.
   3 units, autumn, (Brinton), TTh 9

175. **Reporting of Public Affairs**—Local, state, federal courts; municipal, state, federal administration in the local community. Open only to major students with senior standing.
   4 units, winter, (Bush), MWF 10

199. **Individual Work**—Major students with high academic standing are permitted to undertake individual work in such fields as Women's Departments, Industrial Journalism, News Photography, and a few other specialized fields.
   1 or 2 units, any quarter, (Staff), by arrangement

See also Senior Colloquia.

**Graduate Courses**

211. **Theory of Communication**—Analysis of experimental literature; theory of process, effects of communication.
   5 units, autumn, (Schramm), M 2-4, and additional meetings as needed

212. **Seminar in Communication Theory**—Topics for each offering of this course are selected by vote of the seminar.
   3 to 5 units, winter, (Schramm), M 2-4

217a. **Media and Opinion Measurement**—Basic sampling procedures associated with study of public opinion; audiences of mass media; markets.
   3 units, winter, (Brinton), TTh 11

217b. **Media and Opinion Measurement**—Experimental design, questionnaire construction, interviewing, administration of surveys; content analysis. Field work required.
   5 units, spring, (Bush), MWF 11

220. **The Media of Mass Communication II**—Students who have had Journalism 120 will register for 2 units.
   4 units, autumn, (Bush), MWF 10

255. **International Communication**—Chief patterns of mass communication throughout the world; philosophies behind them; economic, social, political reasons why a given kind of pattern develops where it does; channels by which nations, cultures communicate with each other; kinds of barrier which intervene in those channels; manipulative communication between nations which is characteristic of the "cold war."
   4 units, spring, (Schramm), M 2-4

299. **Advanced Individual Work**—Graduate majors may supplement certain courses with individual projects of distinctly advanced order.
   1 to 5 units, any quarter, (Staff), by arrangement
300. Thesis. 
(Staff), by arrangement

309. Directed Graduate Research—Research in connection with a staff project, in lieu of Master’s thesis. 
(Staff), by arrangement

Practice Courses

121. Advanced Practice—Practice work in executive positions on editorial or business staff of The Stanford Daily; weekly conferences. Open to undergraduate students with junior standing, who qualify by election or appointment; not open to graduate students. Students limited to total of 7 units credit. Credit may not be offered in fulfillment of journalism unit requirements for degrees in journalism. 
1 to 2 units, each quarter, (Staff), by arrangement

183. San Francisco Newspaper Practice—Journalism majors who have made a high record in their entire program, and especially in 175, are permitted to work in San Francisco in the senior year, by arrangement with San Francisco newspapers. Work is under supervision of specially appointed San Francisco newspapermen and faculty of the Department. 
5 units, spring, (Weigle), by arrangement

Curriculum and Instruction in Journalistic Writing—See Education 285.

Economics

Emeriti: Theodore Harding Boggs, John Bennet Canning, Eliot Jones, Albert Conser Whitaker (Professors)

Executive Head: Lorie Tarshis


Professors, Food Research Institute: Merrill Kelley Bennett, Karl Brandt, Helen Cherington Farnsworth, William Orville Jones, E. Louise Pef fer, Boris C. Swerling, Vernon D. Wickizer, Holbrook Working

Associate Professors, Food Research Institute: Roger W. Gray, Bruce F. Johnston

Assistant Professors: William M. Capron, George W. Hilton, Per Goran Ohlin, Benjamin N. Ward

Research Associate: Hirofumi Uzawa

Director of Undergraduate Study: William M. Capron

Director of Graduate Study: Melvin W. Reder

Associate Director of Graduate Study: Per Goran Ohlin

Offerings and Facilities

The Department’s purposes are to acquaint students with the economic aspects of modern society, to familiarize them with techniques for the analysis of contemporary economic problems, and to develop in them an ability to exercise sound judgment in evaluating public policy. There is training for the general student as well as for those who plan careers as economists in civil service, private enterprise, teaching, or research.
The University Library is well supplied with literature in all fields of economics. The Hopkins Transportation Library holds invaluable material on transportation problems, and there are special collections on the institutions and commerce of Latin America, the Orient, and Pacific Coast development. Advanced students have access to the Hoover Institute and Library, with its comprehensive collections of original and secondary materials on many foreign nations.

Qualified graduate students in economics are given the opportunity for training and research in the special fields of the Food Research Institute. A few courses for undergraduates are conducted by the Institute, as well. Courses offered by the Institute count toward completion of requirements for degrees in economics.

DEGREES

Bachelor of Arts

The following Departmental requirements are in addition to the University's basic requirements for the Bachelor's degree:

Enrollment in the Department—Students who have not yet taken any economics courses at Stanford may be enrolled in the Department upon request. All other students will be enrolled only if they have had a C average or better in their previous work in economics at Stanford; however, deficiencies in this average may be made up by repeating courses although no University credit will be given for such repetitions.

Graduation—The student is urged to select his program of study carefully, with a view to his own special needs and interests. His Departmental or Divisional adviser will be prepared to advise him on his program at any time.

To be recommended by the Department for the degree of Bachelor of Arts in economics, the student must have satisfied the following requirements:

1. Completion of 45 units in courses in economics and the curriculum of the Food Research Institute.
   a) Economics 1, 5, 10, 111 and 120 or their equivalent shall be included in the 45 units. All of these should be completed by the end of the junior year except for Economics 120.
   b) Economics courses taken at other universities may be included in the 45 units. The Director of Undergraduate Study for the Department will establish the amount of credit to be granted toward completion of the Departmental requirements. However, if the elementary course is repeated at Stanford, credit will not also be given for the elementary course taken at another institution toward the required 45 units, and in any case no more than 5 units credit will be given for such a course.
   c) A minimum of 25 units of courses numbered 100 or above, of which 20 must be taken at Stanford, shall be included in the 45 units.

2. An average grade of C or better shall have been received for all course units completed at Stanford in economics and the curriculum of the Food Research Institute, and an average grade of C or better shall have been received for Economics 1, 5, and 10.

3. Completion of a program, approved by the student's adviser, of at least 25 units of courses numbered 100 and above in not more than two of the following subjects: business law, cultural anthropology, history, industrial engineering, mathematics (including courses in differential and integral calculus numbered below 100) and mathematical statistics, philosophy, political science, psychology, and sociology.

The Undergraduate Honors Program—All economics majors who qualify are urged to complete the requirements for a degree with honors. The purpose of this program is to encourage the study of economics beyond the ordinary
requirements for the degree of Bachelor of Arts. The Bachelor of Arts degree with honors in economics will be granted upon application to all of those who have met the following requirements in addition to those listed above:

1. The student must have received a grade-point average of at least 3.0 in all courses at the University, excluding the last quarter.
2. The student must have received a grade-point average of at least 3.0 in all economics courses at Stanford.
3. The student must present a minimum of 55 units in economics and the curriculum of the Food Research Institute, including
   a) The Junior Honors Seminar in Economics
   b) A Senior Seminar in Economics
   c) The Synthesis of Economics Course
4. Candidates for admission to the Honors Program should apply through their advisers during the first or second quarter of their junior year. In any case, such application must be made by the beginning of the third quarter of the junior year. (In exceptional cases, the Director of Undergraduate Study for the Economics Department may admit students to the Honors Program at the beginning of the senior year.)

Quantitative Methods—Students who are preparing for professional careers as economists, statisticians, or accountants are advised to register for courses in mathematics through elementary differential and integral calculus. Among the courses of instruction which make use of mathematics are Economics 5M, 10M, and 172, and Statistics 116 and 119 (which may be taken for economics credit).

Qualified students are urged to enter the Honors Program in Quantitative Methods in the Behavioral Sciences, the details of which are given elsewhere in this Bulletin, under the heading Behavioral Sciences (Honors Program). Among the requirements are three courses designated by the Economics Department; these are 5M, 10M, and a third course to be given in subsequent years. Completion of this Honors Program automatically implies satisfaction of the degree requirement of 25 units in two outside fields.

A student may, of course, qualify for both departmental honors and honors in Quantitative Methods in the Behavioral Sciences.

Advanced Degrees

The members of the Department of Economics, with the assistance of certain members of allied departments, undertake to supervise a wide range of individual advanced study and research to supplement instruction that is offered in courses listed below. All candidates for advanced degrees are urged to schedule their entire program of study with the Director of Graduate Study as early as possible.

Master of Arts

The University's basic requirements for the Master's degree (residence, thesis, etc.) are discussed in the section "Degrees" in this Bulletin. The following are Departmental requirements:

Admission to Candidacy—Completion of the Stanford requirements for a Bachelor of Arts degree in economics, or an approximately equivalent training, is required of students who undertake a program of study for the degree of Master of Arts in economics. Provisional enrollment may be permitted, however, in cases in which previous training has been deficient, with the understanding that the deficiency will be remedied in advance of departmental ap-
proval of candidacy. Admission to candidacy for the degree will be restricted to students whose record bears promise of successful graduate work.

Recommendation for the Degree—To be recommended to the University Committee on Graduate Study for the degree of Master of Arts in economics, the student must have satisfied the following requirements:

1. Completion of a program of study at Stanford amounting to not less than 45 units of credit. No courses numbered below 100 and no courses completed with a grade less than C may be counted toward the 45 units required. Ordinarily the program will include at least 30 units of economics, of which at least 15 units (or 10 units in addition to the thesis) must be in courses at the 200 level. Courses in subjects closely related to economics may be included with the approval of the Director of Graduate Study in Economics.

2. Completion of a thesis acceptable to the Department, or of two term papers of acceptable quality. Credit will be allowed for the thesis to a maximum of 9 units toward the 45 units required for the degree.

3. An average grade of B or better shall have been received for the entire program of study approved by the Department.

Doctor of Philosophy

The University's basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the section “Degrees” in this Bulletin. The following are Departmental requirements:

Admission to Candidacy—The Director of Graduate Study in Economics will recommend the student to the University Committee on Graduate Study for admission to candidacy for the degree of Doctor of Philosophy in economics when the following conditions have been satisfied:

1. The Departmental committee on graduate study must have certified that the student is qualified to pursue a program of study for the degree. The committee will base its judgment in part on a Departmental oral examination and in part on the student's achievement in other aspects of his graduate work. Except in special circumstances, this oral examination must be taken in the third quarter of graduate study.

2. The student must have completed the University foreign-language requirement for the degree. The student is required to demonstrate to appropriate examiners a reading knowledge of two languages in addition to English, for one of which he may substitute a coherent program of study of 15 or more quarter units of courses taken as a graduate student in a field external to economics (and to the minor subject, if one is offered) such as, for example, mathematics (including differential and integral calculus). It is recommended that the student offer a program of mathematics in place of the second language. The language or languages selected and the substitute program, if any, shall be chosen so as to be most useful in connection with the student's program of study and his predoctoral and postdoctoral research program.

3. The student must demonstrate an elementary knowledge of mathematics as used in economics. Students who have not had mathematics through calculus should consult the Director of Graduate Study as to ways of satisfying this requirement.

Recommendation for the Degree—Before being recommended for the degree of Doctor of Philosophy in economics, the student must have completed the following stages of preparation:

1. Qualification in six fields of study (if no minor subject is offered) or in three fields of study (with a minor subject). In either case, Price and Allocation
Theory (202, 203, 204) and Money, Income, and Employment (210, 211, 212) will constitute two of the fields. The remaining fields will be chosen according to the following options:

Option A—Without a minor subject:

a) Economic History and Development (215, 216) is required.

b) Three other fields of economics are to be chosen from the following: Public Finance, Labor Problems, Economics of Industry, International Trade and Finance, Economic Statistics, Econometrics, and any two of the fields in Food Research. The preparation required will be determined by the professor in charge of each field and will consist of two courses at the 200 level or their equivalent. (In case of scheduling difficulties, a reading course may be substituted for one of the courses.) An approved program of 20 units in subjects other than economics may be substituted for one field.

Option B—With a minor subject:

a) Economic History and Development (215, 216) or Economic Statistics (270, 271, 272) is required, except that students minoring in statistics must select Economic History and Development.

b) A minor subject, the requirements for which are determined by the department concerned.

For students who elect Option A, competence in four fields (including Price and Allocation Theory and Income and Employment Theory) will be tested by Departmental comprehensive written examinations and in the remaining two by final examinations in specified courses. A grade of B is required.

Students who elect Option B will take Departmental comprehensive written examinations in all three of their fields of study in economics.

The standard of achievement on the comprehensive examinations will be based on the content of the courses indicated. The candidate has the option of taking the entire series of examinations within any one quarter or of dividing them between two quarters with not more than one quarter intervening.

2. A minimum knowledge of background subjects:


   b) The History of Economic Thought (201), except for students electing Option B.

   c) Accountancy (equivalent to 290).

   Each of these requirements may be satisfied by taking either the courses indicated or a written examination.

3. Training in independent research. Participation in three seminars (at the 300 level) in at least two fields, and preparation of satisfactory papers in each.

4. Satisfactory performance in the University oral examination. The first three stages of training must be completed before the student is admitted to the University oral examinations except in special cases. The fields covered will be the same as those tested in the Departmental comprehensive examinations.

5. Completion of a satisfactory doctoral dissertation. Well-qualified students are urged to complete their course work and take the University oral examinations by the beginning of their third year of graduate study. It is very desirable that the bulk of the work on the doctoral dissertation be completed while the student is still in residence.
Minor for the Degree of Doctor of Philosophy—The applicant for admission to candidacy for the degree of Doctor of Philosophy with economics as the minor subject will be expected to demonstrate that he is qualified to pursue advanced studies in the subject. Normally in the third quarter of graduate work in economics he will be subject to a Departmental oral examination. On the basis of this examination and other evidence the Departmental committee on graduate study will rule on his qualifications.

To be recommended for the degree of Doctor of Philosophy with economics as a minor subject, the student is required to qualify in three fields of economics, one of which must be either Price and Allocation Theory or Money, Income, and Employment. Qualification in the required field and in one of the elective fields will be tested in Departmental written examinations; the standard of achievement in these examinations will be the same as for students majoring in economics who do not offer a minor subject. To qualify in the second elective field, the student must obtain a grade of B in the final course examinations in the two courses specified as basic to the field. The candidate will then be recommended to the Committee on Graduate Study for admission to the University oral examination.

TEACHING ASSISTANTSHIPS

The Department nominates a number of graduate students for appointment as teaching assistants. The stipend is $540 per quarter, and appointments may be made for one or more quarters of the academic year. The assistant is expected to conduct sections of an elementary course.

Qualified graduate students who wish to combine graduate study with part-time teaching, may apply for a tuition scholarship covering up to half-time tuition and fees ($564 per year), together with a Teaching Assistantship carrying a stipend up to $1,620 annually for half-time teaching. Graduate students may apply for a Teaching Assistantship without a scholarship, if they are not subject to tuition charges or if they did not require scholarship aid.

Applicants for these appointments for an ensuing year should address their requests to the Executive Head of the Department not later than February 15. The applications should be accompanied by a complete, authenticated transcript of the academic record (graduate and undergraduate). There should be at least three letters of recommendation from persons qualified to speak of the applicant's fitness for appointment.

The attention of prospective graduate students is also directed to the fact that applications for graduate fellowships should be filed by February 15 at the Office of Financial Awards.

COURSES OF INSTRUCTION

Note—Courses offered by the Food Research Institute are listed under the section on the Institute.

It is not possible at the date this announcement goes to press to schedule courses accurately for the year. Application should be made to the secretary of the Department after June for information about the exact times at which courses will be given in 1958-59.

1. Elementary Economics—Introduction to, survey of economics. Prerequisite: sophomore standing.

5 units, autumn, (Staff), MTWThF 9, 12, or 2
or winter, (Staff), MTWThF 9, 12, or 2
or spring, (Staff), MTWThF 9 or 2
or 5 units, summer, (Staff), MTWThF 9 and one hour by arrangement
5. Price Theory and Policy—Function of price system; determination of prices, outputs in different market structures; price theory, public policy. Prerequisite: 1 or equivalent. (May be taken as 105 by graduate students.)

5 units, autumn, (Staff), MTWThF 9
or winter, (Staff), MTWThF 9
or spring, (Staff), MTWThF 9
or 4 units, summer, (Staff), MTWThF 9

5M. Price Theory and Policy—Content same as Economics 5 but use will be made of mathematical tools in presentation. Prerequisites: 1 or equivalent and Mathematics 62 or equivalent. (May be taken as 105M by graduate students.)

5 units, spring, (Arrow), MTWThF

7. Introduction to Statistics—Especially designed for economists. (Same as Statistics 7.)

5 units, autumn, (Bowker), MTWThF, 11

10. Income and Employment—National income accounts; the determination of income, employment, prices. Prerequisite: 1 or equivalent. (May be taken as 110 by graduate students.)

5 units, autumn, (Staff), MTWThF 10
or winter, (Staff), MTWThF 10
or spring, (Staff), MTWThF 10

10M. Income and Employment—Content same as Economics 10 but use will be made of mathematical tools in presentation. Prerequisites: 1 or equivalent and Mathematics 41 or equivalent. (May be taken as 110M by graduate students.)

5 units, winter, (Staff), MTWThF

90, 91. Elements of Accounts—Theory, practice of enterprise accounting. (Students who have taken or are taking a University course in elementary accounting are admitted only by special permission of instructor.) 90 is prerequisite for 91. Freshmen may enroll.

90. 5 units, autumn or winter, (Staff), MTWThF
91. 5 units, winter or spring, (Staff), MTWThF

100. Early Economic Doctrine—The development of early economic thought, with particular attention to English classical economics, and its counterpart in other Western countries, in the period 1776–1850. Prerequisites: 5 and 10. (May be taken as 200 by graduate students.)

5 units, (Staff), MTWThF

105M. Price Theory and Policy—See Economics 5.


110M. Income and Employment—See Economics 10M.

111. Income, Employment, and Money—National income analysis; emphasis on role of financial institutions. Prerequisites: 5 and 10.

5 units, winter, (Staff), MTWThF
or spring, (Staff), MTWThF


5 units, (Staff), MTWThF

115. Economic History of Europe—Forces involved in emergence of modern capitalism. General economic development of Europe from sixteenth century to present. Prerequisite: 1 or equivalent.

5 units, (Staff), MTWThF

117. Economic History of the United States—Economic development of United States in nineteenth, twentieth centuries. Prerequisite: 1 or equivalent.

5 units, (Staff), MTWThF

120. Comparative Economic Systems—Working principles, institutions of
121. Economic Development—Analysis of problems of economic development (spontaneous and planned) confronting both advanced, underdeveloped countries. Prerequisites: 5 and 10 or consent of instructor. (It is recommended that majors take this course in their senior year.)
5 units, autumn, (Staff), MTWThF
or winter, (Staff), MTWThF
or spring, (Staff), MTWThF

122. Socialist Economics—Survey of origins, development of socialist thought; particular reference to early French, British socialists; Marx and followers; Fabians. Prerequisites: 5 and 10 or consent of instructor. (It is recommended that majors take this course in their senior year.)
5 units, (Staff), MTWThF, alternate years, to be given in 1958-59

5 units, (Staff), MTWThF

141. Public Finance—Effects of government expenditure, borrowing, taxation upon allocation of resources, levels of national income, employment, prices. Prerequisites: 1, 5, and 10.
5 units, autumn, (Staff), MTWThF
or winter, (Pagan), MTWThF 11

142. Taxation—Further study of taxation; particular reference to ethical aspects of taxation, concepts of taxable income, shifting and incidence of taxation. Prerequisite: 141.
5 units, spring, (Staff), MTWThF 11

145. Labor Economics—Analysis, description of labor force, labor markets. Impact of legislative measures, productivity changes, labor organizations upon wages, distribution of income. Prerequisite: 1 or equivalent.
5 units, autumn, (Staff), MTWThF
or 4 units, summer, (Staff), MTWThF

147. Collective Bargaining and Public Policy—Techniques, consequences, subject matter of collective bargaining; special attention to role of government policy.
3 units, spring, (Staff), MTWThF

157. Economics of Industry—Factors determining structure, economic behavior of plants, firms, industries. Prerequisite: 1 or equivalent, or consent of instructor.
5 units, (Staff), MTWThF

158. Public Control of Monopoly and Competition—Public policy with regard to the non-regulated competitive sectors of the economy with particular references to the anti-trust laws and their enforcement. Prerequisite: 5.
3 units, (Staff), MWTh

159. The Regulated Industries—A study of the public utilities and the transportation industries, and an evaluation of their regulation. Prerequisite: 5.
3 units, (Staff), MWTh

5 units, (Staff), MTWThF

5 units, (Staff), MTWThF
5 units, winter, (Staff), MTWThF

171. Introduction to Quantitative Analysis — Major problems of quantitative research in economics; relevant sources of statistical information, including national economic accounting, input-output analysis, cost and demand studies, family budget surveys. Prerequisite: 170.
5 units, spring, (Staff), MTWThF

172. Statistical Inference in Economics — Content same as 272.
3 units, (Staff), MWTThF

5 units, winter, (Capron), MTWThF

5 units, spring, (Capron), MTWThF

195. Synthesis of Economics — (Required of all Honors students in their senior year.) Prerequisite: admission to Honors Program.
5 units, (Staff), MTWThF

198. Junior Seminar in Economics — (Required of all Honors students.) Prerequisites: Admission to Honors Program; completion of Economics 1, 5, and 10.
5 units, spring, (Staff), MTWThF

199. Senior Seminar in Economics — (Required of all Honors students.) Prerequisites: major in economics, completion of 130 units of credit, Stanford grade average of at least 3.0, or grade average of 2.5 and consent of instructor.
5 units, autumn, (Staff), MTWThF
or winter, (Staff), MTWThF
or spring, (Staff), MTWThF

COURSES PRIMARILY FOR GRADUATE STUDENTS


A. PRICE AND ALLOCATION THEORY


201. Economic Thought since 1850 — Development of economic doctrine, principally in Western Europe, United States, in modern times.
5 units, winter, (Haley), MTWThF

202. Price and Allocation Theory I — Perfect competition. Meaning, conditions of efficiency in economic organization. Prerequisite: consent of instructor.
5 units, autumn, (Staff), MTWThF

203. Price and Allocation Theory II — Different forms of competitive and monopolistic behavior; their effect on efficiency of economic organization. Prerequisite: 202.
5 units, winter, (Staff), MTWThF

204. Price and Allocation Theory III — Pricing of factors of production. Prerequisite: 203.
5 units, spring, (Staff), MTWThF

301. Seminar in Price and Allocation Theory — Prerequisites: 204, and consent of instructor.
5 units, (Staff), by arrangement
B. Money, Income and Employment

210, 211, 212. The Theory of Income and Economic Fluctuations—Theory of money, employment, income considered from points of view of comparative statistics, causes of instability and long-term change. 210 is prerequisite for 211; 210, 211 are prerequisites for 212.

210. 5 units, autumn, (Tarshis), MTWThF
211. 5 units, winter, (Shaw), MTWThF
212. 5 units, spring, (Staff), MTWThF

310. Seminar in Money, Income and Employment—Prerequisites: 212 and consent of instructor.
5 units, (Staff), by arrangement

C. Economic History and Comparative Systems

215, 216. Economic Development—Outline of origins, development of modern capitalism, other contemporary economic systems. 215 prerequisite for 216.

215. 5 units, autumn, (Baran), MTWThF
216. 5 units, winter, (Staff), MTWThF

315. Seminar in Economic Development and Comparative Systems—Prerequisites: 215, 216, and consent of instructor.
5 units, spring, (Staff), by arrangement

Economics and the Social Sciences—See Graduate Division Special Programs 325.

D. Public Finance

241. Public Finance and Taxation—Prerequisite: 142 or consent of instructor.
5 units, (——), alternate years, to be given in 1958-59

341. Seminar in Public Finance—Prerequisites: 241, consent of instructor.
5 units, by arrangement

E. Labor Problems

245. History of the American Labor Movement—Analytical topics from historical viewpoint. Special attention to growth patterns of specific unions, changes in leadership, and objectives of American labor. Prerequisites: 145 and 147, or consent of instructor.
5 units, (——), MTWThF alternate years, to be given in 1959-60

246. Comparative Labor Movements—Labor forces, labor markets, trade union restrictions of Western European countries, British Commonwealth. Political behavior of unions. Prerequisites: 145 and 147, or consent of instructor.
5 units, (——), alternate years, to be given in 1959-60

248. Wages and Income Distribution—Wage levels, structure; special reference to empirical data. Study of income distributions; particular reference to differences in variations in size distributions among different occupational, racial, regional groups. Open to graduate students, qualified seniors. Prerequisites: 5, 10, and 145, or consent of instructor.
5 units, winter, (Staff), MTWThF

345. Seminar in Wage Theory—Prerequisite: consent of instructor.
5 units, (——), alternate years, to be given in 1959-60

F. Economics of Industry

255. Economics of Industry—Selected topics in economics of industry. Prerequisite: 158 or 159, or consent of instructor.
5 units, (Staff), alternate years, to be given in 1959-60
256. The Structure of Industry—Use of input-output and linear programming techniques to analyze production in plants, firms, and interrelated sectors of the economy. Application to policy making in government and industry. (May also be included in the field of Econometrics.) Prerequisite: consent of the instructor.

5 units, (Chenery), MTWThF, alternate years, to be given in 1959–60

355. Seminar in Economics of Industry—Prerequisite: consent of instructor.

5 units, (Staff), by arrangement

359. Law and the Competitive Economy—Anti-trust laws, their application; particular attention to economic problems involved; application of economic analysis to these problems. (Same as Law 279.) All students must take all three quarters.

359a. 2 units, autumn, (Capron, Neal, Packer), T 3-5
359b. 2 units, winter, (Capron, Neal, Packer), T 3-5
359c. 2 units, spring, (Capron, Neal, Packer), T 3-5

G. INTERNATIONAL TRADE AND FINANCE

265. International Trade and Resource Allocation—Factors that underlie trade, policies for regulating it.

5 units, (Staff), alternate years, to be given in 1958–59

266. International Economics and Income—Significance of international transactions for the national income; related questions.

5 units, (Staff), alternate years, to be given in 1959–60

365. Seminar in International Trade and Finance—Prerequisite: consent of instructor.

5 units, (Staff), alternate years, to be given in 1959–60

H. ECONOMIC STATISTICS

270. Theory of Probability—Elementary probability theory, sampling, distributions. (Same as Mathematics 123 and Statistics 116.) Prerequisite: working knowledge of the calculus.

4 units, autumn, (Scarf, Hoeffding), MTWF 9,10
or winter, (Staff), MTWF 9
or spring, (Karlin), MTWF 9

271. Elementary Statistical Inference—Review of probability; distribution theory; sampling, sampling distributions; univariate, bivariate normal distribution; correlation, regression. (Same as Statistics 119.) Prerequisite: 270.

3 units, winter, (Johns), MWF 9

272. Statistical Inference in Economics—Multiple correlation, special emphasis on economic applications; correlation of time-series; introduction to simultaneous equations estimation.

3 units, spring, (Staff), MWTh

I. ECONOMETRICS

256. The Structure of Industry—(See F. Economics of Industry)

280. Quantitative Analysis in Economics—Economic interdependence in relation to statistical analysis; problems of aggregation, use of cross-section data. Prerequisites: 5, 10, 272.

5 units, (Staff), MTWThF

285. Special Topics in Mathematical Economics—In 1958–59, the course will cover the theory of general competitive equilibrium: existence, optimality, and stability. May be repeated for credit.

5 units, (Arrow), MTWThF
380. Seminar in Econometrics—Prerequisite: consent of instructor.
5 units, winter, (Arrow), by arrangement

J. ACCOUNTANCY

290. Accounting and Economic Theory—Analysis of relationship of accounting theory, practice to economic theory. Prerequisite: consent of instructor.
5 units, (Staff), alternate years, to be given in 1959–60
See also Senior Colloquia.

ENGLISH

Emeriti: Margery Bailey, William Hawley Davis, Albert Guérard, Richard Foster Jones, Edith Ronald Mirrielees (Professors); John McClelland (Associate Professor); Margaret Dille Hudson (Instructor)

Executive Head: Virgil Keeble Whitaker

Professors: Robert W. Ackerman, John Wendell Dodds, William Irvine, Francis Rarick Johnson, Herbert Dean Meritt, Richard Pingree Scowcroft, George Frank Sensabaugh, Wallace Earle Stegner, Virgil Keeble Whitaker, Arthur Yvor Winters


Assistant Professors: Charles N. Fifer, Malcolm Goldstein, David Levin, Thomas C. Moser, Lawrence V. Ryan

Instructor: W. Wesley Trimp, Jr.

Acting Instructor: Lucio P. Ruotolo

The Department of English offers work in English and American Literature, English Philology, and Creative Writing. In connection with these programs, it maintains the William Dinsmore Briggs Memorial Library for the use of graduate students and the Jones Room in the University Library as a center for its work in Creative Writing. The Jones Room includes a library, records, and facilities for small meetings.

PROGRAMS OF STUDY

Bachelor of Arts

The following Departmental requirements are in addition to the University's basic requirements for the Bachelor's degree:

I. Prospective English majors may profitably elect one or more of the following courses: English 25 and 76; Humanities 61.

II. All students majoring in English are required to take the following Departmental courses:

English 102. Introduction to the English Language.
English 141. Chaucer.
English 143. Shakespeare.
English 182. English Literature of the Renaissance.
English 183. English Literature of the Restoration and Eighteenth Century.
English 184. English Literature of the Nineteenth Century.

The last three courses should be taken in sequence during the junior year.
In addition to the courses listed above, the student must complete one of the following programs:

A. English Literature

The student should take a course in English history, such as History 105, before the end of his junior year.

1. One course from each of the following groups:
   a) English 142, 144, 145, 146, 147, 148, 149, 151, 152, 153.
   b) English 100, 237, 238, 241, 242, 251.

2. One of the following senior seminars: English 192, 193, 194.

B. American Literature

The undergraduate major in American Literature should plan to take English 177 and 178 in sequence at the first opportunity—not later than spring of the junior year and autumn of the senior year.

1. English 177. American Literature to 1850.
3. English 266. Chief American Poets.
4. Two additional courses from the following list: English 265, 267, 269, 270; Speech and Drama 292.

C. Creative Writing

All students wishing to major in creative writing must have maintained at least a B record in preliminary writing courses, i.e., English 5 or 133.

1. One course from each of the following groups:
   a) English 142, 144, 145, 146, 147, 148, 149, 151, 152, 153.
   b) English 171, 173, 179, 265, 266, 269, 270; Speech and Drama 292.

2. Completion of at least 12 units of work in one of the programs listed below:
   a) Fiction: English 255, The Development of the Short Story; plus eight units of English 203, Advanced Fiction Writing, or a substitute approved by the director of the Creative Writing Program.
   b) Poetry: English 251, The English Lyric, and English 201, The Writing of Poetry, which may be repeated for a total of 8 units of credit.
   c) Drama: Speech and Drama 294, 295, and one other course to be prescribed by his adviser.
   d) Criticism: English 251, The English Lyric; English 255, The Development of the Short Story; and one other course to be prescribed by his adviser. The student is urged to take also such courses in the history of criticism and in aesthetics as he can.

III. In addition to the English major requirements, courses totaling not less than 16 units of college work must be taken in one of the following minor fields:

- One foreign language and literature.
- Philosophy and/or History.
- Philosophy and Religion (junior and senior courses listed under Special Programs in Humanities: Religion).
- Speech and Drama.
- Music or Art (advanced courses).
- Unified program to be arranged with the approval of the adviser and the Department.
Humanities Honors Program. (The entire Honors Program must be taken to fulfill the minor requirement.)

HONORS PROGRAM IN HUMANITIES

An Honors Program in Humanities is offered for majors of this Department who wish to supplement their departmental major by a related and carefully guided program of studies. See the section "Humanities (Special Programs)" for a description of the Honors Program.

Teachers’ Credentials

Students wishing to obtain the Stanford General Secondary Credential entitling them to teach in grades 7-14 in the public schools of California, or a Junior College Credential for grades 13 and 14, should consult the statement on credentials under "School of Education" in this Bulletin and the Credential Secretary of the School of Education for the requirements.

Candidates for the Stanford General Secondary Credential with a teaching major in English are required to take the following Departmental courses or their equivalents:

<table>
<thead>
<tr>
<th>Teaching Major</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 1, 2, and 3, Freshman English</td>
<td>9</td>
</tr>
<tr>
<td>One course in the English Language, English 102 or 309</td>
<td>4</td>
</tr>
<tr>
<td>English 143. Shakespeare</td>
<td>4</td>
</tr>
<tr>
<td>English 182. English Literature of the Renaissance</td>
<td>5</td>
</tr>
<tr>
<td>English 183. English Literature of the Restoration and Eighteenth Century</td>
<td>5</td>
</tr>
<tr>
<td>English 184. English Literature of the Nineteenth Century</td>
<td>5</td>
</tr>
<tr>
<td>Courses in American Literature (preferably in the chief American poets and American novelists)</td>
<td>8</td>
</tr>
<tr>
<td>Speech and Drama 163. Principles of Directing (3 units); or Journalism 50. Editorial Techniques (2 units) and Journalism 51. Introduction to Journalism (1 unit)</td>
<td>3</td>
</tr>
<tr>
<td>Electives (courses in literary criticism, speech, and radio are strongly recommended) to bring the total number of units to 57</td>
<td>14</td>
</tr>
<tr>
<td>Total units</td>
<td>57</td>
</tr>
</tbody>
</table>

Graduate transfer students who are qualifying for a teaching major or minor in English should confer with Professor Grommon before taking English 182, 183, or 184.

Teaching Minor

Candidates for the teaching minor are urged to register for Education 284a (Methods of Teaching English) in the autumn quarter of their senior year.

<table>
<thead>
<tr>
<th>Teaching Minor</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 102. Introduction to the English Language</td>
<td>4</td>
</tr>
<tr>
<td>English 143. Shakespeare</td>
<td>4</td>
</tr>
<tr>
<td>English 184. English Literature of the Nineteenth Century</td>
<td>5</td>
</tr>
<tr>
<td>Courses in American Literature</td>
<td>8</td>
</tr>
<tr>
<td>Elective, preferably in the English novel</td>
<td>4</td>
</tr>
<tr>
<td>Education 284a. Curriculum and Instruction in Secondary English I</td>
<td>4</td>
</tr>
<tr>
<td>Total units</td>
<td>29</td>
</tr>
</tbody>
</table>
All candidates for a Stanford credential with a teaching major in English are required to take at least three courses in the Stanford Department of English; for the teaching minor, two such courses are required.

A candidate for the Stanford Junior College Credential must begin the program during the summer or autumn quarter. He should apply to the Department of English in advance of registration. The Department will accept only those applicants who seem promising candidates for an advanced degree offered by the Department and meet the standards for college instructors—in other words, those fully qualified to study for the Ph.D. degree, whether or not they plan to do so. Other graduate students interested in obtaining a teaching credential are advised to work for the Stanford General Secondary Credential.

Candidates for the Stanford Junior College Credential must meet the following requirements:

1. Completion of the Master's degree in English.
2. Completion of 24 quarter units in a teaching minor, 12 units of which are advanced undergraduate or graduate units.
3. Completion of the following professional courses in education:
   a) Education 347, The Junior College (3 units), offered in the winter quarter by the School of Education.
   b) Education 248, Student Teaching in Junior College (9 units), to include (1) student teaching in a public junior college, unless the candidate has been officially appointed to the teaching staff of the Department of English; and (2) observation of and, if possible, participation in classes in a public junior college, if the candidate has been officially appointed to the teaching staff of the Department of English. To be supervised by the School of Education and the Department of English.
   c) Education 284a, Curriculum and Instruction in Secondary School English (4 units), offered only during summer and autumn quarters.
   d) Education 241, Introduction to Audio-Visual Education (3 or 4 units), offered by the School of Education in the spring and summer quarters, is required by the California State Code.

**Advanced Degrees**

For University regulations governing admission to advanced standing see the section "Degrees" in this Bulletin.

**Eligibility**—A student may enter upon graduate work toward an advanced degree in English at Stanford if he has received a Bachelor's degree from any college or university of accredited standing, and if his record is acceptable. (Formal application for candidacy is a separate step taken somewhat later.) Students whose previous preparation falls short of the requirements for the degree of Bachelor of Arts in English at Stanford must expect to spend more than the minimum time in residence. The Department reserves the right, moreover, to reject old credits for graduate work done either at Stanford or elsewhere.

**Master of Arts**

The following Departmental requirements are in addition to the University's basic requirements for the Master's degree, dealing with such matters as residence, thesis, etc.:

**Time of Residence**—A candidate for the degree of Master of Arts must take three quarters of full-time work (or the equivalent) at Stanford. He
must complete a minimum of 36 units of course or seminar work in this Department and submit an acceptable thesis.

Program of Study—A candidate for the Master's degree may concentrate in English literature, in American and English literature, in English philology, or, with permission upon demonstration of special aptitude, in creative writing. A candidate in English literature must offer a course or seminar at the most advanced level for which he is actually prepared, in each of the following areas: Old English (310), Middle English, the Renaissance, English literature of the Restoration and eighteenth century, English literature of the nineteenth century, and American literature. At least one of these must be a seminar in the period of his thesis. Any of these requirements may be waived upon demonstration that the candidate has had unusually intensive undergraduate work in the particular area (e.g., a concentration of courses or an undergraduate honors thesis). A candidate in English and American literature may omit one of the areas in English literature and offer instead three courses or seminars in American literature. His thesis and at least one seminar will be in American literature.

A candidate in creative writing will follow the programs prescribed for English, or English and American literature, except that he may include 8 units of advanced work in creative writing in the 36 required for the degree, and these will be regarded as fulfilling the seminar requirements.

Applicants interested in a Master's degree in English philology should correspond with Professors Meritt or Ackerman to determine the requirements.

Candidates for the Ph.D. will be granted the A.M. upon special application, if they have passed the written comprehensives for the Ph.D.

Language Requirements—In addition to Old English, a candidate for the degree of Master of Arts must demonstrate, within two quarters of residence, a reading knowledge of one foreign language approximately equal to that acquired by two years of college work in the language. He will demonstrate this knowledge by passing a two-hour written examination consisting of three passages: (1) poetry, (2) criticism, (3) fiction. He will be expected to read a relatively easy piece of literature accurately without excessive use of the dictionary. Examinations will be given by the Department in the eighth week of each quarter at an hour and date to be announced.

In substitution for the one foreign language, a candidate may offer two foreign languages by passing the examinations prescribed by the University for Ph.D. candidates.

Thesis—The Master's thesis may not be counted for more than 9 units of credit in addition to the required 36 units of course work. Candidates in creative writing will offer a piece or pieces of imaginative writing satisfactory to the members of the Creative Writing Committee. The Master's thesis must be presented in its finished form to the professor under whose direction it is written at least four weeks before the close of the quarter in which the degree is to be granted.

Examinations—Since the distribution of courses required is intended to insure a reasonable familiarity with English or American literature, no comprehensive examination is required for the Master's degree.

Doctor of Philosophy

University regulations regarding admission and application for candidacy are discussed in the section “Degrees” in this Bulletin. The following Departmental requirements are in addition to the University's basic requirements for the doctorate, dealing with such matters as residence, dissertation, and examination:

A candidate for the Ph.D. degree must complete three years (nine quarters) of full-time work, or their equivalent, in graduate study beyond the Bachelor's
degree. He will be expected to offer at least 72 units of graduate courses or seminars in addition to his doctoral dissertation. At least three consecutive quarters of graduate work and also the last courses or seminars in the program must be taken at Stanford.

A candidate for the Ph.D. degree may concentrate in English literature or English philology. Applicants interested in a Ph.D. in English philology should correspond with Professors Meritt or Ackerman to determine the requirements of the program. The program in English literature is as follows:

1. English 301, Bibliography and Methods of Graduate Study, or an equivalent course elsewhere.
2. English 310, 311, 312, the sequence in Old and Middle English, or equivalent work elsewhere.
3. A seminar in each of the six following categories (at least four of these seminars must be taken at Stanford):
   a) Old or Middle English, or principles and structure of the English language (English 309, 314, 316, 318, 320).
   b) English Renaissance (English 323, 325, 331, 334b).
   c) Restoration and Eighteenth Century (English 341).
   d) Nineteenth and Twentieth Centuries (English 351, 354, 358).
   f) One additional seminar related to the period or genre of the student's dissertation. The two seminars in the field of the student's dissertation must be taken at Stanford.

With the Department's permission, an A.M. thesis may be substituted for one seminar in the same period or genre. Any genre seminar may also count for a period, if the student's research centers in that period—i.e., literary criticism in the 16th, 18th, or 19th; the novel in the 18th or 19th; but the same seminar cannot fulfill both requirements.

Each student will be expected to satisfy his adviser and the professor giving the seminar that he has a sound general knowledge of the background or to take preparatory courses or proseminars. The background expected is indicated under each listing. (N.B. In the interest of clarity, prerequisites will ordinarily be listed in terms of Stanford courses, and the syllabus for each of these courses will be available in the Briggs Room. But the notation "equivalent" indicates that a comparable course elsewhere or independent study is equally acceptable.)

4. Graduate electives (courses numbered 200 or 300) amounting to at least 8 units. Graduate courses taken in preparation for seminars may be counted toward this requirement.

5. One of the following minor programs, amounting to at least 24 units taken in graduate standing either at Stanford or elsewhere: (1) a minor in a related department, the choice of minor to be approved by the Department of English, but the program itself to be prescribed by the department in which it is taken; (2) a supplementary program in English philology or American literature (candidates concentrating in English philology may offer English literature through the Renaissance); (3) a special interdepartmental program of studies related to the student's projected research.

A candidate minoring in American literature may also do his dissertation in American literature. If so, he must include in his program two seminars in American literature (English 361, 371, 377, or others to be added).

A student who wishes to begin the study of English on the graduate level, and has had a strong undergraduate major in a subject normally accepted for the Ph.D. minor, may petition the Department to waive the minor requirement,
so that he may devote equivalent time to strengthening his foundation in English.

Language Requirements—All candidates for the Ph.D. degree must take either the year's course in Old and Middle English at Stanford or a written examination on the field. They must demonstrate a reading knowledge of Latin, German, and French by passing the University examinations in these languages (for details see Time Schedule). Another foreign language may be substituted for German or French if it is required for the student's projected research. Italian may be substituted for either language if the candidate's dissertation is concerned with the English Renaissance.

The following schedule for meeting foreign language requirements will apply to all candidates, whether for the A.M. or the Ph.D. degree:

- No graduate student will be allowed to register for his third quarter of work until one foreign language examination has been passed (given by the Department for the A.M.; given by the University Examiner for the Ph.D.). No Ph.D. candidate will be allowed to register for the fifth quarter of work until a second foreign language examination has been passed. No Ph.D. candidate will be allowed to take the written comprehensives until all language requirements (two modern and Latin) have been satisfied.

Examination—In addition to the foreign language examinations prescribed by the University, a Ph.D. candidate must take a comprehensive written examination at least one year before he anticipates receiving the degree. This examination will be given during the winter quarter, and, if demanded, during the summer, but summer results will not be announced until the autumn quarter. Candidates will also take an oral examination over the period and background of the dissertation after approval of the dissertation by the Departmental Committee.

Dissertation—As early as possible during his graduate study, a Ph.D. candidate will be expected to find a topic requiring extensive original research and to enlist the services of a senior member of the Department as his adviser. The adviser will request the Executive Head to appoint a committee to supervise the dissertation. The candidate will then submit to this committee a brief statement of his dissertation project and meet with the committee to confer about his program of study and preparation for the dissertation. A copy of the statement, revised if necessary, and bearing signatures of the three committee members in approval of the topic, will become a part of the Department records. It must be transmitted to the Department not later than the quarter before the candidate takes his written comprehensives. N.B. The candidate should take this crucial step as early in his graduate career as possible, and the deadline stated is to be regarded as the last possible, not the normal or desirable, time. The committee may well advise extra preparation within or outside the Department, and time should be allowed for such work.

The dissertation must be submitted to the adviser in rough draft but in substantially final form at least four weeks before the University deadline in the quarter during which the candidate expects to receive his Ph.D. degree.

Immediately after passing the written comprehensive examination, the candidate will be expected to file a formal application for candidacy as prescribed by the University. Ph.D. dissertations must be completed and approved within five years from the date of that application. A candidate taking more than five years will be required to reinstate his candidacy by passing the written comprehensive once again.

Graduate Program in Humanities

The Department of English participates in the Graduate Program in Humanities leading to the degree of Doctor of Philosophy. Candidates for a
ENGLISH

Ph.D. in English and Humanities may omit 311 or 312 from their requirements, but must offer a reading knowledge in the three foreign languages (Latin, French, German) required by the Department of English.

FRESHMAN AND SOPHOMORE COURSES

The Department does not offer a prescribed course in remedial English. Instead, it administers to matriculating freshmen an examination in fundamentals of correct written expression. Students with unsatisfactory scores in this examination are assigned to sections of English 1 taught by instructors especially selected to direct individual remedial work. In addition to performing the regular work for the course, each student so assigned meets at least once weekly with his instructor for individual conference about his written work and for tutoring in English fundamentals.

1, 2, 3. Freshman English—Expository writing, emphasizing methods of critical thinking, techniques of organization, forms of literature as expressions of thought and emotion.

1. A course in the fundamentals of mature expository writing and effective reading, designed to train the student to write lucid, orderly, and logical prose.

3 units, autumn or winter, (Staff)

2. Continuation of 1; emphasis on problems of organization and research; some introduction to forms of literary expression. Prerequisite: 1.

3 units, winter or spring, (Staff)

3. Continuation of 2; emphasis on reading and analysis of forms of literary expression. Prerequisite: 2.

3 units, autumn or spring, (Staff)

1S, 2S, 3S. Freshman English (Special)—Sections of 1, 2, and 3 for students of exceptionally high aptitude and achievement, paralleling the regular sections but offering more advanced readings and more rigorous training. Open only to students selected by the Department.

3 units each course, autumn, winter, spring, (Staff)

5. Narration—Basic problems of narrative and imaginative writing. Prerequisite: 3.

3 units, autumn, winter or spring, (Staff)

7. Masterpieces of English Literature—Intensive study of a few masterpieces of English literature from various centuries, including poetry, drama, the essay, the novel.

4 units, autumn, (Ruotolo), MTWF 9
or spring, (Ruotolo), MTWF 9

9. Masterpieces of American Literature—Intensive study of a few masterpieces of American literature, including poetry, drama, the essay, the novel.

4 units, winter, (Levin), MTWF 10

25. Shakespeare—Rapid reading of about half the plays and poems in chronological sequence.

4 units, autumn, (Ryan), TWTThF 11
or winter, (——), MTWTh 1
or spring, (Goldstein), MTWF 11

73. Modern British Humorists—Detailed study of Oscar Wilde, Max Beerbohm, G. B. Shaw, G. K. Chesterton, Aldous Huxley; inquiry into the nature, and brief history, of humor, wit, comedy.

3 units, winter, (Irvine), MWF 1

Introduction to the Chief Types of Literature—Open to all undergraduate students. Large courses may be divided into sections.
75. Introduction to the Novel—Various species of novels in English and in translation; analysis of technique of fiction.
   4 units, autumn, (Fifer), MTWF 10
   or spring, (Moser), MTWF 1

76. Introduction to Poetry—Prosody, poetic forms and types, critical theories regarding poetry. Masterpieces of English poetry will be studied in the light of these theories.
   4 units, autumn, (Trimpi), MTWF 1
   or winter, (Stone), TWThF 11

77. Introduction to the Drama—Principal dramatic forms; development of dramatic art; masterpieces of the theater from various periods, countries.
   4 units, autumn, (Goldstein), MTWF 2
   or spring, (Johnson), MWThF 10

England—See History 105.


JUNIOR AND SENIOR COURSES

The following courses (100-184) are open to juniors and seniors of all departments. Well-prepared sophomores may be admitted, but only by special permission of the instructor. Freshmen and sophomores who do not have such permission may be refused admission to the courses. Students in other departments may be especially interested in the following introductory courses: 100, The English Bible as Literature; 102, Introduction to the English Language; 177-9, an introductory survey of American literature; and 182-4, an introductory survey of English literature.

100. The English Bible as Literature—Readings in Old, New Testaments and selected books of the Apocrypha, with some attention to history of the English Bible and use made of Biblical themes in English literature.
   4 units, (Ford), to be given in 1959-60

102. Introduction to the English Language—Designed to give the student a knowledge of fundamental matters about the English language; to familiarize him with terminology, classification of language; to enable him to form standards of judgment about good English.
   4 units, winter, (Meritt), TWThF 11

129. Scientific Writing—Advanced course in exposition especially for science, engineering majors. Prerequisite: 3, or equivalent.
   3 units, autumn, (———), MWF 8, 10; TThS 8
   or winter, (———), MWF 8, 9, 11
   or spring, (———), MWF 9, 10, 11
   or summer, (———), MTWF 9

131. Exposition—Advanced course dealing with more difficult problems of presenting both technical and nontechnical subject matter. Prerequisite: 3, or equivalent.
   3 units, autumn, (———), MWF 10
   or spring, (Ruotolo), MWF 11

133. Directed Writing: Fiction—Intermediate course in which the student is to practice various forms of fiction on his own initiative. Open to sophomores so far as space permits. Prerequisite: 3. May be repeated three quarters for credit.
   3 to 5 units, autumn, (———), TTh 2-4
   or winter, (———), MW 2-4; TTh 2-4
   or spring, (———), TTh 2-4
134. Directed Writing: Poetry—Intermediate course in writing various
types of verse. May be repeated three quarters for credit.
4 units, winter, (Trimpi), MW 2-4

Studies of Individual or Related Authors—The following courses, 141-153,
are concerned with the ideas and the style of the authors treated in them, and
with the development of these authors as literary artists. They stress close
detailed study of individual works.

141. Chaucer.
4 units, autumn, (Ackerman), MTWF 9
or spring, (Meritt), TWThF 11

142. Spenser.
4 units, alternate years, to be given in 1959-60

143. Shakespeare—Intensive study of four or five plays, including sources,
stage history, important critical material.
4 units, winter, (Whitaker), MWThF 8

144. Milton.
4 units, winter, (Sensabaugh), MTWTh 9

145. Donne and Jonson.
4 units, spring, (Trimpi), MTWF 1, alternate years, given in 1958-59

146. Swift and Pope.
4 units, winter, (Goldstein), MTWF 11, alternate years, given in 1958-59

147. Johnson and his Circle.
4 units, spring, (Fifer), MTWF 2, alternate years, given in 1958-59

4 units, (Ford), alternate years, to be given in 1959-60

149. Byron, Shelley, and Keats.
4 units, (Ford), alternate years, to be given in 1960-61

151. Matthew Arnold.
4 units, (Stone), alternate years, to be given in 1959-60

152. Browning and Tennyson.
4 units, autumn, (Stone), TWThF 11, alternate years, given in 1958-59

153. George Bernard Shaw.
4 units, (Irvine), alternate years, to be given in 1959-60

171. Contemporary Drama—Ibsen, subsequent dramatists—English, Con-
tinental, American. Lectures, discussions; critical papers.
4 units, spring, (Dodds), TWThF 9

173. Twentieth Century English Fiction.
4 units, winter, (Scowcroft), MTWTh 2

177. American Literature to 1850.
4 units, spring, (Levin), MTWF 8

178. American Literature, 1850-1900.
4 units, spring, (——), MTWF 10

179. American Literature of the Twentieth Century.
4 units, winter, (——), MTWF 10

182. English Literature of the Renaissance (1500-1660).
5 units, autumn, (Whitaker), MTWThF 10

183. English Literature of the Restoration and Eighteenth Century
(1660-1798)—Prerequisite: 182.
5 units, winter, (Loftis), MTWThF 10

184. English Literature of the Nineteenth Century—Prerequisite: 183.
5 units, spring (Irvine), MTWThF 10

189. Special Work—Under exceptional circumstances advanced undergradu-
ate students may enroll for special work under supervision of some member
of the Department for credit not to exceed four units a quarter.
Any quarter, by arrangement
English 192, 193, and 194 are open only to seniors in the Department of English.

192. Senior Seminar: Selected Topics in Renaissance Literature—Prerequisite: 182.
4 units, autumn, (Sensabaugh), TTh 2–4

193. Senior Seminar: Selected Topics in Eighteenth Century Literature—Prerequisite: 183.
4 units, winter, (Fifer), MW 4–6

194. Senior Seminar: Selected Topics in Nineteenth Century Literature—Prerequisite: 184.
4 units, spring, (Moser), MW 4–6

ADVANCED UNDERGRADUATE AND GRADUATE COURSES

Open only to English majors except with permission of the instructor.

201. The Writing of Poetry—Primarily for students seriously interested in the composition of poetry. First- and second-year students may be admitted to this course and to 251 upon application. 251 must be taken simultaneously with 201 or before it. May be repeated for credit.
2 units, autumn, (Winters), TF 1
and winter, and spring (Winters), TTh 1

203. Advanced Fiction Writing—Advanced undergraduate and graduate students by permission. Applicants should leave samples of writing with secretary of Creative Writing Center at least ten days before beginning of each quarter.
2 to 5 units, autumn, (Scowcroft), MW 2–4
or winter or spring, (Stegner), MW 2–4

231. Medieval Literature.
4 units, autumn, (Ackerman), MTWF 8

237. The English Drama to 1642.
4 units, winter, (Johnson), MTWF 10

238. Drama of the Restoration and Eighteenth Century.
4 units, spring, (Loftis), MTWTh 10
or summer, (Loftis), MTWThF 1

241. The English Novel through the Eighteenth Century—Study of the most significant novels, with emphasis on development of the form.
4 units, winter, (Scowcroft), MTWTh 1

242. The English Novel in the Nineteenth Century—Study of the most significant novels, with emphasis on development of the form.
4 units, spring, (Irvine), TWThF 11

251. The English Lyric—Historical examination of lyric poetry considered in respect to distinctions and historical relationships of schools and movements.
4 units, autumn, (Winters), TWThF 11

255. The Development of the Short Story.
4 units, winter, (Stegner), MTWTh 1

265. Hawthorne and Melville.
4 units, spring, (Winters), TWThF 11

266. Chief American Poets, from 1630 to the Present.
4 units, winter, (Winters), TWThF 11

267. Emerson and Thoreau.
4 units, (Grommon), to be given in 1959–60

268. Narrative Prose in America—A study of most significant nonfictional narrative works, with emphasis on history and biography, including autobiography.
4 units, winter, (Levin), MTWF 9
269. The Rise of Realism in American Fiction—Chief emphasis on Twain, Howells, Crane, Dreiser.
   4 units, autumn, (Moser), MTWF 9

   4 units, spring, (Stegner), MTWTh 1

299. Advanced Work in Writing and Criticism.
   Any quarter, by arrangement

Curriculum and Instruction in Secondary School English I—See Education 284a.

GRADUATE COURSES

300. Thesis.
   Any quarter, by arrangement

301. Bibliography and Methods of Graduate Study—This, or equivalent course, required of all candidates for Ph.D.
   4 units, autumn, (Johnson), TTh 2-4

302. Problems and Methods of Textual Criticism—Various methods used by scholars to determine authorship, establish text of literary works of fifteenth to eighteenth centuries—Prerequisite: English 301 or equivalent.
   4 units, (Johnson), to be given in 1959–60

303. Tragedy — Theory, practice of tragedy in various literatures from Aeschylus to O’Neill. Lectures, reports. Prerequisite: Some introductory reading of drama.
   4 units, winter, (Dodds), MW 2–4

   4 units, alternate years, to be given in 1959–60
305a. The Classical Background and the Renaissance—Prerequisite: English 182 or 330, or equivalent.
305b. The Restoration and Eighteenth Century—Prerequisites: English 183 (or 340) and 238, or equivalent.
305c. The Nineteenth Century—Prerequisite: English 184 or 350, or equivalent.

306. Criticism of Poetry—Prerequisite: English 251.
   4 units, winter, (Winters), TTh 4–6

307. Seminar in the Novel—Prerequisite: The equivalent of English 241, 242, 265, or 270.
   4 units, autumn, (Scowcroft), TTh 2–4

   4 units, summer, ( ), MTWThF 9

310. Old English—Elements of Old English grammar; reading exercises.
   4 units, autumn, (Meritt), TThF 9

311. Beowulf—Prerequisite: English 310 or equivalent.
   4 units, winter, (Meritt), TThF 9

312. Middle English—History, dialects of Middle English; readings of representative selections from the literature—Prerequisite: English 310 or equivalent.
   4 units, spring, (Meritt), TThF 9

   4 units, (Meritt), alternate years, to be given in 1959–60

316. Elizabethan Language—Vocabulary, pronunciation, grammar, orthography of the period—Prerequisite: English 312 or equivalent.
   4 units, autumn, (Meritt), TThF 11, alternate years, given in 1958–59
318. Seminar in Middle English Literature—Prerequisite: English 312 or equivalent.
   4 units, (Ackerman), to be given in 1959-60

320. Chaucer—*Troilus and Criseyde* in some years, selected short poems in others; structure, history of the works, their literary significance—Prerequisite: English 141 or equivalent.
   4 units, spring, (——), TTh 2-4, alternate years, given in 1958-59

323. Rhetoric and English Literature in the Renaissance.
   4 units, (Johnson)
   323a. Prerequisite: English 182 or 330, or equivalent.
       Winter, MW 4-6
   323b. Prerequisite: English 323a.
       Spring, MW 4-6

325. Shakespeare Seminar—Critical study of one or more plays—Prerequisites: The equivalent of English 25 or 143, 182 or 330, and 237.
   4 units, spring, (Whitaker), MW 2-4

   4 units, autumn, (Johnson), MW 4-6

331. Literary Problems of the English Renaissance.
   331d. Spenser—Prerequisite: English 182 or 330, or equivalent.
   4 units, autumn, (Whitaker), TTh 4-6

334. The Age of Milton.
   4 units, (Sensabaugh)
       Autumn, TWThF 10
   334b. Seminar: Problems in Seventeenth Century Literature—Prerequisite: English 330 or 334a, or equivalent.
       Winter, TTh 2-4

   4 units, winter, (Loftis), TWThF 11

341. Literary Problems of the Restoration and Early Eighteenth Century.
   4 units, (Loftis)
   341a. Studies in the Interrelationships of the Literary Genres—Prerequisite: English 183 or 340, or equivalent.
       Spring, MW 4-6
   341b. Studies in the Writings of Dryden, Swift, and Pope—Prerequisite: English 183 or 340, or equivalent.
       Summer, MW 2-4

   4 units, (Ford), to be given in 1959-60

351. Literary Problems of the Romantic Period: Shelley and Keats—Prerequisite: English 184 or 350, or equivalent treatment of Romantic period.
   4 units, (Ford), to be given in 1959-60

354. Victorian Prose: Carlyle and Arnold—Wide readings in two major critical and social thinkers of the nineteenth century. Lectures, reports—Prerequisite: English 184 or equivalent.
   4 units, autumn, (Dodds), MW 2-4

358. Seminar: Literary Problems of the Nineteenth Century.
   358c. Intellectual Problems of the Nineteenth Century—Prerequisite: English 184 or 350, or equivalent.
       4 units, winter, (Irvine), MW 2-4
   358d. The Bloomsbury Group—Prerequisite: English 184 or 350, or equivalent.
       4 units, spring, (Stone), MW 2-4
361. Seminar in American Critics—Prerequisite: English 266 or equivalent.
   4 units, spring, (Winters), TTh 4–6
371. Seminar in American Historians as Men of Letters—Prerequisite: English 268 or equivalent.
   4 units, (Levin), alternate years, to be given in 1960–61
377. Seminar in American Literature of the Colonial Period—Prerequisite: English 177 or equivalent.
   4 units, (Levin), alternate years, to be given in 1959–60
381. Problems of American Literature.
   381a. Henry James—Prerequisite: See instructor.
   4 units, winter, (——), MW 4–6
   381b. The Concept of the Hero in American Fiction, Drama, and Poetry—Prerequisite: See instructor.
   4 units, spring, (——), TTh 2–4
395. Research Course—Student pursues a special subject of investigation under supervision of some member of Department. Thesis work not to be registered under this course.
   Any quarter, by arrangement

The English Review Club meets two times quarterly to discuss recent publications and creative work of interest to graduate students in English.

See also Senior Colloquia.

GEOGRAPHY

Executive Head: Joseph E. Williams
Professors: C. Langdon White, Joseph E. Williams
Associate Professor: Paul F. Griffin
Assistant Professor: Acting: Andrew F. Burghardt
Instructor: John Thompson

A geographer's training must of necessity be very broad. If geography be considered as a science of relationships, then it is obvious that the more courses the student has in geology, biology, physical geography, and climatology, on the one hand, and in anthropology, economics, history, political science, and sociology, on the other, the abler geographer he should become.

OFFERINGS AND FACILITIES

The Department's purposes are to acquaint students with man's adjustments to his physical and cultural world, to familiarize them with techniques for the analysis of contemporary geographic problems, and to develop in them an ability to exercise sound judgment in evaluating geographic data. There is training for the general student as well as for those who plan careers as professional geographers in civil service, land-use planning, cartography, private enterprise, teaching, or research.

The University Library has a wide selection of literature in all fields of geography. The Map Division holds invaluable collections. Hoover Institution and Library has comprehensive collections of original and secondary materials, especially in the Asiatic and Slavic fields. The Food Research Institute is available to advanced students who are interested in world food problems. Branner Library of the School of Mineral Sciences and the nearby United States Geological Survey Library in Menlo Park offer a comprehensive coverage for those interested in physical geography.
# Bachelor of Arts

**Course Requirements for the major:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>1. Human Geography</td>
<td>5</td>
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<tr>
<td>4. Economic Geography</td>
<td>5</td>
</tr>
<tr>
<td>5. Physical Geography: Land forms</td>
<td>4</td>
</tr>
<tr>
<td>6. Physical Geography: Weather and Climate</td>
<td>4</td>
</tr>
<tr>
<td>50. Elementary Cartography</td>
<td>5</td>
</tr>
<tr>
<td>107. Physical Geography: Soils and Vegetation</td>
<td>3</td>
</tr>
<tr>
<td>111. Geography of Eastern United States and Canada</td>
<td>4</td>
</tr>
<tr>
<td>112. Geography of California and the West</td>
<td>4</td>
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<tr>
<td>120. Geography of South America or</td>
<td></td>
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<td>130. Geography of Asia or</td>
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<td>133. Geography of the Soviet Union or</td>
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<tr>
<td>145. Geography of Europe (any two)</td>
<td>10</td>
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<tr>
<td>182. Field Methods and Techniques</td>
<td>3</td>
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</tbody>
</table>

**Total units** 47

**Course Requirements for the minor:**

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>1. Human Geography</td>
<td>5</td>
</tr>
<tr>
<td>4. Economic Geography</td>
<td>5</td>
</tr>
<tr>
<td>50. Elementary Cartography</td>
<td>5</td>
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<tr>
<td>111. Geography of Eastern United States and Canada</td>
<td>5</td>
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<tr>
<td>112. Geography of California and the West</td>
<td>5</td>
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</tbody>
</table>

**Total units** 25

# Master of Arts

An undergraduate record of B grade or better in geography and other social science subjects is required for admission to this Department as a graduate student. The same average for at least one quarter of graduate work at Stanford is required for admission to candidacy for the Master of Arts. Normally the Master's degree requires one year and 45 units of graduate work. If the student enters graduate study without an adequate undergraduate background in geography, the time required for obtaining the degree of Master of Arts will be more than three quarters. The candidate may choose one of the fields of systematic geography, such as cartography, physical geography, economic geography, or planning. Also, he may choose a topic in regional geography. Whichever is chosen, the candidate must be prepared to do field work and show proficiency in gathering and analyzing data.

A thesis is required and may constitute six units of the candidate's program. In general, it is expected that the candidate will complete the following with at least a B average:

<table>
<thead>
<tr>
<th>Units</th>
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<tbody>
<tr>
<td>A. 200. Method and Scope of Geography</td>
</tr>
<tr>
<td>201. Seminar in Cultural Geography</td>
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<tr>
<td>204. Geography of Manufactures</td>
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<tr>
<td>205. Physical Geography Seminar</td>
</tr>
<tr>
<td>240. Geographical Aspects of Business</td>
</tr>
<tr>
<td>300. Thesis with laboratory and/or field work</td>
</tr>
<tr>
<td>Choice of two other seminars</td>
</tr>
<tr>
<td>B. Instruction in related fields such as biology, economics, geology, history, physics, political science, sociology, anthropology, and statistics, as decided by a Geography Department adviser</td>
</tr>
<tr>
<td>C. General Electives</td>
</tr>
</tbody>
</table>

**Total units** 45
Doctor of Philosophy

Geography students with superior qualifications who wish to work for the Ph.D. degree are referred to the section “Graduate Division Special Programs” in this Bulletin.

First- and Second-Year Undergraduate Courses

   5 units, autumn, or winter, or spring, (White), MWF 8 and TTh sections
   (I) 9; (II) 10; (III) 11; (IV) 1:15
   or summer, (———), MTWThF 8 and one hour by arrangement

4. Economic Geography—Relation, from the world point of view, of man's industries—agriculture, lumbering, mining and quarrying, fishing, manufacturing, transportation, commerce—to the natural environment.
   5 units, autumn or spring, (Thompson), MTWThF 9
   or summer, (———), MTWThF 9 and one hour by arrangement

5. Physical Geography, Landforms—The origin, patterns of distribution, and analysis of topographic features.
   4 units, autumn, (Burghardt), MTWF 10

6. Physical Geography, Weather and Climate—The facts and principles concerning behavior of the atmosphere; systems of climatic classification, and the climate of the earth are examined.
   4 units, winter, (Burghardt), MTWF 11

10. Global Geography—General survey course on world geography; sample study of types of geographical factors on world basis. No prerequisites, but not open to students who have had other courses in geography.
    2 units, autumn, (Thompson), T 2:15-4:05
    or winter, (Thompson), M 2:15-4:05

50. Elementary Cartography—Evolution of maps, construction of projections, study of distribution maps.
    5 units, autumn or spring, (Burghardt), TTh 2-5

Third- and Fourth-Year Undergraduate Courses

104. Advanced Economic Geography—Function of resources of agriculture, industry in the modern world; lectures, field trips. Prerequisite: 4 or consent of instructor.
    5 units, winter, (Thompson), TWTh 1 and F 1-5

107. Physical Geography, Soils and Vegetation—The study of types of vegetation and soil, and of water as forming the basis for human activity.
    3 units, spring, (Burghardt), MWF 10

110. Geography of the United States.—A regional survey of the United States as viewed against the physical background. The major land use patterns of each region will be analyzed and compared within the national framework.
    5 units, summer, (———), MTWThF 10 and one hour by arrangement

111. Geography of Eastern United States and Canada—Eastern United States, Canada (east of the Rocky Mountains) are considered region by region in relation to natural environment; economic activities of each region emphasized and related to distribution of resources, population.
    4 units, autumn, (Griffin), MTWF 11

112. Geography of California and the West—Physiography, climate, soils, vegetation, mineral resources, industrial production, population distribution, trends in the West from a regional standpoint.
    4 units, spring, (Griffin), MTWF 9
120. Geography of South America—Systematic study of the countries of South America; analysis of raw material production, development and prospects of manufacturing in Argentina, Brazil, Chile. Special attention to political, economic interest of United States in this region from point of view of geographer.

5 units, winter, (White), MTWTThF 9

121. Geography of Middle America—Systematic study of lands, peoples of Mexico, Central American countries, islands of the Caribbean; their resources, production; their possibilities for future development; their role in international affairs and in inter-American relations.

3 units, spring, (Thompson), MWF 1:15

130. Geography of Asia—Geographic backgrounds of Asia, excepting USSR; interrelationship of physical, economic, social, political factors.

5 units, autumn, (Griffin), MTWTThF 8

131. Geography of India.

3 units, (———), alternate years, to be given in 1959-60

132. Geography of China—Regional analysis—climate, topography, soils, minerals, occupations, etc. Special emphasis to China since 1949.

5 units, (———), alternate years, to be given in 1959-60

133. Geography of the Soviet Union—Land, people, resources in relation to natural environment; particular emphasis to historic-geographical development, new agriculture, new industry, transport, ethnic patterns.

5 units, winter, (Williams), MTWTThF 10

134. Geography of Hawaii and the Pacific—A general study of the geographic makeup of the Pacific Ocean Area supplementing a specific study of the physical, economic, political, and human geography of the Hawaiian Islands and other island groups of the Pacific including the Society Islands, Fiji, Tonga, Samoa, the Gilbert Islands and the Marshall Islands.

5 units, summer, (———), MTWTThF 11 and one hour by arrangement

143. Military Aspects of Political Geography—World treatment of political units in terms of air age inter-relationships; special attention to analysis of major power blocs. For AFROTC students only. (Same as Air Science 143.)

4 units, winter, (Griffin), MWF 8, and one section by arrangement

145. Geography of Europe—Lands, peoples, climate, relief, resources, economic activities.

5 units, spring, (Williams), MTWTThF 8

150. Intermediate Cartography—Topographical map drafting, interpretation of aerial surveys.

3 units, autumn or winter, (Williams), MW 2-5

151. Advanced Cartography—Advanced projects in merged-color-illumination of relief map.

3 units, autumn or winter, (Williams), MW 2-5

175. Special Work in Geography.

2 to 5 units, by arrangement

182. Field Methods and Techniques—For geography majors only. Others by special permission.

3 units, spring, (Griffin), T 1:15-2:15, field trips by arrangement

191. Political Geography—Geographical pattern of major nations; territorial structure, resources, industry, communications, national aspirations; special consideration to role of United States in world. Establishment of base for analyzing current international trends. No credit to students who have had Air Science 143.

5 units, spring, (Griffin), MTWTThF 11

198. The Teaching of Geography—Foundation course for teachers, supervisors in teaching principles of geography, and home, journey, regional geography in first eight grades. Discussion of organization of course of study,
source materials, textbooks, various methods of teaching geography in social studies.

3 units, winter, (Griffin), MWF 9

200. Method and Scope of Geography.
3 units, autumn, (Williams), T 2–5

201. Seminar in Cultural Geography.
3 units, winter, (———), M 2–5

204. Geography of Manufactures.
3 units, spring, (White), T 1:15–4

205. Physical Geography Seminar.
3 units, winter, (Williams), Th 2:15–5

212. Anglo-America Seminar.
3 units, (———), alternate years, to be given in 1959–60

230. Asia Seminar.
3 units, winter, (Griffin), Th 2–5

240. Geographical Aspects of Business.
4 units, autumn, (White), MTWF 11

270. Seminar in Regional Planning.
3 units, winter, (Griffin), T 2:15–5

300. Thesis with Laboratory and/or Field Work.
6 units, (Staff), by arrangement

301. Graduate Research.
2 to 5 units, winter, (Griffin), by arrangement

Geography and Contemporary World Problems—See Graduate Division Special Programs 328.

See also Senior Colloquia.

HISPANIC AMERICAN STUDIES

Committee in Charge: John W. Dodds (Chairman), Ronald Hilton, Charles F. Park, Jr., James T. Watkins IV, C. Langdon White, Ira L. Wiggins
Director: Ronald Hilton
Lecturers: Alfonso Espinosa, Luis Enrique Osorio, Joseph C. Shirley, James L. Taylor

The Hispanic American Studies program at Stanford University is under the jurisdiction of Special Programs in Humanities. It is an area or regional program in that it concerns itself with a definite area—Spain, Portugal, and Latin America—but this is a cultural rather than a geographical region.

The program emphasizes the use of the Spanish and Portuguese languages; the study of a foreign area without a mastery of the language of that area is comparable to engineering without mathematics. Authorities from Spain and Latin America regularly address the Hispanic World Affairs Seminar in Spanish or Portuguese and engage in discussion with members of the seminar. The Hispanic American Studies program strives to bridge the dangerous gap between the humanists and the social scientists.

Every program must have a focus, depending on the idiosyncracies of the civilization studied and on the peculiar interests which have developed at any given institution. The predominant obsession of the Hispanic world today is politics—not the abstract variety which flourishes in more metaphysical lands, but a peculiarly personalist brand, involving a day-to-day struggle in which revolution and unrest are often accompanied in a paradoxical way by economic and social growth. This focus is provided through the Hispanic American
Report, a monthly publication founded in 1948, which has as its theme the political, social and economic development of the area. The Report is prepared by the Hispanic World Affairs Seminar (HAS248), while the basic area analyses are taught in the Hispanic World series of courses (Modern European Languages AS142-148). Hispanic American Studies awards a certificate to those students who have worked on the Hispanic American Report for at least a year.

Other disciplines such as geography, government, history, economics, sociology, and anthropology contribute to the symposium which constitutes Hispanic American Studies. The Schools of Education and Mineral Sciences likewise co-operate with this program.

The requirements for the Bachelor of Arts and Master of Arts in Hispanic American Studies are as follows:

Bachelor of Arts

Language: The sequence of reading and composition courses, terminating with Third-Year Spanish Grammar and Composition (Modern European Languages Sp113)

Civilisation: The Hispanic World (Modern European Languages AS142-148) 10 units

Geography: Geography of South America (Geography 120, 5 units) and Geography of Middle America (Geography 121, 3 units) 8 units

Literature: Two courses of Spanish or Spanish American literature 6 units

History: Latin America to 1825 (History 115, 5 units) and Modern Latin America (History 118, 5 units) 10 units

Inter-American Relations: Government and Politics in Latin America (Political Science 128, 5 units) or Latin America and the United States (Political Science 138, 5 units) 5 units

Anthropology: Cultural Problems in Latin America (Anthropology 158, 4 units) or Early Civilizations of Middle America (Anthropology 159, 4 units), or an equivalent course 4 units

Students who wish to minor in any special field of interest may do so by completing 16 units of work in that field.

Master of Arts

Candidates for the Master's degree in Hispanic American Studies must fulfill satisfactorily the following requirements:

1. A reading, writing, and oral knowledge of Spanish or Portuguese, and a reading knowledge of the other of these two languages.
2. A satisfactory completion of courses followed. A minimum of 36 units is required with a grade of A or B, not including credit for the thesis.
3. A thesis on a regional subject, for which 9 units of credit are granted.
4. The student's program will stress the language, civilization, literature, geography, history, and political affairs of modern Spain and Latin America, with special reference to one of the following areas: Spain and Portugal, Mexico, Central America, the Caribbean republics (Cuba, Dominican Republic, Haiti), Gran Colombia (Colombia, Ecuador, Venezuela), West Coast countries (Bolivia, Chile, Peru), River Plate countries (Argentina, Paraguay, Uruguay), or Brazil.

Doctor of Philosophy

The Ph.D. program is designed to meet the needs of individual students. It is administered under Graduate Division Special Programs. For further details, write to Hispanic American Studies, Room 255, Stanford University.
Teaching Credentials

For information concerning the program of study leading to a teaching credential, students should consult the appropriate section of this Bulletin or the Credential Secretary of the School of Education.

COURSES

HAS 180, 181, 182. La Cultura y Letras Hispanoamericanas—A series of independent courses, which may be taken separately, in which Latin American culture is analyzed from the sociological and historical viewpoint. Given in Spanish.

HAS 180. 3 units, autumn, (Osorio), MWF 10
HAS 181. 3 units, winter, (Osorio), MWF 10
HAS 182. 3 units, spring, (Osorio), MWF 10

HAS 248. Hispanic World Affairs Seminar—Current developments in Spain, Portugal, Latin America; special reference to political, social, economic, cultural developments. Investigations carried on will be incorporated into monthly Hispanic American Report.

3 to 5 units, each quarter, (Hilton, Hispanic American Report Committee), TTh 10

HAS 299. Individual Work (Undergraduate).
Any quarter, by arrangement

HAS 300. Thesis.
Any quarter, by arrangement

HAS 375. Individual Work (Graduate)
Any quarter, by arrangement

For other courses, see under Modern European Languages and other pertinent departments.

HISTORY

Emeriti: Carl Fremont Brand, Yamato Ichihashi, Ralph Haswell Lutz, Edgar Eugene Robinson, Payson Jackson Treat (Professors)

Executive Head: Thomas Andrew Bailey
Associate Executive Head: Gordon Wright
Professors: Thomas Andrew Bailey, William Carroll Bark, Claude A. Buss, David Harris, John J. Johnson, George Harmon Knoles, Anatole G. Mazour, John C. Miller, Charles D. O'Malley, Wayne S. Vucinich, Arthur Frederick Wright, Gordon Wright
Associate Professors: Don E. Fehrenbacher, Richard Wall Lyman, Thomas Carlyle Smith, Rixford K. Snyder
Assistant Professor: Otis A. Pease
Acting Assistant Professor: Raymond G. O'Connor
Instructors: Michael Q. Lavin, Hughson F. Mooney, Ernst L. Presseisen, Gerald D. Nash, David B. Stenzel, James L. Tigner
Acting Instructors: Hubert I. Beatty, Homer C. Chaney, Joseph E. Clark, Carroll E. Harrington, Joseph G. Oswald, Harry Rosenberg

The Department of History offers to all students of the University courses of general cultural and educational value. It seeks not only to provide knowledge in special fields, but also to equip the student for his duties as a citizen
and to give him instruction which will aid him in law, journalism, library work; in local, state, and national public service; and in business where a knowledge of domestic and foreign affairs is desirable.

The course in the History of Western Civilization, which surveys the development of the Western world from earliest times to the present, is required by the University of all students as a necessary part of a liberal education, and supplies a foundation for the other work in the Department.

Bachelor of Arts

The Department offers a variety of courses and programs for fulfilling the requirements of an undergraduate major in history. A student majoring in history must seek breadth of view by a choice of courses in three or more of the fields offered in the Department, at the same time securing specialized knowledge by the selection of courses and seminars in one field of special interest. In addition to Western Civilization, the major program must include at least one course in European history, including English, prior to 1600. For the degree of Bachelor of Arts, the Department requires completion of 48 units of work in history (introductory, intermediate, and advanced courses, seminars, individual reading), with an average grade of not less than C. Included in these 48 units, a basic seminar for 5 units is required.

Each undergraduate major student in the Department shall, in consultation with his adviser, select a minor to consist of a coherent group of courses totaling at least 20 units, to fall within one of the following categories: (1) anthropology, economics, sociology, political science, geography, and Courses 1, 112, and 160 in psychology; (2) religion, philosophy, and the history of science; (3) the history of the visual arts and of music; (4) the literature of one period or people; (5) the Honors Program in Humanities.

The Cory and Riotte scholarships are available for undergraduate women students in the Department.

In order to provide for students with special interests, the course work, seminars, and directed reading taken in the Department, together with the minor and other work taken outside, may be devoted to the development of an integrated program to cover, for example: (1) an area, such as Central Europe, the Far East, Near East, or Latin America; (2) a period, such as Europe in the Middle Ages or in the nineteenth century; (3) a country, such as France, England, Russia, the United States, or Japan; (4) a civilization, such as American civilization or Chinese civilization.

Honors in History

For a limited number of students the Department will offer a special program leading to a Bachelor's degree with Honors in History. To be eligible a student must have at least a B average in History and normally the same standing in the University. The candidate must fulfill the basic seminar requirement, be sponsored by a member of the Department, and have Department approval for his program. Normally students will begin this work in the spring quarter of the third year and after completion of the basic seminar, but in exceptional cases entry may be postponed for one quarter. Students electing the Honors Program will (1) take a minimum of 60 units in history, (2) meet the usual requirements for distribution and a minor, (3) complete an advanced seminar and a course on Interpretations of History, and (4) take an independent study program of 12 units extending over a period of three quarters. A comprehensive examination, mainly upon the independent study work, will be given upon the completion of this program. The Department will recommend that recipients of the James Birdsall Weter scholarships be selected from among honors candidates and that special weight for University honors be given for the quality of work done under this Department program.
History in the Secondary Teacher's Credential

Applicants for the Stanford Secondary Teacher's Credential in the social sciences are required to have completed the following with an average grade of not less than B minus: 35-37 units of history 10, 10, and 15 units in each of three of the other social sciences, namely, economics, political science, sociology, anthropology, and geography. Of the history units at least 15 must be in the history of the United States. Irrespective of work done elsewhere, at least 8 units of history must be taken at Stanford University.

GRADUATE STUDY

Graduate students who are candidates for advanced degrees will be given personal guidance, but the purposeless graduate student will not be accepted by the Department. For the degree of Master of Arts, the University Library contains adequate material in all of the conventional areas of historical study. There are certain special fields, or substantial portions thereof, in which the Department, by virtue of the specialized interests of its staff and the unusual resources of the Library, is prepared to offer graduate work leading to the Ph.D. degree.

1. European History—(a) Middle Ages and the Renaissance and Reformation, especially the history of religion and technology; (b) Modern European History, especially the French Revolution and the Napoleonic Period, for which Stanford has the Jarbo Collection; (c) History of Germany and Belgium in the twentieth century; (d) History of Russia since 1914; (e) History of the Near East since 1914; (f) European History, 1914 to the present, with special reference to the origins, conduct, and results of World War I and World War II.

The rich, and in some respects unique, collections of the Hoover Library on the causes, conduct, and result of World War I are being augmented for World War II and the period between these two wars. The materials include government documents, newspaper and serial files, and organization and party publications (especially British and German labor parties and the German Socialist parties). There are also important manuscript collections, including unpublished records of the Paris Peace Conference of 1919 and the Herbert Hoover Archives, which embrace the records of the Commission for Relief in Belgium; the American Relief Administration; the various technical commissions established at the close of World War I for reconstruction in Central and Eastern Europe; and the personal papers of Herbert Hoover as United States Food Administrator, Secretary of Commerce, and President of the United States. Other important materials for the period since 1914 relate to revolutions and political ideologies of international importance; colonial and minority problems; propaganda and public opinion; military occupation; peace plans and movements; international relations; international organization and administration, including the publications of the League of Nations, the World Court, the International Labor Office, and the United Nations, as well as the principal international conferences. The collection on the Pacific since 1939 is being enlarged.

2. British History—(a) English History since 1200, for which the Library contains important documentary sets; (b) The British Empire, with special reference to Canada since 1840, to India, and to Australia.

3. United States History—(a) British North America to 1783, for which the Library has an unusually complete collection of printed sources; (b) Anglo-American Relations, for which Stanford has unusually complete published documentary sets; (c) The National Period, for which the Library has extensive documents, newspapers, and manuscript collections; (d) History of the Far West, particularly California since 1848, for which use may be made of the Borel Collection.
4. **Latin-American History**—particularly Brazil, for which the Library contains the important Branner Collection.

5. **The Far East**—(a) Diplomatic History of the Far East; (b) History of Japan; (c) History of China. The Stanford and Hoover Libraries have important materials for Far Eastern History, including large holdings of works in Western languages, such as runs of important serials and newspapers and extensive documentary collections of World War II in Asia, and also basic source and reference materials in the Chinese and Japanese languages, especially for the nineteenth and twentieth centuries.

**Master of Arts**

The Department requires for the Master's degree the presentation of an acceptable thesis, a reading knowledge of one modern foreign language, and the completion of 45 units of graduate study, at least 30 of which must be in the Department; a maximum of 10 units may be allotted to the thesis, and 10 units must be taken in graduate seminars. The Department will not recognize for the degree requirements in history any work that has not received the grade of A, B, or plus.

**Doctor of Philosophy**

The Department offers work for the Ph.D. degree in the fields listed above where the Stanford libraries contain rich collections of source material. The general requirements relative to time, foreign languages, examination, and dissertation are stated in the section "Degrees" in this Bulletin. The Department requires a broad preparation in six fields of history to be selected from the following groups, including at least one from each group:

- **Group I**: Ancient Greece, Rome to 500 A.D., Europe from 300 to 843, Europe from 843 to 1300, Europe from 1300 to 1600, England to 1603.
- **Group II**: England since 1603, Europe from 1600 to 1789, Europe from 1789 to 1914, Europe since 1914.
- **Group III**: Colonization of North America to 1789, The United States of America, 1789-1890, The United States in the Twentieth Century.
- **Group IV**: Latin America to 1824, Latin America since 1810, Far East—International Relations, China, Japan, Near East, British Empire, Russia.

The one specific course requirement is History 300, the graduate course in historiography, but if the dissertation is in United States history, a course in American historiography is also required.

The candidate is expected to plan his work and write his dissertation under the direction of the member of the Department designated as his adviser and sponsor.

If the candidate elects to offer a minor subject for examination, he will be expected to devote one-third of his study to it. If no minor is offered, the Department will require a program of at least twenty-five units of work in closely correlated subjects designed to intensify his understanding of his field of special interest.

The Department has several student assistantships which are customarily held by candidates for advanced degrees.

**I. INTRODUCTORY COURSES**

Required of all students. Opportunities for individual study are open to a small group of carefully selected students.

10. **History of Western Civilization**—Western Civilization to circa A.D. 1000; prehistoric man; ancient Orient, Greece, Rome, early Middle Ages. 4 units, autumn, (Staff), M 11, and three hours by arrangement or summer, (Staff), 5 hours to be scheduled.
11. History of Western Civilization—Major developments in Western Civilization in later Middle Ages, Renaissance, seventeenth and eighteenth centuries.

4 units, winter, (Staff), M 11, and three hours by arrangement


4 units, spring, (Staff), M 11, three hours by arrangement

II. INTERMEDIATE AND ADVANCED COURSES

Lecture courses numbered 100-129 are open to all students except freshmen; lecture courses numbered 130-199 are primarily for third- and fourth-year undergraduates and graduates; courses numbered 200 and over, all of a special character, are for advanced and graduate students as indicated.

Courses in independent reading numbered 200-224 are designed not as a substitute for but as a supplement to work in class by providing for specialized readings. Prerequisites: at least an average grade of B in the University; at least an introductory course in the field; third- or fourth-year standing; and permission of the instructor. In a few cases one or more of these prerequisites may be waived by special action of the Department.

Basic seminar courses numbered 225-249 are for history majors of third- or fourth-year standing and others by special permission of the instructor. They provide an introduction to research methods in history; i.e., bibliographies, historical criticism, note taking, and the preparation of a documented paper. Consult the instructor prior to registration.

Advanced seminar courses numbered 250-274 are designed to provide an opportunity to apply the techniques acquired in the junior seminar to a detailed problem on which oral reports will be required and a documented paper prepared. Seniors who have completed their advanced seminar and desire further research in a field in which they are prepared may enroll in senior research courses numbered 275-299.

A. THE ANCIENT WORLD

See Classics, Section V, Courses H100, H101, H102, H103, H200, H205, all of which are accepted for credit toward a major in history.

B. MEDIEVAL AND RENAISSANCE EUROPE

100. Medieval Europe, 300-1300—Emphasis on transition from ancient Mediterranean to European civilization, development of medieval social, cultural institutions and ideas.

5 units, autumn, (Bark), MTWThF 9

101. Renaissance, Reformation, and Counter-Reformation, 1300-1600—Political, economic, religious, intellectual factors involved in expansion of European civilization. Open to all except freshmen.

5 units, winter, (O’Malley), MTWThF 9

125. The Byzantine Empire, 330-1453—The Near East from Constantine to the Turkish Conquest; relations with the Persians, Slavs, and Arabs; the Crusades; Byzantine religion, thought, and culture; contributions to the West. Open to all except freshmen.

5 units, autumn, (Vucinich), MTWThF, alternate years, to be given in 1959-60

134. The Emergence of Medieval Europe—Genesis of European civilization from end of Roman political unity through Carolingian period; special attention to such topics as growth of Christianity, barbarian invasions, rise of Islam.

3 units, winter, (Bark), MWF 9
141. The High Middle Ages—Such aspects of European civilization in twelfth, thirteenth centuries as papacy and Holy Roman Empire, French and English monarchical states, Crusades, medieval towns, rise of universities, scholasticism, Gothic art.

3 units, spring, (Bark), MWF 9

204. Directed Reading in Medieval History.
3 to 5 units, (Bark), by arrangement

227. Basic Seminar in Medieval History.
5 units, winter, (Bark), T 2-4

253. Advanced Seminar in Medieval History.
5 units, spring, (Bark), T 2-4

278. Senior Research in Medieval History.
Units not to exceed 5, (Bark), by arrangement

For graduate courses, see Section III, following.

C. MODERN EUROPE

102. Europe, 1600–1789—Economic, political, cultural survey of seventeenth, eighteenth centuries. Open to all students except freshmen.
5 units, autumn, (O'Malley), MTWTThF 10, to be given in 1959–60

103. Europe in the Nineteenth Century—Eve of French Revolution to beginning of twentieth century.
5 units, winter, (Harris), MTWTThF 10

104. Europe since 1914—Political, social, economic, cultural developments to present. Open to all students except freshmen.
5 units, spring, (G. Wright), MTWTThF 10

112. Russia—Founding of first Russian state to collapse of Russian Empire, 1917. Open to all students except freshmen.
5 units, autumn, (Masour), MTWTThF 8

126. Ottoman Empire—The Turks in the Near East, 1071–1800; the Seljuk and Ottoman states; their institutions and civilization; the Turks in Europe; origin of the Eastern Question. Open to all except freshmen.
5 units, autumn, (Vucinich), MTWTThF 10

137. Humanism and Humanists of the Italian Renaissance.
3 units, spring, (O'Malley), MWF 10, alternate years, to be given in 1958–59

138. Humanism and Humanists of the Northern Renaissance.
3 units, spring, (O'Malley), MWF 10, alternate years, to be given in 1959–60

146. France since 1870—Foundation of Third Republic to present. Open to third- and fourth-year undergraduates, graduates.
3 units, autumn, (G. Wright), MWF 10

148. Germany since 1848—Revolution of 1848 to present. Open to third- and fourth-year undergraduates, graduates.
3 units, winter, (G. Wright), MWF 10

149. Intellectual History of Europe—Analysis of major currents of thought beginning with Natural Law.
4 units, spring, (Harris), MTWTTh 11

150. European International Relations, 1789–1914—Prerequisite: 103 or equivalent.
4 units, autumn, (Harris), MTWTTh 3, to be given in 1959–60

182. The Russian Revolution—Revolutionary era from fall of Tsarist government to present-day Soviet Russia. Open to third- and fourth-year undergraduates, graduates.
5 units, winter, (Masour), MTWTThF 8

183. Soviet Foreign Policy—Foreign policy in the West, Near, Middle, and Far East, 1917 to present.
3 units, spring, (Masour), MWF 8
186. **The Balkans and the Near East since 1800**—Decline of Ottoman Empire, rise of succession states in Europe, Near East. Open to third- and fourth-year undergraduates, graduates.
   4 units, winter, (Vucinich), MTWTh 10

187. **Muslim World**—Political and socioeconomic developments in the Muslim world since 1800. Open to third- and fourth-year undergraduates, graduates.
   3 units, spring, (Vucinich), MWF 10

199. **Interpretations of History.**
   4 units, spring, (Harris), TTh 2-4

206. **Directed Reading in Modern European History.**
   3 to 5 units, (Harris, Masour, O’Malley, Vucinich, G. Wright), by arrangement

230. **Basic Seminar in Modern European History: The Second World War.**
   5 units, autumn, (G. Wright), W 2-4

231. **Basic Seminar in Nineteenth Century Europe.**
   5 units, winter, (Harris), TTh 2-3

232. **Basic Seminar in Early Modern Europe.**
   5 units, winter, (O’Malley), Th 2-4, to be given in 1959–60

233. **Basic Seminar in Balkan and Near East History.**
   5 units, winter, (Vucinich), T 2-4

234. **Basic Seminar in Russian History.**
   5 units, autumn, (Masour), T 2-4

255. **Advanced Seminar in Balkan and Near East History.**
   5 units, spring, (Vucinich), W 2-4

256. **Advanced Seminar: Europe between Wars—1919–1939.**
   5 units, spring, (G. Wright), W 2-4, to be given in 1959–60

257. **Advanced Seminar in Early Modern Europe.**
   5 units, spring, (O’Malley), Th 2-4

258. **Advanced Seminar in Russian History.**
   5 units, winter, (Masour), T 2-4

259. **Advanced Seminar in Nineteenth Century Europe.**
   5 units, winter, (Harris), T 3-5, to be given in 1959–60

281. **Senior Research.**
   Units not to exceed 5, (Harris, Masour, O’Malley, Vucinich, G. Wright), by arrangement

For graduate courses, see Section III, following.

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**D. The British Commonwealth and Empire**

105. **England**—English people, survey of their political, economic, social, cultural history. Open to all except freshmen.
   5 units, autumn, (———), MTWThF 11

106. **Great Britain since 1760**—Political history; foreign, colonial policy; emphasis on economic revolutions of eighteenth century, their results, social reform, socialism, labor movement, democratization of Constitution. Open to all except freshmen.
   5 units, winter, (———), MTWThF 11

107. **The British Empire**—Development of British Empire, British colonial policy since 1783; consideration of background of present problems of Dominions, colonies. Open to all except freshmen.
   5 units, spring, (Snyder), MTWThF 11

158. **English Constitutional History**—Anglo-Saxon origins, Norman innovations; legal, administrative, parliamentary development under Angevins; limitation of royal power, rise of cabinet system, democratization of Constitu-
tion. Open to advanced and graduate students; second-year undergraduates by permission.

4 units, spring, (——-), MTWTTh 9

176. History of Canada—Canada from settlement by French to present; racial, economic, political, cultural problems that have influenced its history. Open to advanced and graduate students; second-year undergraduates by permission.

3 units, winter, (Snyder), MWF 11, alternate years, to be given in 1959–60

177. Australia and New Zealand—Political, economic, cultural phases of these Dominions from discovery to present; social experiments of twentieth century. Open to advanced and graduate students; second-year undergraduates by permission.

3 units, winter, (Snyder), MWF 11, alternate years, to be given in 1958–59

174. Directed Reading in the History of England and the British Empire—For advanced students who under guidance desire to study a problem in English or British Empire history.

3 to 5 units, (——-), by arrangement


5 units, autumn, (——-), Th 2-4

260. Advanced Seminar: Topics in Recent British History—Techniques learned in the Introductory Seminar will be applied to preparation of a substantial, documented paper. An advanced seminar primarily for fourth-year undergraduate history majors.

5 units, winter, (——-), Th 2-4

285. Senior Research—For fourth-year undergraduates who after completing their seminars desire further research in history of England, British Empire.

Units not to exceed 5, (——-), by arrangement

E. THE UNITED STATES

120. American History to 1789—Transit of civilization from Europe to America, beginning with Colonial settlements, considering development of American society, concluding with establishment of independence, formation of Constitution. Open to all except freshmen.

5 units, autumn, (Miller), MTWTThF 8

121. American History, 1789–1890—Major emphasis on political development, some attention to social, economic backgrounds. Open to all except freshmen.

5 units, winter, (Bailey), MTWTThF 8

122. American History since 1890—Transformation of United States in industrial age in its political, economic, social development; in its relation to rest of world. Open to all except freshmen.

5 units, spring, (Pease), MTWTThF 8

123. American Social History—Emergence of American people; development, conflicts of social classes; impact of expansion, industrialization, urbanization upon society. Open to all except freshmen.

5 units, autumn, (Knoles), MTWTThF 10

130. Diplomatic History of the United States—From Colonial times to present, emphasis on role of public opinion. Open to advanced and graduate students.

5 units, spring, (Bailey), MTWTThF 9

4 units, autumn, (Fehrenbacher), MTWTh 9

133. American Constitutional History—Colonial backgrounds, framing of Constitution, significant trends in constitutional development from 1789 to present. Open only to advanced and graduate students.

5 units, winter, (Fehrenbacher), MTWThF 9


3 units, spring, (Miller), MWF 11

163. The American Revolution, 1760–1789—Colonial backgrounds of Revolutionary movement; causes of outbreak; military, diplomatic history of the war; making of Constitution; establishment of federal government. Open to advanced and graduate students.

3 units, winter, (Miller), MWF 11

164. The United States in World History—Advanced survey from age of discovery to present. Emphasis on impacts of United States on outside world, vice versa. Open to advanced and graduate students.

3 units, autumn, (Bailey), MWF 12

166. Intellectual History of the United States in the Nineteenth Century—Changing climates of opinion in thought, expression in United States during nineteenth century. Open to advanced and graduate students.

5 units, winter, (Knoles), MTWThF 10

167. Civilization of the United States in the Twentieth Century—American thought, expression during twentieth century; influences acting upon intellectual, cultural development. Open to advanced and graduate students.

3 units, spring, (Knoles), MWF 10

168. The Age of Big Business, 1877–1919—Rise of industrialism in United States, its impact upon laborers, farmers, urban middle class, other nations, from Reconstruction through First World War. Open to advanced and graduate students.

3 units, winter, (Pease), MWF 1

169. History of California—Development of California from Spanish period to present, emphasis on years since 1850.

3 units, spring, (Fehrenbacher), MWF 12

170. Civil War and Reconstruction, 1850–1877—Political, constitutional, economic, cultural, military aspects of conflict between North and South, emphasis on its lasting effects on American civilization. Open to advanced and graduate students.

3 units, autumn, (Pease), MWF 11

216. Directed Reading in United States History.

3 to 5 units, (Bailey, Fehrenbacher, Knoles, Miller, Pease), by arrangement

238. Basic Seminar in the History of the United States—Basic training in historical research, writing in period since 1789. Desirable background courses: 120, 121, 122.

5 units, winter, (Pease), T 2–4

239. Basic Seminar in United States History—Historical method, application to special problems since 1789. Desirable background courses: 120, 121, 122, 130.

5 units, autumn, (Bailey), W 3–5
240. Basic Seminar in United States History.
   5 units, winter, (Fehrenbacher), W 4-6
   5 units, winter, (Knoles), W 2-4
   5 units, autumn, (Miller), T 3-5
   5 units, autumn, (Pease), T 2-4
264. Advanced Seminar in American Political and Diplomatic History—Emphasis on period since 1865.
   5 units, winter, (Bailey), W 3-5
   5 units, winter, (Miller), W 3-5
266. Advanced Seminar in American Social and Intellectual History.
   5 units, spring, (Knoles), W 2-4
   5 units, autumn, (Fehrenbacher), W 3-5
288. Senior Research in American History.
   Units not to exceed 5, (Bailey, Fehrenbacher, Knoles, Miller, Pease), by arrangement

For graduate courses, see Section III, following.

F. LATIN AMERICA

117. Latin America to 1825—Discovery, conquest, growth of political, social, economic institutions; Wars of Independence in Spanish, Portuguese America.
   5 units, autumn, (Johnson), MTWThF 11
118. Modern Latin America—Political, social, economic institutions in leading republics since Independence. Effect of economic growth since 1920 on social, political patterns emphasized.
   5 units, winter, (Johnson), MTWThF 11
173. Historical Evolution of Mexico—Economic, social development since 1850 and Mexican foreign relations, especially with United States in twentieth century, stressed. Open to third- and fourth-year undergraduates, graduates.
   3 units, spring, (Johnson), MWF 11, alternate years, to be given in 1959-60
175. Latin America since 1939—War and post-War attitudes of the Latin American peoples and governments on such current issues as labor organization, social welfare, the "active" State, foreign investment, nationalism and internationalism.
   3 units, spring, (Johnson), MWF 11, alternate years, to be given in 1958-59
218. Directed Reading in the History of Latin America.
   3 to 5 units, (Johnson), by arrangement
244. Basic Seminar in Latin American History—Methods of historical scholarship, use of source materials.
   5 units, winter, (Johnson), W 2-4
   5 units, spring, (Johnson), W 2-4
293. Senior Research in Latin-American History—Special guidance in individual research problems in Latin-American history. Open only to fourth-year undergraduates who have had 269 or equivalent.
   Units, not to exceed 5, (Johnson), by arrangement

For graduate courses, see Section III, following.
113. Far Eastern Civilizations: Formative Period—The origin and development of the characteristic civilizations of China and Japan. Open to all except freshmen.
   5 units, winter, (A. Wright), MTWTThF 9

114. Far Eastern Civilizations: Modern Period—The development of the civilizations of China and Japan in the period of the Western impact—1600 to present. Open to all except freshmen.
   5 units, spring, (Smith), MTWTThF 9

115. Diplomatic History of the Far East—Middle of nineteenth century to Second World War.
   5 units, autumn, (Buss), MTWTThF 9

118. Recent History of the Far East—Far East in aftermath of Second World War.
   3 units, winter, (Buss), MWF 8

191. China in Modern Times—1500 to present, emphasis on development of China's political, social institutions.
   3 units, spring, (A. Wright), MWF 1

   3 units, autumn, (A. Wright), MWF 2

193. History of Modern Japan, 1600 to Present—End of the “feudal” period; emergence of Japan as a modern state; evolution of new economic and social institutions; problems of cultural change.
   3 units, winter, (Smith), MWF 10

195. History of Modern India—Traditional Indian society and thought; establishment of British dominion; achievement of independence; problems of economic development and cultural change.
   3 units, autumn, (Smith), MWF 11

196. United States and the Far East—Genesis, growth of American interests, policies in Far East, emphasis on immediate background of contemporary period.
   3 units, spring, (Buss), MWF 8

197. Southeast Asia and the Philippines—Indian, Chinese influence on native populations; impact of Europe, America; World War II, rise of nationalism, regionalism.
   3 units, spring, (Buss), MWF 8, to be given in 1959–60

220. Directed Reading in the History of the Far East.
   3 to 5 units, (Buss, Smith, A. Wright), by arrangement

245. Basic Seminar: China.
   5 units, autumn, (A. Wright), T 2-4

246. Basic Seminar in Far Eastern History.
   5 units, winter, (Smith), T 2-4

247. Basic Seminar in Far Eastern History.
   5 units, spring, (Buss), M 2-4

270. Advanced Seminar in Diplomatic History of the Far East.
   5 units, autumn, (Buss), M 2-4

   5 units, winter, (A. Wright), T 2-4, to be given in 1959–60

272. Advanced Seminar in Far Eastern History.
   5 units, spring, (Smith), T 2-4

295. Senior Research in Far Eastern History.
   Units not to exceed 5, (Buss, Smith, A. Wright), by arrangement

For graduate courses, see Section III, following.
III. GRADUATE COURSES

These courses are designed for graduate students, candidates for advanced degrees in history and allied fields, and open to others only upon permission of the instructor.

300. Historiography—Writings, influence of great historians, Herodotus to present. Required of all doctoral candidates in history.
   5 units, winter, (G. Wright), W 2-4

301. American Historiography—Main currents in historical research and writing relevant to United States from earliest days.
   5 units, spring, (Bailey), W 3-5

303. English Historiography—Such major historians as Green, Freeman, Froude, Gardiner, Macaulay, Lecky.
   3 to 5 units, autumn, (———), T 2-4

312. Graduate Seminar in Medieval History—Research on selected topics in medieval history. Reading knowledge of Latin required.
   5 units, autumn, (Bark), by arrangement

313. Graduate Seminar in the Sixteenth Century.
   5 units, autumn, (O'Malley), by arrangement

317. Graduate Seminar in Modern European History.
   3 to 5 units, winter, (Harris), by arrangement

318. Graduate Seminar in Russian History.
   5 units, spring, (Masour), by arrangement

   5 units, autumn, (Vucinich), T 2-4

320. Graduate Seminar: Problems in Medieval English History.
   3 to 5 units, winter, (———), T 2-4

321. Graduate Seminar: Stuart England—Topics, readings.
   3 to 5 units, spring, (———), T 2-4

327. Graduate Seminar in American Diplomatic History.
   5 units, spring, (Bailey)

   5 units, autumn, (Knoles), W 2-4

329. Graduate Seminar in Nineteenth Century United States.
   5 units, spring, (Fehrenbacher), W 4-6

337. Graduate Seminar in American Colonial History.
   5 units, spring, (Miller), T 3-5

   5 units, autumn, (Johnson), W 2-4

345. Graduate Seminar in Diplomatic History of the Far East.
   5 units, winter, (Buss), M 2-4

   5 units, winter, (A. Wright), T 2-4

347. Graduate Seminar in the History of Japan.
   5 units, autumn, (Smith), T 2-4

360. Graduate Research in Medieval History.
   Units by arrangement, (Bark)

363. Graduate Research in the History of the Renaissance—Major source works, individual investigation of selected topics.
   Units by arrangement, (O'Malley)

365. Graduate Research: Modern European History.
   Units by arrangement, (Harris, Masour, O'Malley, Vucinich, G. Wright)
370. Graduate Research in the History of England and the British Empire—Individual guidance to properly qualified graduate students.
   Units by arrangement, (Snyder)

378. Graduate Research in American History—Guidance of graduate students preparing A.M., Ph.D. theses, other properly qualified graduates by permission of instructor.
   Units by arrangement, (Bailey, Fehrenbacher, Knoles, Miller, Pease)

380. Graduate Research: Latin America—Reading knowledge of Spanish and/or Portuguese required.
   Units by arrangement, (Johnson)

385. Graduate Research: Far East.
   Units by arrangement, (Buss, Smith, A. Wright)

See also the courses in directed research in the Hoover Institute on War, Revolution, and Peace.
See also Senior Colloquia.

HUMANITIES (SPECIAL PROGRAMS)

Executive Head: John W. Dodds
Directors: Lawrence V. Ryan (Graduate Honors Program in Humanities); Ronald Hilton (Hispanic American Studies)
Consulting Professor: Paul Fejos (Humanities and Anthropology)
Associate Professors: Alexander Miller (Religion), Jeffery Smith (Humanities and Philosophy)
Assistant Professor: Edwin M. Good (Religion)
Lecturers: Alfonso Espinosa, Luis Enrique Osorio, Joseph C. Shirley, James L. Taylor (Hispanic American Studies)
Instructor: George John Sullwold, Jr. (Classics and Humanities)

Special Programs in Humanities include:
1. The Undergraduate Honors Program in Humanities
2. Graduate Program in Humanities
3. Hispanic American Studies (see page 185)

Undergraduate programs for the Bachelor of Arts degree are offered in Hispanic American Studies, and in Humanities in conjunction with the Honors Program. The Honors Program, however, is offered primarily for those students who are majoring in some humanistic department.

Two programs are offered at the graduate level: (1) a graduate program leading toward a joint Ph.D. degree in Humanities and in one of the humanistic departments; (2) a program for the Master of Arts degree in Hispanic American Studies. A program in Hispanic American Studies leading to the Doctorate of Philosophy is offered under the University Graduate Division Special Programs.

UNDERGRADUATE HONORS PROGRAM

Committee in Charge: John W. Dodds (Chairman), Henry Blauth, Philip W. Harsh, George H. Knoles, John Loftis, Otis A. Pease, Norman Philbrick, George F. Sensabaugh, Jeffery Smith, Arthur F. Wright.

Freshmen and sophomores who are interested in the Honors Program described below should consult with their General Studies advisers and with the
chairman of the Honors Committee. It is desirable that the student begin to plan his program as early as possible.

Purpose of the Program:

The Honors Program aims to develop in its students a greater sense of the interrelatedness of the many strands that make up our knowledge and experience, and to make them more aware of basic values—intellectual, aesthetic, social, and ethical. It asks them not merely to acquire factual knowledge and scholarly techniques, but also to interpret their knowledge and techniques in the light of human values. The Committee in charge, composed of representatives of various departments in the Humanities, will help each Honors student to plan a balanced and integrated program.

Admission to the Program:

A University average of B is required for admission to the program and for graduation with Honors in Humanities.

Students may enroll in the Honors Program under one of two alternative plans:

1. Preferably as prospective majors in the Departments of Art and Architecture, Asian Languages, Classics, English, Modern European Languages, History, Music, Philosophy, and Speech and Drama.

   In this case the Honors Program will supplement the General Studies and departmental requirements, and students will graduate in the departments of their choice with Honors in Humanities.

   It should be noted that the Honors Program in Humanities may be used as a departmental minor where needed.

2. In unusual cases as prospective majors in Humanities, on approval by the Committee.

   In this case the student will complete the Honors Program and, in addition, 30 units of predominantly third- and fourth-year work in one of the departments listed above. He will receive a Bachelor of Arts degree in Humanities with Honors.

Requirements of the Program:

1. Requirements during the first two years:
   a) The General Studies requirements of Stanford University.
   b) The “World Literature” sequence—Humanities 61, 62, 63—12 units.
   c) Philosophy, a minimum of 8 units.
   d) Fine arts (music, art and architecture, theater), a minimum of 8 units.

   Note—In exceptional cases, some of the work mentioned under b, c, and d may be completed during the third year.

2. Requirements during the third year:
   a) Participation for three quarters (4 units each quarter) in the Humanities Seminar, 12 units.
   b) Humanities 194. Senior Essay Pro-Seminar, 3 units.

3. Requirements during the fourth year:
   a) Participation, for two quarters, in the Senior Colloquia in Humanities, 4 units.
   b) Senior essay. In his senior year each honors student will write a senior essay on a subject growing out of his departmental field, but not confined to it. A credit of 8 units is allowed for the essay.
   c) Oral examination. In the last quarter of his senior year each student must take an oral examination centered in the field of the essay and testing
the student's critical abilities. The student's performance will be considered by the Committee in determining the grade on the senior essay.

**COURSES, FIRST AND SECOND YEAR**

21, 22, 23. **World Personalities**—A study of the lives and personalities of men and women, as living manifestations, positive and negative, of human values central to the humanities. Personalities, selected for significance, variety, will include such as Buddha, Moses, Socrates, St. Francis, Leonardo da Vinci, Beethoven, Madame Curie, Hitler, Gandhi.

21. **World Personalities: Ancient and Medieval.**
   3 units, autumn, (Smith), MWF 10
22. **World Personalities: Renaissance and Modern.**
   3 units, winter, (Smith), MWF 10
23. **World Personalities: Contemporary.**
   3 units, spring, (Smith), MWF 10

61, 62, 63. **World Literature and the History of Ideas**—An introduction to fundamental ideas of the past; lectures, discussions, reading of selected masterpieces of literature. The course is conceived of as a unity; strongly recommended that students take all three quarters in sequence.

61. **Classic Literature**—Homer, Greek dramatists, Plato, Aristotle, Lucretius, Vergil, Gospels of Mark and John.
   4 units, autumn, (Harsh, Staff), TWTh 11 and 1 hour by arrangement
62. **Medieval and Renaissance Literature**—Medieval epics, Augustine, Aquinas, Dante, Chaucer, Thomas More, Luther, Erasmus, Calvin, Montaigne, Spenser, Hobbes, others.
   4 units, winter, (Strothmann, Staff), TWTh 11 and 1 hour by arrangement
   4 units, spring, (Strothmann, Weinstein, Staff), TWTh 11 and 1 hour by arrangement

**THIRD AND FOURTH YEAR**

175. **Individual Work**—For students with definite objectives not met by current course offerings.
   2 to 4 units, each quarter, (Staff), by arrangement
176. **Individual Study: Sequoia.**
   1 to 2 units, autumn, winter, spring, (Pease), by arrangement

**INTERDEPARTMENTAL SEMINARS**

191, 192, 193. **Seminar in Humanities**—Varieties of human experience and values as seen in the lives of significant men and women (autumn quarter); in works of literature, music and the plastic arts (winter quarter); and in philosophy and history (spring quarter).

191. 4 units, autumn, (Blauth, Smith, Sullwold), by arrangement
192. 4 units, winter, (Isenberg, Ratner, Smith), by arrangement
193. 4 units, spring, (Isenberg, Pease, M. Wright), by arrangement

194. **Senior Essay Pro-Seminar**—A study of the assumptions and methods guiding various disciplines of humanities; writing essays on topics growing out of selected readings in the history of ideas; possible preparation of outline of senior essay. Required of, and limited to, all honors candidates.
   3 units, spring, (Fifer, Goldstein), MWF 3, 4
199. Humanities Colloquium—The analysis and interpretation of significant documents and works of art in terms of fundamental meaning. Individual works discussed will center about a general theme selected for the quarter. Required of all honors students during senior year; open by permission of Director, Honors Program, to a limited number of students not enrolled in the Program.

2 units, autumn, (Dodds, Locke), by arrangement or spring, (Murphy, Stegner), by arrangement

200. Senior Essay—An essay of about 15,000 words.

8 units, (Staff), by arrangement

See also Senior Colloquia.

GRADUATE PROGRAM

Committee in Charge: John W. Dodds (Chairman), Philip W. Harsh, George H. Knoles, John L. Mothershead, Jr., Brooks Otis, Norman D. Philbrick, Lawrence V. Ryan, Friedrich W. Strothmann, Virgil K. Whitaker

The Graduate Program in Humanities supplements the doctoral programs of certain departments (English, Modern European Languages, History, Philosophy, Speech and Drama), with an interdepartmental program devoted to the study of the Western tradition as a whole. The degree offered is a joint Ph.D., and is awarded in "History and Humanities," "Philosophy and Humanities," "English and Humanities," etc.

Since the Graduate Program is designed as a supplement to, and not a substitute for, departmental specialization, its courses cannot be taken independently of graduate work in one of the five co-operating departments. Graduate students enrolled in the Program take its courses in addition to the courses required by their major departments. Only students accepted for graduate work by one of the five co-operating departments are eligible for enrollment in the Graduate Program in Humanities.

Requirements

a) Prerequisite for entering the Program:

In general, candidates may apply for entrance to the Program either during their senior year or during their first year of graduate study.

b) Requirements within the Program:

1. Continued work in the candidate’s major field in accordance with departmental requirements. For these requirements the prospective student should consult the departmental listings.

2. One course for each of six quarters in the “Western Traditions” series—the reading, interpretation, and discussion of significant writers. This Western Traditions course is divided, according to the Stanford quarter system, as follows: The Classical Period (1st and 2d quarter); The Medieval Period (3d quarter); From the Renaissance to 1700 (4th quarter); From 1700 to 1900 (5th quarter); The Twentieth Century (6th quarter).

3. Participation in the Graduate Humanities Seminar. The Seminar discusses basic intellectual and educational problems of the present in the light of Western traditions. The themes of the first quarter may change from year to year. That of the last quarter is fixed. Topics treated in 1956–57 were: The Specific Functions of the Various Humanistic Disciplines (1st quarter); The Functions of a University and the Meaning of Education (3d quarter).

4. Completion of one additional graduate course or seminar outside the candidate’s major department.
5. The writing of a Ph.D. dissertation acceptable both to the Humanities Committee and the major department, as well as to the University Committee on Graduate Study.

6. The passing of a reading examination in two foreign languages, one ancient and one modern. (Certain departments require a third language.) One of these examinations must be passed during the first two quarters of the candidate's second year of work beyond the A.B. degree.

7. The passing of a comprehensive written examination and the University oral examination.

FELLOWSHIPS

The Program awards a number of fellowships which are available to properly qualified students. Detailed information concerning these may be obtained by addressing the Director of the Program.

GRADUATE COURSES

301, 302, 303. The Western Traditions.
301. The Classic Period.
4 units, autumn, alternate years, to be given in 1959-60
302. The Classic Period.
4 units, winter, alternate years, to be given in 1959-60
303. The Medieval Period.
4 units, spring, alternate years, to be given in 1959-60

304, 305, 306. The Western Traditions.
304. From the Renaissance to 1700.
4 units, autumn, (Whitaker), MTWTh 9
305. From 1700 to 1900.
4 units, winter, (Staff), MTWTh 9
306. The Twentieth Century.
4 units, spring, (Staff), MTWTh 9

351, 353. Basic Humanistic Problems.
351. Basic Humanistic Problems.
3 to 4 units, autumn, (Ryan), MTh 7-9 p.m.
353. The Functions of a University and the Meaning of Education.
4 units, spring, (Mothershead), MTh 7-9 p.m.

RELIGIOUS STUDIES

Committee in Charge: John W. Dodds (Chairman), Alexander Miller, Robert M. Minto, Frederic Spiegelberg, Friedrich W. Strothmann, James T. Watkins IV.

The Curriculum in Religious Studies is designed to provide the essentials for an understanding of Biblical Religion and of the Christian inheritance in its basic documents, in its history and doctrine, in its relation to contemporary life and to alternative world-views. Certain of the offerings are listed in the General Studies Program Bulletin to which reference should be made.

COURSES

2 units, spring, (Miller), TTh 10
R100. Comparative Religion—Leading conceptions of great world religions: Hinduism, Buddhism, Taoism, Confucianism, Shinto, Zoroastrianism, Manichaeism, Mohammedanism analyzed, compared with leading ideas of Christianity.

4 units, spring, (Spiegelberg), MTWTh 10
or summer, (Spiegelberg), MTWThF 11


4 units, autumn, (Good), TWThF 10, alternate years, to be given in 1958–59


4 units, winter, (Good), TWThF 9


4 units, spring, (Good), TWThF 11

R110. Christian Political Thought: Historical—Tradition of Christian theology as related to social and political development of Western society.

4 units, autumn, (Miller), TWThF 9

R111. Christian Political Thought: Contemporary—Thought of influential theologians of society, e.g., Jacques Maritain, John Courtney Murray, Reinhold Niebuhr, in its relevance to contemporary social and political life.

4 units, winter, (Miller), TWThF 10


4 units, spring, (Miller), TWThF 11


4 units, autumn, (Miller), TWThF 11


4 units, winter, (Miller), TWThF 1


4 units, autumn, (Good), to be given in 1959–60


2 units, spring, (Good), MW 10

R155. The Prophets of Israel—One or more of the most significant prophets as poets and thinkers. Major motifs: Covenant, Sin, Judgment, Mercy, Future Hope.

4 units, autumn, (Good), TWThF 1, alternate years, to be given in 1958–59


4 units, autumn, (Good), to be given in 1959–60

*4 units, winter, *(Good), TWThF 11, alternate years, to be given in 1958-59*


*4 units, winter, *(Good), to be given in 1959-60*


*4 units, spring, *(Staff), TTh 2-4*

R195. Seminar in Biblical Studies—A consideration of Biblical and other texts bearing on an important literary, historical, or theological problem. Possible subjects: The Old Testament Idea of the Covenant; The Dead Sea Scrolls; etc. Prerequisite: one course in Bible or permission of the instructor.

*3 units, spring, *(Good), W 2-4*

R199. Individual Work.

*(Staff), by arrangement*

See also Senior Colloquia.

MATHEMATICS

EMERITI: Charles Loewner, William Albert Manning, George Polya (Professors)

EXECUTIVE HEAD: Menahem Max Schiffer


ASSOCIATE PROFESSORS: Paul Walter Berg, Newton Seymour Hawley, Erhard Heinz, Gordon Eric Latta, Harold Levine

ASSISTANT PROFESSORS: Solomon Feferman, Theodore Thomas Frankel, Karel de Leeuw, James L. McGregor, Robert Osserman, Mary Virginia Sunseri

INSTRUCTOR: John W. Lamperti

OFFERINGS AND FACILITIES

The introductory courses consist of four alternative sequences in analytic geometry and calculus (10, 11, 21, 22, 23, and 24, or 41, 42, 43, and 24, or 41, 52, 53, and 54, or 41, 62, 63, and 64). These courses are provided for students who wish to graduate with a major in mathematics as well as for students in other departments who need or desire mathematics above the level of secondary school work. Students electing one of the above series are expected to complete the work in that series. Changes from one series to another are permitted only by special arrangement.

Honors sequence Mathematics 52, 53, and 54 is an honors course in calculus for students intending to major in the physical sciences. These courses cover the material contained in Mathematics 42, 43, and 24, but students who take
this sequence need to spend less time on drill, and consequently it is possible to explore some of the interesting implications of calculus in science, engineering, and mathematics. Prerequisites: Mathematics 41 and the consent of the instructor.

The calculus sequence 41, 62, 63, and 64 is a special version of the 41, 42, 43, and 24 series primarily for students majoring in one of the behavioral sciences. This sequence stresses applications to probability theory and the behavioral sciences rather than mechanics.

**DEGREES**

**Bachelor of Science**

The following Departmental requirements are in addition to the University's basic requirements for the Bachelor's degree:

1. Analytic Geometry and Calculus (Courses 10, 11, 21, 22, 23, and 24, or 41, 42, 43, and 24, or 41, 52, 53, and 54). These courses should be started during the first year.

   Students intending to major in mathematics are advised to begin or continue the study of French, German, or Russian in the first year.

2. One quarter of Advanced Calculus (100); two quarters of Algebra (114, 120); two quarters of Differential Equations (130, 131); two quarters of Fundamental Concepts of Analysis (115, 116); one quarter of Vector Analysis (113) [Functions of a Complex Variable (106) may be substituted for this course]; one quarter of Higher Geometry (142) [one quarter of Differential Geometry (217) may be substituted for this course].

3. Nine units of courses in mathematics numbered above 100 in addition to those listed in 2.

4. French 23, German 23, or Russian 21; Physics 51, 53, 55, and 57.

**Master of Science**

The University's basic requirements for the Master's degree (residence, thesis, etc.) are discussed in the section “Degrees” in this Bulletin. The following are Departmental requirements:

Candidates will be expected to complete, in addition to the requirements for the Bachelor's degree, a minimum of 45 units of work in the University, of which 30 units must be in this department. This work shall include a thesis and Mathematics 212. Candidates are expected to have a reading knowledge of French and German sufficient to read mathematical papers in these languages.

The Department also offers a program in Scientific Computation leading to a Master of Science degree. In this program 6 units of Mathematics 239 are substituted for the thesis. In addition to his work in mathematics a student in this program is ordinarily expected to take 9 units of engineering courses concerned with the theory or application of computing machines.

In cooperation with the School of Education, the Department offers a program leading to a degree of Master of Arts in the Teaching of Mathematics. See the section “School of Education, the Master of Arts in Teaching,” in this Bulletin.

**Doctor of Philosophy**

The University's basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the section “Degrees” in this Bulletin. The following are Departmental requirements:

In order for a student to be admitted to candidacy for the Ph.D. degree, he must have successfully completed Mathematics 205a, b, and 206a, b, 210a, b, 212, together with 24 additional units of graduate courses (i.e., courses numbered
200 and above), and must have demonstrated the ability to read French, German, or Russian. In addition, he must pass an oral examination given by the Department.

Beyond the requirements for candidacy, the student must complete a course of study of at least 30 units approved by the Graduate Study Committee of the Department of Mathematics. This program must either display sufficient breadth in mathematics outside the student's field of specialization, or fulfill the requirements for a minor in another department. In addition, the student must pass his second language examination and the University oral examination, and submit an acceptable dissertation. A student must receive a grade of B or better in a course in order for that course to satisfy the requirements for the Ph.D. degree.

For further information concerning degree programs, requirements for a Ph.D. minor in mathematics, fellowships, and assistantships, inquire of the Department secretary.

Teacher's Credentials

The requirements for a teaching major in mathematics for the General Secondary Credential are: Courses 10, 11, 21, 22, 23, 24 (or 41, 42, 43, 24, or 41, 52, 53, 54) together with 21 units selected from courses numbered 100 or above, and in addition, 15 units selected from courses numbered 100 or above or in courses in other departments requiring extensive application of mathematics. The requirements for a teaching minor in mathematics are Courses 10, 11, 21, 22, 23, 24 (or 41, 42, 43, 24, or 41, 52, 53, 54) together with 12 units as follows: 9 units in mathematics courses numbered 100 or higher; 3 units either in mathematics courses numbered 100 or higher or in courses requiring extensive application of mathematics given in other departments. In order to receive the recommendation of the department for a teaching major or a teaching minor, the candidate is expected to have an average grade of B in these required courses. If work in mathematics has been taken at another institution, it is expected that at least one course numbered 100 or above will be taken in the Department. Attention is called to Courses 111, 129, 142, and 157 as particularly appropriate to these programs.

COURSES

I. INTRODUCTORY AND UNDERGRADUATE

Introductory courses will be offered only if ten or more students enroll. Mathematics courses numbered 100 and above presuppose a knowledge of calculus through Mathematics 24 or 54; these courses are also open to graduate students.

A. Algebra—Fundamental laws: negative and fractional powers; quadratic equations, curve plotting, logarithms, binomial theorem, complex numbers.

3 units, autumn or winter, (——), MTWThF 10, 12, or 2
or spring, (——), MTWThF 2

C. Plane Trigonometry—Trigonometric functions; identities, equations; solution of right triangles, oblique triangles, including use of logarithms; applications to practical problems; De Moivre's Theorem. Continuation in course depends upon student's passing a qualifying examination given during first week of course and covering algebra.

3 units, autumn or winter, (——), MTWThF 10, 12, or 2
or spring, (——), MTWThF 10 or 2

1. Elementary Mathematical Analysis—Evolution of number system; logic of algebra; introduction to basic ideas of analytic geometry, calculus.

5 units, autumn, winter, or spring, (——), MTWThF 9
10. **Analytic Geometry and Calculus**—Geometry of the straight line; function; limit; derivative of algebraic, logarithmic functions; integral; maxima, minima; area under a curve. Continuation in course depends upon student's passing a qualifying examination given during first week of course and covering algebra, plane trigonometry. Prerequisites: Algebra and plane trigonometry.

*3 units, autumn, (—), MWF 8, 10, or 2
or winter, (—), TThS 10, or MWF 2*

10a. **Analytic Geometry and Calculus, special course**—Same as 10 with addition of some review work in algebra, trigonometry. Admission only by assignment following qualifying test mentioned for 10.

*5 units, autumn, (—), MTWThF 10 or 2*

11. **Analytic Geometry and Calculus**—Continuation of 10, 10a. Derivatives of trigonometric, inverse trigonometric, logarithmic, exponential functions; conic sections; translation, rotation of coordinate axes; angle between lines; analytic proofs of geometric theorems.

*3 units, winter (—), MWF 8, 10, or 2
or spring, (—), TThS 10, or MWF 2*

21. **Analytic Geometry and Calculus**—Continuation of 11. Polar coordinates; parametric representation; additional applications of derivatives; hyperbolic, inverse hyperbolic functions; the differential; approximate computation; curvature.

*3 units, autumn, (—), TThS 8, or MWF 3
or spring, (—), MWF 8, 10, or 2*

22. **Analytic Geometry and Calculus**—Continuation of 21. Rectilinear, curvilinear motion; Rolle's Theorem; Theorem of the Mean; indeterminate forms; Taylor's, Maclaurin's Theorems; formal integration; definite integral as limit of a sum; improper integrals.

*3 units, autumn, (—), MWF 9, 11, or 1
or winter, (—), TThS 8, or MWF 3*

23. **Analytic Geometry and Calculus**—Continuation of 22. Space coordinates; quadric surfaces; vectors in space; equations of planes, lines; application of definite integral to finding areas, volumes, length of arc, surface of revolution; mean value of a function; work; centroids; fluid pressure; moments of inertia; trapezoid and Simpson's rules; partial derivatives.

*3 units, winter, (—), MWF 9, 11, or 1
or spring, (—), TThS 8, or MWF 3*

24. **Analytic Geometry and Calculus**—Continuation of 23 or 43 (below). Partial derivatives (continued); tangent plane, normal line; maxima, minima; multiple integrals with applications; infinite series; expansion of functions in power series; introduction to differential equations.

*3 units, autumn, (—), MWF 8, 9, or 11
or spring, (—), MWF 9, 10, or 12*

41. **Analytic Geometry and Calculus**—41, 42, 43 together cover same subjects as 10, 11, 21, 22, 23. Requirements for admission to 41 same as for 10.

*5 units, autumn, (Bacon), MTWThF 9 or (—), MTWThF 9 or 12
or winter, (—), MTWThF 12*

42. **Analytic Geometry and Calculus**—Continuation of 41.

*5 units, winter, (Bacon), MTWThF 9 or (—), MTWThF 9 or 12
or spring, (—), MTWThF 12*

43. **Analytic Geometry and Calculus**—Continuation of 42.

*5 units, spring, (Bacon), MTWThF 9 or (—), MTWThF 9 or 12
or autumn, (—), MTWThF 12*

52. **Honors Calculus**—Honors version of 42 for students who intend to major in a physical science. Prerequisites: 41 and consent of instructor.

*5 units, winter, (Schiffer), MTWThF 9*
53. Honors Calculus—Honors version of 43.
   5 units, spring, (Schiffer), MTWThF 9
54. Honors Calculus—Honors version of 24.
   5 units, autumn, (Loewner), MTWThF 9
62. Calculus—Special version of 42 primarily for students majoring in a behavioral science. Prerequisite: 41 or 11.
   5 units, winter, (Scarf), MTWThF 9
63. Calculus—Continuation of 62. Mathematical material corresponds to 43.
   5 units, spring, (Scarf), MTWThF 9
64. Calculus—Continuation of 63; partial derivatives, multiple integrals; joint distributions of random variables; infinite series; discrete probability distributions; Laplace transforms; introduction to differential equations.
   3 units, autumn, (Scarf), MWF 9

II. COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

100. Advanced Calculus—Topics in functions of several variables, including partial differentiation, Taylor's series, maxima and minima with side conditions, Jacobians, implicit function theorem, Lagrange Multipliers, transformation of multiple integrals, surface-integrals, Gamma function, elliptic integrals.
   3 units, autumn, ( ), MWF 1
106. Introduction to Functions of a Complex Variable—Complex numbers, analytic functions, Cauchy-Riemann equations, complex integration, Cauchy formula; elementary conformal mappings.
   3 units, autumn, (Latta), MWF 11, or (Osserman), MWF 2 or spring, ( ), MWF 8
111. Mathematical Methods in Science—Setting up scientific, technical problems in mathematical terms; differential equations. Use of physical suggestions in solving mathematical problems. Recommended for candidates for teaching credentials in mathematics, science.
   3 units, summer, ( ), alternate years, to be given in 1958-59
113. Vector Analysis—Vector algebra, calculus; vector fields, Stokes' Theorem, divergence theorem, curvilinear co-ordinates, applications to potential theory and mathematical physics.
   3 units, winter, (Leirine), MWF 1
   3 units, autumn, spring, ( ), MWF 1
115. Fundamental Concepts of Analysis—Rigorous treatment of real numbers, limits, function, continuity, differentiability, integral, infinite series, other infinite processes for students who have had elementary calculus. Especially recommended for students who intend to major in mathematics or to work for advanced degrees.
   3 units, winter, (McGregor), MWF 10
   3 units, spring, (McGregor), MWF 10
120. Modern Algebra—Integral domains, fields; polynomials; divisibility theory. Introduction of real and complex numbers; solution of cubic, quartic equations. Group theory. Prerequisite: 114.
   3 units, winter, ( ), MWF 1
121. Modern Algebra—Continuation of 120. Extended discussion of rings, ideals, fields. Applications to algebraic number theory.
   3 units, spring, ( ), MWF 1
123. Theory of Probability—Enroll in Statistics 116,
129. Elementary Mathematics from the Higher Point of View—Special emphasis on methodical, historical points; ideas of broader scientific interest. Recommended for candidates for teaching credentials in mathematics.

*3 units, spring, (Bacon), MWF 8, alternate years, to be given in 1958–59*

130. Ordinary Differential Equations—Special equations, exact equations, linear equations; series solutions, numerical solution; Laplace transform and operational methods. Courses 130, 131, 132 form a sequence.

*3 units, autumn, (Latta, ———), MWF 8 or 11*

131. Partial Differential Equations I—Boundary value problems for wave, heat equations; separation of variables, Fourier series, Bessel functions.

*3 units, winter, (Latta, ———), MWF 8 or 11*

132. Partial Differential Equations II—Boundary value problems for Laplace's equation; Legendre polynomials, spherical harmonics, Poisson's formula, Green's functions.

*3 units, spring, (Latta, ———), MWF 8 or 11*

137. Numerical Analysis—Numerical solution of algebraic, transcendental equations and systems of equations; interpolation, finite differences, numerical integration, numerical solution of differential equations, least squares. Prerequisite: 24 or equivalent.

*3 units, winter, (Herriot), MWF 11*

138. Numerical Analysis—Continuation of 137.

*3 units, spring, (Herriot), MWF 11*


*3 units, autumn, (Herriot), MWF 11*

142. Higher Geometry—Homogeneous and projective co-ordinates with applications; projective correspondence in forms of one dimension; involution; projective correspondence in forms of two dimensions; collineations, their classification; correlation, polarity; projective, affine, metric properties of conics.

*3 units, autumn, (Bacon), MWF 8, alternate years, to be given in 1959–60*

152a. Elementary Theory of Numbers—Euclid's algorithm, fundamental theorems on divisibility; prime numbers; congruence of numbers; theorems of Fermat, Euler, Wilson; congruence of first and higher degrees; Lagrange's Theorem, its applications; residues of power; quadratic residues; introduction to theory of binary quadratic forms.

*3 units, winter, (———), MWF 3, alternate years, to be given in 1959–60*


*3 units, spring, (———), MWF 3, alternate years, to be given in 1959–60*


*3 units, autumn, (Bacon), MWF 8, alternate years, to be given in 1958–59*

199. Undergraduate Honors.

*(Staff), by arrangement*

### III. Courses Intended Primarily for Graduate Students

200a, b. Advanced Ordinary Differential Equations—Fundamental existence theorems; successive approximations, Cauchy-Lipschitz method, power series solutions in the complex domain; zeros, singularities; asymptotic behavior, stability; Sturm-Liouville problems.

*3 units, winter, spring, (Latta), MWF 10, alternate years, to be given in 1959–60*
201. Calculus of Variations—Maxima, minima of integrals. Euler-Lagrange equation, applications to geometry, mechanics; second variation, sufficient conditions.
3 units, spring, (Levine), MWF 2

202. Infinite Processes—A rather thorough treatment of infinite series, infinite products, continued fractions, various methods of summability, etc. Applications to orthogonal expansions. Prerequisites: 115 and 116, or equivalent.
3 units, autumn, (Szegö), MWF 2

204a, b, c. Functional Analysis—Banach spaces, linear operators and functionals. Hilbert spaces, orthogonal systems, theory of completely continuous operators. Spectral theory. Groups, semi-groups and algebras of operators. Numerous applications to differential and integral equations, stochastic processes, moment problems, and integral transforms. Previous or concurrent registration in 205a, b is advisable.
3 units, autumn, winter, spring, (——), TTh 11-12:15, alternate years, to be given in 1959-60

205a, b, c. Theory of Functions of a Real Variable—Properties of point sets. Lebesgue measure, Lebesgue, Stieltjes integrals; function of bounded variation, absolute continuity. Point set theory; metric spaces, Banach spaces, convergence in the mean; linear functionals. Advanced theories of measure, integration.
3 units, autumn, winter, spring, (Lamperti), MWF 9

206a, b. Theory of Functions of a Complex Variable—Calculus of residues, power series, analytic continuation, conformal mapping. Prerequisite: 106.
3 units, winter, spring, (Szegö), MWF 2

207. Fourier Series—Convergence of Fourier series; Cesaro and Abel summation; Riesz-Fischer theorem. Prerequisite: 205a.
3 units, winter, (Herriot), MWF 1, alternate years, to be given in 1959-60

3 units, autumn, winter, spring, (——), MWF 10, alternate years, to be given in 1959-60

209a, b, c. Advanced Partial Differential Equations—Classification of partial differential equations according to type; characteristics, successive approximations, Riemann method for hyperbolic equations, parabolic equations; fundamental solutions, Green's functions; maximum principle, Dirichlet problem for elliptic equations.
3 units, autumn, winter, spring, (——), MWF 11

210a, b, c. Algebra—Groups, rings, modules, fields, linear spaces and linear transformations; Galois theory; applications to algebraic number theory and algebraic geometry. Prerequisite: Mathematics 121.
3 units, autumn, winter, spring, (deLeewu), MWF 1

211. Foundations of Set Theory—Enroll in Philosophy 211.

212. Proseminar—Objective to give candidates for M.S., Ph.D. degrees a first introduction into independent study, research. Work consists of solving problems from various branches of mathematics which are not of routine type, but which do not require a broad knowledge of subject. Students further introduced into reading, presenting research papers of a more elementary character. Prerequisite for M.S. degree and University oral examination required for Ph.D. Expected to be taken during senior year of undergraduate study or by new graduate students during first quarter of graduate study. May be repeated for credit.
3 units, autumn, (Loewner), MW 4-5:30

215. Transform Theory—Selected topics from classical transform theory including Fourier, Laplace, Hankel, Mellin, Lebidoff transforms with applications to boundary value problems. Prerequisite: Previous or concurrent registration in 206b.

3 units, spring, (Latta), MWF 10, alternate years, to be given in 1958–59

216a, b, c. Geometry—Invariants and the role of groups in geometry; Euclidean, affine and projective geometries; the Erlanger program. Algebraic curves, intersections, singularities, theory of correspondences. Algebraic varieties. Transcendental theory. Intrinsic geometry on curves and surfaces. Complex manifolds. Prerequisites: Mathematics 120 and 206a.

3 units, autumn, winter, spring, (Hawley), MWF 8, alternate years, to be given in 1958–59

217a, b. Differential Geometry—Theory of space curves, surfaces; Gauss curvature, intrinsic invariants, geodesics; foundations of Riemannian geometry.

3 units, autumn, winter, spring, (Hawley), TTh 10 and one hour by arrangement, alternate years, to be given in 1959–60

237a, b. Advanced Numerical Analysis—Selected topics from theory and practice of using automatic digital computers for: approximating arithmetic operations, approximating functions, solving systems of linear and nonlinear equations, computing eigenvalues, and solving ordinary and partial differential equations. Testing of methods on a digital computer. Prerequisite: 139 or equivalent.

3 units, winter, spring, (Forsythe), by arrangement

240a, b. Selected Topics in Function Theory.

3 units, winter, spring, (Osserman), by arrangement

243. Conformal Mapping—Prerequisite: 206b.

3 units, autumn, (Schiffer), by arrangement, alternate years, to be given in 1959–60

247. Linear Differential Equations in the Complex Domain—Elements of the Fuchs' theory, with particular reference to the hypergeometric and confluent hypergeometric equations. Prerequisites: 130 and 206a.

3 units, spring, (Szegö), MWF 3

252a, b. Orthogonal Polynomials.

3 units, autumn, winter, (Szegö), MWF 3, alternate years, to be given in 1959–60

255a, b. Analytic Theory of Numbers.

3 units, autumn, winter, (Szegö), MWF 3, alternate years, to be given in 1958–59

256. Asymptotic Expansions.

3 units, (——), by arrangement, alternate years, to be given in 1959–60

262a, b. Exterior Differential Forms and Their Applications—Theory of exterior differential forms from its algebraic background, the Grassmann algebra. Application to analytical dynamics (Hamilton-Jacobi theory), differential geometry, systems of partial differential equations and Lie-group theory.

3 units, winter, spring, (Loewner), alternate years, to be given in 1959–60

271. Wave Motion—A study of basic phenomena in wave motion, including reflection, diffraction, dispersion, surface waves, with illustrations from acoustics, optics, elasticity, and water waves.

3 units, spring, (Levine), MWF 3

272a, b. Selected Topics in Fluid Dynamics—Mathematical theory of
cavitational flow, subsonic and transonic flow, viscous fluids; recent developments.

3 units, winter, spring, (Gilbarg), by arrangement

273a, b. Electromagnetic Theory—A systematic characterization of equations for the electromagnetic field by variational principles. Techniques for solution of field equations.

3 units, autumn, winter, (Levine), MWF 2, alternate years, to be given in 1958-59


3 units, autumn, (Gilbarg), by arrangement

290a, b. Selected Topics in Abstract Analysis—Theory of semi-groups, functional analysis. Prerequisite: 205.

3 units, winter, spring, (Karlin), by arrangement

312. Departmental Seminar.

2 units, autumn, winter, spring, ( ), T 2-4

360. Advanced Reading and Research.

Any quarter, (Staff), by arrangement


Any quarter, (Staff)

381. Seminar in Analysis.

3 units, autumn, winter, and spring, (Bergman), by arrangement

385. Seminar in Abstract Analysis.

386. Seminar in Geometry and Topology.

387. Seminar in Function Theory.

MODERN EUROPEAN LANGUAGES

Emeriti: Frederick Anderson, Alfred Coester, Aurelio Macedonio Espinosa, Bayard Quincy Morgan, Stanley Astredo Smith (Professors); Earl Kendall Carter (Assistant Professor)

Executive Head: F. W. Strothmann
Assistant Executive Head: Aurelio Macedonio Espinosa, Jr.
Associate Professors: Henry Blauth, Helmut R. Boeninger, Daniel C. McCluney, Jr., Gail Keith Meadows, Alexander E. A. Naughton, Roberto B. Sangiorgi, Gertrude L. Schuelke
Assistant Professors: Grace Knopp, Carmine R. Linsalata, Frederick W. Locke, N. Patricia O'Conner, Isabel Schevill, Jessie Smith, Leo Weinstein, Ruth Hirsch Weir, John M. J. Wolpe
Instructors: Sarra Kliachko, Pauline Newman, Elizabeth S. Steinke. Acting: Kurt Mueller-Vollmer

The Department accepts candidates for the degrees of Bachelor of Arts, Master of Arts, and Doctor of Philosophy, and for certification as high school and junior college teachers. Special consideration is given to the needs of those who intend to make teaching their profession.
Bachelor of Arts

The degree of Bachelor of Arts may be taken in French, German, Russian, or Spanish; or in Modern European Literature.

I. Candidates for the degree of Bachelor of Arts in French, German, or Spanish must have completed the first- and second-year courses in reading, composition, and conversation (or their equivalent) offered in the language of their choice.

Candidates for the Bachelor of Arts degree in French, German, or Spanish are expected to complete a minimum of 35 units, selected with the approval of their adviser, from courses numbered 100 and higher, designated Fr, G, L, or Sp. These 35 units must include:
- For French majors: Fr110, Fr111, Fr112, Fr113, Fr130a, Fr130b, L150;
- For German majors: G100, G110, G111, G112, G113, G131, G132, G133, G134, L151;

In addition to the 35 units mentioned above, students not enrolled in the Honors Program in Humanities are to select a minimum of three courses or 9 units from the general courses given by this Department.

II. Candidates for the Bachelor of Arts degree in Russian will complete the following program: Three years of Russian, plus at least 21 units from Departmental course offerings in the literature and civilization of Russia. All majors are required to take the Senior Seminar R191.

III. Candidates for the Degree of Bachelor of Arts in Modern European Literature are expected to complete the following program:

A. Prerequisites:
1. Philosophy 5. Introduction to Philosophy.

B. Required courses (39 to 43 units):
1. One of the following series of literature courses:
   Either Fr130a, Fr130b, and two other courses designated Fr dealing with modern literature.
   Or G131, G132, G133, and G134,
   Or Sp133, Sp134, Sp142, and Sp143.
2. One course dealing with a major author, e.g., Dante, Cervantes, Goethe, or Shakespeare.
3. One course each in modern English and Slavic literature.
4. 12 units of courses designated A, AF, AG, AI, or AS, dealing with modern European literature.
5. Two quarters of the undergraduate seminar, A150 and A151.

Master of Arts

The degree of Master of Arts may be taken in French, German, or Spanish. No student is accepted for candidacy unless he has completed the equivalent of the training represented by the requirements for the A.B. degree.
Requirements:

I. A working knowledge of Latin.

II. 30 units of graduate work in the candidate's major field, to be distributed as follows:

   a) Advanced composition ........................................ 5 or 6 units
   b) One graduate seminar dealing with a specific linguistic or
      literary problem ............................................... 2 units
   c) Philology and Linguistics ...................................... 8 units
   d) Three graduate courses in the History of Literature, to be
      chosen from courses numbered 200 or higher ............. 10 or 12 units
   e) Thesis ............................................................ 4 units

III. 14 units of electives chosen, with the approval of the student's
    adviser .............................................................. 14 units

Total ................................................................. 44 units

Master of Arts in Teaching

Candidacy:

1. The applicant must have completed a bachelor's degree with sufficient
   units and scholarship to permit graduate work. The Department of Modern
   European Languages determines the adequacy of this preparation for the par-
   ticular program desired. The School of Education will determine the ade-
   quacy of the candidate's background in professional education.

2. The candidate must hold a teaching credential.

3. The applicant must submit evidence of one or more years of successful
   teaching experience.

Requirements:

1. Three quarters of full time residence (or its equivalent). This require-
   ment may be satisfied by attending a series of summer sessions.

2. A minimum of 40-45 quarter units of work is required for the degree,
   with at least 36 units of work completed at Stanford.

3. 30 units of work in the candidate's major field.

4. Requirements in Education consist of recent advanced courses in the fol-
   lowing areas to supplement the candidate's preparation:

   a. Curriculum and methods in the candidate's teaching field.
   b. General curriculum in Secondary or Elementary education.
   c. Foundations of Education (such as Psychological, Social, Health;
      History, Philosophy, Comparative Education, Cultural Transmis-
      sions). Recent work in Psychological and Social Foundations is re-
      quired.

General Secondary Teaching Credential

French, German, or Spanish

State of California minimum requirements:

For the major in any subject field: 36 semester hours or 54 quarter units. A
minimum of 6 semester hours or 9 quarter units must be taken as a graduate
student. These courses must be either graduate courses or advanced courses
for which graduate credit is granted by the Department.

For the minor in the subject field: 20 semester hours or 30 quarter units.
Stanford requirements:

All students eligible for the General Secondary Credential Program with either a teaching major or a teaching minor in a foreign language must have at least a B average in that language in courses which follow the first-year series (or their equivalent). After admission to the program, a B average must be maintained.

The following requirements must be met for certification by Stanford for teaching French, German, or Spanish in a California high school. Students who have received the A.B. degree in French, German, Spanish, or Hispanic American Studies will have fulfilled most of the requirements listed below.

Teaching major in French:  

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. First-Year French (Fr1, Fr2, Fr3)</td>
<td>12</td>
</tr>
<tr>
<td>2. Second-Year French (Fr52–54 or equivalent)</td>
<td>15</td>
</tr>
<tr>
<td>3. Fr100. Advanced Conversation</td>
<td>3</td>
</tr>
<tr>
<td>4. Fr110. French Pronunciation</td>
<td>3</td>
</tr>
<tr>
<td>5. Fr111–113. Third-Year French Composition</td>
<td>6</td>
</tr>
<tr>
<td>6. Fr201*-202. Advanced Composition and Grammar</td>
<td>6</td>
</tr>
<tr>
<td>8. Freely elected advanced courses dealing with the literature or civilization of France totaling at least</td>
<td>11</td>
</tr>
<tr>
<td>Total minimum</td>
<td>60</td>
</tr>
</tbody>
</table>

Teaching minor in French:

The following courses constitute the minimum requirements: First-Year French; Fr52–54; Fr100; Fr110; Fr111–113*; L260. This is a total of 43 units. If the student's major is not a language, Ed282a must be taken during the senior year.

* A qualifying language examination is required for admission to Fr201, or as a terminal language requirement for minors in French.

Teaching major in German:  

<table>
<thead>
<tr>
<th>Course Description</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. First-Year German (G1, G2, G3)</td>
<td>12</td>
</tr>
<tr>
<td>2. Second-Year German (G52, G53, G54 or equivalent)</td>
<td>15</td>
</tr>
<tr>
<td>3. G100. Advanced Conversation</td>
<td>3</td>
</tr>
<tr>
<td>4. G110. German Pronunciation</td>
<td>3</td>
</tr>
<tr>
<td>5. G111–113. Third-Year Composition</td>
<td>6</td>
</tr>
<tr>
<td>8. Freely elected advanced courses dealing with the literature or civilization of Germany, totaling at least</td>
<td>12</td>
</tr>
<tr>
<td>Total minimum</td>
<td>60</td>
</tr>
</tbody>
</table>

Teaching minor in German:

The following courses constitute the minimum requirements for the teaching minor: G1–3; G52–54; G100; G110; G111–G113*; L260. This is a total of 43 units. If the student's major is not a language, Ed282a must be taken during the senior year.

* A qualifying language examination is required for admission to G201, or as a terminal language requirement for minors in German.
Teaching major in Spanish:

1. First-Year Spanish (Sp1, Sp2, Sp3) ........................................ 12
2. Second-Year Spanish (Sp28, Sp52, Sp53 or equivalent) ............... 12
3. Sp100 or 104. Advanced Conversation or Spanish Dramatics .......... 3
4. Sp110. Spanish Pronunciation .............................................. 3
5. Sp111–113. Third-Year Composition ...................................... 7
7. L260. Applied Linguistics .................................................. 4
8. Freely elected advanced courses dealing with the literature or civiliza-
   tion of Spain or Hispanic America, totaling at least ................... 13

Total minimum ................................................................. 60

Teaching minor in Spanish:

The following courses constitute the minimum requirements for the teaching minor: Sp1–3; Sp28; Sp52-53; Sp100 or 104; Sp110; Sp111–113*; L260. This is a total of 41 units. If the student’s major is not a language, Ed282a must be taken during the senior year.

* A qualifying language examination is required for admission to Sp201, or as a terminal language requirement for minors in Spanish.

Doctor of Philosophy

The degree of Doctor of Philosophy may be taken with French, German, Italian*, or Spanish as a major. Candidates are not obliged to present a minor but they are urged to offer one. A minor in a second language is strongly recommended. A minor in French, German, or Spanish is equivalent to requirement IIa, b, c, d, for the degree of Master of Arts.

Candidacy:

Candidates should read carefully the general regulations governing the conferring of this degree, as described in the section “Degrees” in this Bulletin. No student is accepted as a candidate until he has completed the equivalent of the training represented by the requirements for the Master of Arts degree as described above.

General Requirements:

All candidates, regardless of their field of specialization, are expected to fulfill these requirements:

1. Have a working knowledge of Latin and one modern language other than the one in which the degree is taken. Knowledge of the second modern language must be demonstrated by passing a University examination.
2. Write a thesis that embodies such results of research as would merit publication.
3. Pass successfully an oral examination along the following lines:
   a) The principles of general and descriptive linguistics and the outlines of the history of the French (German, Italian, Spanish) language.
   b) The general outlines of the history of French (German, Italian, Spanish) literature.
   c) The essentials of the political and cultural history of France (Germany, Italy, the Hispanic world).
4. Prove, by examination, that they can write and speak French (German, Italian, Spanish) correctly.
5. Have read the works enumerated in the Department's reading list for their major language.

6. Candidates for the Ph.D. degree in one of the Romanic Languages must have a reading knowledge of French, Spanish, and Italian or Portuguese. This knowledge must be demonstrated by passing a University examination.

7. Teaching experience in this Department is required of all candidates for the Ph.D. degree as a condition to receiving such degree. Teaching assistantships are available to help candidates fulfill this requirement, which will be waived only in the case of students who have a minimum of two years of teaching experience in other institutions.

Specialization:

1. Candidates in French or German specialize either in linguistics or literature. Candidates who specialize in linguistics must complete the amount of literary study required of candidates for the Master of Arts degree (i.e., three graduate courses in the history of literature, and one graduate seminar dealing with a literary problem). Similarly, candidates in literature must complete a minimum of 12 units in philology and linguistics.

2. Candidates for the Ph.D. degree in Spanish specialize either in literature, or in linguistics, or in Hispanic American Studies. Irrespective of their field of specialization, all candidates are required to complete the following “core” curriculum: Sp201 and Sp202 (6 units); two graduate courses in the literature of Spain and Hispanic America (8 units); two quarters of HAS248 (6 units); 12 units of work in philology and linguistics. Upon completion of this “core” program, candidates must pass a qualifying examination before being permitted to specialize in one of the three fields cited above.

3. Candidates specializing in literature who do not elect a formal minor and are not enrolled in the Graduate Humanities Program are required to take a substantial amount of work in a related minor field. If the minor field selected is French, German, Italian, or Spanish, the amount of work completed should total not less than 18 units of advanced work (including Fr113, G113, It112, or Sp113).

Course Work:

Candidates for the Ph.D. degree should arrange their course work in such a way as to fulfill all requirements for their major and minor within nine quarters after receiving the A.B. degree. This can be done by enrolling for a minimum of 12 units per quarter, and by starting work on their respective reading lists as soon as possible. Candidates who do not enroll for a minimum of 12 units per quarter must expect a corresponding delay.

Graduate Program in Humanities

The Department of Modern European Languages participates in the Graduate Program in Humanities leading to the Ph.D. degree. For a description of that program see the section “Humanities (Special Programs)” in this Bulletin.

Hispanic American Studies

The attention of students majoring in Spanish (A.B. or A.M.) is called to the possibility of qualifying for a special certificate by working for three quarters on the Hispanic American Report (HAS248). For details about this program, consult Hispanic American Studies.

* See Graduate Division Special Programs.
COURSES OPEN TO ALL STUDENTS

The courses in this section do not require a knowledge of any language other than English. Students desiring French (German, Italian, Russian, or Spanish) language credit for these courses must secure the permission of the Department and do the assigned readings in French (German, Italian, Russian, or Spanish).

A. General Courses:

A101. Science of Language—Inquiry into the essential nature of language by comparison of various Romance tongues among themselves and with other languages such as English, German, Swedish, American Indian, Chinese.
3 units, spring, (Meadows), MWF 10

A141. The Reflection of World War II in European Literature—An attempt to evaluate, discuss impact of World War II on work of significant Continental authors.
3 units, (Wolpe), alternate years, to be given in 1959-60

A142. The Theological Novel of Modern Europe—Lectures, discussions on theological problems in works of Dostoevski, Bloy, Mauriac, Greene, Waugh, C. S. Lewis, Le Fort, Werfel, etc.
3 units, spring, (Reinhardt), MWF 9

A143. Communism in Modern European Literature—Conflicting presentations of the main challenge of our time in its impact upon the individual, the masses.
3 units, (Blauth), alternate years, to be given in 1959-60

A150. Introduction to the Critical Reading of Literature.
2 units, winter, (Locke), T 4-6

A151. Introduction to the Critical Reading of Literature—Continuation of A150.
2 units, spring, (Locke), T 4-6

A185. Existentialism in Modern Thought and Literature—Analysis, synthesis of human existence in works of Pascal, Kierkegaard, Nietzsche, Heidegger, Jaspers, Rilke, Kafka, Camus, Marcel, Caruso, etc.
3 units, winter, (Reinhardt), MWF 9

A199. Individual Work—Thirty-six hours of reading per unit, weekly conference with instructor.
1 to 3 units, each quarter, (Staff), by arrangement

AF. French:

AF151. French Civilization I—Origin; Roman Gaul; cultural, religious, artistic background of French life during Middle Ages until Hundred Years’ War. Lectures, outside readings.
3 units, autumn, (Lemaitre), MWF 9

AF152. French Civilization II—End of Middle Ages; Renaissance and Reform; formation of ideals of Classical Age. Lectures, outside readings.
3 units, winter, (Lemaitre), MWF 9

3 units, (Lemaitre), to be given in 1959-60

AF154. French Civilization IV—Political, social problems; cultural, religious developments from French Revolution to World War I. Lectures, outside readings.
3 units, winter, (Lemaitre), MWF 2

AF155. Political Problems of Contemporary France I.
3 units, autumn, (Lemaitre), MWF 10
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Semester</th>
<th>Instructor(s)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF156</td>
<td>Political Problems of Contemporary France II.</td>
<td>3</td>
<td>Winter</td>
<td>(Lemaitre)</td>
<td>MWF 10</td>
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<tr>
<td>AF157</td>
<td>Political Problems of Contemporary France III.</td>
<td>3</td>
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<td>(Lemaitre)</td>
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<tr>
<td>AF160</td>
<td>Molière—Representative comedies of Molière in English translation.</td>
<td>4</td>
<td>Winter</td>
<td>(Weinstein)</td>
<td>MTWTh 2</td>
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<tr>
<td>AF170</td>
<td>Modern French Novels in Translation.</td>
<td>3</td>
<td>Autumn</td>
<td>(Naughton)</td>
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<tr>
<td>AF171</td>
<td>Contemporary French Novelists — Significant authors of contemporary France:</td>
<td>3</td>
<td>Winter</td>
<td>(Lemaitre)</td>
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<td></td>
<td>Proust, Gide, Malraux. Lectures, readings in English.</td>
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<tr>
<td>AF172</td>
<td>Sartre—Introduction to French Existentialism—Lectures, readings in English.</td>
<td>4</td>
<td></td>
<td>(Lemaitre),</td>
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<tr>
<td>AF175</td>
<td>From Cubism to Surrealism — Modern French art, literature against background</td>
<td>4</td>
<td></td>
<td>(Lemaitre),</td>
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<td></td>
<td>of French ideas, French social life. Lectures, readings in English.</td>
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<tr>
<td>AF180</td>
<td>Modern French Thinkers in Translation.</td>
<td>3</td>
<td>Winter</td>
<td>(Naughton)</td>
<td>MWF 9</td>
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<tr>
<td>AG75</td>
<td>Goethe's Faust—Lectures in English, reading of Faust in translation.</td>
<td>3</td>
<td>Autumn</td>
<td>(Blauth), alternate</td>
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<td>years, not open to freshmen.</td>
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<tr>
<td>AG156</td>
<td>The Modern German Drama in Translation — Representative German plays since</td>
<td>3</td>
<td></td>
<td>(Boeninger),</td>
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<td></td>
<td>World War I.</td>
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<td>alternate years,</td>
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<td>AG164</td>
<td>Problems of Human Existence in Kierkegaard and Ibsen.</td>
<td>3</td>
<td></td>
<td>(Reinhardt), alternate</td>
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<td></td>
<td>years, to be given in 1959-60</td>
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<td>years, to be given in</td>
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<tr>
<td>AG181</td>
<td>Nietzsche—Life and works, considered in relation to contemporary German</td>
<td>3</td>
<td>Spring</td>
<td>(Reinhardt),</td>
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<td></td>
<td>thought, culture.</td>
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<td>MWF 2</td>
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<tr>
<td>AG183</td>
<td>Thomas Mann — Major works in both fiction and essay in English translation.</td>
<td>2 or 3</td>
<td></td>
<td>(Boeninger),</td>
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<td>alternate years, to be given in 1959-60</td>
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<td>alternate years,</td>
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<tr>
<td>AG184</td>
<td>Contemporary German Fiction—Cultural, social trends in representative recent</td>
<td>3</td>
<td>Autumn</td>
<td>(Boeninger),</td>
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<tr>
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<td>fiction (in translation).</td>
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<td>MWF 9</td>
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<tr>
<td>AI75</td>
<td>Dante in English—Reading, interpretation of Vita Nuova and The Divine Comedy</td>
<td>3</td>
<td>Autumn</td>
<td>(Locke),</td>
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<td>in translation.</td>
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<td>MWF 2</td>
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<tr>
<td>AI140</td>
<td>The Contemporary Italian Novel in Translation—Reading, discussion of</td>
<td>3</td>
<td></td>
<td>(——), alternate years</td>
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<td></td>
<td>significant novels of such authors as D’Annunzio, Silone, Berti, Levi,</td>
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<td>to be given in 1959-60</td>
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<td></td>
<td>Moravia.</td>
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<tr>
<td>AR91</td>
<td>Russian Civilization—Geography and history; peoples and institutions;</td>
<td>5</td>
<td>Autumn</td>
<td>(Posin), MTWThF 11</td>
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<td>religion and philosophy; language and literature; art and music. Open to all</td>
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<td>students except freshmen.</td>
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<tr>
<td>AR145</td>
<td>Russian Literature—Russian literature of nineteenth century up</td>
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</tbody>
</table>
MODERN EUROPEAN LANGUAGES

5 units, winter, (Posin), MTWThF 11

AR151. Fedor Dostoyevsky.
3 units, (Posin), alternate years, to be given in 1959-60

AR153. Leo Tolstoy—Chief works of fiction in English translation. Open to all students except freshmen.
3 units, spring, (Posin), MWF 2

AR162. Modern Russian Literature—Social and literary scene and personalities from end of nineteenth century to present. Open to all students except freshmen.
4 units, spring, (Posin), MTThF 10

AS. Spanish:

AS75. Don Quixote in Translation—Reading, interpretation of Don Quixote.
3 units, spring, (Linsalata), MWF 2

AS142. The Hispanic World—Spain and Portugal.
2, 3, or 4 units, spring, (Hilton), TTh 8

AS143. The Hispanic World—Mexico and Central America.
2, 3, or 4 units, (Hilton), alternate years, to be given in 1959-60

AS144. The Hispanic World—The Caribbean.
2, 3, or 4 units, (Hilton), alternate years, to be given in 1959-60

AS145. The Hispanic World—The Pacific Coast Republics.
2, 3, or 4 units, (Hilton), alternate years, to be given in 1959-60

AS146. The Hispanic World—The River Plate Republics.
2, 3, or 4 units, autumn, (Hilton), TTh 8

AS147. The Hispanic World—Brazil.
2, 3, or 4 units, winter, (Hilton), TTh 8

AS148. The Hispanic World—Problems of Spain, Latin America. May be repeated for credit.
2, 3, or 4 units, summer, (Hilton), TTh 8 and by arrangement

The Hispanic World series of courses (AS142-AS148), given in English, provide, with convenient regional subdivisions, a general picture of Hispanic civilization, both in its sociological aspects (physical and human geography, social organization, resources and problems) and in its cultural aspects. An attempt is made to evaluate historically the achievements of Spain, Portugal, and Hispanic America, and their place in the world of both the past and the present. These courses are the basic requirement for the Hispanic American regional major.

AS150. Unamuno and Ortega—Present-day conflicts in literary works of Unamuno, Ortega y Gasset.
2 units, autumn, (Schevill), TTh 1

AS151. The Contemporary Spanish Novel in Translation—Analysis, discussion of representative works of Spanish novelists of present day.
3 units, spring, (Schevill), MWF 10

AS152. The Contemporary Spanish Drama in Translation—Modern trends, tensions as reflected in significant Spanish dramatists of present day.
3 units, winter, (Linsalata), MWF 2

3 units, (———), alternate years, to be given in 1959-60

AS156. Introduction to Mexican Culture—Mainly Mexican folkways, but also illustrated lectures on fine arts, arts and crafts.
2 units, spring, (Rael), TTh 1
Note: Students registering for the first time in a first- or second-year course must take a placement test, if they have had any training in French before entering Stanford.

**Fr1. First-Year French.**
4 units, each quarter, (Staff)

**Fr2. First-Year French—Continuation of Fr1.**
3 units, autumn, (Staff)
4 units, winter or spring, (Staff)

**Fr3. First-Year French—Continuation of Fr2.**
3 units, autumn, winter, (Staff)
4 units, spring, (Staff)

**Fr5. Elementary French—Accelerated course for beginners, particularly for those seeking to fulfill the University requirement of a reading knowledge for the Ph.D. degree. Open to senior, graduate students only.**
4 units, autumn, (Staff), MTWTh 8
or summer, (Staff), MTWThF 8

**Fr13. First-Year Conversation—Open only to students enrolled in Fr2 or Fr3.**
2 units, autumn or winter, (Staff)

Note: Students wishing to stress speaking and writing in addition to reading are advised to take Fr52, Fr53, and Fr54.

**Fr21. Second-Year Reading—(See note above.) Prerequisite: Fr3.**
3 units, autumn, winter, or spring, (Staff)

**Fr22. Second-Year Reading—Continuation of Fr21.**
3 units, autumn, winter, or spring, (Staff)

**Fr23. Second-Year Reading—Continuation of Fr22. Reading material assigned will vary from section to section.**
3 units, autumn, winter, or spring, (Staff)

**Fr24. Second-Year Grammar and Composition—Prerequisite: Fr3 or equivalent.**
2 units, autumn or winter, (Staff)

**Fr25. Second-Year Grammar and Composition—Continuation of Fr24.**
2 units, winter or spring, (Staff)

**Fr27. Second-Year Conversation—Prerequisite: Fr3.**
2 units, autumn or winter, (Staff)

**Fr28. Second-Year Conversation—Prerequisite: Fr27.**
2 units, winter, or spring, (Staff)

**Fr52. Second-Year French—Emphasizes speaking, writing in addition to reading. Reading material corresponds to that of Fr22. A grade of B in Fr3 (or equivalent) required for admission. Students electing this course may not take Fr22 and Fr27. Enrollment limited to 15.**
5 units, autumn, (Staff)

**Fr53. Second-Year French—Continuation of Fr52. Level of reading material corresponds to that of Fr23. Students electing this course may not take Fr23 and Fr24. Prerequisite: Fr52 (or Fr22 plus Fr27). Enrollment limited to 15.**
5 units, winter, (Staff)

**Fr54. Second-Year French—Continuation of Fr53. Students electing this
MODERN EUROPEAN LANGUAGES

course may not take Fr25 and Fr28. Prerequisite: Fr53 (or Fr23 plus Fr24 and Fr27). Enrollment limited to 15.

5 units, spring, (Staff)

Fr99. Individual Reading—Prerequisite: Fr23. Enrollment only by special permission of Department. Not required for majors in French. Thirty-six hours of reading per unit, weekly conference with instructor.

1 or 2 units, summer, (Staff), by arrangement

THIRD- AND FOURTH-YEAR COURSES

Fr100. Advanced French Conversation—Prerequisite: Fr54 or equivalent. May be repeated for credit.

3 units, winter, (Newman), MWF 11

Fr110. French Pronunciation—Prerequisites: Fr23 and 27 or equivalent.

3 units, autumn, (Newman), MWF 11
or spring, (Meadows), MWF 11

Fr111. Third-Year French Composition—Prerequisite: Fr54 or equivalent.

2 units, autumn, (Smith), TTh 11

Fr112. Third-Year French Composition—Continuation of Fr111.

2 units, winter, (Smith), TTh 11

Fr113. Third-Year French Composition—Continuation of Fr112.

2 units, spring, (Smith), TTh 11

Fr120. French Cultural Readings—Training in careful reading of books with a significant cultural content. Prerequisite: Fr23.

4 units, spring, (Naughton), MWF 2

Fr130a. Introduction to French Literature I—From 1800 to present. Prerequisite: Fr23.

4 units, autumn, (Wolpe), MTWTh 10

Fr130b. Introduction to French Literature II—Prior to 1800. Prerequisite: Fr23.

4 units, winter, (Wolpe), MTWTh 10


3 units, spring, (Locke), MWF 2


3 units, winter, (Naughton), MWF 2

Fr143. The Classical French Theater—Lectures, readings, reports; interpretation, discussion of representative plays of Corneille, Molière, Racine. Lectures in English; readings in French.

4 units, (Naughton), alternate years, to be given in 1959–60

Fr147. Pascal.

2 units, winter, (Locke), TTh 2

Fr151. French Literature in the Eighteenth Century—Prerequisite: Fr130b or equivalent.

3 units, (Wolpe), alternate years, to be given in 1959–60

Fr153. Le Roman au XVIIIe Siècle.

4 units, spring, (Wolpe), MTWTh 10

Fr155. Voltaire.

2 units, spring, (Wolpe), TTh 2

Fr160. The Nineteenth Century French Theater—Lectures, readings, reports; interpretation, discussion of plays by Dumas père, Hugo, Vigny,
Musset, Dumas fils, Augier, Becque. Lectures in English; readings in French.  
3 units, (Weinstein), to be given in 1960-61

Fr161. The Nineteenth Century French Novel I — Lectures, readings, reports; interpretation, discussion of representative novels of Chateaubriand, Constant, Hugo, Balzac, Stendhal, Vigny, Mérimée. Lectures in English; readings in French.  
3 units, autumn, (Weinstein), MWF 3

Fr162. The Nineteenth Century French Novel II—Lectures, readings, reports; interpretation, discussion of representative novels of Daudet, Flaubert, Maupassant, Zola. Lectures in English; readings in French.  
3 units, spring, (Weinstein), MWF 3

Fr163. The Development of the Regional Novel—Selective readings from Restif de la Bretonne, Florian, Mistral, George Sand, Balzac and Eugène LeRoy.  
3 units, autumn, (Newman), TTh 3

Fr180. La Littérature française au vingtième siècle I — Outstanding writers of prewar period: Maeterlinck, Rostand, Anatole France, Loti, Romain Rolland. Lectures, readings in French.  
3 units, (Lemaître), to be given in 1959-60

3 units, (Lemaître), to be given in 1960-61

Fr182. La Littérature française au vingtième siècle III — Modern French novelists: Jules Romains, Mauriac, Duhamel, Colette, Maurois, Saint-Exupéry. Lectures, readings in French.  
3 units, (Lemaître), to be given in 1959-60

Fr190. French Poetry—French lyrical poetry, Villon to Valéry.  
3 units, spring, (Naughton), MTTh 1

Fr199. Individual Work—Thirty-six hours of reading per unit, weekly conference with instructor. Open only to majors in French.  
1 to 3 units, summer, (Staff), by arrangement

Graduate Courses in French and French Literature

Fr201. Advanced Composition and Grammar — Prerequisite: qualifying examination.  
3 units, autumn, (Naughton), MWF 11

Fr202. Advanced Composition and Grammar — Continuation of Fr201.  
3 units, winter, (Naughton), MWF 11

Fr210. Middle French Literature—Reading of Middle French texts from fourteenth, fifteenth centuries; Villon.  
2 units, (Locke), alternate years, to be given in 1959-60

Fr211. Problems of Medieval and Sixteenth Century French Literature—Prerequisite: L201. Old French.  
4 units, spring, (Locke), MTWTh 11

Fr212. Problems of Seventeenth Century French Literature.  
4 units, (Naughton), alternate years, to be given in 1959-60

4 units, (Wolpe), alternate years, to be given in 1959-60

Fr216. Problems of Nineteenth Century French Literature I.  
4 units, (Weinstein), MTWTh 2

Fr217. Problems of Nineteenth Century French Literature II.  
4 units, (Weinstein), alternate years, to be given in 1959-60
Fr250. Graduate Seminar—Subject announced in Time Schedule.
2 units, autumn, (Wolpe), Th 4-6
or winter, (Locke), T 4-6
or spring, (Naughton), Th 4-6
Fr251. Graduate Seminar—Subject announced in Time Schedule.
4 units, autumn, (Meadows), T 4-6
or winter, (Newman), Th 4-6
Fr299. Individual Work—Exclusively for graduate students in French
working on thesis or engaged in special work.
1 to 12 units, each quarter, (Staff), by arrangement.

G. GERMAN

FIRST- AND SECOND-YEAR COURSES

[Under the direction of Daniel C. McCluney, Jr.]

Note: Students registering for the first time in a first- or second-year course
must take a placement test if they have had any training in German before
entering Stanford.

G1. First-Year German.
4 units, autumn, winter, or spring, (Staff)
G2. First-Year German—Continuation of G1.
4 units, autumn, winter, or spring, (Staff)
G3. First-Year German—Continuation of G2.
4 units, autumn, winter, or spring, (Staff)
G5. Elementary German—Accelerated courses for beginners, particularly
for those seeking to fulfill University requirement of reading knowledge for
Ph.D. degree. Open to senior and graduate students only. Students who com-
plete this course will be eligible for G26.
4 units, autumn or winter, (Staff), MTWTh 8
or summer, (Staff), MTWThF 8
G12. First-Year Conversation—Open only to students enrolled in G2 or G3.
2 units, autumn or spring, (Staff)

Note: Students wishing to stress speaking and writing in addition to reading
are advised to take G52, G53, and G54.

G22. Second-Year Reading—Prerequisite: G3.
3 units, autumn, winter, or spring, (Staff)
G23. Second-Year Reading—Continuation of G22. Reading material as-
signed will vary from section to section.
3 units, autumn, winter, or spring, (Staff)
G23a. Science Reading—Prerequisite G22.
3 units, winter, (Staff)
G24. Second-Year Composition—Prerequisite: G3 or equivalent.
2 units, autumn or spring, (Staff)
2 units, winter, (Staff)
G26. Research German—Reading, syntactical analysis of texts exemplary of
technical journals, articles. Prerequisite: G5 or equivalent. Open only to
graduate students and seniors who have not had G22 nor G23.
2 units, winter or spring, (Staff)
G27. Second-Year Conversation—Prerequisite: G3. May be repeated twice
for credit.
2 units, autumn, winter, or spring, (Staff)
G52. Second-Year German—Emphasizes speaking, writing in addition to
reading. Reading material corresponds to that of G22. A grade of B in G3
(or equivalent) required for admission. Students electing this course may not take G22 and G24. Enrollment limited to 15.

**G53. Second-Year German**—Continuation of G52. Level of reading material corresponds to that of G23. Students electing this course may not take G25 and G27. Prerequisite: G52 (or G22 plus G24). Enrollment limited to 15.

**G54. Second-Year German**—Continuation of G53. Students electing this course may not take G27. Prerequisite: G53 (or G23 plus G25 and G27).

**G99. Individual Reading**—Prerequisite: G23 or G53. Enrollment only by special permission of Department. Not required for majors in German. Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit.

1 or 2 units, each quarter, (Staff), by arrangement

**THIRD- AND FOURTH-YEAR COURSES**

**G100. Third-Year Conversation**—Prerequisite: G54 or equivalent. Course may be repeated twice for credit.

3 units, spring, (Blauth), MWF 10

**G110. German Pronunciation**—Prerequisite: G22.

3 units, winter, (Boeninger), MWF 10

**G111. Third-Year German Composition**—Prerequisite: G54 or equivalent.

2 units, autumn, (Boeninger), TTh 10

**G112. Third-Year German Composition**—Continuation of G111.

2 units, winter, (Boeninger), TTh 10

**G113. Third-Year German Composition**—Continuation of G112.

2 units, spring, (Boeninger), TTh 10

**G131. Masterworks of German Literature**—Reading, interpretation of outstanding dramas, novels, short stories of classical period. Prerequisite: G23 or G53.

3 or 4 units, autumn, (McCluney), by arrangement

**G132. Masterworks of German Literature**—Reading, interpretation of outstanding dramas, novels, short stories of nineteenth century. Prerequisite: G23 or G53.

3 or 4 units, winter, (McCluney), by arrangement

**G133. Masterworks of German Literature**—Reading, interpretation of outstanding dramas, novels, short stories written between 1890 and 1918. Prerequisite: G23 or G53.

3 or 4 units, spring, (McCluney), by arrangement

**G134. Masterworks of German Literature**—Reading, interpretation of outstanding dramas, novels, short stories written since 1918. Prerequisite: G23 or G53.

3 or 4 units, autumn, (Boeninger), MWF 10

**G142. The German Novelle**—Reading, discussion of representative Novellen of nineteenth, twentieth centuries. Prerequisite: G23 or G53.

3 units, (McCluney), alternate years, to be given in 1959–60

**G144. Goethes Dramen.**

3 units, winter, (Reinhardt), MWF 3

**G146. Goethes Faust.**

4 units, winter, (Blauth), MTWTh 11

**G150. Schiller.**

4 units, (Reinhardt), alternate years, to be given in 1959–60

**G158. Die deutsche Lyrik.**

3 units, autumn, (Reinhardt), MWF 3
ADVANCED AND GRADUATE COURSES

G180. The Dramas of Kleist, Grillparzer, and Hebbel.
3 units, spring, (McCluney), MWF 11

G181. Der Roman seit 1918.
4 units, (Strothmann), alternate years, to be given in 1959-60

G183. Rilke—An introductory study of Rilke’s major works in prose and poetry.
2 units, (Schuelke), alternate years, to be given in 1959-60

G187. Hauptmann and Hofmannsthall.
4 units, (Boeninger), alternate years, to be given in 1959-60

G195. Moderne Lyrik—The importance of lyric poetry in German literature. A study of contemporary authors.
2 units, (Schuelke), alternate years, to be given in 1959-60

G199. Individual Work—Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit. Open only to majors in German.
1 to 3 units, each quarter, (Staff), by arrangement

GRADUATE COURSES IN GERMAN AND GERMAN LITERATURE

G201. Advanced Composition and Grammar—Prerequisite: qualifying examination.
2 units, (Boeninger), alternate years, to be given in 1959-60

3 units, autumn, (Blauth), by arrangement

G211. Deutsche Literatur- und Kulturgeschichte I—(Von den Anfängen bis zur Reformation.)
4 units, (Schuelke), alternate years, to be given in 1959-60

G212. Deutsche Literatur- und Kulturgeschichte II—(Von der Reformation bis zu Goethes Tod.)
4 units, (Blauth), alternate years, to be given in 1959-60

G213. Deutsche Literatur- und Kulturgeschichte III—(Romantik und Realismus.)
4 units, autumn, (Reinhardt), MTWTh 11

G214. Deutsche Literatur- und Kulturgeschichte IV—(Vom Naturalismus bis zur Gegenwart.)
4 units, spring, (Boeninger), MTWTh 3

G222. Bibliographie der Literaturgeschichte.
2 units, winter, (Staff), by arrangement

G230. Die Methodenlehre der Literaturwissenschaft—New approaches to literary criticism (Dilthey, Rickert, Nadler, Jung, Strich, Walzel, Gundolf, Pongs, etc.)
2 units, (Reinhardt), alternate years, to be given in 1959-60

G250. Graduate Seminar—Subject to be announced in Time Schedule.
2 units, winter, (Reinhardt), by arrangement
or spring, (Reinhardt), by arrangement

G251. Graduate Seminar.
2 units, spring, (Blauth), by arrangement

G299. Individual Work—Exclusively for graduate students in German working on thesis or engaged in special work.
1 to 12 units, each quarter, (Staff), by arrangement

Note: Additional courses are listed under L. Linguistics and Philology.
IT. ITALIAN

Note: Students registering for the first time in a first- or second-year course must take a placement test if they have had any training in Italian before entering Stanford.

It1. First-Year Italian.
   4 units, autumn, (Sangiorgi), MTWF 1

It2. First-Year Italian—Continuation of It1.
   4 units, winter, (Sangiorgi), MTWTh 1

It3. First-Year Italian—Continuation of It2.
   4 units, spring, (Sangiorgi), MTWTh 1

It5. Elementary Italian—Accelerated course for beginners, particularly for those seeking to fulfill University requirement for Ph.D. degree. Open to senior, graduate students only.
   4 units, spring, (Meadows), MTWF 4

It22. Second-Year Reading—Prerequisite: It3.
   3 units, autumn, (Sangiorgi), MWF 11

It23. Second-Year Reading—Continuation of It22.
   3 units, winter, (Sangiorgi), MWF 11

It99. Individual Reading—Prerequisite: It23. Enrollment only by special permission of Department. Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit.
   1 or 2 units, each quarter, (Sangiorgi), by arrangement

It111. Italian Composition and Conversation.
   2 units, autumn, (Sangiorgi), TTh 11

It112. Italian Composition and Conversation—Continuation of It111.
   2 units, winter, (Sangiorgi), TTh 11

It151. Dante, La Divina Commedia—Study, interpretation.
   4 units, autumn, (Sangiorgi), MTWTh 3

It152. Dante, La Divina Commedia—Continuation of It151.
   4 units, winter, (Sangiorgi), MTWTh 3

It162. Humanism and Renaissance—History of Italian literature, civilization during fifteenth and sixteenth centuries. Influence of Italian Renaissance in Europe.
   3 units, (Sangiorgi), alternate years, to be given in 1959-60

It163. Classicism and Romanticism—Various aspects of Italian classicism, romanticism in nineteenth century.
   3 units, spring, (Sangiorgi), MWF 3

It165. Modern Italian Drama—Italian drama, Goldoni to present. Lectures, reports.
   3 units, (Sangiorgi), alternate years, to be given in 1959-60

It199. Individual Work—Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit.
   1 to 3 units, each quarter, (Staff), by arrangement

It201. Advanced Composition and Grammar—Prerequisite: It112.
   3 units, spring, (Sangiorgi), by arrangement

It230. Fundamental Aspects of Italian Literature and Civilization—A study of the outstanding literary works from Dante to modern times, and their relationship to other European literatures. Lectures, readings, and discussions.
   4 units, autumn, (Sangiorgi), by arrangement

It250. Graduate Seminar—Subject announced in Time Schedule.
   2 units, spring, (Sangiorgi), by arrangement

It299. Individual Work—Exclusively for graduate students.
   1 to 3 units, each quarter, (Meadows, Sangiorgi), by arrangement
L. LINGUISTICS AND PHILOLOGY

2 units, winter, (Meadows), TTh 2

L151. History of the German Language.
2 units, winter, (Schuelke), TTh 2

L200. Introduction to Romance Philology—Principal Romance languages, their relation to Latin; phonology, morphology, syntax. Prerequisite: Working knowledge of Latin.
3 units, autumn, (Meadows), MTTh 4

L201. Old French—Elements of phonology, morphology; reading of Chanson de Roland. Prerequisite: L200.
3 units, winter, (Meadows), MWF 4

L205. Old Provençal—Reading of selected poems of the troubadours, with study of Old Provençal morphology, phonology.
3 units, spring, (Meadows), MWF 2

L207. Vulgar Latin—Phonology, morphology, syntax of Vulgar Latin, as compared to Classical Latin and as established from subsequent Romance developments. Reading of selected texts. Prerequisite: working knowledge of Classical Latin.
3 units, autumn, (Meadows), by arrangement

L211. Old Italian—Phonology, morphology of Old Italian; preliterary linguistic monuments, Sicilian School, pre-Dantean literature.
3 units, (Meadows), by arrangement

L212. Italian Dialects—Elements of phonology, morphology of leading dialects of Italy; reading of selected passages.
3 units, (Sangiorgi), by arrangement

L221. Modern Romanian—Elements of modern Romanian, phonology, morphology; designed primarily to give a reading knowledge. No prerequis-sites; not open to freshmen and sophomores.
3 units, (Meadows), alternate years, to be given in 1959–60

L222. Modern Romanian Readings—Selected readings from Creangă, Vlahuta, Eminescu, etc.
3 units, (Meadows), alternate years, to be given in 1959–60

L230. History of the Spanish Language—Growth of Spanish language from origins to present day.
3 units, (O'Connor), alternate years, to be given in 1959–60

L231. Old Spanish—Elements of phonology, morphology; reading, interpretation of Old Spanish texts. Prerequisite: L200.
3 units, spring, (O'Connor), MWF 11

L233. Spanish Historical Grammar.
3 units, winter, (Weir), by arrangement

L251. Gothic and Historical Germanic Grammar—Development of Germanic Languages; reading of selected texts from Gothic Bible.
5 units, autumn, (Schuelke), MTWThF 10

L253. Old Norse.
4 units, (Schuelke), alternate years, to be given in 1959–60

L255. Old Saxon.
2 units, winter, (Schuelke), MW 10

L257. Old High German.
2 units, winter, (Schuelke), TTh 10

L258. Middle High German.
4 units, (Schuelke), alternate years, to be given in 1959–60

4 units, autumn, (O'Connor), MTWTh 8
L270. Structural Linguistics.  
2 units, spring, (Weir), TTh 11

P. PORTUGUESE

P5. Elementary Portuguese—Intensive course primarily for social scientists, students specializing in Hispanic American literature, civilization. Cannot be taken to fulfill General Studies language requirements.  
4 units, autumn, (——), MTWTh 2

4 units, winter, (——), MTWTh 2

4 units, spring, (——), MTWTh 2

P99. Individual Reading—Prerequisite: P7. Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit.  
1 to 3 units, each quarter, (Staff), by arrangement

R. RUSSIAN

R1, R2, R3. First-Year Russian—Grammar, reading, conversation, elementary composition.  
5 units, autumn, winter, and spring, (Posin, Kliachko), MTWThF 9 or 1

R5. Intensive Russian—Equivalent to R1, 2, and 3 combined. Enrollment limited. Consent of instructor necessary.  
15 units, summer, (——), MTWThF 9-12 (10 weeks)

R21, R22, R23. Second-Year Russian—Reading, conversation, composition, review of grammar. Prerequisite: R3 or R5 or equivalent.  
5 units, autumn, winter, and spring, (Posin, Kliachko), MTWThF 1

R30. Russian Conversation—Consent of instructor.  
1 unit, winter, (Kliachko), by arrangement

R31. Scientific Russian—Social, physical, biological sciences. Consent of instructor.  
1 to 3 units, winter, (Posin), by arrangement

R101, R102, R103. Third-Year Russian—Advanced reading, conversation, composition. Prerequisite: R23 or equivalent.  
5 units, autumn, winter, and spring, (Posin, Kliachko), MTWThF 2

R121. Translation—Training in translation from Russian into English. Prerequisite: R23 or equivalent. Consent of instructor necessary.  
1 to 3 units, autumn, (Posin), by arrangement

R191. Senior Seminar—for graduating seniors in the Department.  
2 units, spring, (Posin), by arrangement

R199. Directed Reading in Russian—for advanced students who wish to prepare for specialized research in their major field of interest. Consent of instructor necessary.  
1 to 3 units, autumn and winter, (Posin), by arrangement

SP. SPANISH

FIRST- AND SECOND-YEAR COURSES

[Under the direction of Ruth H. Weir and Grace Knopp]

Note: Students registering for the first time in a first- or second-year course must take a placement test if they have had any training in Spanish before entering Stanford.

Sp1. First-Year Spanish.  
4 units, autumn, winter, or summer, (Staff)
Sp2. First-Year Spanish—Continuation of Sp1.
4 units, autumn, winter, or spring, (Staff)

4 units, any quarter, (Staff)

Sp5. Elementary Spanish—Accelerated course for beginners, particularly for those seeking to fulfill the University requirement of a reading knowledge for the Ph.D. degree. Open to senior, graduate students only.
4 units, autumn, (Schevill), MTWTh 8

Note: Students wishing to stress speaking and writing in addition to reading are advised to take Sp52 and Sp53 instead of Sp22 and Sp23.

Sp22. Second-Year Reading—Aims primarily at reading ability. Prerequisite: Sp3.
3 units, autumn, or winter, or spring, (Staff)

Sp23. Second-Year Reading—Continuation of Sp22. Reading material assigned will vary from section to section.
3 units, autumn, or winter, or spring, (Staff)

Sp24. Second-Year Grammar and Composition—Students taking Sp52 may not take this course. Prerequisite: Sp3.
3 units, autumn or winter, (Staff)

Students taking Sp53 may not take this course.
2 units, winter or spring, (Staff)

Sp27. Second-Year Conversation — Prerequisite: Sp3. Students taking Sp53 may not take this course.
2 units, autumn or winter, (Staff)

Sp28. Second-Year Conversation—Prerequisite: Sp27.
2 units, winter or spring, (Staff)

Sp52. Second-Year Spanish—Emphasizes speaking, writing in addition to reading. Reading material corresponds to that of Sp22. Grade of B in Sp3 (or equivalent) required for admission. Students electing this course may not take Sp22 and Sp24. Enrollment limited to 15.
5 units, autumn, (Rael), MTWThF 9
or winter, (Rael), MTWThF 9

Sp53. Second-Year Spanish—Continuation of Sp52. Level of reading material corresponds to that of Sp23. Students electing this course may not take Sp25 and Sp27. Prerequisite: Sp52 (or Sp22 plus Sp24). Enrollment limited to 15.
5 units, winter, (Espinosa), MTWThF 9
or winter, (Rael), MTWThF 9

Sp63. Advanced Second-Year Reading—Continuation of Sp22 or Sp52. This course concerns itself with the general development of Latin American civilization rather than with belles-lettres. It is conducted partly in Spanish. Students are normally expected to have received a grade of A, B, or C in Sp22 or Sp52.
3 units, autumn or winter, (Hilton), MWF 8

Sp99. Individual Reading—Prerequisite: Sp23 or Sp53. Enrollment only by special permission of Department. Not required for majors in Spanish.
Thirty-six hours of reading per unit, weekly conference with instructor.
1 or 2 units, summer, (Staff), by arrangement

Third- and Fourth-Year Courses

Sp100. Advanced Spanish Conversation—Prerequisite: Sp28 or equivalent. May be repeated for credit.
3 units, winter, (Schevill), MWF 11
Sp104. Spanish Dramatics—Reading, staging of a Spanish play. May be repeated for credit. Prerequisite: Permission of instructor. Tryouts for play(s) in winter quarter.
   2 or 3 units, spring, (Schevill), TTh 4-6
Sp107. The Spanish Film and Advanced Oral Practice in Spanish.
   2 units, summer, (Hilton), Th 7-10 p.m., and by arrangement
Sp110. Spanish Pronunciation—Prerequisite: Sp22.
   3 units, autumn, (O'Connor), TTh 11, and by arrangement
Sp111. Third-Year Spanish Grammar and Composition—Prerequisite: Sp53 or equivalent.
   3 units, autumn, (Knopp, Rael), MWF 8 or 10
Sp112. Third-Year Spanish Grammar and Composition—Prerequisite: Sp11 or equivalent.
   2 units, winter, (Rael), TTh 8 or 10
Sp113. Third-Year Spanish Grammar and Composition—Continuation of Sp112.
   2 units, spring, (Rael), TTh 8 or 9
Sp120. Hispanic American Cultural Readings—Training in careful reading of books with significant cultural content. Prerequisite: Sp23. May be repeated for credit.
   3 or 4 units, autumn, or winter, or spring, (Hilton), MWF 10, and by arrangement
Sp131. Masterworks of Spanish Literature I—From its origins to end of fifteenth century. Prerequisite: Sp23 or equivalent.
   3 or 4 units, (Espinosa), alternate years, to be given in 1959-60
Sp132. Masterworks of Spanish Literature II—Sixteenth and seventeenth centuries. Prerequisite: Sp23 or equivalent.
   3 or 4 units, spring, (Espinosa), MWF 11
Sp133. Masterworks of Spanish Literature III—From 1700 to 1898. Prerequisite: Sp23 or equivalent.
   3 or 4 units, (Linsalata), alternate years, to be given in 1959-60
Sp134. Modern and Contemporary Spanish Literature—Prerequisite: Sp23 or equivalent.
   3 or 4 units, (Schevill), MWF 10
Sp142. The Spanish Novel of the Nineteenth Century.
   3 or 4 units, autumn, (Linsalata), MWF 10
Sp143. The Spanish Romantic Drama.
   3 or 4 units, (Linsalata), alternate years, to be given in 1959-60
Sp150. Introduction to Spanish-American Literature.
   3 or 4 units, summer, (Hilton)
Sp151. Spanish-American Literature I—General introduction to Spanish-American Colonial literature; literature of Cuba, Venezuela. Prerequisite: Sp23 or equivalent.
   3 or 4 units, autumn, (Rael), MWF 8
Sp152. Spanish-American Literature II—Literature of Bolivia, Chile, Colombia, Ecuador, Peru. Prerequisite: Sp23 or equivalent.
   3 or 4 units, winter, (Rael), MWF 8
Sp153. Spanish-American Literature III—Literatures, cultural history of Argentina, Uruguay. Prerequisite: Sp23 or equivalent.
   3 or 4 units, (Rael), alternate years, to be given in 1959-60
Sp154. Spanish-American Literature IV—Cultural history of Mexico, representative writers. Prerequisite: Sp23 or equivalent.
   3 or 4 units, (Rael), alternate years, to be given in 1959-60
Sp162. El pensamiento hispanoamericano—La cultura hispanoamericana interpretada por sus escritores.
   3 units, (Hilton), alternate years, to be given in 1959-60
Spl99. Individual Work—Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit. Open only to majors in Spanish.

1 to 3 units, summer, (Staff), by arrangement

Note: For other courses see under Hispanic American Studies.

GRADUATE COURSES IN SPANISH AND SPANISH LITERATURE

Sp201. Advanced Composition and Grammar—Translation of connected English prose into Spanish; original compositions; dictation. Prerequisite: qualifying examination.
3 units, autumn, (Schevill), MWF 3

3 units, winter, (Schevill), MWF 3

Sp211. History of Spanish Literature and Civilization I—From the origins to 1500.
3 or 4 units, (Espinosa), alternate years, to be given in 1959–60

Sp212. History of Spanish Literature and Civilization II—Sixteenth and seventeenth centuries.
3 or 4 units, autumn, (Espinosa), MWF 11

Sp213. History of Spanish Literature and Civilization III—From 1700 to 1898.
3 or 4 units, winter, (Espinosa), MWF 11

Sp214. History of Spanish Literature and Civilization IV—From 1898 to present.
3 or 4 units, (Schevill), alternate years, to be given in 1959–60

Sp217. Spanish Drama of the Golden Age.
4 units, winter, (Linsalata), MTThF 8

Sp220. Cervantes.
3 or 4 units, (Linsalata), alternate years, to be given in 1959–60

2 units, (Rael), alternate years, to be given in 1959–60

Sp226. The Modernist Movement in Spanish America—Selections from the best poets of this movement; their influence on subsequent writers.
3 or 4 units, spring, (Rael), MWF 8

Sp250. Graduate Seminar—Subject announced in Time Schedule.
2 units, spring, (Espinosa), by arrangement

Sp299. Individual Work—Exclusively for graduate students in Spanish working on thesis or engaged in special work.
1 to 12 units, any quarter, (Staff), by arrangement

Note: For other courses see under Hispanic American Studies.

T. TEACHER TRAINING

T400. Seminar in the Use of a Language Laboratory.
1 to 2 units, summer, (Weir), TTh 1 and by arrangement

TF199. Practice Teaching in French in the Elementary Schools—May be taken for six quarters. Prerequisites: Fr54 or equivalent.
1 unit, any quarter, (Schevill, Weir), by arrangement

TG199. Practice Teaching in German in the Elementary Schools—May be taken for six quarters. Prerequisite: G54 or equivalent.
1 unit, any quarter, (Schevill, Weir), by arrangement

TS199. Practice Teaching in Spanish in the Elementary Schools—May be taken for six quarters. Prerequisite: Sp53 or equivalent.
1 unit, any quarter, (Schevill, Weir), by arrangement
   4 units, summer, (Staff), MTWThF 8

   4 units, summer, (Staff), MTWThF 9

   2 units, summer, (Staff), MWF 9

TS300. Seminar in the Development of Instructional Materials.
   4 units, summer, (Staff), MWF 2-4

See also Senior Colloquia.

MUSIC

Emeritus: Warren Dwight Allen (Professor)

Executive Head: William Loran Crosten
Associate Professor: Herbert Boswell Nanney
Assistant Professor: ———, Acting: Leland C. Smith
Instructor and Music Librarian: Edward Eugene Colby
Lecturer in Piano: Earle Blew
Lecturer in Violoncello: Jean M. Maguire
Lecturer in Voice: Ivan Burdette Rasmussen
Director of Bands: Julius Edward Shuchat

OFFERINGS AND FACILITIES

The Department's aims are to promote understanding and enjoyment of music in the University at large and to provide specialized training for those who plan careers in music as teachers, composers, performers, or research scholars.

Excellent facilities for practice are available in Stanford's new Music Building, which also includes a well-equipped modern theater for concert and operatic productions.

The Departmental library contains a comprehensive collection of complete editions, scores, books, and records. Supplementing this is the Stanford Memorial Library of Music, which is an invaluable collection of musical manuscripts and first editions.

DEGREES

Bachelor of Arts

The following Departmental courses and performance are required in addition to the University's basic requirements for the Bachelor's degree:

I. Theory of Music: 11, 21, 22, 23, 24, 26, 121, 122, 126
   (Note: Secondary Credential candidates are excused from taking Music 126)

II. Music History: 100, 101, 102, 103, 104, 105

III. Musical Performance:
a) All students are required to demonstrate a minimum proficiency in piano which will include sight-reading as well as playing two prepared pieces on the order of an easier Chopin Prelude or a Clementi Sonatina. This requirement should be fulfilled as early as possible and not later than the beginning of the junior year.

b) Ensemble: At least six quarters of work elected from courses 160, 161, 162, 163, 165, and 171.

Music majors will be expected to maintain a grade-point average of at least 2.0 in music classes excluding performance activities.

An Honors Program in Humanities is offered for undergraduate majors in this Department who wish to supplement their Departmental major by a related and carefully guided program of studies. See Humanities (Special Programs) for a description of the Honors Program.

**Teachers' Credentials**

Students in the Department may work for the Stanford General Secondary Credential with a teaching major in music. This credential requires completion of the A.B. degree and one year of graduate work.

The student is admitted to the program at first on a provisional basis. After completing one year of study, he will appear before a Music faculty committee for Departmental certification of his candidacy. Candidates will be selected on the basis of their academic attainments and personal aptitude for the teaching profession.

Following are the course requirements:

- **General Studies**: As specified by the University
- **Music Theory**: 11, 21, 22, 23, 24, 26, 121, 122, 127
- **Music History**: 100, 101, 102, 103, 164, 105
- **Piano**: Sufficient to pass the piano proficiency test
- **Voice Class**: Music 83a, b, c (3 units)
- **Instrumental Classes**: Music 84, 85, 86 (3-5 units)
- **Conducting**: Music 130, 131 (9 units)
- **Ensemble**: 6 units
- **Music 181a, b, c**: Curriculum and Instruction in Secondary School Music.
- **Teaching minor**: Units vary according to the subject; the average is 30 units.
- **Courses in the School of Education**: 32 units.
- **Proficiency examinations** must be taken in piano, voice and conducting.

**Master of Arts**

The University's basic requirements for the Master's degree (residence, admission to candidacy, etc.) are discussed in the section "Degrees" in this Bulletin. The following are Departmental requirements:

To attain graduate standing in Music, students must have completed the equivalent of the Department's requirements for Bachelor of Arts degree, which includes the ability to play the piano with moderate facility. Deficiencies must be made up even though the applicant holds an A.B. degree. A placement examination will be given each student prior to his initial registration in order to determine the character and scope of his previous training and to serve as a guide in planning a program of study.

Each candidate must complete a program of 40 units based on the graduate courses offered by the Department. The distribution of work, as indicated below, will vary according to the concentration that is selected.
I. Concentration in Musical Research:

Music 200—Music Bibliography (3 units)
Music 221—Readings in Music Theory (3 units)
Music 226—Fugue (3 units)
Music 240—Seminar in Music History (two quarters, 8 units)
Music 241—Master of Arts Project in Musical Research (4 units)
Electives (19 units)

Foreign language—Demonstrate a reading knowledge of French, German, or Italian, and a comprehension of the principal musical terms encountered in one of these languages. This test will be given at the same time as the placement examination.

II. Concentration in Composition:

Music 200—Music Bibliography (3 units)
Music 221—Readings in Music Theory (3 units)
Music 223—Seminar in Composition (two quarters, 6 units)
Music 226—Fugue (3 units)
Music 240—Seminar in Music History (4 units)
Music 250—Master of Arts Project in Composition (4 units)
Electives (17 units)

Foreign language—Same as under concentration in musical research

III. Concentration in Music Education:

Three advanced courses in music history and theory (9–12 units)
Music 230 or 231—Advanced Conducting (3 units)
Music 282—Seminar in the Teaching of Music (4 units)
Music 283—Master of Arts Project in Music Education (4 units)
Electives (15–18 units)

No foreign language requirement

Doctor of Education

In co-operation with the School of Education the Department offers work leading to the Doctor of Education degree with a concentration in music education. Students in this program normally will take about one-third of their work in Education and two-thirds in Music.

Doctor of Philosophy

A limited number of students with superior qualifications are accepted by the Department for work toward the Ph.D. degree in music.

General University regulations regarding this degree are discussed in the section "Degrees" in this Bulletin. The following are departmental requirements:

An applicant for admission should possess a well-rounded education as well as sound basic training in the theory and analysis, the history, and the performance of music. Prior to his initial registration the student will be given a placement test in those fields. He should also be prepared at that time to demonstrate a reading knowledge of French or German and a moderate proficiency on the piano.

Residence—The candidate must spend at least three consecutive quarters beyond the first year of graduate study as a registered student at Stanford, and must devote at least one full quarter in residence to work on his dissertation.

Basic requirements—In addition to his doctoral dissertation, each candidate must complete approximately 90 units of study beyond the Bachelor's degree. The program will include work under the following headings;
(1) music bibliography, (2) musical notation, (3) history of music theory, (4) advanced practical studies in music theory or composition, (5) studies in musical performance, (6) historical studies in musical style and aesthetics, (7) humanistic studies totaling 24 units outside the Department of Music.

Specialisation—As soon as feasible the candidate will select the field of study in which he proposes to do independent research leading ultimately to the writing of a dissertation. Considering the interests of the faculty and the resources of the Stanford Library, doctoral concentrations generally will be confined within the period from the Renaissance to the present day.

Foreign language requirements—A reading knowledge of French and German plus any other language necessary to research in the candidate’s field of specialization.

Departmental examinations—(1) An oral advisory examination will be given toward the end of the student’s first year of doctoral study, to explore the strengths and weaknesses of his preparation; (2) a qualifying examination will be taken upon completion of the formal course requirements for the degree. This will be in four parts, dealing with systematic and historical aspects of musical composition, music theory and notation, performance practice, and musical aesthetics.

COURSES

FOR THE GENERAL STUDENT

Any of the following courses may be used as partial fulfillment of the Humanities requirement in the General Studies Program:

1. Introduction to Music—Musical expression, style, structure explained, illustrated for the listener. No prerequisites.
   3 units, any quarter, (Staff)

2. Symphony—Selected symphonic works from Classic, Romantic, Modern repertories. Prerequisite: Music 1 or equivalent.
   3 units, (Salgo)

3. Opera—Opera as a musico-dramatic form; examples from Mozart to present. Prerequisite: Music 1 or equivalent.
   3 units, (Crosten)

7. Concerto—Selected concertos, seventeenth century to present. Prerequisite: Music 1 or equivalent.
   3 units, (Salgo)

MUSIC THEORY AND COMPOSITION

11a, b. Music Listening and Reading Skills—Sight-reading, ear-training, dictation dealing with rhythm, intervals, scales, notation. No prerequisites.
   3 units, autumn, winter, (Rasmussen); winter, spring, (Smith)

21, 22. Elementary Harmony—Basic rhythmic, harmonic materials; relation of rhythm, harmony to musical form. Written exercises, analysis, ear-training, keyboard drill dealing with procedures based on classic style. Prerequisite: 11 or permission of instructor.
   4 units, autumn, winter, (Smith); winter, spring, (Nanney)

   4 units, autumn, winter, (Nanney)

26. Tonal Counterpoint—Study of polyphony based on eighteenth century harmonic practice leading to writing of simple inventions. Prerequisite: 22.
   4 units, spring, (Smith)
3 units, autumn, winter, (Ratner)

123. Composition—Individual projects in creative work. May be repeated for credit. Prerequisites: 122 and permission of instructor.
3 units, any quarter, (Smith)

126. Advanced Counterpoint—Prerequisites: 24 and 26.
3 units, spring, (Ratner)

127. Orchestration—Prerequisite: 24 or equivalent.
3 units, autumn, (Smith)

221. Readings in Music Theory.
3 units, winter, (Ratner)

223. Seminar in Composition—May be repeated for credit.
3 units, any quarter, (Ratner, Smith)

226. Fugue—Prerequisite: 126.
3 units, autumn, (Smith)

250. Master of Arts Project in Composition.
4 units, any quarter, (Ratner, Smith)

**HISTORY AND LITERATURE OF MUSIC**

Unless otherwise stated, prerequisite for any course in this section is Music 22 or equivalent.

100. Medieval and Renaissance Music.
3 units, autumn, (Schmidt)

3 units, winter, (Schmidt)

102. Music of the Classic Period.
3 units, spring, (Ratner)

3 units, autumn, (Nanney)

104. Music of the Modern Period.
3 units, winter, (Ratner)

105. Aesthetics and Criticism of Music—Prerequisites: 100 through 104.
3 units, spring, (Crosten)

4 units, (——)

142. The String Quartets of Beethoven—Prerequisite: 102.
4 units, (Ratner)

150. Comparative Studies in Opera.
4 units, (Crosten)

4 units, (Schmidt)

199. Individual Work—For advanced undergraduates who wish to do work in fields not covered by regular curriculum. Projects for study must be specific and must be submitted for faculty approval before registration in the course. Credit not to exceed 4 units per quarter.
Any quarter, (Staff), by arrangement

240. Seminar in Music History—Historical studies in musical style, aesthetics. May be repeated for total of 8 units.
4 units, autumn, winter, (Crosten, Ratner)

**The Nature of Music**—See Graduate Division Special Programs 313.

**Physical Basis of Music**—See Graduate Division Special Programs 375.
12. **Introductory Piano.**
   1 unit, autumn, winter, spring, (Blew, ———)

72, 172. **Vocal and Instrumental Instruction.**
   1 unit, autumn, winter, spring
   72a, 172a. Piano, (Blew)
   72b, 172b. Violin, (Salgo)
   72c, 172c. Viola, (Salgo)
   72d, 172d. Violoncello, (Maguire)
   72f, 172f. Harpsichord, (Aldrich), to be given in 1959-60
   72g, 172g. Organ, (Nanney)
   72h, 172h. Voice, (Rasmussen)

Note: A special fee of $40 per quarter is charged for enrollment in Music 12
or in any branch of 72 or 172.

170. **Studies in Performance Practice**—Individual projects concerned with
realization of style concepts in performance.
   2 units, any quarter, (Staff)

130a, b. **Orchestral Conducting.**
   3 units, (Salgo), to be given in 1959-60

131a, b. **Choral Conducting.**
   3 units, autumn, winter, (Schmidt)

230. **Advanced Orchestral Conducting.**
   3 units, (Salgo)

231. **Advanced Choral Conducting.**
   3 units, (Schmidt)

**ENSEMBLE**

All courses listed in this section may be repeated for credit, with a maximum
of 24 units allowed toward graduation. Membership in these organizations
is not limited to students who register in the courses for credit, and unless
otherwise stated, is open to both men and women. An audition, however, is
required for admission to any University musical organization. Audition
schedules will be announced in advance of each registration period.

160. **University Orchestra.**
   1 unit, autumn, winter, spring, (Salgo), MTh 7:15 p.m.

161. **University Band**—Autumn: marching band open only to men. Winter,
spring: concert band open to both men, women.
   1 unit, autumn, winter, spring, (Shuchat), TTh 7:15 p.m.

162. **University Chorus.**
   1 unit, autumn, winter, spring, (Schmidt), M 4-5:30, W 7-8:30 p.m.

163. **University Choir**—Official choir of Memorial Church, which furnishes
music for Sunday services, special occasions in Church calendar. Eight mem-
bers chosen by audition may receive an honorarium for performing duties other
than those of regular Choir.
   2 units, any quarter, (Schmidt), T 5-5:45, Th 7-8:30 p.m., Sunday 10-12 a.m.

165. **Stanford Chorale**—Small vocal ensemble specializing in performance
of Renaissance, contemporary music.
   1 unit, autumn, winter, spring, (Schmidt)

171. **Chamber Music**—Open to any student with sufficient technical ability
to play in combinations for strings, wind instruments, piano.
   1 unit, autumn, winter, spring, (Salgo)
SCHOOL OF HUMANITIES AND SCIENCES

**Music Education**

80. **Musicianship for Elementary Teachers.**
   2 units, winter, (---), MW1

83. **Voice Class—Given in two sections.**
   I, for Secondary Credential candidates.
   1 unit, autumn, winter, spring, (Rasmussen)
   II, for Elementary Credential candidates.
   1 unit, winter, spring, (Rasmussen)

84, 85, 86. **Instrumental Classes for Secondary Credential Candidates.**
   84a, b. **Strings.**
   1 unit, autumn, to be given in 1959-60
   85a, b. **Woodwinds.**
   1 unit, autumn, (Shuchat)
   86a, b. **Brass and Percussion.**
   1 unit, winter, spring, (Shuchat)

88. **Teaching Music in the Elementary School.**
   3 units, spring, (---)

181a, b, c. **Curriculum and Instruction in Secondary School Music.**
   3 units, autumn, winter, spring, (---)

282. **Seminar in the Teaching of Music.**
   4 units, (Crosten)

283. **Master of Arts Project in Music Education.**
   4 units, any quarter, (---)

381. **Doctoral Research in Music Education.**
   Any quarter, (---), by arrangement

**Musical Research**

200. **Music Bibliography — Use of bibliographical materials in graduate study; introduction to methods of research.**
   3 units, autumn, (Colby)

241. **Master of Arts Project in Musical Research.**
   4 units, any quarter, (Staff)

300a, b, c. **Seminar in Musical Notation.**
   4 units, autumn, winter, spring, (Aldrich), to be given in 1959-60

302. **Doctoral Research in Musicology.**
   Autumn, winter, spring, (Crosten, Rainer), by arrangement

**PHILOSOPHY**

*Executive Head:* John David Goheen
*Professors:* John David Goheen, John Leland Mothershead, Jr., Philip Hamilton Rhinelander
*Associate Professors:* Donald Davidson (on leave 1958-59), Arnold Isenberg, Patrick Suppes
*Associate Professor of Humanities and Philosophy:* Jeffery Smith
*Assistant Professor of Philosophy and Chinese:* ---
*Instructors:* Montgomery T. Furth, William W. Tait

**OFFERINGS AND FACILITIES**

Courses in philosophy give the student a knowledge of major philosophical ideas as they have developed historically and in terms of their contemporary analysis. The historical courses listed below emphasize change and develop-
ment of philosophical ideas over a period of time, whether in the form of a widespread movement or the intellectual history of an individual philosopher. Other courses, such as those in systematic philosophy (cf. the listing which follows), or, in some instances, in the single work of a philosopher, emphasize the analysis, clarification, and elaboration of ideas. In recognition of the fact that philosophy gains significance as it draws from and contributes to other fields of human interest and knowledge, the programs of all philosophy majors will be planned to include courses outside the Department.

The Philosophy Building contains an excellent working library for the use of students and faculty. Several Philosophy Colloquia are held during the academic year at which students, faculty, and distinguished visitors present papers that are informally discussed.

DEPARTMENTAL SCHOLARSHIPS

A number of scholarships for undergraduate majors in Philosophy and several fellowships and teaching assistantships for graduate students in Philosophy are available. In addition to general university scholarships, undergraduate majors in the Department may apply for tuition scholarships available from the Crossett fund. For graduate students in philosophy the Weiss and Locke funds supplement the scholarship funds available to graduate students generally.

DEGREES

Bachelor of Arts

The following Departmental requirements are in addition to the University's basic requirements for the Bachelor's degree:

The major program shall consist of a minimum of 60 units, 40 units of which shall be within the Department and, at least, 15 units outside the Department. It is quite possible that courses meeting some of the general studies requirements may also meet some of the Departmental requirements. Majors in philosophy must maintain at least a C average in their work in the Department.

All majors shall take Philosophy 1, 2 or 5, 100, and 102. Consult Department concerning special seminars in the history of philosophy which all majors are urged to take in place of Philosophy 100 and 102. All majors shall elect some field of emphasis within philosophy and the remaining 22 to 27 required units in philosophy and the 15 to 20 required units to be taken outside the Department shall be planned in consultation with Departmental advisers according to the election.

Among possible fields of emphasis are: epistemology and metaphysics, history of ideas, logic and the philosophy of science, and theory of value. Sample programs of philosophy courses in each of these fields follow. In each case the courses listed are in addition to the courses required of all majors, and it is understood that the required courses outside the Department are to be elected only on the advice of a Departmental adviser.

Epistemology and Metaphysics: Philosophy 184; and three of the following: 105, 121, 145, 147, 160, 161, 164, 182, 189, 202, 204; at least one of these courses to be drawn from the group 160, 161, 164, 202, 204.

History of Philosophy: Philosophy 101, 104, and 105, a course in a period such as 121, 124 and 127, and a course in a single philosopher who falls into the period of concentration (see courses numbered 135-152).

Logic and the Philosophy of Science: Philosophy 160, 161, 164, and two courses from either of the following groups: (a) 184, 201, 202, 205, 211; (b) 184, 201, 202, 204, 205.

Theory of Value: Philosophy 170, 172, 174 and two of the following: 178, 180, 192.
ADMISSION TO GRADUATE STUDY

All students contemplating application for graduate study in philosophy at Stanford are requested to take, in their senior year or later, the Graduate Record Aptitude Test and the Graduate Record Advanced Test in Philosophy.

Master of Arts

The University's basic requirements for the Master's degree are discussed in the section "Degrees" in this Bulletin. The following are Departmental requirements:

The candidate for the Master's degree must have completed as an undergraduate or take as a graduate the following courses or their equivalents:

a) Epistemology: one of the following: 182, 184, 202
b) History of Philosophy: 100, 101, 102, 104
c) Logic and the Philosophy of Science: one of the following: 160, 161, 164
d) Theory of Value: 170

A maximum of 9 units credit will be allowed for work on the thesis. The candidate will normally be expected to complete a total of at least 45 units, of which 40 units must be within the Department, including the units granted for work on the thesis.

Minor in Philosophy for the Degree of Doctor of Philosophy

Each student shall take 30 units of work within the Department to be chosen according to the student's interests in consultation with a Departmental adviser. One hour of the doctoral oral examination is ordinarily devoted to the minor subject.

Doctor of Philosophy

The University's basic requirements for the doctorate are described in the section "Degrees" in this Bulletin. The following are Departmental requirements: To be acceptable to the Department as a candidate for the doctoral degree the student must pass written examinations in the following fields: Ethics and Theory of Value; Epistemology and Metaphysics; the History of Philosophy; and Logic and the Philosophy of Science. These examinations of four hours each must be taken and passed as a group. No student shall be permitted to take the examinations more than three times. Upon passing the written examinations the candidate will be assigned to a member of the faculty for direction in research and the writing of the dissertation.

Depending upon their backgrounds, students intending to pursue the Ph.D. degree will be given advice by members of the Department with regard to course work and reading in preparation for the preliminary examinations. Reading lists helpful to the candidate in preparing for preliminary examinations are available.

Candidates for advanced degrees in philosophy who have already obtained an advanced degree in another academic subject may, under certain circumstances, be permitted to waive some of the requirements for the Ph.D. degree in philosophy mentioned above. For details consult the Department.

Honors Program in Philosophy

Qualified seniors majoring in philosophy may apply to participate in an Honors Program in Philosophy. If accepted, the student will write a senior essay under the guidance of a member of the Department. In order to provide time for the essay and the guided reading connected with it, the candidate may, if he chooses, register for as many as 9 units of honors work (Philosophy 198)
during his senior year. These units may be counted toward the requirements for graduation in philosophy.

Honors Program in Humanities.

An Honors Program in Humanities is offered for philosophy majors who wish to supplement their Departmental work for the A.B. degree by a related carefully guided program of studies. See the section “Humanities (Special Programs)” for a description of the Honors Program.

Honors Program in Behavioral Sciences

Philosophy majors with a central interest in methodological problems may participate in an Interdepartmental Program in Quantitative Methods in the Behavioral Sciences. See the section “Behavioral Sciences (Honors Program) in Quantitative Methods” for a description.

Graduate Program in Humanities

The Department of Philosophy also participates in the Graduate Program in Humanities leading to the Ph.D. degree. For a description of that program, and fellowships offered in connection with it, see the section “Humanities (Special Programs).”

COURSES

Elementary

1. Introduction to Logic—An introduction to the methods and principles of formal logic. Exploration of modern techniques of deduction. Applications to philosophy and the exact sciences. (Graduate students should enroll in 157.)

   5 units, autumn, (Tait, Suppes), MTWTh 9 or 1, and Th or F section
   or winter, (———), MTWTh 11 and Th or F section
   or spring, (Tait), MTWTh 11 and Th or F section

2. Introduction to Ethics—An introduction to the study of human values, the grounds of reasonable choice and standards of right and wrong. Problems of ethics will be examined in light of materials drawn from such fields as psychology, sociology, politics, as well as from works of philosophers.

   5 units, winter, (Furth), spring, (Isenberg), MTWTh 1 and Th or F section

3. Introduction to Critical Thinking—Analysis and criticism of thought, its presuppositions, methods and its objectives. Problems of meaning, validity and truth are viewed as central and practical applications are stressed. Illustrative materials are drawn chiefly from humanities, social sciences, everyday life. Primarily for freshmen, sophomores; no prerequisite.

   4 units, (———), MTWTh, three lectures and one hour discussion

4. Introduction to Chinese and Indian Philosophy—Some basic features of Chinese, Indian philosophical traditions; comparison of selected philosophers and their views with Western counterparts.

   4 units, autumn, (———), MTWTh 2

5. Introduction to Philosophy—Principal problems with which philosophy deals. Emphasis on conflicts in points of view which result from attempts to deal with these problems, and on practical consequences of various solutions offered. Prerequisite: sophomore standing (third quarter freshmen with good records may be admitted).

   5 units, autumn, (Mothershead), MTWThF 10
   or winter, (Goheen), MTWTh 10 and Th or F section
   or summer, (———), MTWThF 10 and one hour by arrangement

6. Problems of Good and Evil—Problem posed in Book of Job is taken as
central. Various attitudes toward this problem considered, including those of
the Greek tragedians, Plato, Stoics and Epicureans, New Testament, Pope,
Hume, Marx, J. S. Mill, Dostoevsky, William James.

4 units, winter, (Rhinelander), TWTh 11 and F section

8. Philosophy of Art—Nature and function of artistic creation and expres-
sion. Unique and common characteristics of various arts. Relation of arts to
other human interests.

4 units, spring, (Smith), MTWTh 9

9. Philosophy in the World Today—A study and analysis of some of the
principal philosophies current in the world today. Lectures will discuss a
number of contrasting philosophies such as Existentialism, Marxism, Idealism
(both Asian and Western), Empiricism.

3 units, spring, (Goheen), MWF 10

Advanced

I. History of Philosophy from Ancient Times to the Present

One elementary course in philosophy is the general prerequisite for advanced
courses. Additional prerequisites are stipulated where necessary.

100. Greek Philosophy—Characterization of historical situation in which
Western science and philosophy began. Rise of critical thought. Early meta-
physical speculation. Sophists and Socrates. Post-Socratic ethical schools.
Philosophies of Plato, Aristotle.

4 units, autumn, (Mothershead), MTWTh 11

101. Hellenistic, Mediaeval and Renaissance Philosophy—Stoics, Epi-

cureans, Skeptics. Neo-Platonism and the struggle of Greek philosophy and
Christianity. St. Augustine and early Christian philosophy. Early mediaeval
thought. St. Thomas Aquinas and the rise of scholasticism in thirteenth cen-
tury. William of Occam and the nominalist attack on scholasticism. Philosophic
thought in the Renaissance. Prerequisite: 100 or equivalent.

4 units, winter, (Mothershead), MTWTh 11

102. Modern Philosophy—Francis Bacon and the new scientific empiricism.
Materialism of Thomas Hobbes. Philosophic systems of Descartes, Spinoza,
Leibniz. Locke, Berkeley, Hume and the philosophy of the Enlightenment.
Philosophy of Immanuel Kant. Prerequisite: a total of two philosophy
courses; 101 is recommended.

4 units, spring, (Furth), MTWTh 11

103. Philosophy in the Nineteenth and Early Twentieth Centuries—
Trends in philosophy during the period considered as a background for under-
standing of ideas influential today. Philosophers to be studied include Fichte,
Hegel, Schopenhauer, Marx and Engels, Comte, J. S. Mill, Spencer, Bradley,
Nietzsche, Bergson, James, and Dewey. Prerequisites: two philosophy courses;
102 is recommended.

4 units, winter, (Mothershead), MTWTh 9

105. Contemporary Philosophy—Some principal developments in contem-
porary philosophical thinking. Prerequisite: a total of two philosophy courses.

4 units, (———), MTWTh, to be given in 1959-60

II. Courses in the Philosophy of a Period

121. British Empiricism—Analysis of the foundations and some of the prob-
lems of British empiricism. Readings and discussions based mainly on selections
from writings of Bacon, Locke, Berkeley, Hume.

4 units, (———), MTWTh, to be given in 1959-60
124. Continental Rationalism—Critical study of methods and results of philosophic rationalism as exemplified by systems of Descartes, Spinoza, Leibniz.
   4 units, (——), to be given in 1959–60

125. Modern Chinese Thought—Major currents of thought in China from fifteenth century to present.
   4 units, spring, (——), MTWTh 8

127. American Philosophy—A study of the main currents of American philosophical thought. Some readings and lectures will concern early American thinkers, but main emphasis will be on nineteenth and twentieth century developments.
   4 units, (Goheen), MTWTh 3, to be given in 1959–60

III. Courses in Individual Philosophers or Works

135. The Philosophy of Plato—The Early and Middle Dialogues—Prerequisite: 100 or equivalent.
   4 units, (Davidson), MTWTh, to be given in 1959–60

136. The Philosophy of Plato—Later Dialogues—Prerequisite: 135 or equivalent.
   4 units, (Davidson), MTWTh, to be given in 1960–61

   3 units, autumn, (Goheen), Th 2–4 and one hour by arrangement

139. The Philosophy of Augustine—Readings in Confessions and City of God.
   4 units, (Goheen), MTWTh, to be given in 1959–60

140. The Philosophy of Aquinas—Some of the basic philosophical distinctions in the philosophy of Thomas Aquinas. Readings in Summa Theologica, Part I, will be discussed in detail.
   4 units, (Goheen), to be given in 1959–60

144. Seminar in the Philosophy of Spinoza—A study of the basic works of Spinoza.
   3 units, spring, (Rhinelander), Th 2–4 and one hour by arrangement

145. The Philosophy of David Hume—Prerequisite: 102 or equivalent.
   4 units, (——), MTWTh, to be given in 1959–60

147. The Philosophy of Kant—An analysis of Critique of Pure Reason. Prerequisite: 102 or equivalent.
   4 units, autumn, (——), MTWTh 2, to be given in 1959–60

   4 units, summer, (——), MTWThF 1

IV. Systematic Philosophy

157. Introduction to Logic—For graduate students. Lecture same as Philosophy 1.
   5 units, autumn, (Suppes, Tait), MTWTh 9 or 1 and Th or F section or winter, (——), MTWTh 11 and Th or F section or spring, (Tait), MTWTh 11 and Th or F section

160. Intermediate Logic—Development of propositional calculus and the lower functional calculus. Consideration of decision procedures, questions of consistency, completeness, and independence. Prerequisite: 1 or permission of instructor.
   4 units, winter, (Tait), MTWTh 3
161. Set Theory—Axiomatic development of general set theory. Relation of set theory to foundations of mathematics. Set operations, operations on relations, ordering relations, congruence relations, functions, ordinal numbers, transfinite induction. Philosophy 1 recommended.

3 units, winter, (Suppes), TTh 9 and one hour by arrangement

164. Philosophy of Science—Theory of models in the empirical sciences. Role of conventionalism and operationalism in scientific theory construction. Some discussion of probability, logic of measurement, and theory of rational behavior.

4 units, spring, (Suppes), MTWTh 9

168. Philosophy of History—Nature and limits of our knowledge of the past, the categories of explanation used by historians, and the aims of historical inquiry; relation of these problems to speculation about the “meaning” of history and the structure of historical process.

4 units, autumn, (Smith), MTWTh 9

170. Theory of Value—Definitions of “value”; psychological and social conditions of different values; function of value judgments; nature of standards and their role in criticism—in art, science, morals. Foundations of the normative disciplines, i.e., logic, ethics, aesthetics.

4 units, spring, (Goheen), MTWTh 2

172. Proseminar in Ethical Theory—Analysis and class discussion of selected writings in contemporary ethical theory leading to short student papers to be read and discussed in class. Prerequisite: 2 or permission of instructor.

4 units, spring, (Mothershead), MTWTh 10


4 units, autumn, (Isenberg), MTWTh 10

178. Social and Political Philosophy—Study of principal theories of state and society. Relation between individual values and social policy. Critique of logical basis of democracy. Relations between political theory and recent work in welfare economics. Political and social values in light of general theory of value. Previous course in logic or ethics recommended.

4 units, (Davidson, Suppes), MTWTh, to be given in 1959-60

179. Philosophy of Law—Enquiry into historical sources and present significance of concepts underlying some of the jural systems of the West, together with analysis of criteria proposed for validation of legal principles and relation of such criteria to a general theory of value.

3 units, (———), MWF, to be given in 1959-60

180. Philosophy of Religion—Critical enquiry into the nature and validity of religious experience, its unity and variety, its relation to other human interests.

4 units, (Smith), MTWTh 1, to be given in 1959-60

182. Metaphysics—Several typical metaphysical systems; special attention will be given to contemporary analysis of the nature of metaphysical knowledge.

4 units, winter, (Isenberg), MTWTh 1

184. Theory of Knowledge—Systematic analysis of the central problems of epistemology. Idealism, phenomenalism, pragmatism, empiricism, realism as theories of knowledge will be discussed in the light of contemporary developments.

4 units, autumn, (Furth), MTWTh 2

189. Concept of Self—This course will first, collate concepts of ego, self, and person to be found in (1) modern classical philosophers, (2) contemporary philosophy, (3) contemporary psychology; and second, give a positive
analysis of the idea of self. Readings in such authors as Hume, James, Freud, Mead.

192. Ideas in Literature—This course will explore ways in which philosophical ideas receive literary expression. Readings in such authors as Homer, Greek dramatists, Augustine, Dante, Montaigne, Marlowe, Shakespeare, Milton, Wordsworth, Hardy, Kafka, Eliot, Joyce.

194. Philosophy of Comparison—Critical examination of methods and presuppositions employed in the comparing of ideas, philosophers, and intellectual tendencies of different civilizations.

195. Seminar in Comparative Philosophy: Buddhist Phenomenalism.

198. Directed Reading for Honors.

201. Mathematical Logic—Modern results concerning incompleteness of certain formal systems; decidable and undecidable systems. (Same as Mathematics 213.) Prerequisite: 160 or equivalent.

202. Theory of Meaning—Theory of truth. Survey of positions of Frege, Quine, Church, Fitch, Carnap, Wittgenstein, Strawson, others. Analysis of belief sentences and modal sentences; Russell's theory of descriptions; problem of analyticity. Prerequisite: two courses in logic or permission of instructor.

204. Induction and the Theory of Rational Behavior—Axiomatic development of probability; survey of recent work in confirmation theory. Discussion of the traditional problem of induction in light of recent work on rational behavior in the theory of games and theory of statistical decisions. Prerequisite: 1, or permission of instructor.


240. Individual Work.


299. Advanced Seminar in Recent Philosophical Literature.

310. Philosophy of Language—Nature and uses of signs. Concepts of meaning, syntax, metaphor, ambiguity, vagueness, definition, semantics. Comparison of scientific, poetic, philosophic uses of language. Applications in the fields of
psychology, linguistics, anthropology, literary criticism. This course does not presuppose training in philosophy.

4 units, autumn, (———), MTWTh 3

See also: Colloquia: Plato's Republic, Marxist Ethics, Contemporary Philosophical Ideas; and the following courses listed under Special Programs in Humanities: 192 and 193, Senior Seminars; and 353, The Function of a University.

PHYSICAL SCIENCES (GENERAL PROGRAM)

Professor: Claudio Alvarez-Tostado
Instructor: ———

Physical Sciences Subcommittee: Claudio Alvarez-Tostado, Willis W. Harman, Leonard I. Schiff, Konrad B. Krauskopf (Chairman)

The general program in Physical Sciences is designed to give students an acquaintance with all the principal fields of physical science without requiring specialization in any one. It provides training suitable especially for students who are preparing to teach science courses in secondary schools.

DEGREES

Bachelor of Science

The following requirements are in addition to the University's basic requirements for the Bachelor's degree:

Chemistry 1, 2, 3, Mathematics 41, 42, 43, Mineral Sciences G1, G2, Physics 21, 23, 29, or equivalents.

45 additional units of work in chemistry, physics, mathematics, geology, or related fields.

A reading knowledge of a modern foreign language, preferably French or German. This will normally mean the completion of a course numbered 23 in one of the modern languages.

Programs of study must be approved by an adviser appointed by the chairman of the Physical Sciences Subcommittee. The average grade for the science and mathematics courses specified above must be at least C.

Master of Science

Candidates for the degree of Master of Science in Physical Sciences (General Program) are expected to complete, in addition to the general residence and other requirements of the University for that degree, a program of study approved by an adviser assigned by the chairman of the Physical Sciences Subcommittee. A reading knowledge of French or German is required. The program of study will include (1) an acceptable thesis; (2) the satisfactory completion of at least 30 units of advanced work in physics, chemistry, mathematics, geology, or related fields; and (3) such other advanced work in the University, making a total of at least 45 units, as may be approved by the adviser.

COURSES

1, 2, 3. Physical Science—Survey of physical sciences as an expanding field of knowledge. Lectures, demonstrations, laboratory work in astronomy, chem-
istry, physics, geology, to give a concept of the general field rather than empha-
size its divisions. Primarily for freshmen. Students who have taken Physics
21 or 51 will not be given credit for Physical Science 1; no credit will be given
for Physical Science 2 following Chemistry 1, nor for Physical Science 3 follow-
ing Geology 1.

3 units, autumn, winter, spring, (Alvarez-Tostado), TTh 8 or 9, lab. by
arrangement

50. Descriptive Astronomy — Nonmathematical course, emphasis on solar
system, comets, fixed stars, other relatively near-by systems. Especially for
students who desire only a general knowledge of astronomy. Time will be
allotted for telescopic observations.

3 units, spring, ( ), MWF 11

100. Physical Science and Modern Life—Review of important conclusions,
theories of modern physical science; discussion of methods, values, limitations
of scientific inquiry; survey of relations of science to technology, economics,
sociology, philosophy, religion. Prerequisite: Junior or senior standing, or
consent of instructor.

3 units, winter, (Krauskopf), MWF 8

140. Electron Tubes in Research—Elementary study of electron tubes, their
characteristics and application to control, measurement. Emphasis on applica-
tions, particular attention to photo tube, DC amplifier circuits. Prerequisite:
Physics 23, or equivalent.

3 units, autumn, (Alvarez-Tostado), to be given in 1959–60


Any quarter, (Staff)

PHYSICS

Emeriti: Joseph Grant Brown, David Locke Webster, (Professors)

Executive Head: Leonard Isaac Schiff

Professors: Felix Bloch, Marvin Chodorow, Edward Leonard Ginzton, Robert
Hofstadter (on leave 1958–59), Paul Harmon Kirkpatrick, George Edward
Pake, Wolfgang Kurt Herman Panofsky, Leonard, Isaac Schiff

Associate Professors: Sidney David Drell, Walter Ernst Meyerhöf

Assistant Professors: Henry Way Kendall, William Arthur Little, Charles
Leon Schwartz, Fredrik Zachariasen

Acting Assistant Professors: James Harland Burgess, Jerome Sheldon Pine

Lecturer: Edwin Thompson Jaynes

OFFERINGS AND FACILITIES

Opportunities for research are available to graduate students in the fields
of high-energy physics, nuclear physics, nuclear induction, microwave spectro-
scopy, microwaves, X-rays, biophysics, and theoretical physics.

The University subscribes to all of the important physical journals, and the
Library contains complete sets of the more important of these and of the trans-
actions and proceedings of a number of learned societies. The more important
treatises on physical subjects, in English, French, and German, and the collected papers of a number of the most eminent physicists are also in the Library.

W. W. Hansen Laboratories

The Hansen Laboratories consist of the Microwave Laboratory, directed by E. L. Ginzton, the High-Energy Physics Laboratory, directed by W. K. H. Panofsky, and the Biophysics Laboratory, directed by H. S. Kaplan. Several other members of the staff of the Department of Physics participate in the activities of the Laboratories: M. Chodorow, S. D. Drell, R. Hofstadter, E. T. Jaynes, and L. I. Schiff. The Laboratories offer facilities for research and instruction in the fields of high-energy physics, biophysics, microwave physics and engineering to suitably qualified students and staff members of the Departments of Physics and Electrical Engineering, and to others. Course listings are included with others offered by these two Departments, and research work that can lead to the degrees of Master of Science and Doctor of Philosophy is supervised by staff members of these Departments. A number of research programs are now actively under way; these deal with the properties of klystrons and related tubes, microwave-measuring techniques, electronic phenomena at very high frequencies, microspectroscopy, electron paramagnetic resonance, radiobiology, and the design, construction, and operation of very high-energy linear electron accelerators. Of particular interest to physicists is the largest electron accelerator, which provides facilities for research up to 700 Mev.

The study of physics is undertaken by three principal classes of students: those preparing for careers in professional fields such as medicine or engineering, those who wish to include physics as a part of a general education, and those preparing for teaching or research careers in physics itself. In this Department the courses numbered below 100 are planned to serve all three of these groups. The courses numbered in the 100's and 200's meet the needs of the third group and of students majoring in other branches of science.

Bachelor of Science

For the recommendation of this Department for the degree of Bachelor of Science, the minimum course requirements are completion of 51, 53, 55, 57, 61, 87, 89, 101, 102, 103, 135, 136, 137, and 11 units of chemistry. The mean grade for all physics and chemistry courses must be C or better. The foreign language requirement may be satisfied by (a) completion of 18 units of either German, French or Russian, or (b) demonstration of a reading knowledge of one of these three languages such as 18 units of instruction normally confers, or (c) completion of 12 units of each of any two of the three languages.

For the first two years the scheduling of physics and mathematics courses is rather inflexible, but in the last two years many variations in the program are possible. Two typical four-year sequences are shown below. The tabulated numbers denote quarter units. Sequence I is an intensive program for physics majors who intend to continue study toward an advanced degree. Sequence II is recommended for those who wish to pursue a broader program of study. Scheduling of other required courses and electives should be arranged in consultation with the adviser. The prudent student will plan his course at all times a few quarters ahead, or to graduation, bearing in mind the following points: first-year students must take English 1, 2, 3; they should also take a language sequence, a chemistry sequence, or History 10, 11, 12. In any case, it is desirable that the chemistry sequence be completed during the first two years. The general University requirements should be completed as early as possible.
PHYSICS

Sequence I

<table>
<thead>
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<th>Course</th>
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<th>2nd year</th>
<th>3rd year</th>
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<td>or 173, 175, 177</td>
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or 9 9 6

Sequence II

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<th>3rd year</th>
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<td>Physics 101, 102, 103</td>
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<td>Physics 135, 136, 137</td>
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<td>Physics 142</td>
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<td>Mathematics 41, 42, 43, 24</td>
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<td>Mathematics 130, 131, 132</td>
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Of the two series into which beginning courses are divided, the Twenty series (21, 23, 29) includes courses prescribed or recommended for general students and for students preparing for medicine or biology; the Fifty series (51, 53, 55, 57) includes courses for students of engineering, chemistry, geology, and physics.

The two series are similar in content and objectives. Both comprise demonstration lectures on fundamental principles of physics, problem work on application of these principles to actual cases, and laboratory experiments closely correlated with the lectures. Their objectives are not only to give information on particular subjects, but also to provide training in the use of the scientific method.

The primary difference between the two series of courses lies in the fact that topics are discussed more thoroughly and are treated with greater mathematical rigor in the Fifty series. Also, more topics are discussed in the Fifty series which comprises 18 units; the Twenty series comprises 13 units. The Twenty series presumes a working knowledge of elementary algebra and geometry. Calculus is used freely in the Fifty series which presumes completion of one quarter of Mathematics 41 or 10, plus concurrent registration in the continuation of either of these mathematics series.

Ordinarily students enrolling in the Twenty series take lecture and laboratory work concurrently. In the Fifty series one three-hour laboratory period and one two-hour period devoted to supervised problem work per week are parts of each course, except 57, which consists only of lectures with outside reading and homework problems.
The number of graduate students admitted to the Physics Department is strictly limited. Students should complete application by February 15, 1959, for the following autumn.

**Master of Science**

The University's basic requirements for the Master's degree (residence, thesis, etc.) are discussed in the section "Degrees" in this Bulletin. The following are Departmental requirements:

Each candidate for this degree will be required to pass an examination before the Department of Physics in the quarter in which he takes the degree. Suitable course work or a reading knowledge of German, French, or Russian is required. Thirty-six units of physics and mathematics are minimum unit requirements for the degree. Up to six units of transfer credit for post-B.S. work taken elsewhere may be granted at the discretion of the Department. Minimum subject matter requirements for the Master's degree include courses 111, 113, 115, 135, 136, 137, 173, 175, 185, 187, or their equivalents; if no thesis is submitted, the program must also include at least 9 units of courses above 200. A minimum grade average of B is required in the courses taken toward the Master's degree.

**Doctor of Philosophy**

The University's basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the section "Degrees" in this Bulletin. The following are Departmental requirements:

This degree may be obtained either in physics or in applied physics. The distinction is based both on the subject of the dissertation and on the program of courses pursued. A good reading knowledge of any two of the three languages, French, German, and Russian, is required for the degree of Doctor of Philosophy. Each candidate for this degree will be required to pass an examination before the Department of Physics prior to his oral examination by the committee appointed by the Dean of the Graduate Division. Minimum subject matter requirements for this degree include 111, 113, 115, 135, 136, 137, 173, 175, 185, 187, 221, 223, 225, 231, 233, 235. Candidates for this degree in applied physics must meet these course requirements with the exception of 223, 225, 233, and 235; additional course requirements will be arranged in consultation with the major professor, with the approval of the graduate study committee of the Department of Physics, and may include courses in engineering or other related fields. A minimum grade average of B during the last five quarters is required in the courses taken toward the Ph.D. degree.

All graduate students majoring in physics who have not qualified for the Departmental examinations for advanced degrees, and all graduate students minoring in physics who have not completed the minor requirements, will be required to take a comprehensive examination in physics that is given annually in the winter quarter.

Physics minors must take either Physics 111, 113, and 115 or Physics 135, 136, and 137, with the appropriate prerequisites. Physics minors should map out a program in physics in consultation with the Graduate Adviser in the Department of Physics as early as possible.

**The Teacher's Recommendation**

In its capacity as agent for the State Board of Education, the University grants credentials for teaching in California in junior and senior high schools and junior colleges. Applicants for these credentials should consult the Credential Secretary of the School of Education for details of the requirements in connection with the teaching of physics.
FELLOWSHIPS AND ASSISTANTSHIPS

Besides the University fellowships open to all graduates, there are available in the Department a few special fellowships and several assistantships involving teaching or research. Applications for fellowships are made to the Office of Financial Awards, and applications for teaching or research assistantships to the Admissions Officer of the Department; they must be completed by February 15, 1959.

COURSES

21. Mechanics and Heat — Equilibrium, uniform and accelerated motion, force, work, momentum and energy; heat, temperature, properties of matter. Prerequisite: working knowledge of elementary algebra, geometry, i.e., ability to pass examination in these subjects.
   4 units, autumn, (Kirkpatrick), lec. and lab.
23. Sound and Electricity—Electric charges and currents, electrons, magnetism, induced currents, electric oscillations; acoustic vibrations. Prerequisite: 21.
   4 units, winter, (Kirkpatrick), lec. and lab.
29. Optics and Atomics—Reflection, refraction of light, waves; experimental basis of modern ideas concerning atoms, radioactivity, atomic structure. Prerequisite: 23.
   5 units, spring, (Kirkpatrick), lec. and lab.
51. Mechanics and Sound—Equilibrium, uniform and accelerated motion, force, work, momentum and energy; acoustic, mechanical vibrations. Discussions based on use of calculus. Prerequisite: Mathematics 41 or 10, or equivalent.
   5 units, winter, (Schiff), lec., lab., problem session
53. Electricity—Electric charges and currents, magnetism, induced currents, electric oscillations; atomic origin of electromagnetic phenomena. Prerequisites: 51 and Mathematics 42 or 11.
   5 units, spring, (Chodorow), lec., lab., problem session
55. Light and Heat—Reflection and refraction of light, lens systems; light as electromagnetic waves; temperature, properties of matter, introduction to kinetic theory of matter. Prerequisites: 53 and Mathematics 43 or 21.
   5 units, autumn, (Pake), lec., lab., problem session
57. Atomic Physics—Experimental basis of quantum theory; atoms, nuclei, x-rays, atomic structure, radioactivity. Prerequisite: 55.
   3 units, winter, (Pine), TThS 11
61. Optics and Wave Motion—Theory of wave motions from point of view of Huygens' principle, superposition; interference, diffraction phenomena. Prerequisites: 55 and Mathematics 130.
   3 units, spring, (Zachariasen), TThS 11
87, 89. Intermediate Mechanics—Vectors, statics of rigid bodies, dynamics of point particles, theory of small vibrations, the physical pendulum, impulsive motion, elementary mechanics of deformable solids; introduction to Special Theory of Relativity. Prerequisites: 55 and concurrent registration in Mathematics 130.
   87. 3 units, winter, (Schwartz), MWF 11
   89. 3 units, spring, (Schiff), MWF 11
101, 102, 103. Intermediate Electricity and Magnetism—Passive d.c., a.c. circuits in steady, transient states; fields, potential; electrostatics in simple geometries, law of magnetostatics, magnetic circuits, slowly-varying magnetic fields, Maxwell's equations, plane waves, dispersion, skin effect, waveguides, propagation in non-isotropic media, motion of charged particles in electric, magnetic fields; laboratory in electric measurements. Prerequisites: 61, Mathematics 130, and vector algebra.
101. 3 units, autumn, (Burgess), MWF 8
102. 5 units, winter, (Burgess), MWF 8, lab. M or Th 1-4
103. 3 units, spring, (Burgess), MWF 8

107, 108. Elementary Nuclear Physics—Elements of nuclear structure, systematics of nuclei, radioactivity, interactions of nuclear radiations with matter, detection of nuclear radiations, nuclear models, fission and fusion, neutron physics. Prerequisites: 55, and knowledge of calculus.
107. 3 units, autumn, (Meyerhof), TThS 10
108. 3 units, winter, (Meyerhof), TThS 10

111. 3 units, autumn, (Meyerhof), MWF 9
113. 3 units, winter, (Meyerhof), MWF 9
115. 3 units, spring, (Schiff), MWF 9

135. 3 units, autumn, (Kendall), TThS 8
136. 3 units, winter, (Kendall), TThS 8
137. 6 units, spring, (Kendall), TThS 8, lab. M, T, Th, or F 1-5

3 units, autumn, (Pine), by arrangement

173. Thermodynamics—Derivation of laws of thermodynamics from basic postulates. Macroscopic properties of matter as consequences of these laws. Prerequisites: 55 and Mathematics 130.
3 units, autumn, (Block), TTh 11-12:15

175. Kinetic Theory and Introduction to Statistical Mechanics—Kinetic theory of gases; introduction to statistical concepts from Boltzmann point of view, including quantum statistics, applications. Prerequisites: 135 and 173, or equivalent.
3 units, winter, (Block), TTh 11-12:15

176, 177. Physics of Solids—Introduction to the principal types of solids, with emphasis on their electrical and magnetic properties. Elementary treatment of electrons in metals, energy bands, semi-conductors, rectification, and ferromagnetism. Prerequisites: 57 and Mathematics 131 or equivalent.
176. 3 units, winter, (Pake), TTh 11-12:15
177. 3 units, spring, (Pake), TTh 11-12:15

185. 3 units, autumn, (______), MWF 10
187. 6 units, winter, (———), MWF 10, lab. T or F 1-5
189. 3 units, spring, (Pine), TThS 10
199. Independent Study—Experimental or theoretical physics under supervision of a faculty member. Prerequisites: superior work as undergraduate physics major, approval of instructor and of undergraduate study committee of Department of Physics.
   Any quarter, (Staff), by arrangement
201. Literature of Physics—Intensive study of literature of any special topic. Chiefly preparation, presentation of reports upon topics studied. Prerequisites: 25 units of college physics, and permission of instructor.
   Any quarter, (Staff), by arrangement
203. Statistical Mechanics—Development of concepts, methods of classical and quantum statistical mechanics from ensemble viewpoint; density matrix; microscopic basis for thermodynamics. Prerequisites: 175, enrollment in 235, and Mathematics 106.
   3 units, spring, (Bloch), MWF 1:15
207. Advanced Fluid Dynamics—Selected topics from the linear and non-linear dynamics of fluids. Prerequisites: 115 and Mathematics 132.
   3 units, spring, (———), in alternate years, to be given in 1959-60
209. Boundary Value Problems in Electromagnetic Theory—Self-adjoint differential equations; eigenfunctions, expansion theorems. Use of Green's function, elementary applications of group theory for symmetrical structures. Approximate solutions by variational methods, perturbation theory. Methods illustrated by specific application to structures of practical interest. (Same as Electrical Engineering 209p.) Prerequisite: 221 or Electrical Engineering 272.
   3 units, winter, (Jaynes), TThS 10
210. Advanced Microwave Theory—Continuation of 209. Reduction of field theory to circuit theory, general network theorems for microwave structures, analysis in terms of scattering matrices, interconnection of multiterminal structures, special microwave structures. Radiation from prescribed current distributions, theory of properties of materials at microwave frequencies. (Same as Electrical Engineering 210p.) Prerequisite: 209.
   3 units, spring, (Jaynes), TThS 10
211. Microwave Electronics—Detailed treatment of motion of electrons in microwave devices, including beam focusing, interaction with electromagnetic fields, space-charge effects. Emphasis on general properties of electron dynamics common to all microwave tubes. Specific types of tubes such as klystrons, traveling-wave tubes, etc., in so far as they illustrate general principles. Transit time loading, space-charge waves, Llewellyn's equations, noise in beams, etc. (Same as Electrical Engineering 211p, 212p.) Prerequisite: Electrical Engineering 231 or equivalent.
   211. 3 units, autumn, (Chodorow), TThS 9
   212. 3 units, winter, (Chodorow), TThS 9
213. Microwave Measurements I—Lecture course, which together with 214 is intended to introduce fundamental measurement methods, instruments in microwave region. Measurement of impedance, power, frequency, wavelength; laboratory oscillators, methods of detection. (Same as Electrical Engineering 213p.) Prerequisites: Electrical Engineering 270 and concurrent registration in Electrical Engineering 271 or equivalent.
   2 units, autumn, (Ginston), TTh 8
214. Microwave Measurements Laboratory I—Experimental work to accompany 213. Concurrent registration in 213 required. (Same as Electrical Engineering 214p.)
   3 units, autumn, (Ginston), by arrangement
215. Microwave Measurements II—Continuation of 213. Microwave theory as related to laboratory practice: waveguide impedance concepts; representation, measurement of microwave circuits. Selected topics from following: periodically loaded transmission lines and space harmonics; determination of properties of materials; impedance bridges, directional couplers, filters, attenuators; experimental study of microwave vacuum tubes (klystron, magnetron, traveling-wave tube, backward-wave oscillator). (Same as Electrical Engineering 215p.) Prerequisites: 213 and 214.

2 units, winter, (Ginston), TTh 8

216. Microwave Measurements Laboratory II—Laboratory course to accompany 215. (Same as Electrical Engineering 216p.) Prerequisites: 213 and 214. Concurrent registration in 215 required.

2 units, winter, (Ginston), by arrangement


3 units, autumn, (Panofsky), MWF 11


3 units, winter, (Panofsky), MWF 11


3 units, spring, (Panofsky), MWF 11

231, 233, 235. Quantum Mechanics—Physical basis of quantum mechanics, Schrödinger wave equation, energy levels, collision theory. Heisenberg matrix mechanics and transformation theory, approximation methods, identical particles, spin, radiation theory; applications to atomic, molecular, nuclear systems. Prerequisites: 111 and 136, and Mathematics 106 and 132, and preferably Physics 137 and 221.

231. 3 units, autumn, (Zachariasen), MWF 9

233. 3 units, winter, (Zachariasen), MWF 9

235. 3 units, spring, (Zachariasen), MWF 9

237, 238, 239. Advanced Quantum Mechanics—Dirac’s relativistic electron theory; quantization of electron, electromagnetic fields; covariant perturbation theory, applications to high-energy processes; mass and charge renormalization of quantum electrodynamics; radiative corrections to scattering; Lamb shift. Prerequisites: 225 and 235.

237. 3 units, autumn, (Drell), by arrangement

238. 3 units, winter, (Drell), by arrangement

239. 3 units, spring, (Drell), by arrangement

240. Advanced Topics in Theoretical Physics—Discussion of selected topics of current interest in theoretical physics. Prerequisite: 237.

3 units, winter, (Drell), by arrangement


241. 3 units, autumn, (Schwartz), MWF 10
242. 3 units, winter, (Schwartz), MWF 10
243. 3 units, spring, (Schwartz), MWF 10

246. **Nuclear Moments**—Electric, magnetic moments of atomic nuclei, their relation to nuclear constitution. Investigation of the moments by measurements on hyperfine structure, molecular beams, nuclear induction. Prerequisite: 235.

247, 248, 249. **Structure of Condensed Matter**—Topics such as the following from solid state and low temperature physics: crystallographic groups, theory of specific heats, electronic structure of solids, free electron and band approximations, semi-conductors, superconductivity, magnetism at ordinary and low temperatures, theory and properties of liquid helium. Prerequisites: 175 and 235.

247. 3 units, autumn, (Little), TThS 9
248. 3 units, winter, (Little), TThS 9
249. 3 units, spring, (Little), TThS 9

250. **Research**—All work in experimental or theoretical problems in research, as distinguished from independent study of nonresearch character listed as 199 and 201. Written report of work required at end of quarter. Open only to graduate physics major students, with permission of instructor.

Any quarter, (Staff), by arrangement

**Physical Basis of Music**—See Graduate Division Special Programs 375.

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**POLITICAL SCIENCE**

**Emeriti:** Thomas S. Barclay, Graham H. Stuart (Professors)

**Executive Head:** Robert A. Walker
**Professors:** Philip W. Buck, Anthony E. Sokol, Robert A. Walker, James T. Watkins IV
**Associate Professors:** Cornelius P. Cotter, Robert A. Horn, Nobutaka Ike, Hubert R. Marshall, Robert C. North, Martin B. Travis
**Assistant Professors:** John H. Bunzel, Kurt Steiner

**OFFERINGS AND FACILITIES**

The purpose of instruction in the Department of Political Science is (1) to offer all students courses designed to introduce them to the political aspects of society, to train them in the analysis of political problems and to equip them for the exercise of their duties as citizens, (2) to provide undergraduate majors with a program of study leading to the A.B. degree in political science as a foundation for a liberal education, (3) to prepare students for post-graduate executive management programs in government and industry, (4) to give candidates for graduate degrees training preparatory to careers in government, research, teaching, or private enterprise where a knowledge of domestic politics and foreign affairs is in demand, and (5) to prepare students for a career in the foreign service.

The University Library has excellent resources for study and research in all fields of political science. Special collections are also found in the Hoover Institution and the Library of the Law School. The West Memorial Library which is housed in the same building with the Department's offices is maintained as a working collection serving political science students.
Students may be enrolled as undergraduate majors in political science with the approval of the Department.

Political Science majors of high scholastic standing who wish to study for special honors in political science in a program providing individual direction, independent study, and a senior thesis should consult their adviser.

DEGREES

Bachelor of Arts

The minimum requirements for recommendation for the degree of Bachelor of Arts with political science as the major subject are:

1. Registration as a major student in the department for at least one quarter, a C average or better in all requirements for the major, and a minimum of 15 units of work offered by this Department.

2. The completion of 50 units of political science, including:
   a) Courses 10, 20, and 150, or their equivalent.
   b) Advanced courses in at least three of the following fields: administration, comparative government, international relations, political theory, politics, and public law. Political Science 150 may be counted as one of those advanced courses. With the approval of the student's adviser, a maximum of 10 units selected from the following may be counted toward the political science requirement: Economics 1, Elementary Economics; History 130, Diplomatic History of the U.S.; History 158, English Constitutional History; Philosophy 1, Logic, Philosophy 2, Ethics; Psychology 1, General Psychology, Psychology 60, Statistical Methods, or Statistics 50, Statistics; Psychology 112, Social Psychology, or Sociology 110, Social Psychology; Religion 110, 111, Christian Political Theories.

3. The completion of 15 units of appropriate advanced courses in anthropology, economics, history, law, philosophy, and sociology, selected with the approval of the student's adviser.

Attention of students interested in the Latin American field is called to the additional opportunity for training in research and publication offered in connection with the Hispanic American Report by Humanities 248, Hispanic World Affairs Seminar.

SPECIAL CURRICULA

Executive and management option—An executive and management program is offered to prepare students to meet the increasing demand of federal, state, and local governments, as well as industry, for college graduates. Students thus recruited after graduation usually enter executive training programs looking to eventual middle and upper level executive positions. The program, reflecting the close interrelation of government and business and recognizing that such positions call for a broad educational background, is drawn from course offerings in a number of departments. Three courses, 100, Public Administration; 105, Public Personnel Administration; and 107, Government Control of Business; and 25 additional units of related work, are required. Students electing this option are eligible for salaried internships with federal, state, and local agencies. Interested students should request a more detailed statement of the executive and management option from the Departmental secretary.

Students interested in city management as a profession may wish, after consultation with Professor Marshall, to elect from the following non-mathematical courses offered by the School of Engineering: C.E. 134, Construction Estimates and Costs; C.E. 135, Construction Equipment and Methods; C.E. 138, Specifications and Contracts; C.E. 150, Transportation Engineering; C.E. 166,
Elements of Sanitary Engineering; C.E. 230, Civil Engineering Economy; I.E. 130, Engineering Economy; and I.E. 133 or 133a, Industrial Accounting.

Diplomacy and foreign service—For many years the Department has been unusually successful in placing students in careers in the United States Foreign Service and allied overseas positions. A special program exists within the Department designed to prepare students for such careers. This is a broadly integrated curriculum also drawing upon course offerings from other departments. Interested students should consult the Department faculty in the international relations field.

Law—Many students desiring to complete an undergraduate liberal arts education before entering law school take a political science major since “law” and “government” are inseparable. Preparation should include study of political, social, and economic theories and institutions and achieve thorough competence in the use of English. Interested students should consult with Department faculty in public law.

Public Affairs—Students looking forward to a career in politics and in public affairs should consult with Department faculty members in charge of the integrated curriculum in that area. This curriculum prepares for public life with course offerings drawn also from a number of departments.

Master of Arts

A candidate for the Master's degree must have a creditable record (with average grade of B or better) of undergraduate work in political science and other social science subjects. During the first week of his second quarter in residence he must apply to the Department for admission to candidacy for the degree.

The faculty of the Department recommends a candidate for this degree upon the satisfactory completion of at least one full academic year as a graduate student in this Department, with 45 units of work in political science including at least 15 units in seminars and the presentation of an approved thesis for which no more than 5 units of formal credit will be counted toward the degree. By special permission, work done in related departments may be accepted in lieu of a portion of the work in political science. It is expected that a graduate student will maintain at least an average grade of B in all his work.

At the earliest opportunity a graduate student should register for Political Science 400, Method and Scope of Political Science.

The University's basic requirements for this degree are discussed in the section “Degrees” in this Bulletin.

Doctor of Philosophy

A candidate for the doctorate shall have a creditable record of previous work in political science and the other social science subjects. Waiving the Master of Arts requirement may be recommended for Department approval by the professor in charge of the student's special field. During his second quarter in residence there will be an oral interview with the candidate.

Formal admission to candidacy is further dependent upon successful examination in a reading knowledge of two modern languages in addition to English, which normally will be French and German. For students with public law, politics, or administration as the area of research, one language, French or German, and a special-skill field in another discipline may be approved in exceptional cases. Language study should begin no later than the second quarter of graduate study.

Major Requirements—The work in the major department, apart from the dissertation, represents approximately two-thirds of the program for the
doctorate. It should consist of the preparation of four fields chosen from the following: administration; comparative government; international relations; political theory; politics (parties and elections); and public law. In addition, candidates are required to have had some work, at least the basic course, in each of the remaining political science fields. Ph.D. candidates are expected to participate in the Departmental Research Seminar which will meet approximately once a month on an announced schedule.

The Department recommends the candidate for the University oral examination after satisfactory completion of a written examination in each of his four fields and a Department oral examination. Department examinations, both written and oral, are uniformly scheduled in the autumn and spring quarters.

Requirements for Minor—In addition to the preparation of these four fields in political science the candidate shall complete either (1) a minor in another department which comprises part of the University oral examination or (2) a supplemental program of advanced studies outside the department of not less than 25 units taken in his graduate program, upon which the candidate will normally be examined in the University oral examination. Approval either of the minor or the supplemental program by the Department of Political Science is required.

Recommendation for the Degree—The degree will be granted upon recommendation by the Department and the University Committee on Graduate Study after satisfactory completion of the University oral examination and a dissertation.

The University's basic requirements for the doctorate are discussed in the section "Degrees" in this Bulletin.

Minor and Teacher's Credential

Minor in Political Science—Candidates in other departments offering a minor in political science must present themselves for an interview with the faculty of this Department. Each candidate must prepare two fields in political science in each of which he must take a minimum of 10 units and at least one graduate seminar. Not later than one month before recommendation for the general oral examination, the candidate must pass a satisfactory written examination in the selected fields.

Teacher's Recommendation—For the recommendation for the Stanford Junior College Teacher's Credential with political science as a major, the applicant should have completed, in a manner satisfactory to the Department, as least 40 units in political science, including courses 10 and 20. For a minor, the applicant should have completed 24 units, including course 10.

ASSISTANTSHIPS, SCHOLARSHIPS, AND PRIZES

The Department has seven teaching assistantships in Political Science 1 and 10 and graduate assistantships in connection with its other courses. These customarily are granted to applicants only after they have been at Stanford for at least one quarter.

Scholarships and fellowships, including the Hollingsworth and Webster Fellowships reserved for political science students, are also available. The attention of undergraduate students is called to the annual Lindsay Peters, Jr., Memorial Prize for the year's outstanding student in Political Science 10 and the annual Arnaud B. Leavelle Memorial Prize for the outstanding student in Political Science 150.

The Information Bulletin contains full descriptions of scholarships and fellowships from University sources available to Stanford students.
POLITICAL SCIENCE

COURSES

I. INTRODUCTORY

1. Major Issues of American Public Policy—Alternative public policies in selected areas, including control of monopoly, labor relations, agriculture, social welfare, civil rights, foreign policy. Political process; influence of cultural, economic, political factors on determination of public policy. Prerequisites: History 10 and 11.

   5 units, autumn, (Marshall), MTWThF 10
   or winter, (Marshall), MTWThF 11
   or spring, (-----), MTWThF 1

10. American Government—What the informed citizen and specialist should know about the organization and operation of American government. The Constitution and what it means today; Congress, political parties, pressure groups; growth of the Presidency; Supreme Court, judicial review; federalism; separation of powers; Bill of Rights. Prerequisite: third-quarter freshman standing.

   5 units, autumn, (Cotter), MTWThF 10
   or winter, (Horn), MTWThF 11
   or spring, (Bunsel), MTWThF 9

20. Contemporary Governments Abroad—General survey of governments of England, France, Russia, Italy, Germany, Japan, China. Present-day political situation in these states described and analyzed. Prerequisite: second-year standing.

   5 units, autumn or spring, (Buck, Steiner), MTWThF 8 or 2

II. ADVANCED

Open to students who have taken the necessary prerequisites and also to graduates where advisable.

Administration

100. Public Administration—Relation of policy to administration, planning, principles of organization, problems of supervision and personal motivation, public relations, decision-making, the budget, administrative responsibility. Prerequisite: 1 or 10.

   5 units, autumn, (Walker), MTWThF 11

103. State and Local Government—Role of states in the Federal system; state constitutions; state government; political process. Federal-state, inter-state, state-local relations. Municipal government; politics, popular control, administrative organization. Prerequisite: 10.

   5 units, spring, (Marshall), MTWThF 9

104. Local Government Laboratory—Field course in municipal affairs offered in co-operation with the Coro Foundation (San Francisco).

   2 units, spring, (-----), T 2-4:30

105. Public Personnel Administration—Personnel administration in large-scale organizations; recruitment, position-classification, training, promotion, human relations and morale, labor unions in the public service, political activity of public servants, loyalty. Organization for personnel administration. Prerequisite: 100.

   5 units, winter, (Marshall), MTWThF 9

107. Government Control of Business—Federal policy regulating or promoting business. Interrelationship of such programs, impact upon international affairs. Defense mobilization. Politics of establishing, revising, administering regulatory programs. Prerequisite: 1 or 10, or Economics 1.

   5 units, winter, (Cotter), MTWThF 10
108. Enforcing National Economic Controls—Administrative techniques for applying congressional regulatory policy. Scope of rule-making, decision-making, licensing, examining, enforcing powers; how to ensure their responsible exercise. Prerequisite: permission of instructor.

5 units, autumn, (Cotter), TTh 2-4

109. Government Control of Labor Relations—Federal regulation of labor-management relations; political, social forces which operate through Congress, courts, N.L.R.B. to influence labor policy. Prerequisite: 1 or 10, or Economics 1.

5 units, spring, (Cotter), MTWThF 10

110. Administrative Behavior—Environment of administrative action; political, social, psychological factors in management; problem of incentives. Prerequisite: 100.

5 units, winter, (Walker), MTWThF 10

111. Municipal Management—Directed reading in the problems and techniques of municipal management; on-the-job experience in nearby cities under supervision of co-operating city managers. Prerequisites: 100, 103, and permission of instructor.

5 units, any quarter, (Marshall), by arrangement

113. Introductory Seminar in Government and Natural Resources—Political, economic, administrative factors affecting public policy for river basin development, soil conservation, management of public domain, related problems. Pressure groups, legislative bodies, administrative agencies in the planning process. Prerequisite: 100. Economics 1 is desirable.

5 units, spring, (Marshall), T 2-4

114. Introductory Seminar in the Administration of Wartime Controls—Political and administrative problems of a representative democracy in time of defense preparedness or war. Mobilization of industry, labor; problem of supply; civil defense; suppression of disloyalty. Prerequisites: senior or graduate standing, permission of instructor.

5 units, winter, (Cotter), T 2-4

115. Introductory Seminar in Administrative Responsibility—Conflicting loyalties, accountabilities of administrative officials in decision-making process; responsibility to public at large, pressure groups, chief executive, legislature, profession. Case study method used. Prerequisite: 100.

5 units, autumn, (Marshall), M 2-4

118. Directed Reading in Government Control of Business—Literature describing rise of economic regulatory programs in Great Britain, United States; evaluating contemporary experience with such programs. Prerequisites: senior or graduate standing, permission of instructor.

5 units, spring, (Cotter), W 7:30-9:30 p.m.

119. Directed Reading in Administration—Advanced individual study in public administration. Prerequisite: 100.

Autumn, winter, and spring, (Cotter, Marshall, Walker), units by arrangement

For graduate courses in Administration, see Part III.

Comparative Government

120. Problems of Modern Government—Government organization, constitutional framework; administrative action and procedures; political parties and public opinion; emphasis on United States, Great Britain, France, Germany, Russia. Topics deal with each problem in several countries.

5 units, autumn, (Buck), TTh 1-3

122. The British Commonwealth and Empire—Imperial organization,
Dominion status; governments of Canada, Australia, South Africa. Pre-
requisites: 10 and 20.
3 units, winter, (Buck), MWF 8

123. Governments of Asia—Survey of governmental institutions and the
political process in Asian countries. Desirable prerequisite: 20 or previous
study of the area.
5 units, winter, (Steiner), MTWThF 10

124. Government and Politics in Japan—Special problems of government
5 units, spring, (Steiner), MTWThF 9

125. Government and Politics in China—Special problems of govern-
ment since the Republic. Desirable prerequisite: 20.
5 units, alternate years, to be given in 1959–60

126. Government of the Soviet Union—Soviet State as a product of
Marxist theory and Russian history. Nature and function of Communist Party,
5 units, spring, (Buck), MTWThF 10

5 units, autumn, (Travis), by arrangement

127b. Seminar in Comparative Government: Patterns of Politics in
Non-Western Countries.
5 units, spring, (Steiner), by arrangement

5 units, winter, (Steiner), by arrangement

128. Government and Politics in Latin America—Desirable prerequi-
site: 20.
5 units, spring, (Travis), MTWThF 9, alternate years to be given in 1958–59

129. Directed Reading in Comparative Government—Prerequisites: 10
and 20.
(Buck, Steiner), units by arrangement

For graduate courses in Comparative Government, see Part III.

International Law and Relations

130. Introduction to International Law—Prerequisite: advanced stand-
ing.
5 units, autumn, (Travis), MTWThF 9

131. Control of American Foreign Policy—How American foreign policy
is made; problems of administrative co-ordination, public opinion, decision-
making process. Special attention to State Department and the Foreign Serv-
ice.
5 units, winter, (Travis), MTWThF 9, alternate years, to be given in 1958–59

132. Principles and Problems of American Foreign Policy—The great
traditions and their contemporary application; neutrality, freedom of the seas,
Monroe Doctrine, Pan-Americanism, pacific settlement, international co-opera-
tion, etc.
5 units, autumn, (Watkins), MTWThF 11

133. Control of Foreign Policies in Major World Powers—How for-
eign policies are made by the major foreign powers; important social, economic,
political factors in actual formulation and conduct of respective foreign policies.
5 units, winter, (Travis), MTWThF 9

134. Germany between East and West—Problems resulting from Ger-
many's position between the two power blocs; its significance for the United
States.
5 units, winter, (Sokol), MTWThF 11
135. Regional Arrangements for Collective Security—International pacts for mutual defense of the United States and its allies; NATO, SEATO, etc.
5 units, (Sokol), alternate years, to be given in 1959-60
136. Southeast Asia—Political, economic, social, cultural, and military problems of that area; their significance for the United States.
5 units, (Sokol), alternate years, to be given in 1959-60
137. Indonesia—Case study of a former colonial region, recently liberated, and the various problems with which it is confronted.
5 units, autumn, (Sokol), MTWThF 11
138. Latin America and the United States—Diplomatic and commercial relations between United States and the republics of Latin America.
5 units, spring, (Travis), MTWTh 9
139. Directed Reading in International Relations.
(Watkins, Travis), units by arrangement
140. Introductory Seminar in International Relations—May be repeated for credit.
5 units, autumn, (Watkins), W 7:30-9:30 p.m.
5 units, spring, (Travis), by arrangement
142. War as an Instrument of Policy—The nature of war and its use in the pursuance of national policy.
5 units, spring, (Sokol), MTWThF 11
145. International Relations—Introductory survey of the national state system, its characteristic forms and the principal forces making for conflict and adjustment. Nationalism, imperialism, economic relations, war, diplomacy, international organization given special attention.
5 units, spring, (Watkins), MTThF 11
5 units, winter, (Watkins), MTThF 11
148. Introductory Seminar in International Organization—Prerequisite: 147 or equivalent.
5 units, spring, (Watkins), Th 7:30-9:30 p.m.
149. Directed Reading in International Organization.
(Watkins), units by arrangement
For graduate courses in International Relations, see Part III.

Political Theory

150. Introduction to Political Thought—Principal schools of political thought; major political philosophers, Plato to French Revolution. Prerequisite: advanced standing.
5 units, autumn, (- - - - - - - -), MTWThF 10
151. Modern Political Thought—Political thought in the nineteenth and twentieth centuries. Special emphasis on Socialism, Communism and Fascism, Liberalism, Democracy. Prerequisite: advanced standing.
5 units, winter, (- - - - - - - -), MTWThF 10
152. American Political Thought—Main periods and contributors, Puritans to present. Prerequisite: advanced standing.
5 units, spring, (- - - - - - - -), MTWThF 10
156. Contemporary Problems in Political Philosophy—Analysis of philosophical problems of government in a contemporary context: political
power; normative theories of politics; limits of government; modern political, economic, sociological trends, their implications for political philosophy. Prerequisite: advanced standing.

5 units, (Smith), by arrangement

159. Directed Reading in Political Theory—Prerequisite: 150.

(——), units by arrangement

For graduate courses in Political Theory, see Part III.

Politics

160. American Parties and Politics—Nature and development of American political parties; party organization, structure, leadership, activities; theories, functions of party system, responsibility; attitudes and behavior in the political community; party and public opinion as influences upon government. Prerequisite: 10.

5 units, autumn, (Bunzel), MTWThF 9

162. Social and Economic Basis of American Politics—Ideological and sociological background of American democracy; political, economic, and social forces in relation to the political system; political power, stratification, class, and status as conditioning factors in American politics.

5 units, spring, (Bunzel), MTWThF 11

164. Public Opinion and Behavior—Origins, patterns, organization, control of popular attitudes and behavior in the political community. Prerequisite: 10.

5 units, (——), MTWTh

165. Politics of Pressure Groups—Role of interest groups in the political process; theories of American pluralism; group pressures and the formation of public policy; ideology, character, and politics of American business as a case study; analysis of the internal politics and structure of private associations, especially the American trade union. Prerequisite: 10.

5 units, winter, (Bunzel), MTWThF 9

167. Introductory Seminar in Politics.

5 units, (——), by arrangement

169. Directed Reading in Politics—Prerequisite: 10.

(——), units by arrangement

For graduate courses in Politics, see Part III.

Public Law

170. The Supreme Court and the Constitution—Theory and practice of limited constitutional government as exemplified in the United States. Federal court system; separation of powers; judicial review; doctrines of political questions and emergency. Emphasis on nature of legal reasoning and judicial process. Prerequisite: third-year standing.

5 units, autumn, (Horn), MTWThF 1

172. The Constitution and Economic Justice—Changing concepts of private property rights and governmental powers over the economy in American constitutional law; Supreme Court interpretation of the contract and due process clauses versus state police powers; recent expansion of congressional currency, commerce, taxing and spending, and war powers used to regulate property and the economy. Prerequisite: third-year standing; 170 desirable.

5 units, winter, (Horn), MTWThF 1

173. Civil Liberties in the United States—Civil liberties in contemporary American culture; theory, history underlying them. Free speech, press in era of mass communications; freedom of association for religious, political, eco-
Nominal groups; rights of aliens, ethnic minorities; fair trial, rights of accused persons.

175. Introductory Seminar in Jurisprudence — Legal theories, relationships between legal and political philosophy. Logical analysis of legal orders. Relation of ethics to law as seen by natural lawyers, idealists, utilitarians, positivists, pragmatists. Rise, achievements, and limitations of modern sociological jurisprudence and American legal realism. Prerequisite: consent of instructor.

179. Directed Reading in Public Law — Prerequisite: consent of instructor.

For graduate courses in Public Law, see Part III.

III. Graduate

Conducted as seminars or reading and discussion groups. Limited to graduates and seniors in political science and other departments who have completed 20 units in political science. Students should consult instructor before enrolling.

200. Seminar in Administration.

219. Directed Reading in Administration.

220. Seminar in Comparative Government.

229. Directed Reading in Comparative Government.

230. Seminar in International Relations.

231. Seminar in International Law.

232. Seminar in International Relations Theory.

233. Seminar in National and Collective Security: Europe—(Same as Hoover Institution 233.)

234. Seminar in National and Collective Security: Pacific Area—(Same as Hoover Institution 234.)

235. Seminar in National and Collective Security: Problems of Sea Power—(Same as Hoover Institution 235.)

238. Directed Reading in International Law.

239. Directed Reading in International Relations.

247. Seminar in International Organization.

249. Directed Reading in International Organization.

250. Seminar in Political Theory: Democratic Thought.


259. Directed Reading in Political Theory.
   5 units, (———), by arrangement

262. Seminar in Public Opinion and Behavior.
   5 units, (———), by arrangement

263. Seminar in Political Leadership.
   5 units, (———), by arrangement

269. Directed Reading in Politics.
   (———), units by arrangement

270. Seminar in Public Law.
   5 units, (Horn), to be arranged

279. Directed Reading in Public Law.
   (Horn), units by arrangement

300. Thesis.
   Each quarter, (Staff), units by arrangement

400. Method and Scope of Political Science—Required for students in first graduate year. Selected topics of major importance in modern government. In preparing periodical reports, students will be expected to familiarize themselves with use of source materials such as American, foreign, international public documents, bibliographical aids.
   5 units, autumn, (———), W 2-4

See also Senior Colloquia.

PSYCHOLOGY

Emeriti: Maud Merrill James, Lois Meek Stolz, Edward Kellogg Strong, Jr., (Professors)

Executive Head: Robert Richardson Sears
Associate Executive Head: Paul Randolph Farnsworth
Professors: Alex Bavelas, Paul Randolph Farnsworth, Leon Festinger, Thomas Willard Harrell, Ernest Ropiequet Hilgard, Douglas Howard Lawrence, Henry Bonner McDaniel, Quinn McNemar, Robert Richardson Sears
Associate Professors: Arthur Paul Coladarci, Edith Mary Dowley (Director, Stanford Village Nursery School), Clarence Leland Winder. Acting: Eleanor Maccoby
Instructor: Charles Dicken

GENERAL INFORMATION

Fellowships and Assistantships

The Dr. C. Annette Buckel Foundation, supplemented by additional support from the Board of Trustees of the University, has provided a teaching assistantship for the psychology and pedagogy of backward children. The Thomas Welton Stanford Fellowship in Psychic Research is a post-doctoral fellowship for research in psychic phenomena, established by the Trustees, in 1913, from the "Psychic Fund" created by Thomas Welton Stanford. There are teaching assistantships in general and experimental psychology, child psychology, statistics, clinical psychology, and the nursery school. Usually several
research assistantships are available in connection with special investigations. Readers are employed to assist in course examinations. Veterans Administration assistantships are available locally, and United States Public Health Service stipends can be assigned.

**Laboratories**

Aside from lecture and seminar rooms and offices, the Department has well-equipped laboratories comprising some 30 rooms which are adapted to research and laboratory course work. Special facilities are available, in addition to the general laboratory, for experimentation with animals.

**Nursery School**

The Department maintains the Stanford Village Nursery School in order to provide a laboratory for child observation, for training in nursery school practice, and for research.

**Summer Quarter**

The courses announced for the summer quarter are those regularly scheduled in the Department curriculum. Additional courses may be announced in the *Summer Quarter Bulletin*, to be issued in February, 1959.

### DEGREES

#### Bachelor of Arts

For the Bachelor's degree, 45 units of psychology are required, including courses 1, 60, and one laboratory course from among 100, 102, 117, and 133. If 117 is chosen to satisfy the laboratory requirement, it must be taken for four or five hours of credit. The following courses in other fields allied to psychology may be counted as fulfilling up to 10 of the nonlaboratory units for the degree:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
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<tbody>
<tr>
<td>Anthropology 1, General Anthropology</td>
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<td>5</td>
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<tr>
<td>Anthropology 130, Social Anthropology</td>
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<td>4</td>
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<tr>
<td>Anthropology 163, Cultural Dynamics</td>
<td></td>
<td>4</td>
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<tr>
<td>Anthropology 164, Culture and Personality</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Biology 25, Genetics</td>
<td></td>
<td>3</td>
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<tr>
<td>Statistics 116 (Math. 123 or Econ. 270), Theory of Probability</td>
<td></td>
<td>4</td>
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<tr>
<td>Philosophy 1, Introduction to Logic</td>
<td></td>
<td>5</td>
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<tr>
<td>Physiology 101, Introduction to Human Physiology</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Sociology 2, Introduction to Social Psychology</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Sociology 125, Crime and the Criminal</td>
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<td>5</td>
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</tbody>
</table>

A student must have an average grade of C or better for his work in psychology and have taken at least 15 units in the department in order to receive the Departmental recommendation for graduation.

A Psychology Honors Program is designed for those exceptionally able students who wish, in their major, to pursue an intensive and somewhat independent study of psychology, and to engage in psychological research. It is directed toward the integrating of a substantial body of theoretical and factual information, and the development of creative scholarly skills, by independent study, small seminars, and extended research experience. Particular emphasis is laid on the planning of an individual program for the student that will combine his specialized interests with the body of basic general psychology essential for all students who are undertaking their first two years of concentrated study in the field. The plan will be aimed at helping the student prepare for a comprehensive examination to be taken in the final quarter of his senior year, over
his entire area of psychological study. The plan will include arrangements for continuous supervised research activity from the beginning of the student's junior year until the end of the winter quarter of his senior year, at which time he will submit a written report of his work as a thesis.

It is possible for a student to elect both the Psychology Honors Program and the Honors Program in Quantitative Methods in Behavioral Sciences. See the section "Behavioral Sciences (Honors Program in Quantitative Methods)" in this Bulletin.

**ADMISSION TO GRADUATE STANDING**

An applicant for admission to graduate work must file a report of his scores (aptitude and advanced psychology) on the Graduate Record Examination as part of his application. This examination may be taken at most American colleges (see your registrar for further information). Application must be completed by June 1. Admission to both clinical and nonclinical training programs is strictly limited. After an applicant is admitted, he may have until June 15 to notify the Department of Psychology of his formal acceptance. Unless such notification is received by June 15, the admission will be revoked, and that opening will be offered to the next alternate on the list. Except for students who wish to concentrate in the preschool area no student will be accepted who does not plan to continue through to the doctorate. The taking of the degree of Master of Arts is optional. It is contrary to the policy of the Department to accept candidates for the major or minor who have reached the age of 40.

**Master of Arts**

For the degree of Master of Arts, 27 units in psychology beyond the equivalent of an undergraduate major are required. In partial fulfillment of this unit requirement, 150a and 150b must be elected as well as four additional courses from a list which includes the following three groups: 208 and 209, 210 and 214, and 211 and 212. At least one course must be chosen from each of these three groups. In addition to the above six courses the first-year graduate student must enroll in 275 for a minimum of three units of research work a quarter. The total graduate units should not be less than 45.

**Doctor of Philosophy**

In addition to fulfilling the residence requirement for the degree, the following requirements are stipulated:

1. The course requirements mentioned above, in connection with the Master's degree, must also be met by all candidates for the doctorate. If a student already has a Master's degree in psychology from another institution, he must present evidence of his competence in these course-areas during his first year at Stanford. This may be done either by examination or by taking the courses.

2. A nine-hour written examination must be taken in one of the major areas of psychology. The area is to be selected by the student after consultation with his adviser and ordinarily would be one of the following: clinical, counseling, developmental (including child and adolescent), social and personality, social and motivation, physiological and comparative, perception and learning, and psychometrics.

3. Completion of a university minor, or its equivalent, satisfactory to the University Committee on Graduate Study. Candidates for the Ph.D. degree may have the minor waived by selecting 12 units outside the Department and by taking a six-hour written examination in a secondary area in psychology. A secondary area in psychology is defined primarily in terms of the areas listed
above except that a secondary area does not involve as extensive a mastery. Additional secondary areas may be defined for the individual student upon approval of the faculty.

4. Demonstrated reading knowledge of two foreign languages, preferably French and German. Upon petition to the Departmental faculty another modern language may be substituted for one of these, or upon petition to the University Committee on Graduate Study a special program of courses may be substituted for one language. Not more than one Romanic language may be offered.

5. Completion of the University oral examination on the major and minor.

6. A dissertation satisfactory to a Departmental committee of three members and to the University Committee on Graduate Study.

Ph.D. candidacy expires five years after admission to candidacy by the University Committee on Graduate Study. Reapplication will require Departmental re-examination.

Minor for the Degree of Doctor of Philosophy—Candidates for the degree of Doctor of Philosophy in other departments who elect a minor in psychology will be expected to complete the equivalent of 45 units in psychology, of which at least 15 must be taken as a graduate student at Stanford. The program to be followed will be adapted to the needs of each candidate and will be under the direction of the Department’s Committee on Minors.

THE DOCTORAL TRAINING PROGRAM

As indicated by the examination requirements described above, a student may concentrate in any one of several areas within psychology. Regardless of area, however, the training program places emphasis on the development of research competence, and students are encouraged to develop those skills and attitudes which are appropriate to a career of continuing research productivity.

Two kinds of experience are necessary for this purpose. One involves the learning of substantial amounts of technical information. A number of courses, seminars, and reading lists are provided to assist in this learning, and a student is expected to work out a program, with his adviser, that will permit him to secure such knowledge in the most stimulating and economical fashion. Beyond the first-year graduate courses mentioned above, there are no required courses for any of the areas of concentration. The curriculum has been designed to offer as much help as possible for such learning, of course, and a glance at the list of courses and seminars available will suggest some of the help that may be gained in preparation for the doctoral examinations.

A second aspect of training is one that cannot be gained from reading or seminars. This is the first-hand knowledge of, and practical experience with, the methods of psychological investigation and study. These methods do not exist in the abstract; they are ways of behaving with the people or animals who are being studied. They are skills, and they require guided practice for their perfection. Doctoral training involves experience in the actual processes of working with people. Some areas require more intensive practice than others; for example, the diagnostic testing of emotionally disturbed children is a more difficult skill for a psychologist to learn than is the presentation of verbal learning tests to normal adults. Hence, the amount of supervised practicum experience required for doctoral training in such an area as clinical psychology is likely to be greater than that needed for the experimental psychology of human learning. Again, however, as with formal courses, there are no specific requirements; students are provided with whatever practicum opportunities they need to reach those levels of competence representative of doctoral standing. For this purpose, the Department maintains a Nursery School and an Animal Laboratory, and provides supervised practice experiences in various hospitals, clinics, community agencies, and other facilities. Continuing research
programs, sponsored by members of the faculty, offer direct opportunities for experience in the fields represented by the faculty's several research interests.

For certain areas, particularly clinical and counseling psychology, the amount of supervised practice ordinarily needed by students is quite substantial. For example, a clinical psychologist who plans a career to include professional employment in a Veterans Administration installation will require about two academic years of practicum work during his doctoral training because he will need to have a variety of skills immediately available when he enters his hospital position. Preparation for the degree in clinical and counseling psychology, therefore, requires four full years. On the other hand, a student who plans an academic career, in which college teaching rather than professional clinical work would accompany his research activities, may find himself able to complete his training in less time. So far as is practicable, the Department attempts to offer remunerative work opportunities (or other stipends) in connection with supervised practicum experiences.

Each student will achieve competence in somewhat unique ways and at a somewhat unique rate. Each student and his adviser share in planning a program which will lead to the objectives discussed.

COURSES

OPEN TO ALL STUDENTS

   5 units, autumn, (Sears), MWThF 2 and sections
   or winter, (Winder), MWThF 10 and sections
   or spring, (Farnsworth), MWThF 2 and sections
   or summer, (——), MTWThF 9 and one hour by arrangement

50. Statistical Methods—Prerequisite: Mathematics A or equivalent.
   5 units, autumn, (Lawrence), MTWThF 1
   or winter, (McNemar), MTWThF 8
   or spring, (McNemar), MTWThF 8
   or summer, (——), MTWThF 9 and one hour by arrangement

100. Individual Differences Laboratory—Prerequisites: 1 and 60.
   3 units, autumn, (Wiggins), lec. TTh 1; lab. (I) T 2-4 or (II) Th 2-4

101a. Learning—Prerequisites: 1 and 60.
   3 units, autumn, (Lawrence), MTWThF 10

101b. Perception—Prerequisites: 1 and 60.
   3 units, autumn, (Lawrence), to be given in 1959-60

102. Learning and Perception Laboratory—Prerequisite: 101a or 101b.
   3 units, winter, (Lawrence), by arrangement

103. Junior Research Seminar—Planning research, designing experiments.
    Limited to 8 students with junior standing. Prerequisites: 1, and 60, and consent of instructor.
    2 units, autumn, (Bandura), W 3-5

104. Special Laboratory Projects—Prerequisites: 100, 102, 103 or 133, and consent of instructor.
    3 units, each quarter, (Staff), by arrangement

110. Motivation and Personality—Prerequisite: 1 or equivalent.
    3 units, winter, (Sears), MWF 2

111. Child Psychology—Prerequisite: 1 or equivalent.
    4 units, autumn, (Maccoby), MWF 9
    or spring, (——), MWF 3
    or summer, (——), MTWThF 10

112. Social Psychology—Prerequisite: 1.
    3 units, autumn, (Farnsworth), MWF 10
    or summer, (Farnsworth), MTWThF 11
113. Industrial Psychology—Prerequisite: 1 or equivalent.
   3 units, spring, (Bavelas), MWF 8

114. Psychology of Music—Prerequisites: 1, and some knowledge of music.
   3 units, winter, (Farnsworth), to be given in 1959–60

   5 units, autumn, (McDonald), MTWThF 11
   or spring, (McDonald), MTWThF 9
   or 4 units, summer, (McDonald), MTWTh 3 and one hour by arrangement

116. Adolescent Development—Same as Education 116. Prerequisite: 111.
   4 units, winter, ( ), MWF 10

117. Observation of Children—Prerequisites: 111 or equivalent, and permission of instructor. Enrollment limited to 16.
   3 to 5 units, autumn, winter, or spring, (Dowley), Th 2–4 and by arrangement

127a. Physiological Psychology—Prerequisites: 1, and one or more courses in zoology, or physiology.
   3 units, autumn, (Warren), MWF 8

127b. Physiological Psychology—Prerequisite: 127a.
   3 units, winter, (Warren), MWF 1

130. Comparative Psychology—Phylogenetic survey of animal behavior; consideration of experiments on learning, retention, imitation, ideation, innate behavior. Prerequisites: 1, and a course in zoology.
   4 units, winter, (Warren), MWF 9

133. Experimental Animal Behavior—Student may undertake series of experiments or one minor research. Prerequisite: 60 or special permission.
   1 to 3 units, autumn, winter, or spring, (Lawrence, Warren), by arrangement

135. Intermediate Social Psychology—Prerequisite: 60 or equivalent.
   3 units, autumn, (Festinger), W 1-3

   2 to 5 units, winter and spring, (Festinger), by arrangement

150a. Advanced Statistical Methods—Correlational analysis: for continuous variables, categorical data. Prerequisite: 60, or calculus.
   3 units, autumn, (McNemar), MWF 8

   3 units, winter, (McNemar), MWF 10

152. Measurement of Intelligence—Basic concepts, tests of intellectual abilities. Prerequisites: 1 and 60.
   3 units, autumn, (McNemar), MWF 10

155. Measurement of Personality—Prerequisites: 1 and 60.
   3 units, winter, (Wiggins), MWF 8

160. Abnormal Psychology—Behavior deviations, psychopathology; conceptions regarding these conditions. Three Saturday clinics. Prerequisites: 1 and at least third-year standing.
   4 units, autumn, (Winder), MTWF 11
   or spring, (Winder), MTWThF 11

169. Nursery School Practice—Supervised experience with the nursery school child. Prerequisites: 111, 117, and consent of instructor.
   3 to 5 units, autumn, winter, or spring, (Dowley), T 2–4 and by arrangement

190. Exceptional Children—Psychological assessment of children with special mental, physical, emotional, behavioral adjustment problems. Prerequisites: 1, and either 116 or 152.
   3 units, spring, (Rau), T 9–12
   or summer, ( ), MTWF 1
191. **Verbal Behavior**—Prerequisite: 101a or 101b.  
3 units, winter, (Adams), MWF 2

192. **Industrial Relations**—Meaning of industrial relations; scope, variety of problems that may be considered under it; policies of labor organizations, industrial relations programs of management; trade agreements, grievance procedures, other phases of collective bargaining.  
4 units, autumn or winter, (Troxell), MTWF 11

197. **Dynamic Psychology**—Personality development, emotional adjustment; emphasis on psychoanalytic theory. Prerequisites: 111 and 160, and senior or graduate standing.  
4 units, autumn, (Hilgard), MWF 11

198. **Senior Seminar**—Limited to seniors majoring in psychology who have maintained an average grade of B.  
2 units, autumn, (Adams), T 2-4

199. **Reading and Special Work**—Independent study.  
1 to 3 units, each quarter, (Staff), by arrangement

For further courses on psychological topics see section on Senior Colloquia.

**Primarily for Graduate Students**

*Undergraduate students may be admitted only by special permission.*

202. **Research Methods.**  
3 units, winter, (Weitsenhoffer), MWF 1

207. **History of Psychology.**  
3 units, autumn, (Farnsworth), MWF 9

208. **Physiological and Comparative Psychology**—Prerequisites: introductory courses in zoology, comparative psychology.  
3 units, spring, (Warren), MWF 2

209. **Perception.**  
3 units, autumn, (Weitsenhoffer), MWF 1

210. **Learning.**  
3 units, winter, (Lawrence), MWF 2

211. **Advanced Child Psychology**—Prerequisite: 111 or equivalent.  
3 units, spring, (Sears), TTh 12:30-2  
or summer, (——), MTWTh 3

212. **Advanced Social Psychology**—Prerequisite: permission of instructor.  
3 units, autumn, (Festinger), W 3-5:30 p.m.

213. **Advanced Industrial Psychology.**  
3 units, winter, (Bavelas), MWF 3

214. **Motivation.**  
3 units, spring, (Hilgard), MWF 8

217. **Child Research Practicum**—Prerequisites: 117 or permission of instructor:  
3 to 5 units, autumn, (Dowley), TTh 1

249. **Seminar-Practicum in Teaching Psychology**—Consideration of principles, techniques and problems in teaching psychology. Prerequisite: consent of instructor.  
3 units, autumn, (——), by arrangement

250. **Advanced Statistical Methods**—Factor analysis, statistical theory of psychological tests. Prerequisites: 150a, and 152 or 155.  
3 units, spring, (McNemar), MWF 10

251. **Introduction to Clinical Psychology**—History; functions of clinical psychology, including basic concepts, theories. Prerequisite: consent of instructor.  
3 units, autumn, (Bandura), MWF 10
252. Psychopathology—Behavior disorders. Prerequisite: consent of instructor.
   3 units, winter, (Rau), MWF 11

253. Personality Evaluation—Theories, techniques. Prerequisite: consent of instructor.
   3 units, spring, (Wiggins), MWF 9

254. Psychodiagnosis—Diagnostic principles, practice. Prerequisite: consent of instructor.
   3 units, autumn, (Rau), MWF 1

255. Theories of Psychotherapy—Psychological treatment of behavior disorders. Prerequisite: consent of instructor.
   3 units, winter, (Bandura), MWF 11

256. Psychotherapeutic Techniques—Specialized methods of psychological treatment of behavior disorders. Prerequisite: consent of instructor.
   3 units, spring, (Bandura), T 10-12

257a. Clinical Techniques Laboratory: Behavioral Observations—Prerequisite: consent of instructor.
   2 units, autumn, (Bandura), TTh 9-12

257b. Clinical Techniques Laboratory: Intelligence Tests—Prerequisite: consent of instructor.
   2 units, winter, (Rau), TTh 9-12

257c. Clinical Techniques Laboratory: Projective Techniques—Prerequisite: consent of instructor.
   2 units, spring, (Wiggins), TTh 9-12

257d. Clinical Techniques Laboratory: Diagnostic Interviewing and Interpretation of Test Results—Prerequisite: consent of instructor.
   2 units, autumn, (Rau), by arrangement

257e. Clinical Techniques Laboratory: Psychotherapy—Prerequisite: consent of instructor.
   2 units, winter, (Bandura), by arrangement

257f. Clinical Techniques Laboratory: Psychotherapy—Prerequisite: consent of instructor.
   2 units, spring, (Bandura), by arrangement

258. Clinical Practicum—Laboratory, field work in selected clinical training facilities. Registration by permission.
   3 units, each quarter, (Clinical Staff), by arrangement

259. Internship in Psychology—As part of training for advanced degrees in clinical, child, vocational, industrial psychology, arrangements are made for residence service in hospitals, penal institutions, schools, business and industrial establishments.
   5 to 15 units, each quarter, (Staff), by arrangement

261. Seminar in Social Psychology—Prerequisite: consent of instructor.
   2 units, winter or spring, (Festinger), Th 2-4

262. Seminar in Psychological Theory—Prerequisite: consent of instructor.
   2 units, autumn, (Bavelas), Th 8–10 p.m.
   or winter, (Hilgard), Th 8–10 p.m.
   or spring, (Weitsenhoffer), Th 8–10 p.m.

265. Seminar in Clinical Psychology—Prerequisite: consent of instructor.
   2 units, autumn, (Winder), F 10–12
   or winter, (Wiggins), by arrangement
   or spring, (Rau), by arrangement

275. Research—Research of intermediate nature, whether or not to be used toward Master's thesis, may be undertaken with members of Department faculty.
   (Staff), by arrangement
SOCIAL SCIENCES (SPECIAL PROGRAMS)

(Staff), by arrangement

Physiology of the Central Nervous System—See Physiology 305.
Psychological Assessment of the Individual—See Education 316.
Guidance—See Education 330.
Counseling Techniques: The Interview—See Education 333a.
Counseling Techniques: Techniques—See Education 333b.
Seminar in Educational Psychology and Guidance—See Education 415.

SOCIAL SCIENCES (SPECIAL PROGRAMS)

GENERAL PROGRAM

Chairman: Paul R. Farnsworth

The General Program, leading to the degree of Bachelor of Arts (Social Sciences—General), is designed for students wishing to pursue a broad educational program emphasizing the social sciences without concentrating upon a particular branch of the social sciences to the extent required of departmental undergraduate majors. Candidates are urged at an early stage to plan their programs with the faculty advisers to whom they will be assigned upon designation of their choices of fields of concentration (see below).

REQUIREMENT FOR ENROLLMENT

The requirement for enrollment in the General Program as a major student is an average grade of C in all social science courses previously taken at Stanford University.

GRADUATION

Required Courses—The following basic courses, totaling 40 to 42 units, must be completed by students majoring in the program:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Econ. 1. Elementary Economics</td>
<td>5</td>
</tr>
<tr>
<td>Hist. 10, 11, and 12. History of Western Civilization</td>
<td>12</td>
</tr>
<tr>
<td>Psych. 1. General Psychology</td>
<td>5</td>
</tr>
</tbody>
</table>

In addition to the foregoing, 15 units are to be completed from the courses listed below:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geog. 1. Human Geography</td>
<td>5</td>
</tr>
<tr>
<td>Soc. 1. Introduction to Sociology</td>
<td>5</td>
</tr>
<tr>
<td>Anth. 1. General Anthropology</td>
<td>5</td>
</tr>
<tr>
<td>Phil. 1. Introduction to Logic</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: Two of the 5-unit survey courses in American and European History, History 102, 103, 104, 121 or 122, may be substituted for History 10, 11, and 12.

Fields of Concentration—In addition to the basic required courses, students majoring in the program must complete 50 units in courses numbered 100 and over in three fields of concentration, with 20 units falling in one field and 15 units in each of two others.

The fields of concentration are: (a) Economics (which may include Food Research); (b) History; (c) Political Science; (d) Psychology; (e) Sociology; (f) Cultural Anthropology; (g) Economic and Political Geography.
Upon petition there will be consideration of other program arrangements designed to satisfy the 50-unit requirement in courses numbered 100 and over. A course in statistical methods is strongly advised; and either Psychology 60, Statistical Methods (5 units); Statistics 50, Elementary Statistics (5 units); Economics 7, Introduction to Statistics (5 units); if taken, will be counted as a course numbered 100 or over within any of the three fields, economics, psychology or sociology, or as an additional social science course outside of the concentrations, as the student elects.

**General Requirements**—Candidates are recommended for the degree of Bachelor of Arts on completion of the 90 (or 92) units of work specified above. An average grade of C is required in all social science courses taken at Stanford University and counting toward the major. Additionally, students must achieve an average grade of C in work taken at Stanford within each of the three chosen fields of concentration including courses numbered 1-99 in those fields.

See Senior Colloquia.

Students with questions about the Program may see the Program secretary in Room 1F (Inner Quad) or the Program chairman, Professor Paul Farnsworth, in Room 11 of the Education Building during his office hours.

**INTERNATIONAL RELATIONS PROGRAM**

*Chairman:* James T. Watkins IV

The Program in International Relations is designed to serve two purposes: (1) to provide an undergraduate major for students interested in the whole field of international relations; and (2) to provide a vocational preparation for students expecting to enter one of the professional fields of work in international relations. Professional occupations exist in governmental service, in international agencies, in business and commercial activities, in the work of foundations and charitable institutions, and in teaching.

The program may lead successively to the degrees of Bachelor of Arts and Master of Arts. Candidates for the degree of Bachelor of Arts, with vocational interests, are especially urged to consult promptly with the faculty advisers to whom they will be assigned.

Students expecting to pursue graduate study beyond the Master of Arts degree are advised to familiarize themselves at an early date with the requirements of the disciplines of their preference: normally, economics, history, or political science.

**DEGREES**

**Bachelor of Arts**

Students will be recommended for graduation upon completion, with a C average or better, of the required courses and concentrations listed below.

**Required Courses**

The following courses are required for students majoring in the program. Students should note that prerequisites for admission are established only for Economics 115, 117, 165.

- Economics 165. International Economics
- Geography 4. Economic Geography
- History 104. Europe since 1914
- History 130. Diplomatic History of the United States
- Political Science 10. American Government
Political Science 20. Contemporary Governments Abroad
Political Science 130. Introduction to International Law
Political Science 147. The United Nations and Its Antecedents

One of the following:
  Economics 115. Economic History of Europe
  History 103. Europe in the Nineteenth Century

One of the following:
  Economics 117. Economic History of the United States
  History 121. American History, 1789–1890
  History 122. American History since 1890
  History 123. American Social History
  History 132. The Westward Movement in the United States

Concentrations
Candidates for the degree of Bachelor of Arts, in addition to the required courses listed above, must offer a minimum concentration of 10 units in each of two of the five groups described below. *Other pertinent courses and seminars, though unlisted, may be offered on consent of the adviser.*

**Group I. Economic and Political Geography**
- Anthropology 150. Peoples of the Pacific
- Anthropology 152. Peoples of Asia
- Food Research 101. The World's Food
- Food Research 140. International Trade in Agricultural Commodities
- Food Research 210. Agriculture in Tropical Economies
- Food Research 212. African Agricultural Development
- Food Research 220. Seminar: American Agricultural Policy
- Food Research 227. Agricultural Expansion in the Americas
- Geography 1. Human Geography
- Geography 10. Global Geography
- Geography 104. Advanced Economic Geography
- Geography 111. Geography of Eastern United States and Canada
- Geography 112. Geography of California and the West
- Geography 120. Geography of South America
- Geography 121. Geography of Middle America
- Geography 130. Geography of Asia
- Geography 131. Geography of India
- Geography 132. Geography of China
- Geography 133. Geography of the Soviet Union
- Geography 145. Geography of Europe
- Geography 191. Political Geography
- Sociology 130. Population

**Group II. International Economic Relations**
- Economics 115. Economic History of Europe
- Economics 117. Economic History of the United States
- Economics 120. Comparative Economic Systems
- Economics 121. Economic Development
- Economics 167. International Specialization
- Economics 200. Early Economic Doctrine
- Economics 201. Economic Thought since 1850
- Food Research 120. American Agricultural Policy
- Food Research 140. International Trade in Agricultural Commodities
Group III. International Law, Organization, and Administration

Anthropology 165. Problems of Administration in Pacific Territories
Hoover Institution 114. International Organization and World Politics
Political Science 100. Public Administration
Political Science 120. Problems of Modern Government
Political Science 131. Control of American Foreign Policy
Political Science 132. Principles and Problems of American Foreign Policy
Political Science 133. Control of Foreign Policies in Major World Powers
Political Science 135. Regional Arrangements for Collective Security
Political Science 145. International Relations

Group IV. World Politics

Geography 191. Political Geography
History 103. Europe in the Nineteenth Century
History 107. The British Empire
History 150. European International Relations, 1789–1914
History 164. The United States in World History
History 173. Historical Evolution of Mexico
History 177. Australia and New Zealand
History 183. Soviet Foreign Policy
History 186. The Balkans and the Near East since 1800
History 187. Muslim World
History 196. United States and the Far East
History 197. Southeast Asia and the Philippines
Hoover Institution 114. International Organization and World Politics
Hoover Institution 235. Problems of Sea Power
Political Science 122. The British Commonwealth and Empire
Political Science 133. Control of Foreign Policies in Major World Powers
Political Science 135. Regional Arrangements for Collective Security
Political Science 145. International Relations
Political Science 150. Introduction to Political Thought

With special permission of his adviser, when appropriate, a student may select one of the following: Classics H100, Greek History: The City States; Classics H101, Alexander and the Hellenistic World; Classics H103, The Roman Empire.

Courses, not more than one from each, may be selected from the regional groups following for satisfying Group IV requirement.

Group V. Regional Studies

Any one of the following subgroups may be chosen by the student. The student is permitted to petition to elect a subgroup different geographically from the ones illustrated following, e.g., Southeastern Europe, the United States, the Near East, etc.

Subgroup 1. Western Europe

Geography 145. Geography of Europe
History 142. The French Revolution and the Napoleonic Era
History 146. France since 1870
History 148. Germany since 1848
SOCIAL SCIENCES (SPECIAL PROGRAMS)

History 158. English Constitutional History
Political Science 134. Germany Between East and West
Modern European Languages AF154. French Civilization IV
Modern European Languages AF155. Political Problems of Contemporary France I

Subgroup 2. The British Empire

History 105. England
History 106. Great Britain since 1760
History 107. The British Empire
History 158. English Constitutional History
History 176. History of Canada

Subgroup 3. The Soviet Union

Asian Languages R91. Russian Civilization
Geography 133. Geography of the Soviet Union
History 112. Russia
History 182. The Russian Revolution
History 183. Soviet Foreign Policy
Hoover Institution 141. Eastern Europe since 1945
Political Science 126. Government of the Soviet Union

Subgroup 4. Latin America

Geography 120. Geography of South America
Geography 121. Geography of Middle America
History 118. Modern Latin America
History 173. Historical Evolution of Mexico
Political Science 128. Government and Politics in Latin America
Political Science 138. Latin America and the United States
Modern European Languages AS143-145. Hispanic World

Subgroup 5. Asia

Anthropology 152. Peoples of Asia
Asian Languages C161. Contemporary China
Asian Languages E91. Indian Civilization
Asian Languages R100. Directed Reading in English
History 114. Far Eastern Civilizations: Modern Period
History 115. Diplomatic History of the Far East
History 193. History of Modern Japan
History 196. United States and the Far East
Hoover Institution 189. Reform and Revolution in Twentieth Century China and Japan
Political Science 123. Governments of Asia
Political Science 124. Government and Politics in Japan
Political Science 125. Government and Politics in China
Political Science 136. Southeast Asia
Political Science 137. Indonesia

Master of Arts

Provisional enrollment for the degree of Master of Arts in the International Relations Program will be made on presentation of a creditable record of undergraduate work (with average grade of B) equivalent to the subject-matter requirements of the degree of Bachelor of Arts stated above. Subject-matter deficiencies in the undergraduate record have to be made up before the
degree is granted. Faculty advisers will provide guidance in course work and in choice and direction of thesis, and will approve application for formal admission to candidacy to the University Committee on Graduate Study.

Candidates will be recommended for the degree upon satisfactory completion (with average grade of B) of at least one full academic year as a graduate student with 45 units of work, not more than 15 units of which may be fulfilled by the required thesis. The candidate must also demonstrate a satisfactory reading knowledge of one modern foreign language, competence to be established by two quarters of second-year reading courses with average grade of C, certification of adviser, or examination, at discretion of committee in charge; and, if he offers a regional field of study, the language must be appropriate to that field.

Work for the degree must be concentrated in three of the five fields of study (groups) given above under "Bachelor of Arts." One field requirement may be satisfied by presentation of the required thesis on a subject lying within that field; the other two field requirements must be met by work in courses of an advanced character.

Special Programs

Attention of both undergraduate seniors and graduate students interested in Latin American Studies is called to the opportunity for training in research and publication provided by the Hispanic American Report in connection with the Hispanic World Affairs Seminar (Humanities 248).

Course of Instruction

100. International Relations: Advanced Practice — Practice work in executive positions of the Institute of International Relations, with weekly conferences. Restricted to undergraduate officers of the Institute of International Relations admitted by consent of instructor. May be taken for a maximum of three quarters.

1 unit, autumn, winter, and spring, (Watkins), by arrangement

See also Senior Colloquia.

SOCIOMETRY

Emeritus: Charles Nathan Reynolds (Professor)

Executive Head: Edmund Howell Volkart
Professors: Richard Tracy LaPiere, Paul Wallin
Associate Professors: Edmund Howell Volkart, ———
Assistant Professors: Robert Arthur Ellis, William Maxwell McCord
Instructor: ———

The courses offered by this Department are designed to acquaint students with the methods, theories, and problems of modern sociology. Special emphasis is placed on the analysis of contemporary American society, with offerings adapted to both the general student and the specialist.

DEGREES

Bachelor of Arts

In addition to the basic University requirements for this degree, forty-five units of sociology are required. This program must include Sociology 1,
Sociology 2, Anthropology 1, and Psychology 1. To be recommended for the degree the student must maintain an average grade of C or higher in the major field. The student's program is arranged in consultation with the Department adviser, and it is strongly recommended that an elementary course in statistics be included—especially if the student intends to pursue graduate work in this field.

Master of Arts

To enter this program a student is required to have a Bachelor's degree in sociology and he must have completed an elementary course in statistics. When, under special circumstances, a student is admitted without having met these conditions, the Department will require that he undertake an undergraduate program in preparation for his graduate work.

To be recommended for the degree, forty-five units of approved work must be completed; no units will count which do not have a grade of C or higher, and to obtain the degree the student must receive an average grade of B or better. At least thirty of the forty-five units must be received in courses offered by the Department.

Twelve of the required forty-five units may be obtained either by completing a Master's thesis, or by participating in one of the formal research programs being conducted by the faculty. The candidate's program must be formulated in consultation with the Department's Director of Graduate Studies and must be approved by him. The following courses are required: 251 (Trends in Contemporary American Sociology) and 255 (Methods of Social Research).

Doctor of Philosophy

To be recommended to the University Committee on Graduate Study for admission to candidacy for this degree, the student must satisfy the following requirements: (a) he must have an A.M. in sociology, or the equivalent thereof in course work; (b) he must demonstrate to appropriate examiners his knowledge of two languages other than English, which languages are to be approved by the Department; or, if the Department and the University Committee on Graduate Study approve, he may demonstrate his knowledge of one language other than English, and, in addition, must satisfactorily pass at least fifteen units of work in a field other than sociology, but related to it, e.g., statistics. Normally, both of these requirements will be satisfied no later than during the second year of graduate study.

To be recommended for this degree, the candidate must (a) pass two courses in statistics, one of which may be 267 (Quantitative Methods in Sociology); and (b) pass a Departmental written examination in the following subjects: (1) History and Modern Viewpoints (required); and (2) three of the following areas: demography, social organization, social pathology, and social psychology. Fields of specialization within these areas may be selected in consultation with the Director of Graduate Studies, and the examinations will ordinarily be offered only within the first seven weeks of each of the three major quarters.

When these Departmental examinations are satisfactorily passed, the candidate will be certified for the University oral examination for the degree. Thereafter he must complete satisfactorily a doctoral dissertation.

Teaching Assistantships and Fellowships

The University has a number of fellowships and scholarships available. Information about these, as well as application blanks, may be secured by writing the Office of Admissions.
In addition, the Department nominates a number of graduate students as Teaching Assistants on either an annual or quarterly basis. The stipend for each Assistant varies with the average weekly work-load. Normally, such appointments are restricted to students who have had at least one quarter's residence as a graduate student in the Department.

**Courses Primarily for Undergraduates**

1. **Introduction to Sociology**—Basic concepts; theories; emphasizes group aspects of human behavior.
   - 5 units, autumn, (McCord), MTWThF 11
   - or spring, (———), MTWTh F 11
   - or summer, (Wallin), MTWThF 11

2. **Introduction to Social Psychology**—Interactions of the individual and his social milieu; emphasis on cultural basis of personality. Prerequisite: 1.
   - 5 units, winter, (Ellis), MTWThF 11

Note—The course sequence 1 and 2 is required of all majors in sociology. For others, 1 may be taken independently of 2.

The following 5-unit courses may, at the discretion of the instructor, meet either 4 or 5 days a week. Should a course meet 4 days only, extra work in the form of special reading, term paper, laboratory work, or otherwise, will be required for 5 units credit. In general, the higher the number of the course, the more advanced and technical is the material covered.

100. **Social Organization**—The structure and functions of human groups. Prerequisite: 1.
   - 5 units, autumn, (———), MTWThF 9

108. **Social Stratification**—Theories of social class; survey of studies of American social classes.
   - 5 units, autumn, (Ellis), MTWThF 10

109. **American Minorities**—Cultural groups in contact, conflict, cooperation.
   - 5 units, autumn, (———), MTWThF 11

116. **Mass Media and Modern Life**—Interdependence of mass communication and the forms and process of modern society.
   - 5 units, winter, (Volkart), MTWThF 1

118. **Mass Behavior**—Collective forms of social action as found in audiences, crowds, mobs, social movements. Prerequisite: 2.
   - 5 units, autumn, (LaPiere), MTWThF 2

122. **Social Conflict**—Processes and consequences of industrial, political, community, and national conflicts.
   - 5 units, spring, (———), MTWThF 10

124. **Social Disorganization**—Analysis of individual, family, community disorganization. Prerequisites: 1 and 2.
   - 5 units, winter, (Ellis), MTWThF 9

125. **Crime and the Criminal**—Varieties of crime; analysis of criminal as deviant type. Prerequisites: 1 and 2.
   - 5 units, winter, (Wallin), MTWThF 10

126. **Personality Maladjustments**—Relationships between personal maladjustment and social disorganization. Prerequisites: 1 and 2, and Psychology 1, or equivalents.
   - 5 units, spring, (LaPiere), MTWThF 11

129. **Social Psychology of Family Relationships**—Interpersonal relations in contemporary American families. Prerequisites: 1 and 2.
   - 5 units, winer, (———), MTWThF 2
138. Sociology of the Professions—Background, processes, consequences of professionalization in modern occupations.
  5 units, winter, (———), MTWThF 11

139. Sociological Theory—Critical analysis of the ideas of major sociological thinkers.
  5 units, spring, (Volkart), MTWThF 1

140. Social Control—Conforming behavior with special reference to status-seeking, small groups, and the larger society.
  5 units, winter, (———), MTWThF 1, to be given in 1959-60

141. Small Group Behavior—Experimental studies of interaction, leadership, structure in small groups. Prerequisites: 2, and Psychology 1.
  5 units, spring, (———), MTWThF 9, to be given in 1959-60

143. Social Psychology—Social psychological aspects of health, illness. Prerequisites: 2 and Psychology 1 and 110.
  5 units, autumn, (Volkart), MTWThF 1

145. Social Change—Societal adjustments to changes in technology, ideology, social organization. Prerequisite: 1.
  5 units, winter, (LaPiere), MTWThF 10

146. Social Research—Methods and techniques of research. Prerequisites: 1 and 2.
  5 units, spring, (Ellis), MTWThF 10, to be given in 1959-60

190. Directed Individual Study—For undergraduate students with special needs and showing capacity to do independent work. Prerequisite: consent of instructor.
  (Staff), by arrangement

COURSES PRIMARILY FOR GRADUATES

250. Development of Sociological Theory—Historical, analytical study of leading sociological thinkers. Prerequisite: consent of instructor.
  5 units, autumn, (Volkart), MW 4-6

251. Trends in Contemporary American Sociology—Critical analysis of more recent contributions of American sociologists. Prerequisite: consent of instructor.
  5 units, winter, (LaPiere), MW 4-6

255. Methods of Social Research—Logic of scientific research, methods commonly used for collection and analysis of social data. Prerequisites: introductory statistics, consent of instructor.
  5 units, autumn, (Ellis), TTh 4-6

256. Sociology and Medicine—Sociological, psychological problems relating to incidence, distribution, treatment of mental, physical illness. Prerequisite: consent of instructor.
  5 units, spring, (Wallin), Th 2-5

258. Seminar in Social Psychology—Analysis of concepts, theories of modern social psychology.
  5 units, spring, (Volkart), TTh 4-6

259. Seminar in the Social Psychology of Personality—Theoretical and empirical analysis of personality development. Prerequisite: consent of instructor.
  5 units, spring, (McCord), by arrangement

265. Seminar in Social Research—Theory, practice of techniques for measurement of attitudes, opinions, other social phenomena. Prerequisite: consent of instructor.
  5 units, winter, (Wallin), T 2-5
267. Quantitative Methods in Sociology — Prerequisites: introductory statistics, consent of instructor.
   5 units, spring, (Ellis), MW 4–6

300. Graduate Research—Special research projects undertaken for credit.
   (Staff), by arrangement

301. Graduate Research in History and Modern Viewpoints.
   (LaPiere), by arrangement

302. Graduate Research in Demography.
   (——), by arrangement

303. Graduate Research in Social Organization.
   (——), by arrangement

304. Graduate Research in Social Psychology.
   (Volkart, ———), by arrangement

309. Directed Graduate Research—As alternative to Master's thesis.
   (Staff), by arrangement

   (Staff), by arrangement

The Nature of American Society—See Graduate Division Special Programs 323.
See also Senior Colloquia.

Graduate students in sociology may, on consent of their Department advisors, count for sociology credit certain anthropology courses and seminars relevant to their special interests. Graduate courses offered in other departments and institutes within the University, such as the Psychology Department, the Food Research Institute, and the Hoover Institution, may also be elected for graduate credit, provided the course concerned is approved by the adviser as fitting into the student's program.

SPEECH and DRAMA

Emeriti: Lee Emerson Bassett, James Gordon Emerson (Professors); Elizabeth Lee Buckingham (Associate Professor)

Executive Head: Norman Philbrick (on leave 1958–59)
Acting Executive Head: Wendell Cole
Professors: Leland Taylor Chapin, Stanley T. Donner, Norman Philbrick (on leave 1958–59), H. Donald Winbigler
Associate Professors: Wendell Cole, Robert Loper, F. Cowles Strickland (on leave 1958–59)
Assistant Professors: Helene Blattner, Dorothy Huntington, James J. Murphy, Helen W. Schrader, George Willey. Acting: Stirling L. Huntley

CURRICULUM

The curriculum and the requirements for degrees in the Department of Speech and Drama are organized to provide opportunity for adequate training in the major fields of speech instruction, and also opportunities for teacher training. Its program of study and its requirements for degrees are designed to provide, in co-operation with other departments and courses of study, a broad
liberal education as well as specific professional training. In the training of the student, emphasis is placed by the Department upon acquiring skill as well as knowledge. In addition to opportunities for a liberal education, the work of the Department of Speech and Drama offers professional training for teachers; for theater arts; for radio and television; for rhetoric and public address; and for interpretative reading.

Qualified students who are in first- and second-year status are permitted to take certain third- and fourth-year courses.

The subject matter, areas, and nature of the courses are further indicated by the numbering system as follows:

1 to 9 on any level (1 to 9, 101 to 109, 201 to 209, etc.) are general.
10 to 14, Radio and Television
15 to 19, Teacher Training
20 to 29, Public Speaking
30 to 39, Interpretation
40 to 49, Speech Improvement
60 to 99, Theater and Drama
60 to 69, Acting and Directing
70 to 79, Stage Production and Technical
80 to 89, Children's Theater, Motion Pictures, Miscellaneous
90 to 99, Dramatic Literature, Theater History, Criticism

First- and second-year students who are preparing to major in speech and drama should include in their first- and second-year programs at least the following basic courses: 1 or 2 or 9, and 20 and 30. Normally these basic courses should be completed before a student pursues other work within the Department. The following courses are also recommended for prospective major students with a concentration in theater and drama: 70, 71, 75, and English 25.

ATTAINMENT EXAMINATIONS

Any student transferring to this Department with credit in college courses similar to any of the basic courses—1, 2, 9, 20, and 30—may evaluate the credit by taking an attainment examination in these courses. Success in passing an attainment examination entitles the student to substitute a more advanced course for the basic course.

Students entering with advanced standing who present credit in any basic required course must pass the attainment examination before Department credit is allowed or before being excused from the course. The examinations are given during the second week of the quarter and are designed to test adequate comprehension of subject matter covered in the course.

Students wishing to take attainment examinations should consult with the Executive Secretary of the Department during registration week.

ORAL SKILLS EXAMINATION

All undergraduates who are candidates for a degree with a major in speech and drama are required to demonstrate, before a committee of the Department, their satisfactory attainment in oral skills through a platform performance involving extemporaneous speaking and interpretative reading. This performance is also the means through which the student's adequacy in voice and diction is examined. This requirement should be fulfilled by the end of the junior year, and must be fulfilled not later than the first quarter of the senior year. Dates for oral skills examinations are listed each quarter on the Department calendar. The Secretary has application blanks and descriptive matter concerning the oral skills examination. A student is not eligible to take the examination until
he has satisfactorily completed the basic courses—20, 30, and one of the following: 1, 2, 9, or their equivalents. In special instances, as in the case of students transferring into the Department in the junior year, permission to take the examination before completing the basic course requirements must be obtained from the undergraduate advisory committee of the Department and be approved by the student's academic adviser.

DEGREES

Bachelor of Arts

The requirements for the degree of Bachelor of Arts with a major in speech and drama are planned to allow the student the widest possible latitude in the development of his special aptitudes and interests. A minimum program is required of all students. Beyond this minimum requirement, the student is permitted to elect in accordance with his interests either a general program in speech and drama or a professional program in radio and television, rhetoric and public address, teacher training, or theater and drama. The requirements for the degree of Bachelor of Arts may be summarized as follows:

1. The satisfactory completion, with an average grade of C or better, of not less than 45 units in speech and drama courses, including the following minimum general requirement: 20, 30, and one of the following: 1, 2, 9.

2. The satisfactory completion of one of the following programs:
   I. General Speech and Drama—31, 123 or 223, 121, and a sequence of 23 or 24 units from one of the following:
      a) Public Speaking 125, 223, 226, and approved electives.
      b) Interpretation 131, 230, 238, and approved electives.
      c) Radio and Television 10, 110a, b, and c, 113, 210a, b, or c, and 214, plus approved electives.
      d) Theater and Drama.
         1) Acting and Directing 61, 163, 191, 294 or English 171, and approved electives.
         2) Literature and Analysis 190, 191, 294, English 171.
         3) Technical Production 70, 71, 75, 74, and approved electives.
   II. Radio and Television—10, 110a, b, and c, 113, 210 a, b, and c, 212a, or b, or c, 213 and 214, plus approved electives for a minimum total of 45 units.
   III. Rhetoric and Public Address. A limited number of undergraduate majors will be accepted; for details consult the undergraduate adviser for public speaking.
   IV. Teacher Training—These courses are listed elsewhere in this Bulletin under teaching credentials.
   V. Theater and Drama—62, 70, 71, 74, 75, 164a, 164b, 164c, 190, 191, 294, English 171.

3. The completion of the oral skills examination. (See above.)

4. The satisfactory completion, with an average grade of C or better, of a minor program of not less than 20 units of advanced course work closely allied to the field of concentration, chosen from courses offered in a department or departments other than Speech and Drama. The minor program must be chosen with the advice and approval of the student's faculty adviser from among those programs approved by the faculty of the Department.

Special Major Program for Honors Candidates in Humanities—Students who are planning to take the special Honors Program in Humanities may fulfill the requirements for their major in speech and drama by the following:
1. The satisfactory passing of the oral skills examination.
2. Satisfactory completion of one of the following programs:
   I. General Speech and Drama—20, 30, and one of the following: 1, 2, 9; and 123 or 223, 121, 31, 131, 148, 190 or 191, 226, 242 or 245.
   II. Theater and Drama (Directing)—60, 61, 164a, 164b, 164c, 171, 190, 191, 264, 294, English 171.
   III. Theater and Drama (Dramatic Literature)—60, 163, 171, 190, 191, 291, 292, 294, English 25, 171 and 6 units of electives in speech and drama.

*Students electing either II or III above are not held to the prerequisite of completing 20, 30, and one of the following: 1, 2, 9.*

**Honors and Graduate Programs in Humanities**

For acceptable majors in Speech and Drama, an Honors Program in Humanities is offered, a description of which will be found under "Humanities (Special Programs)."

The Department of Speech and Drama participates in the Graduate Program in Humanities leading to the degree of Doctor of Philosophy.

**Teaching Credentials**

*General Secondary Credential*—Students wishing to obtain the Stanford General Secondary Credential should consult the Credential Secretary of the School of Education for the general requirements, and the teacher training adviser in the Department of Speech and Drama for Departmental requirements. Candidates for the General Secondary Credential with a teaching major in speech and drama should select two of the following programs in consultation with the teacher training adviser.

- **Public Speaking**: 10, 30, 31, 121, 125, 126, 223, 226, Speech Pathology and Audiology 130
- **Theater and Drama**: 60, 61, 70, 163, 174, 190, 191, English 171.
- **Speech Correction**: Speech Pathology and Audiology 110, 130, 140, 180, 184, 220, 240.

For programs and courses in Speech Correction, Hearing, and the Speech Sciences, please refer to the Division of Speech Pathology and Audiology listed in the section "Allied Medical Sciences" in this Bulletin.

It is assumed that the teaching major in speech and drama will also complete courses in English composition and literature. All candidates with a teaching major in speech and drama are required to take at least three courses in residence; for the teaching minor, two such courses are required. All majors are expected to meet the general Departmental requirements.

It is recognized that in some instances the total number of units represented by the courses listed above may exceed 60. The student may, in consultation with the teacher training adviser, substitute the nine units of general Departmental requirements for certain of the above courses. Students electing speech correction and theater and drama may, in consultation with the adviser, substitute 83, 180, and 182 for 190, 191, and English 171. Candidates for the General Secondary Credential with a teaching minor in speech and drama will take Speech and Drama 20 and 30, and will select an additional minimum of 24 units in consultation with the adviser for teacher training.

*Special Credential in Speech Correction*—For information regarding requirements for the Special Credential in Speech Correction and Lipreading, please refer to the Division of Speech Pathology and Audiology listed in the section "Allied Medical Sciences” in this Bulletin.
Advanced Degrees

Any student wishing to enter upon graduate work in the Department of Speech and Drama at Stanford University should apply to the Office of the Director of Admissions. In addition the student should submit directly to the Department of Speech and Drama the results of the following sections of the Graduate Record Examinations:

a) the Aptitude Test  
b) an Advanced Test in one of the areas chosen by the applicant from the brochure of the Educational Testing Service.

For information regarding the administering of these tests, the applicant should contact his nearest college or university or write directly to the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey, or Box 27896, Los Angeles, Calif. Admission to courses of advanced standing does not, however, imply admission to candidacy for an advanced degree. Students who are deficient in their undergraduate training in the fields of speech and drama will be required to make up such deficiencies.

Master of Arts

Before admission to candidacy for the Master of Arts degree, a student takes in his first quarter of residence diagnostic or program-planning tests, consisting of written examinations. The written examinations covering the specific field of the student's major interest are normally given within the first four weeks of the quarter. Entering graduate students are required to take these examinations during the first quarter of residence.

On the basis of the results of the diagnostic tests the student in consultation with a faculty adviser plans a complete program of study and selects a thesis subject. This program of study and the outline of the proposed research for the thesis should be submitted on proper forms to the Departmental Committee on Graduate Study for approval. There is no set program of graduate courses rigidly required of all prospective candidates for the Master of Arts degree. Each student with his adviser plans, in terms of his previous training as exemplified in the diagnostic examinations and in terms of his goals, an individual program to meet the requirements of the Department.

Admission to candidacy is granted by the University Committee on Graduate Study on the basis of a formal application approved in writing by the Department. Upon securing from the Department the approval of his program and thesis subject, the student should immediately file an application for admission to candidacy with the Registrar. This application must be filed not later than the fourth week of the quarter preceding that in which the candidate expects to receive his degree.

Requirements for the Degree—Candidates for the degree of Master of Arts in speech and drama must present a minimum of 40 units of graduate work and must spend at least one year (three quarters) or three summer quarters in full-time residence study. This program may include course work offered in other departments of the University. Of these units, not less than 4 nor more than 6 may be devoted to a thesis or project. For more than 6 units, however, the candidate may petition the Departmental Committee on Graduate Study. Students are required to maintain a satisfactory scholastic rating in all course work. Candidates are normally required to plan their programs to include a major from one of the following four fields of speech and drama: public speaking, interpretation, theater and drama, radio and television; and to include a minor from a second one of these fields, or from a related field in another department of the University. The minor program consists of 12
units; these 12 units are included in the 40 required units of graduate work. First- and second-year courses required of a candidate because of deficiencies in undergraduate preparation, as revealed by a preliminary examination, may not be used in satisfying the requirement of 40 units of advanced work. Full instructions concerning the Master of Arts program and review bibliographies should be obtained from the office of the Department.

Examinations—At the end of the last quarter of residence each candidate will be required to pass satisfactory comprehensive written examinations, demonstrating his command of that field or those fields of speech in which he has elected to study. Candidates who fail to pass these examinations may take them again but are disqualified by a second failure.

Candidates who fail to present an approved thesis in final form within one calendar year after passing the comprehensive examinations may be required to repeat the comprehensive examinations before being recommended for a degree. If the length of time intervening is beyond one calendar year, additional course work may be required before repetition of the examinations.

Thesis or Project—The thesis or research project must be carried on under the direction of a member of the faculty of the Department of Speech and Drama or under the direction of a member of the faculty of an allied department at the discretion of the adviser. Choice of subject and first steps in the work should be begun immediately after completion of the preliminary examinations and normally should not be delayed beyond the first quarter in residence. An adequate first draft must be submitted to the adviser not later than the end of the fourth week of the last quarter of resident study. The final draft must be submitted three weeks prior to the end of the quarter in which the degree is expected. After acceptance by the Department, three copies of the thesis or project must be presented for acceptance by the University Committee on Graduate Study. The thesis form and time of presentation prescribed by that Committee must be adhered to.

A limited number of students with major interest in theater and drama may, upon selection by the theater and drama staff, present a production project in lieu of the regular research thesis. Such a project consists of the selection and direction of a production for public presentation in the Studio Theater. The production book in proper form is presented in lieu of the regular thesis. Students who elect this production program must plan to spend six quarters in residence. Full particulars of the program may be obtained from the Executive Secretary of the Department.

The Department of Speech and Drama offers a special program of work in radio and television leading to the Master's degree. Enrollment in this program is limited to not more than 12 students per year. Upon completion of the academic requirements for the degree, which correspond to the requirements described above, each candidate is required to spend an internship of approximately three months in a professional radio or television station, or a related organization approved by the Department. For further particulars, write to the Executive Secretary of the Department.

Doctor of Philosophy

In the program leading to the doctorate in speech and drama, primary emphasis is placed upon training for research. A prospective candidate may plan a program with a concentration in one of the following two fields: theater and drama; rhetoric and public address.

The University regulations defining the requirements apply to all students who wish to become candidates for this degree. The program of courses and research is individually planned for each student. A full outline of procedures and requirements may be obtained upon application to the Executive Secretary of the Department.
SEMINARS

Attention of graduate students is directed to the series of seminars numbered 300 and above. These seminars cover the areas of radio and television, public address, dramatic literature, theater history, and playwriting. At least two seminars are offered each quarter in theater and drama, while at least one is offered each quarter in the other Departmental areas.

SPEECH CORRECTION, HEARING, AND SPEECH SCIENCES

For programs and courses in Speech Correction, Hearing, and the Speech Sciences, please refer to the Division of Speech Pathology and Audiology listed in the section “Allied Medical Sciences” in this Bulletin.

Attention of Speech and Drama majors is especially directed to the following courses which may be of interest: Speech Pathology and Audiology 110 (Principles of Phonetics), and Speech Pathology and Audiology 232 (Principles of Voice Training).

SUMMER QUARTER

The summer quarter courses regularly scheduled in the speech and drama curriculum are listed below. Additional courses will be published in the Summer Quarter Bulletin in February 1959.

Some courses which are repeated in the summer quarter carry decreased credit.

COURSES

GENERAL

General first- and second-year courses open to all interested students without prerequisites include Speech and Drama 1, 2, 9, 10, 20, 25, 30, 60, 61, 62, 70, 71, 74, 75, 85, 175. Special courses for foreign students interested in improving their pronunciation and understanding of English speech and their use of the written language are Speech and Drama 47, 48, 49.

1. Improving the Speaking Voice—Basic theory, practice; open to all students desiring to improve quality, flexibility of normal speaking voice. 3 units, autumn, winter, spring, (Huntington, Staff), MWF 8, 9, or 10

2. Improving Articulation and Pronunciation—Basic; emphasis on establishing of habits of distinct, accurate articulation, correct pronunciation of standard American speech. May be taken concurrently with Speech 1. 2 or 3 units, spring, (Blattner), TTh 9, one hour by arrangement

9. Dialects for Stage, Radio, and Television—Development of skill in use of sound, melody, emphasis patterns in major dialects of English. 3 units, winter, (Blattner), MWF 9

47. English Communication for Foreign Students—For foreign students interested in improving pronunciation, understanding of English speech, use of written language. 6 units, autumn, (Huntington, Staff), MTWThF 4, one hour by arrangement

48. English Communication for Foreign Students—Intermediate. 3 units, autumn or winter, (Huntington, Staff), MW 4

49. English Communication for Foreign Students (Advanced)—Emphasis on fluency, ability to communicate effectively in spoken, written Eng-
lish. Material will vary from time to time; hence course may be repeated for total of 6 units.
1 to 3 units, autumn, (Huntington, Staff), TTh 3, one hour by arrangement or winter, (Huntington, Staff), TTh 4, one hour by arrangement or spring, (Huntington, Staff), MW 4, one hour by arrangement

100. Individual Instruction—Continued study under direction and guidance in fields or subjects of special interest. Credit limited to 6 units.
2 or 3 units, any quarter, (Staff), by arrangement

300. Introduction to Research Methods—Emphasis on bibliographical methods, composition and style in research. Required of all Master of Arts candidates and those doctoral candidates who were not required to submit a thesis for the A.M. degree.
2 units, autumn or spring, (Cole), TTh 4-5

308. Research—Special problems in speech and drama under supervision of member of Department. May be repeated for total of 8 units.
1 to 4 units, any quarter, (Staff), by arrangement

1 to 6 units, any quarter, (Staff), by arrangement

400. Doctoral Research.
Any quarter, (Staff), by arrangement

RADIO AND TELEVISION

3 units, autumn, winter, or spring, (Clark), MWF 9

11. Radio Station Operation: KZSU—For management personnel. Consent of instructor. May be repeated for a total of 6 units.
2 units, autumn, winter, or spring, (Clark), by arrangement

3 units, each quarter, (Staff), MWF 10
110a. Radio.
3 units, autumn
110b. Television.
3 units, spring
110c. Film.
3 units, winter

113. Radio and Television Writing—All nondramatic forms.
3 units, autumn or winter, (Clark), MWF 11

4 units, each quarter, (Staff), TTh 1–3
210a. Radio.
4 units, winter
210b. Television.
4 units, autumn
210c. Film.
4 units, spring

212. Experiment in Broadcasting—Experimental approach to the creation, development and production of new ideas, techniques and methods. Consent of instructor.
3 units, each quarter, (Staff), T 10, and Th 10–12
212a. Radio.
3 units, spring
212b. Television.
3 units, winter
212c. Film.
3 units, autumn

4 units, winter or spring, (Clark), MTh 3–5
214. **Radio and Television Criticism**—The theory and practice of professional criticism based upon the objectives and potential of the broadcast media. For advanced students. Consent of instructor.

3 units, autumn, (Willey), MWF 3

310. **Proseminar in Radio and Television**—Introduction to various types of research, research methods in radio and television. Required of all graduate students specializing in radio and television.

4 units, autumn, (Willey), by arrangement

311. **Seminar in Radio and Television**—Directed studies in areas of bibliography, audience research, program analysis, production problems, effects of these media on society.

4 units, spring, (Donner), by arrangement

**Summer Radio and Television Institute**

R200. **Broadcasting Today**—Survey of nature, responsibilities of the media; structure of the industry; problems of regulation; general pattern of radio, television broadcasting. Required of all students.

3 units, summer, (Donner, Guest Lecturers, Staff), by arrangement

R201. **Non-Commercial Telecasting**—Taught in the studios of KQED for advanced students. The philosophy, the origination, the planning, the coordination and finally the production of non-commercial television programs. The course work will include an on-the-air series of telecasts. Limited to twenty students. (Same as Education 341.)

3 units, summer, (Donner, Staff), by arrangement

R202. **Radio Broadcasting Laboratory**—Direct application of all radio course work will be made by student through management, operation of intercampus radio station KZSU. Recommended for all students.

2 units, summer, (Donner, Staff), by arrangement

R204. **Radio Program and Production Techniques**—Major program forms; opportunity for experimenting with various types included in local station operation. Professionals from KNBC staff will present wide range of production problems.

2 units, summer, (Donner, Staff), by arrangement

R206. **Music in Radio and Television**—Orientation; various aspects of popular, classical music in broadcasting; production.

2 units, summer, (Donner, Staff), by arrangement

R207. **Radio Writing**—Commercial, music, talk, audience-participation, feature, documentary.

3 units, summer, (Donner, Staff), by arrangement

R208. **Advanced Radio and Television Dramatic Writing**—Creative dramatic writing for qualified students. Consent of instructor.

4 units, summer, (Donner, Staff), by arrangement

R209. **Radio News and Special Events**—Practical course to train students for work in radio and/or television newsroom—production, direction of special event broadcasts, telecasts. Limited to 12 students.

3 units, summer, (Donner, Staff), by arrangement

R210. **Television Selling and Advertising**—Audience analysis, sales promotion, time buying, agency relations, program sales.

2 units, summer, (Donner, Staff), by arrangement

R211. **Radio and Television Program Planning and Scheduling**—Seminar; current problems of program planning, building; local radio station operation. Limited to 12 students.

3 units, summer, (Donner, Staff), by arrangement

R212. **Survey of Television**—Electronic background, means of production,
writing, acting in television. Guest lecturers from allied fields of University, industry.

3 units, summer, (Donner, Staff), by arrangement

R214. Television Production—Practice in commercials, various kinds of shows under exacting requirements of television production. R212 should be taken concurrently.

3 units, summer, (Donner, Staff), by arrangement


5 units, summer, (Donner, Staff), by arrangement


3 units, summer, (Donner, Staff), by arrangement

R217. Television Station Management—Over-all view of problems facing top management; detailed functions of operating departments: program, sales, promotion, auditing, engineering. Limited to advanced students.

4 units, summer, (Donner, Staff), by arrangement

Teacher Training

115. Speech for the Classroom Teacher—Principles, methods of expository speaking for non-speech majors working for teaching credentials.

3 units, any quarter, (Schroder), MWF 11, MWF 1

Student Teaching in Speech Correction—See Education 242.

Student Teaching Junior College—See Education 248.

Curriculum and Instruction in Speech—See Education 286a and 286b.

Individual Study in Curriculum and Instruction—See Education 486i.

Curriculum and Instruction in Junior College—See Education 289.

Rhetoric and Public Speaking

20. Introduction to Public Speaking—Practice in composition, delivery of original speeches; special emphasis on problems of organization. Selected readings from Greek, Roman, English, American rhetorical prose.

3 units, any quarter, (Chapin or Murphy or Schrader), MWF 11, MWF 1

25. Introduction to Discussion and Debate—Basic practical course; emphasis upon orientation into allied disciplines of problem-solving discussion, effective use of argument in debate.

2 units, autumn, (Chapin or Murphy), alternate years, to be given in 1959–60

120. Advanced Public Speaking—Continuation of 20; emphasis on speech composition, style, audience response.

3 units, winter, (Chapin or Murphy), alternate years, to be given in 1959–60


3 units, autumn, (Chapin), M 3–5, and one hour to be arranged

123. Contemporary Public Address—Prominent speakers of twentieth century. During election years convention and campaign oratory emphasized.

2 units, autumn, (Wood), TTh 9

125. Discussion and Group Processes—Methods of problem-solving in discussion group; emphasis on leader’s role, processes of interaction.

3 units, winter or spring, (Schrader), MWF 10


1 or 2 units, autumn, winter, or spring, (Murphy, ———), by arrangement
223. **American Public Address**—Analysis of speeches on critical issues in history of American politics, government, education, religion.
3 units, autumn, (Schroder), MWF 9

226. **Classical and Medieval Public Address**—Survey of oratory and rhetoric from Greek period to 1530. Special attention to Aristotle, Cicero, Quintilian, medieval preaching. Third-, fourth-year students and graduate students.
4 units, autumn, (Murphy), TTh 2-4

227. **Senior Seminar in Public Address.**
4 units, winter, (Chapin or Murphy or Schroder), by arrangement

320. **Proseminar in Rhetoric and Public Speaking**—Introduction to various types of research, research methods in rhetoric, public speaking. Required of graduate students specializing in rhetoric, public speaking.
4 units, autumn, (Chapin, Murphy, Schroder), MW 2-4

321. **Seminar in Rhetoric and Public Speaking**—Directed studies in classical, medieval, modern rhetoric; dialectic; history of oratory.

321a. **Seminar in Rhetoric since the Renaissance.**
4 units, winter, (Murphy), by arrangement

321b. **Seminar in Rhetorical Criticism.**
4 units, spring, (Schroder), by arrangement

321c. **Seminar in Selected Studies.**
4 units, summer, (Chapin), by arrangement

322. **Seminar in American Public Address.**
4 units, autumn, (Chapin, Schroder), alternate years, to be given in 1959-60

328. **Seminar in Classical Rhetoric.**
4 units, spring, (Murphy), by arrangement, alternate years, to be given in 1959-60

329. **Seminar in British Public Address.**
4 units, winter, (Chapin), by arrangement

**Business and Professional Speaking**—See Business 301, Graduate School of Business Bulletin.

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**INTERPRETATION OF LITERATURE**

30. **Beginning Oral Interpretation**—Fundamental training in understanding thought and feeling in literature, communicating it to an audience.
3 units, autumn, winter, spring, (Blattner, Staff), MWF 8, 9, 10

31. **Intermediate Oral Interpretation**—Training in analysis of various forms of poetry, prose; emphasis on techniques of oral interpretation. Prerequisites: 30, and consent of instructor.
3 units, winter, (Blattner), MWF 10

131. **Interpretation of Literature**—Oral reading of poetry, prose; emphasis on literary values which may be expressed in oral interpretation. Prerequisite: 31, or consent of instructor.
3 units, autumn, (Blattner), MWF 11

230. **Oral Interpretation Programming and Performance**—Problems of choice, arrangement of materials to be prepared for oral interpretation for public presentation.
4 units, winter, (Blattner), TTh 2-4

238. **The Art of Interpretation**—Theories on the art of interpretation.
4 units, autumn, (Blattner), TTh 2-4

239. **Special Problems in Interpretation**—Detailed study of selected subject in field of interpretation.
3 units, spring, (Blattner), MW 2-3:30
330. Seminar in Interpretation—Material for study, in theory or in literature, will vary from quarter to quarter, hence seminar may be repeated for credit.
   4 units, spring, (Blattner), TTh 2-4

THEATER AND DRAMA

60. Introduction to the Contemporary Theater—Survey of group art of the theater: backgrounds; working principles in writing, production; interpretation of contemporary life.
   3 units, winter, (Loper, Staff), MW 11

61. Theory of Acting—Actor's resources; character, play analysis; methods of acting.
   3 units, spring, (Loper or ———), TTh 10; lab. MWF 2-3

62. Fundamentals of Movement—Bodily movement, basic pantomime for actors. Required of all students registered in acting courses.
   2 units, autumn or winter, (Crowder), TTh 1-3

63. Advanced Fundamentals of Movement—Body movement; emphasis on specific historical movement, dances.
   2 units, spring, (Crowder), TTh 1-3

70. Elementary Make-up—Practical laboratory course in fundamentals of make-up; required of all students concentrating in field of theater and drama.
   1 unit, spring, (Griffin), F 1-3

71. The Theory of Costume—Lectures, laboratory, demonstrations to acquaint student with theory of costuming a play, elementary techniques of costume construction. Required of all undergraduate theater and drama students.
   2 units, autumn and spring, (Griffin), TTh 10, lab. MW 1-4; crew by arrangement

74. Elementary Stage Production—Theory, practice in construction and painting of scenery, assembling of properties; stage management, including lectures, demonstrations, laboratory, crew work. Required of all undergraduate theater and drama students.
   3 units, autumn and spring, (Landry), MW 10; lab. TTh 1-3; crew by arrangement

75. Introduction to Stage Lighting—Lectures, demonstrations, assignments in theory, practice of stage lighting.
   2 units, spring, (Huntley), TTh 11; lab., M 2-5; crew by arrangement

85. Development of the Motion Picture—Theatrical, cinematic method from Garrick to Milestone, including Griffith, Eisenstein, etc.; laboratory, classroom showings of early and other significant films in range of styles.
   4 units, spring, (Huntley), MWF 8; lab. Th 7:15-9:30 p.m.

160. Theater Practice—Credit for participation in productions in acting or stagecraft. May be repeated for total of 9 units. Consent of instructor.
   1 to 3 units, any quarter, (Staff), by arrangement

163. Principles of Directing—Use of areas of stage, arrangement of furniture for actors, picturization, balance, use of levels, psychology of actors; coordination of playwright, electrician, designer, actor. Special emphasis for teachers in secondary schools. Practice, demonstration.
   3 units, spring, (Loper or ———), TTh 11; lab. MTWTh 2-3

164. Techniques of Acting and Directing—Fundamental principles of acting and directing, with an emphasis on practical technique in analysis, composition, rhythm, and style.
   164a. 3 units, autumn, (Loper or ———), MWF 10; lab. MW 1-2
   164b. Continuation of 164a. 3 units, winter, (Loper or ———), MWF 10; lab. MW 1-2
164c. Continuation of 164b. 3 units, spring, (Loper or ———), MWF 10; lab. MW 1-2

170. Advanced Costume Technique—Draperies, constructing, wigs, masks, headdresses, makeup, etc. Special emphasis on period styles. Prerequisites: 71 or 174.
3 units, winter, (Griffin), T 10; Th 10-12; lab. by arrangement

171. History of Costume—Historical survey of costumes including those for stage from ancient times to present. Prerequisite: 164, a, b, or 174 or 71.
3 units, autumn or summer, (Griffin), MWF 9

172. Introductory Costume Design—Design techniques for drama, opera, musical comedy, ballet, television, motion pictures. Intensive sketching of problems. Prerequisite: 171, or consent of instructor.
3 units, spring, (Griffin), MWF 11
or summer, (Griffin), MWF 10

174. Stage Production Survey—Intensive training in (a) scenery construction, (b) costuming, (c) theatrical lighting. Lectures, demonstrations, laboratory, course work. Required of all graduate students in theater and drama who fail to demonstrate adequate previous training in this field. May be taken in separate sections by those who have demonstrated adequate previous training in one or more of these areas.
2, 4, or 6 units, winter or summer, (Huntley, Landry, Griffin), MWF 11; lab. MF 1-4 and four crew hours by arrangement

175. Stage Design I—Perspective and mechanical drawing for the stage; principles of design; limitations of the stage. Prerequisites: 74 and 75, or 174, or consent of instructor.
3 units, autumn, (Hay), MWF 11; painting crew by arrangement

176. Advanced Stage Lighting—Colloquy, practice in design, execution of lighting plot. Control board design, operation. Prerequisite: 75 or 174.
3 units, autumn or summer, (Huntley), MWF 1, lab. by arrangement

177. Advanced Stage Production—Advanced techniques in scene construction, manipulation, drafting, stage management. Prerequisite: 74, or 164, or 174.
3 units, autumn, (Huntley), MW 1, one hour by arrangement

178. Stage Design II—Practice in stage design; analysis and expression of the play in scenic terms. Prerequisites: 175, and 163 or 164a, or equivalent work, and consent of instructor.
3 units, winter or summer, (Hay), MWF 11; painting crew by arrangement

3 units, autumn, (———), TTh 2, one hour by arrangement

181. Dramatization of Children's Literature—Children's literature adapted to needs of elementary, secondary school teachers; fundamentals of play adaptation for child actors, audience. Prerequisite: 180.
3 units, summer, (———)

183. Puppetry—Lectures, practical laboratory; construction, production practice of hand puppets for adult theater, children's theater, speech therapy. May be repeated for credit with marionettes instead of hand puppets.
3 units, autumn or spring, (———), MF 2-4, two hours by arrangement

190. Development of Dramatic Art (Ancient)—Development of physical stage, technical structure of drama; types, forms of drama from origins in Greece to end of medieval period.
4 units, autumn, (Loper or ———), MTWF 9

191. Development of Dramatic Art (Modern)—History, development of drama, theater from medieval period to modern times.
4 units, winter, (Cole or Loper or ———), MTWF 9
263. Advanced Directing—Interpreting the play, plotting action, methods of achieving climax; handling of group and mob scenes. Demonstration, practice. Prerequisite: 163 or 164 series.
3 units, winter or summer, (Loper or ———), TTh 10, lab. MWF 2-3

264. Projects in Directing—Problems in theory involving examination of various historic, modern styles of drama. Prerequisite: 263 or equivalent. May be repeated for total of 9 units. Permission of instruction.
3 units, any quarter, (Loper or ———), M 3-5; W 4-5

272. Projects in Stage Costume—Individual work in design, creating costumes, accessories for various productions. Prerequisites: 172 or permission of instructor.
3 to 5 units, any quarter, (Griffin), TTh 10

276. Projects in Stage Lighting—Advanced work in styles of production, or special lighting and model projects. Designing for productions. Prerequisites: 176 and 178.
3 units, any quarter, (Landry), TTh 9; lab. by arrangement

277. Projects in Technical Production—Advanced work involving technical direction, stage management of Department productions. Theater, house management. Prerequisites: 74 or 174, and 177.
3 units, any quarter, (Huntley), MW 9; lab., crew by arrangement

278. Projects in Stage Design—Advanced work in styles of production, or special design and model projects. Prerequisites: 176, and 178, and permission of instructor.
3 units, any quarter, (Hay), MW 10, one lab. by arrangement

282. Advanced Creative Dramatics—Practical experience to develop leadership in creative dramatics. Prerequisite: 180.
3 units, spring, (———), TTh 9, one hour by arrangement

291. American Drama—History of theater, dramatic literature of America from Colonial days to Civil War.
4 units, winter, (Cole or ———), MTWF 10

292. Modern American Drama—History of theater, dramatic literature of America from Civil War to present.
4 units, spring, (Cole or ———), MTWF 10

294. Playwriting and Dramatic Structure—Critical analysis of dramatic structure and technique for student interested in dramatic literature, play directing, or writing of original plays. May be taken for graduate credit in speech and drama.
4 units, autumn, (———), MTWF 9

295. Advanced Playwriting—Continuation of 294, but open only to students who have shown distinctive abilities as writers in 294.
4 units, winter, (———), MTWF 9

297. Theaters and Staging I (Classical)—Survey of theaters, staging methods, scenic design in relation to social, dramatic values, styles of theatrical production, from Greeks through Neo-Classical.
4 units, autumn, (Cole), TTh 4-6

298. Theaters and Staging II (Modern)—Survey of theaters, staging methods, scenic design in relation to social, dramatic values, styles of theatrical production, from Neo-Classical to Modern.
4 units, winter, (Cole), TTh 4-6

360. Proseminar in Theater and Drama—Introduction to various types of research, research methods in theater, drama. Required of graduate students specializing in theater and drama.
4 units, winter or summer, (Loper or ———), TTh 2-4

390. Seminar in Theatrical History and Dramatic Literature—Material for study will vary from year to year: hence, may be repeated for credit.
4 units, winter or summer, (Cole or Loper or ———), MW 2-4
391. Seminar in Comedy—Comedy as a dramatic form; emphasis on trends in American comedy, various historical theories of comedy.
   4 units, autumn, (———), MW 2-4

393. Seminar in Contemporary Drama—Major emphasis on development of modern realism; attention also to naturalism, expressionism as these affected contemporary drama.
   4 units, spring, (Loper or ———), TTh 4-6

395. Survey of Dramatic Literature for the Graduate Student—Development of European dramatic literature, special emphasis on certain areas according to needs of students enrolled.
   4 units, winter, (Cole or ———), MWF 1

396. Projects in Playwriting—Seminar in composition of full-length play. Open to students who have completed advanced playwriting, or its equivalent, or who have through submission of original plays demonstrated an aptitude for advanced technical qualifications in playwriting. Consent of instructor. May be repeated for total of 8 units.
   2 to 4 units, spring or summer, (———), by arrangement

397. Seminar in Stage Arts and Techniques—Reading, research in various fields of technique, art of theatrical production. Limited to 10 students.
   4 units, spring, (Cole), by arrangement

See also Senior Colloquia.

STATISTICS

Executive Head: Albert Hosmer Bowker
Professors: Kenneth Joseph Arrow, Albert Hosmer Bowker, Herman Chernoff (on leave 1958-59), Samuel Karlin, Quinn McNemar, Charles Stein
Visiting Professor: Wassily Hoeffding
Consulting Professor: William G. Madow
Associate Professors: Gerald J. Lieberman, Lincoln E. Moses
Assistant Professors: Milton Vernon Johns, Emanuel Parzen, Herbert E. Scarf

OFFERINGS AND FACILITIES

In addition to the program for statistics majors, several courses are offered for students majoring in other departments. General students with an interest in the principles of statistical inference and the theory of making decisions in the face of uncertainty should take Statistics 50. Statistics 110 covers the most important techniques used in the analysis of experimental data in engineering and science, and 116 provides a general introduction to the theory of probability; the sequence 116, 119, 120 is a basic one-year course in mathematical statistics; the sequence 116, 117a, and 117b is a basic one-year course in probability theory.

The program for majors prepares students to work as professional statisticians in government, business, industry, and for advanced students in teaching. The emphasis in undergraduate and Master's degree programs is on statistical techniques; the doctoral program emphasizes the mathematical theory of statistics and probability.

Students interested in computing and data processing have access to the Stanford Computation Center which contains an IBM 650.

Several other departments of the University also offer course work which
STATISTICS

may be used to satisfy some of the requirements for a degree in statistics. These courses are listed below.

Psychology 150a, 150b, and 250. Advanced Statistical Methods
Graduate School of Business 232. Business Forecasting
Graduate School of Business 331. Business Research Methods
Graduate School of Business 348. Marketing Research
Industrial Engineering 120. Quality Control by Statistical Methods
Industrial Engineering 220. Quality Control Applications
Industrial Engineering 261. Data Processing Seminar
Industrial Engineering 263. Data Processing Laboratory
Mathematics 100. Advanced Calculus
Mathematics 114. Matrix Theory
Mathematics 115, 116. Fundamental Concepts of Analysis
Mathematics 137, 138. Numerical Analysis
Mathematics 139. Theory and Operation of Computing Machines
Economics 170. Economic Statistics
Economics 171. Introduction to Quantitative Analysis
Economics 280. Quantitative Analysis in Economics
Economics 285. Special Topics in Mathematical Economics
Economics 380. Seminar in Econometrics

DEGREES

Bachelor of Science

The following Departmental requirements are in addition to the University's basic requirements for the Bachelor's degree:

1. Mathematics through Mathematics 24 or equivalent.
2. 40 units of work in statistics, including:
   a) 50, or equivalent
   b) 116, 119, 120, 122, 124
   c) Additional units to complete the 40 chosen from offerings in the Statistics Department or from the authorized courses in other departments listed under "Offerings and Facilities" above.

Master of Science

In addition to the University's basic requirements for the Master's degree, the Department requires that at least 30 units of the work at Stanford be chosen from the offerings in the Statistics Department or from the authorized courses in other departments listed under "Offerings and Facilities." Programs are ordinarily arranged to provide specialization in mathematical statistics, industrial statistics, or data processing and operations research.

The mathematical statistics option is flexible, depending on the background of the candidate; ordinarily it will include 122, 124, 126, 117a, 117b, 136, or more advanced courses if the student has had the equivalent of these as an undergraduate.

The program in industrial statistics is directed toward students with undergraduate training in engineering or science. Students will take 110, 116, 119, 120, 214, 216, and Industrial Engineering 120 and 220.

The data processing option is for students who are interested in the application of modern high speed electronic computer machines to business and industrial technology. The program requires Statistics 110, 116, 119, 120, 252, 253; Mathematics 114, 137, 139; and Industrial Engineering 261, 262. Students who do not have undergraduate work in calculus find it necessary to spend additional time obtaining a mathematical background.
Doctor of Philosophy

Candidates for the degree of Doctor of Philosophy in statistics will follow such courses as are approved by the Department faculty, subject to general University regulations. Each student's program should be arranged to include work in pure mathematics, mathematical statistics, and the application of statistics to some particular field. In preparation for research, students will be encouraged to include as much pure mathematics as possible in their studies. Work in a field of application should be stressed in the case of students who have concentrated heavily on mathematics as undergraduates.

The relative amount of time allotted to study under each of these headings will vary from individual to individual, according to previous training and experience. In any case, the following requirements are stipulated:

1. Familiarity with the mathematical theory of probability and the major divisions of statistical theory. Ordinarily, students will take 122, 124, 126, 218a, b, c, 230a, b, c, 236a, b, c.
2. Satisfactory completion of Mathematics 205a, b, c, and 206a or equivalent.
3. Completion of satisfactory minor in a field outside the jurisdiction of this Department.

Doctor of Philosophy Minor

The general requirements for the minor in statistics are a reasonable knowledge of the principal branches of the theory of statistics and professional competence in those branches of statistical theory commonly applied in the major. The degree of proficiency ordinarily required is that which an able graduate student might be expected to acquire in 30 hours of graduate work in statistics, its applications, and relevant mathematics. Ordinarily, about one-third of the minor will be in areas directly related to the major, one-third will consist of the basic sequence in mathematical statistics (116, 119, and 120), and the remainder will be chosen from courses in the Department and those listed under other departments.

Fellowships and Assistantships

Fellowships and research assistantships carry stipends of $2,000 to $3,000 for the academic year of three quarters (nine months). Teaching assistants, who teach one section of elementary mathematics per quarter, receive $1,620 for the academic year and scholarships covering tuition for nine units of course work per quarter. If qualified, they are awarded additional stipends of up to $1,400 as research assistants. Fellows and teaching assistants are also eligible for research assistantships during the fourth or summer quarter. Application for University fellowships should be made to the Office of Admissions; applications for teaching and research assistantships should be made to the Executive Head of the Department.

COURSES

7. Introduction to Statistics—Especially designed for economists. (Same as Economics 7.)
   5 units, autumn, (Bowker), MTWThF 11
   3 units, autumn, (———), MWF 10
   or spring, (———), MWF 10
50. Elementary Statistics—An introduction to statistics for the general student with emphasis on concepts of decision making in the face of uncertainty.

5 units, autumn, MTWThF 11
or spring, (Moses), MTWThF 8

51. Statistical Methodology—Tests of significance and estimation, with emphasis on the application and rationale of the commonest methods. Chi-square, least squares, regression, non-parametric methods, and analysis of variance. Prerequisite: an elementary statistics course.

3 units, spring, by arrangement

108. Sampling from Human Populations—Theory of sampling from finite populations; efficiency of various survey designs; application.

4 units, spring, (Madow), by arrangement

110. Statistical Methods in Engineering and the Physical Sciences—Use of statistical methods in research, production. Measurement errors, comparison of two or more means, curve fitting, correlation, design of engineering experiments. Prerequisite: Calculus.

4 units, autumn, (Lieberman), MW 4 and TTh 10
or winter, (———), MTWF 11
or spring, (———), MTWF 10

116. Theory of Probability—Elementary probability theory, sampling, distributions. (Same as Mathematics 123 and Economics 270.) Prerequisite: working knowledge of calculus.

4 units, autumn, (I) (Scarf), MTWF 9; (II) (Hoeffding), MTWF 10
or winter, (———), MTWF 9
or spring, (Karlin), MTWF 9

117a. Introduction to Stochastic Processes—Examples from scientific fields to indicate use of stochastic processes in construction of models of physical and behavioral phenomena. Random variables, counting processes, shot effect, Gaussian processes, stationary and ergodic processes, correlation and spectral distribution functions, birth and death processes, applications to communication theory, learning theory.

3 units, winter, (Parzen), MWF 2

117b. Stochastic Processes and Distribution Theory—Continuation of 117a. Emphasis on use of theory of stochastic processes to obtain distributions of random variables that arise in statistical theory and in models of physical, social phenomena. Random walk and ruin, random flights, random division of an interval, goodness of fit, renewal and queueing theory.

3 units, spring, (Parzen), MWF 2

119. Elementary Statistical Inference—Review of probability; distribution theory; sampling, sampling distributions; univariate, bivariate normal distribution; correlation, regression. (Same as Economics 271.) Prerequisite: 116.

3 units, winter, (Johns), MWF 9

120. Statistical Inference—Point estimation; interval estimation; tests of hypothesis; linear hypothesis; distribution free methods; sequential analysis. Prerequisite: 119.

3 units, spring, (Johns), MWF 9

122. Analysis of Variance—Theory of general linear hypotheses; important special cases of analysis of variance; case of unequal class frequencies. Prerequisite: 120, and some knowledge of matrix algebra, or consent of instructor.

3 units, autumn, (Moses), MW 3:30–5:00

124. Experimental Design—Randomization basis of experimental inference; randomized blocks; Latin squares; factorial experiments; split blocks; confounding, fractional replication; special topics. Prerequisite: 122.

3 units, winter, (Moses), MTW 11
126. Sequential and Non-Parametric Tests—Sequential method of statistical decisions; probability ratio tests; fundamental identity; simple hypotheses; composite hypotheses; rank order statistics; tests based on permutations of observations; non-parametric tolerance intervals. Prerequisite: 120.

3 units, spring, (______), by arrangement

136. Introduction to the Theory of Games and Statistical Decisions—Two person-zero sum games; strategy; elementary idea of statistical decision theory; Bayes, minimax solutions of decision problem; applications. Prerequisite: 110 or equivalent.

3 units, autumn, (______), MWF 10

138. Linear Programming—Fundamental theorems; variations of the simplex method; parametric programming; standard model formulations; quadratic programming; discussion of current developments. Prerequisite: 114 or equivalent.

3 units, spring, (______), MWF 3

152. Introduction to Operations Research—Application of mathematical models to industrial problems; such topics as linear programming, queueing, game theory, inventory. Discussion, solution of actual problems encountered in management, production, economics of industry. (Same as Industrial Engineering 152.) Prerequisite: 110.

3 units, autumn, (Lieberman), MWF 10

or winter, (______), MTW 4:15

210. Statistical Laboratory—Training in planning of statistical inquiry, analysis of results. Under direction of faculty member, students will carry out research project in applied statistics.

2 to 5 units, autumn, winter, or spring, (Staff), by arrangement

214. Experimental Statistics—Continuation of 110. Multivariate normal distribution; multiple correlation, regression; estimation, tests of hypotheses about regression coefficients; analysis of variance; selected topics. Prerequisite: 110.

3 units, winter, (______), by arrangement

216. Sampling Inspection—Review of principles of lot-by-lot acceptance inspection; variable inspection; general principles of sequential sampling plans; sampling plans for continuous production which control average outgoing quality. Prerequisite: 110.

3 units, spring, (Lieberman), by arrangement

218a, b, c. Problems Seminar—Study of specialized field in statistics; emphasis on solution of problems drawn from this field; required of all first-year graduate students studying for Ph.D. Prerequisite: 120.

3 units, autumn, winter, spring, (Stein), TTh 1–2:30

226. Colloquium in Statistics—Reports on current literature; discussion, presentation by graduate students, faculty interested in statistics; emphasis on theory of games, statistical decisions.

2 to 5 units, autumn, winter, or spring, (Staff), by arrangement

228a, b. Non-Parametric Statistical Inference—Statistical inference when functional form of underlying distribution is unknown; rank order statistics; sign tests; non-parametric discriminant analysis; non-parametric tolerance limits; theory of runs.

3 units, autumn, winter, (Hoeffding)

230a. Advanced Probability—Foundations of probability theory. Probability spaces, random variables; independence; conditional expectation; modes of convergence of sequences of random variables; distribution functions, characteristic functions; probability laws. Prerequisite: Mathematics 205 or equivalent.

3 units, autumn, (Parsen), MWF 3

3 units, winter, (Parsen), MWF 3

230c. Advanced Probability—Strong Probability Limit Theorems. Convergence of infinite series of random variables; Strong Law of Large Numbers; Law of Iterated Logarithm; orthogonal random variables; Martingales.

3 units, spring, (Parsen), MWF 3

236a, b, c. Decision Theory and Statistical Inference—Minimax theorem, admissibility and complete class theorem, formulation of statistical decision problems, sufficient statistics, testing hypotheses, estimation, comparison of experiments, and sequential problems.

3 units, autumn, winter, spring, (Stein), MTWTThF 10


(Staff)

252. Operations Research—A rigorous treatment of linear programming, queueing, inventory theory, and other techniques used in Operations Research. (Same as Industrial Engineering 252.) Prerequisite: 152.

3 units, spring, (Lieberman), MTW 4:15

253. Operations Research—Continuation of 252; emphasis on the inventory problem, including static and dynamic programming models. (Same as Industrial Engineering 253.) Prerequisite: 252.

3 units, autumn, (______), to be given in 1959-60

256. Inventory and Production Control—General discussion of inventory models; costs; analysis of the one stage model; the sequential inventory problem; time lags; operating characteristics; statistical considerations. Prerequisite: 116.

3 units, winter, (Scarf), by arrangement
SCHOOL of LAW

Emeriti: Joseph Walter Bingham, James Emmet Brenner, Marion Rice Kirkwood, George Edward Osborne, William Brownlee Owens (Professors)

Dean: Carl B. Spaeth
Associate Dean: Preston N. Silbaugh
Professors: Moffatt Hancock, John Bingham Hurlbut, John Richard McDonough, Jr., J. Keith Mann, Phil C. Neal, Harry John Rathbun, Gordon Kendall Scott, Harold Shepherd, Carl B. Spaeth, Samuel David Thurman, Lowell Turrentine
Associate Professors: Lawrence F. Ebb, John Henry Merryman, Herbert L. Packer, Preston N. Silbaugh
Librarian: John Henry Merryman

THE WORK OF THE LAW SCHOOL

The School of Law was established as a department of the University in 1893. Its purpose is to provide a thorough legal education for students who are fitted by their maturity and their previous academic training to pursue professional study under university methods of instruction. The curriculum leading to the first degree in law (LL.B.) constitutes an adequate preparation for the practice of law in any English-speaking jurisdiction. Graduate work leading to the degrees of Master of Laws and Doctor of the Science of Law is also offered. (For Law School curriculum see the Law School Bulletin.)

NONPROFESSIONAL COURSES

The following nonprofessional courses open to undergraduate students may be counted toward the A.B. degree but not toward professional degrees in law.

101. Business Law I—Elementary legal theory, method, and history under the Anglo-American legal system with particular reference to the law on contract and of quasi contract. The subject is approached primarily through the study of decided cases. Open to seniors and graduate students only. Sections are limited to 100 students. Textbook: Teevan and Smith, Business Law, Vol. I.
- 5 units, autumn, MTWThF 11
  or winter, MTWThF 10 (Rathbun)

104a, b. Law in Society—This course is designed to provide for students who do not intend to take up the professional study of law, insight into how law and legal institutions function as a means of social control. The materials chosen for this purpose are cases revolving about the general theme of Freedom of Contract and Its Limitations. Attention will be focused on the process of decision making and the growth of legal doctrine in the area covered by the course in response to changing conditions and evolving social problems.
Specific topics considered are: the nature of the contract transaction; the concept of freedom of contract in nineteenth and twentieth century America; freedom to select the persons with whom one will contract; freedom in the process of bargaining and in the subject matter of bargain; freedom of contract
in the area of remedies for nonperformance of contract and the law's allo-
ca-
tion of risk of loss due to changed or unusual circumstances.

The case method of study will be followed and students will be required to
brief, analyze, and participate in the discussion of cases.

The course will be continuous through winter and spring quarters. Final
credit is dependent on completion of the work of both quarters. Enrollment
limited to 30 seniors and juniors. Applicants must register for the course by
December 1, 1958 at the office of Professor Shepherd, Law School building.

3 units, winter, and 3 units, spring, (Shepherd), MWF 10
SCHOOL of MEDICINE

A separate bulletin describing all the offerings of the School of Medicine is issued annually by that School. Certain departments of the School of Medicine are also listed here because of their interest to students not working for an M.D. degree.

ALLIED MEDICAL SCIENCES

DIVISION OF PHYSICAL THERAPY

Director: Lucille Daniels
Professor: William H. Northway (Physical Medicine)
Associate Professors: Lucille Daniels, Marian Williams. Clinical: Herbert Browne, Helen Hardenbergh
Assistant Clinical Professor: Maurice Grossman
Instructors: Madeline M. Faller, Catherine Graham, Sarah Semans. Clinical: Anne J. Janett, Michael Keropian

OFFERINGS AND FACILITIES

The following programs in physical therapy are offered in conjunction with the Division of Physical Therapy of the Stanford University Hospitals:

I. A four-year course leading to the Bachelor of Arts degree.
II. A four-quarter, 12-month course for students with the Bachelor's degree and adequate training in the basic sciences.
III. The Master of Arts degree.
IV. A minor field for the Doctor of Education degree.
V. A minor for the Doctor of Philosophy degree.

Program I, plus an additional quarter of clinical training, and Program II conform to the standards of the Council on Medical Education and Hospitals of the American Medical Association and prepare for examinations for registration in California and other states.

Admission

Applicants for the program leading to the Master of Arts degree are admitted summer and autumn quarters and graduate students applying for the certificate program autumn quarter. Admission dates for undergraduates and general information for all students will be found in the Information Bulletin of the University.

Scholarships, Fellowships, Loan Funds

Scholarships for students who have completed prerequisite courses are available through the California Elks Association, the Elks National Foundation, and the United Cerebral Palsy Association of the Peninsular Cities. The National Foundation for Infantile Paralysis offers such scholarships and also teaching fellowships for students who are working toward an advanced degree.
and are interested in teaching. The Kellogg Foundation maintains a loan fund for junior, senior, and graduate students.

Commissions in the Armed Services

The Air Force and the Navy offer commissions to senior women in the Bachelor's degree program, and to graduate women who are accepted for the 12-month course. Students pay tuition and maintenance from their officers' salaries.

Facilities

All prerequisite courses and the basic science courses that are a required part of the physical therapy curriculum are given in the respective departments on the campus. The courses in physical therapy theory and technique are held in Building 101 at Stanford Village, which houses lecture, laboratory, and research rooms, a library, and a well-equipped teaching clinic for patients from the University and the community. Following initial experience in the Department's own clinic, assignment to hospitals, rehabilitation centers, and crippled children's schools on the Peninsula, in San Francisco, and in the East Bay area assures well-rounded clinical training.

I. PROGRAM FOR THE DEGREE OF BACHELOR OF ARTS

The following Departmental requirements are in addition to the University's basic requirements for the Bachelor's degree:

First- and second-year undergraduate program:

Courses in biological science equivalent to one course each quarter for three quarters are required. General biology, botany, zoology, comparative vertebrate anatomy or embryology, and general or plant physiology may be used to fulfill this requirement (all courses must include laboratory work).

Courses in physical science equivalent to one course each quarter for three quarters are required; of these, at least one should be taken in chemistry. Courses in physics or mathematics or both may be used to fulfill the additional two-quarter requirement (chemistry and physics courses must include laboratory work).

General Psychology and Introduction to Physical Therapy should be taken during the first two years.

Students should confer with a physical therapy adviser as early as possible to determine the best course sequence.

Third- and fourth-year undergraduate program:

Physiology 101. Principles of Human Physiology.
Physiology 113. Physiology of Adaptation.
Anatomy 114. Practical Anatomy.
Physical Therapy 150 to 195, and at least one Upper Division course in psychology are required. Education 155, Elementary Analysis of Body Movement, and Education 169, Kinesiology, courses in health education, and additional courses in psychology should be included in this program.

II. PROGRAM FOR THE TWELVE-MONTH COURSE

Students applying for this course should present a Bachelor's degree. They should have completed the biological science, physical science and psychology courses listed under the first- and second-year undergraduate program and
additional courses in physiology, human anatomy, and social science including psychology.

Courses in this program include Physiology 101, Anatomy 114, and Physical Therapy 150–200.

III. PROGRAM FOR THE DEGREE OF MASTER OF ARTS

Candidates should present a Bachelor's degree in physical therapy, or a Bachelor's degree and a credential of completion for a course in physical therapy approved by the Council on Medical Education and Hospitals of the American Medical Association.

Experience in the field is a prerequisite and the program will be planned with each individual on the basis of former training and present interest. A thesis satisfactory to the faculty adviser and the University Committee on Graduate Study is required. Candidates must complete a minimum of 45 units of credit (including units for thesis).

IV. PROGRAM FOR MINOR FIELD FOR ED.D., OR PH.D. MINOR

A qualified physical therapist may select, with the approval of the adviser, units from the courses numbered above 200.

COURSES

Basic

50. Introduction to Physical Therapy—General survey of current procedures; brief review of historical background.
   2 units, winter, (Daniels), T 3–5

150. Elements of Pathology.
   2 units, autumn, (Hardenbergh), by arrangement

155. Ethics and Clinic Procedures—Ethics, professional organizations, administration of physical therapy departments. General clinic procedures analyzed; students are given opportunity to observe, assist in treatment of patients.
   3 units, autumn or spring, (Daniels, Graham), by arrangement

162. Physical Agents—Analysis of the principles underlying the use of hydrotherapy and massage; practice of essential techniques.
   3 units, autumn, (Faller), by arrangement

170. Physical Therapy as Applied to Orthopedics and Surgery.
   2 units, winter, (Browne), by arrangement

175. Electrotherapy and Light Therapy—Principles underlying the use of high- and low-frequency currents, ultra-violet and infrared radiation in treatment of injury, disease; laboratory work included.
   4 units, winter, (Northway and Graham), by arrangement

   4 units, autumn, (Semans), by arrangement

188. Basic Therapeutic Exercise—Theory, practice of manual muscle testing, neuromuscular re-education. Posture, body mechanics, functional activities in relation to various pathological conditions.
   4 units, winter, (Staff), by arrangement

   2 or 3 units, spring, (Staff), by arrangement
   2 units, spring, (Northway), by arrangement

   2 units, summer, (Daniels, Graham), by arrangement

194. Psychology of the Handicapped—Special problems of handicapped individual; emphasis on total rehabilitation.
   2 units, spring, (Grossman), by arrangement

   2 to 4 units, any quarter, (Staff), by arrangement

   4 to 8 units, any quarter, (Staff), by arrangement, given in San Francisco

Advanced

In the Master's degree program, courses are available in advanced basic science, scientific writing, education, and speech correction. A minimum of 20 units must be taken from the following:

   5 units, autumn or summer, (Williams, Staff), by arrangement

221. Problems in Kinesiology and Therapeutic Exercise—Continuation of 220; emphasis on research methods in specialized areas of rehabilitation.
   5 units, winter or summer, (Williams, Staff), by arrangement

   5 units, spring or summer, (Semans, Staff), by arrangement

   3 units, spring or summer, (Graham, Staff), by arrangement

232. Curriculum Development and Instruction—Objectives, organization, content, techniques in teaching courses in physical therapy.
   3 units, winter, (Daniels), by arrangement

234. Seminar in Administration—Administrative problems in hospitals, clinics, public health agencies, schools of physical therapy; interprofessional relationships in comprehensive patient care (rehabilitation).
   3 units, autumn or summer, (Daniels), by arrangement

244. Clinical Practice in Special Parts of the Field.
   1 to 6 units, any quarter, (Staff), by arrangement

245. Clinical Supervision of Students.
   2 or 3 units, any quarter, (Graham), by arrangement

246. Individual Work.
   1 to 8 units, any quarter, (Staff), by arrangement

   1 unit, autumn, winter or spring, (Northway, Staff), by arrangement

   1 to 3 units, winter, summer, (Staff), by arrangement

   5 to 8 units, (Williams, Staff), by arrangement

295. Research.
   (Staff), by arrangement
SPEECH PATHOLOGY and AUDIOLOGY

Director: Virgil A. Anderson
Professors: Virgil A. Anderson, Hayes A. Newby
Assistant Professor: Dorothy Huntington. Acting: ———

OFFERINGS AND FACILITIES

The chief purpose of the Division of Speech Pathology and Audiology is to prepare students for professional careers in the fields of speech correction, hearing, and the speech sciences. The rapid expansion of these fields in recent years has created many opportunities for properly trained individuals to work in hospital clinics, rehabilitation centers, in industry, and in various local, state, and federal agencies dealing with the handicapped. In addition, the curriculum prepares one for careers in public school speech and hearing work, for private practice, for teaching at various academic levels, and for research positions. The program of the Division is so organized, however, as to make ample provision for electives outside of the major and minor, affording the student opportunity to gain a liberal education along with his professional preparation. It is hoped that a number of the courses will also prove useful as electives to majors and minors from other departments.

The Division is fortunate in having its own library, containing a highly selected core of books and journals, not only in the immediate fields of speech and hearing but also in the related areas of psychology, special education, the physical sciences, and certain aspects of medicine as well. A well-equipped speech and hearing clinic provides ample opportunity for the student to supplement course work with practical experience with a wide range of speech and hearing disorders.

Three major areas of concentration are provided: speech correction, hearing, and speech science. While a student may specialize in any one of the three, he is expected to have some background in the other two as well. Undergraduate programs provide specializations for the degree only in speech correction and hearing.

The courses in the Division are numbered according to the following scheme:

- 0 to 9 on any level (0 to 9, 100 to 109, 200 to 209, etc.) are general
- 10 to 39, Speech Sciences
- 40 to 59, Speech Correction
- 60 to 79, Combined Speech and Hearing
- 80 to 99, Audiology (hearing)

DEGREES

Bachelor of Arts

The Bachelor of Arts program in Speech Pathology and Audiology is designed to fulfill the academic requirements for Basic Certification in The American Speech and Hearing Association. It thus prepares a student professionally to accept certain positions in speech therapy or in hearing. While additional work at the graduate level is recommended for more adequate preparation in these fields, a number of positions are open to students with only the Bachelor's degree. With moderate additional course work and clinical practice, it is possible for the student to satisfy Basic Certification requirements in both speech therapy and hearing. The following requirements are in addition to the University's basic requirements for the Bachelor's degree:

1. As a minimum program, the satisfactory completion, with an average grade of C or better, of the following courses:
110. Principles of Phonetics ........................................ 4
130. Introduction to Voice Science ................................. 4
140. Speech Re-education ........................................... 4
180. Introduction to Audiology ..................................... 4
184. Basic Audiometry .................................................. 4
220. The Psychology of Speech ...................................... 4
232. Principles of Voice Training .................................... 3
240. Speech Correction .................................................. 5
Speech and Drama 20. Public Speaking I ........................... 3
Speech and Drama 30. Fundamentals of Oral Reading I ........... 3

Completion of either of the following programs:

a) 241. Advanced Speech Correction ............................... 5
268. Clinical Methods ................................................... 2
270. Clinical Practice in Speech and Hearing ..................... 4
(Sufficient to total 200 clock hours of clinical experience)

b) 290. Aural Rehabilitation ............................................ 4
294. Speechreading .......................................................... 4
270. Clinical Practice in Speech and Hearing ..................... 4
(Sufficient to total 200 clock hours of clinical experience)

Total 49 or 50

2. The satisfactory completion, with an average grade of C or better, of a minor program of not less than 20 units of advanced work in a department or in departments closely allied with the student's program in speech correction and hearing. The minor program will be planned in consultation with the student's adviser.

Master of Arts

The University's basic requirements for the Master's degree (residence, thesis, etc.) are discussed in the section "Degrees" in this Bulletin. Details of the Master's program in the Division of Speech Pathology and Audiology are presented in the following paragraphs.

There is no set program of courses rigidly required of all candidates for the Master's degree, with the exception of 300 (Introduction to Graduate Study) and 304 (Master of Arts Thesis), which are required of all such candidates. Within limits, each program is planned individually to fit the needs, interests, and previous background of the student. In general, if the candidate expects to complete his degree within the minimum residence period of three quarters, his previous training should have included substantially the equivalent of the A.B. requirements outlined above. Deficiencies here will add somewhat to the amount of time required to complete the A.M. degree.

In terms of units, minimum requirements for the Master's degree are interpreted as being 40 units of graduate work. This program may include course work offered in other departments of the University. Of these units, not less than 4 nor more than 6 will be devoted to the thesis. Deviation from these limits will be allowed only upon petition to the faculty of the Division.

Masters' programs in the Division are normally planned to include a minor program of 12 units in a department or in departments closely allied with speech pathology and audiology. These 12 units are included in the total of 40 required for the degree. Departments most commonly chosen for the minor include Speech and Drama, Psychology, and Education, or a combination of the latter two. The student is expected to maintain a B average grade in his
minor work, as well as in his major. If his grade average falls below B in the minor, he will be required to pass an examination to be taken at the conclusion of his work for the degree. Otherwise, there will be no final examination on the minor.

Examinations—Early in his first quarter of residence the candidate will take a diagnostic examination covering the various subjects involved in his specialty. These include speech pathology, audiology, voice science, phonetics, and the psychology of speech. These examinations are truly diagnostic; they are not recorded as “passing” or “failing,” but are used as a basis for advising the student and planning his program.

Near the end of his final quarter of course work the student takes a written examination covering the three areas: speech pathology, audiology, and speech sciences. The relative emphasis devoted to each of these three areas in the examination will vary according to the particular specialization of the student. In order to be admitted to this examination the candidate must have presented a complete first draft of his thesis which must have the preliminary approval of his adviser.

Doctor of Philosophy

The University’s basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the section “Degrees” in this Bulletin. The program at the doctoral level in the Division of Speech Pathology and Audiology prepares the student academically for Advanced Certification in The American Speech and Hearing Association. He may specialize in any one of the three fields—speech pathology, audiology, or speech sciences—but he is expected to acquire a substantial background in the other two as well.

The doctoral program cannot be laid out in advance in terms of specific courses routinely required, but it is planned individually with the needs and interests of the candidate in mind. The general University requirements for the doctorate are followed as they apply to residence, foreign languages, and the possibility of substituting a course program in another department in lieu of a reading knowledge of one of the languages. The basic University residence requirement is nine quarters, or the equivalent thereof, beyond the Bachelor’s degree. This includes the minor program and the units allowed for dissertation.

All doctoral candidates must complete the following courses: 300 (Introduction to Graduate Study), 308 (Proseminar), and 400 (Doctoral Research) which is the formal course registration for the dissertation. Fifteen units of 400 must be included in the candidate’s program. Candidates for the doctorate normally include a formal minor as a part of their total program. The minor is chosen in consultation with the candidate’s major adviser, but the content and details of the minor program are specified and administered by the department in which the minor is taken.

Examinations—The doctoral candidate takes the same diagnostic examinations as described earlier for the Master’s degree. He also takes an additional higher-level examination covering these same five subjects to be used as a basis for program planning. Not later than the quarter prior to that in which the candidate expects to take his University oral examination, he must pass written examinations administered by the Division covering the three fields: speech pathology, audiology, and speech sciences, with the major emphasis being placed upon the candidate’s area of specialization. This is followed by an oral examination administered by the staff of the Division as a further preparation for the University oral examination.

Teaching Credentials

In cooperation with the School of Education, the Division of Speech Pathology and Audiology offers a program leading to the Special Credential
in Speech Correction and Lipreading, which authorizes the holder to work as speech therapist and hearing specialist in the public schools of California.

Requirements for the Special Credential are as follows:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education 330 or 330a—Guidance</td>
<td>3</td>
</tr>
<tr>
<td>Education 242—Student Teaching in Speech Correction</td>
<td>6</td>
</tr>
<tr>
<td>Psychology 190—Exceptional Children</td>
<td>3</td>
</tr>
<tr>
<td>And the following courses in Speech Pathology and Audiology:</td>
<td></td>
</tr>
<tr>
<td>110—Phonetics</td>
<td>4</td>
</tr>
<tr>
<td>140—Speech Re-education</td>
<td>4</td>
</tr>
<tr>
<td>180—Introduction to Audiology</td>
<td>4</td>
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<td>184—Basic Audiometry</td>
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<td>240—Speech Correction</td>
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<td>241—Advanced Speech Correction</td>
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<td>268—Clinical Methods</td>
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<td>270—Clinical Practice</td>
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<td>294—Speechreading</td>
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<td><strong>Total</strong></td>
<td><strong>47</strong></td>
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This Special Credential is based upon a teaching credential of General grade, such as a General Elementary or General Secondary, which means that the candidate for the Special Credential must already have, or must obtain, a General Credential.

A special program developed in cooperation with the School of Education makes it possible to obtain the Special Credential in Speech Correction and Lipreading, together with the General Elementary Credential at the end of the fifth year, within the period usually devoted to the General Elementary alone. Information concerning this combined program may be obtained from the Director of Speech Pathology and Audiology or from the Credential Secretary in the School of Education.

In cooperation with the Department of Speech and Drama, the Division of Speech Pathology and Audiology offers one of the sequence of courses required for the General Secondary Credential with a teaching major in Speech and Drama. For information concerning this program, please consult the section under Speech and Drama elsewhere in this Bulletin.

**Speech and Hearing Clinic**

Throughout the school year, including the summer quarter, a Speech and Hearing Clinic is maintained by the Division for the purpose of diagnosing and treating speech and hearing disorders. Individual instruction is provided for students suffering from minor disturbances of voice and speech, as well as for those with more serious disorders. A special program is maintained, providing both group and individual therapy, for those who stutter. For those students with hearing problems, the Clinic offers group and individual instruction in speechreading, evaluation of hearing aids and instruction in their use, and assistance with the speech problems arising from the hearing disorder. The services of the Speech and Hearing Clinic are extended without charge to all students and employees of the University.

**Scholarships and Assistantships**

The University has a number of scholarships and fellowships available. Particulars are to be found in the annual *Information* Bulletin distributed from the Registrar's Office. In addition, the Phi Chapter of Kappa Alpha Theta Fund and the J. D. Zellerbach Fund provide scholarships specifically for
students in Speech Correction and Hearing. Application for these special scholarships should be made directly to the Director of the Division of Speech Pathology and Audiology.

A number of clinical assistantships are available to students who have some background of training and experience. Some of these involve internships in near-by medical facilities and hence offer valuable experience in addition to the financial remuneration.

COURSES

1. Speech Clinic—Remedial work in speech defects, hearing problems. Open to all students in need of corrective treatment.
   *No credit, any quarter, (Anderson, Newby, Staff), by arrangement*

60. Introduction to Speech Therapy and Hearing—Elective, to acquaint undergraduate student with subject matter, vocational opportunities, in fields of speech therapy and hearing, which involve work with individuals having speech defects or hearing impairments. Lectures, demonstrations, films, field trips.
   *2 units, spring, (Anderson, Staff), TTh 8*

101. Independent Study—Individual study under direction in fields or subjects of special interest. Credit limited to 6 units.
   *1 to 3 units, any quarter, (Staff), by arrangement*

110. Principles of Phonetics—English phonetics as applied to articulation, standards of pronunciation, teaching of speech, speech correction.
   *4 units, autumn, (Huntington), MTWF 11*
   *or summer, (———), MTWThF 10*

130. Introduction to Voice Science—Physics, physiology of voice and speech; lectures, reports, demonstrations.
   *4 units, winter, (Huntington), MTWTh 2*

140. Speech Re-education—Fundamental training in recognition, treatment of more common types of vocal, articulatory defects.
   *4 units, autumn, (Anderson), MTWF 9*

150. Stuttering—Theories of stuttering, modern approaches to therapy.
   *3 units, spring, (Huntington), TTh 10, one hour by arrangement*
   *or summer, (———), MWF 1, one hour by arrangement*

180. Introduction to Audiology: Hearing and Deafness—Anatomy, physiology, acoustics of hearing; survey of field of audiology.
   *4 units, autumn, (Huntington), MTWF 1*

   *4 units, summer, (Newby), MTWThF 8*

184. Basic Audiometry—Theory, practice in administering individual, group hearing tests; emphasis on public school audiometry.
   *4 units, winter, (Newby), MWF 8, one hour by arrangement*

   *2 units, winter, (Huntington), by arrangement*

220. The Psychology of Speech—Origin, development of speech, semantics; relation of speech to thought, emotion, personality.
   *4 units, winter, (Anderson), MTWF 1*

230. Advanced Voice Science—Principally the physical characteristics of voice, speech as applied to problems in hearing and in speech training, correction, recording.
   *3 units, spring, (Huntington), MWF 10*

232. Principles of Voice Training—Theories, methods of training speake-
ing voice as applied to both normal, abnormal voice. Problems in teaching of
diction. Prerequisites: some background in voice, a course in phonetics.

3 units, spring, (Anderson), MWF 2

240. Speech Correction—Classification, diagnosis, treatment of speech de-
fects. Supervised practical work in Speech Clinic.

5 units, winter, (Anderson), MTWF 9, one hour by arrangement

241. Advanced Speech Correction—Continuation of 240; emphasis on more
serious types of speech disorders.

5 units, spring, (Anderson), MTWF 9, one hour by arrangement
or summer, (———), MWF 24, one hour by arrangement

252. Aphasia—Historical survey, pathology; methods of testing, diagnosis, therapy.

3 units, winter, (Newby), to be given in 1959-60

254. Speech Problems in Cerebral Palsy—Diagnosis, therapy for speech, language disturbances associated with cerebral palsy.

3 units, autumn, (———), MWF 8

260. Medical Backgrounds of Speech and Hearing Disorders—Diagnosis, treatment of speech, hearing disorders having an organic basis.

4 units, winter, (Newby, Staff), MF 11 and W 4-6

264. Clinical Testing and Diagnosis—Theory, practice in use of tests, other diagnostic techniques that can be applied to speech correction.

3 units, spring, (———), MWF 1

268. Clinical Methods—Theory, practical demonstrations of materials, techniques applicable to speech and hearing therapy.

2 units, winter, (———), TTh 8

270. Clinical Practice in Speech and Hearing—Prerequisite: 240. May be
repeated for total of 8 units.

1 to 3 units, any quarter, (Anderson, Staff), by arrangement

284. Advanced Audiometry—Pure tone, speech audiometric practices for audiology clinic. Prerequisite: 184 or equivalent.

4 units, spring, (Newby), MWF 11

290. Aural Rehabilitation: Auditory Training and Speech—Rehabilita-
tive procedures for hard-of-hearing child, adult. Supervised practical work in Clinic.

4 units, autumn, (Newby), to be given in 1959-60

294. Speechreading—Principles, methods of teaching acoustically handicapped to utilize visual cues in communication. Supervised practical work in Clinic.

4 units, spring, (Newby), MWF 8, one hour by arrangement
or 3 units, summer, (Newby), MWF 11

300. Introduction to Graduate Study—Bibliography, methods for stu-
dents of speech correction, hearing, speech sciences. Required of graduate students.

3 units, autumn, (Huntington), T 2-4; Th 2-3

301. Research—Independent study for graduate students. Credit limited to
total of 8 units.

1 to 3 units, any quarter, (Staff), by arrangement


1 to 6 units, any quarter, (Staff), by arrangement

308. Proseminar—Research, research methods in speech correction, hearing, speech science. Required of all Ph.D. degree candidates. Prerequisite: some training in statistics.

2 units, winter, (Huntington), by arrangement

320. Psychoacoustics—Study of the literature on nature of auditory stimuli, their perception.

3 units, spring, (Huntington), by arrangement
330. Seminar in Speech Sciences—Material will vary from year to year; hence, may be repeated for credit.
   4 units, spring, (Huntington), by arrangement

340. Seminar in Speech Correction—Material will vary from year to year; hence, may be repeated for credit.
   4 units, autumn, (Anderson), by arrangement
   or 3 units, summer, (---), by arrangement

370. Clinical Internship—In-service clinical practice in selected speech and hearing centers. Registration by permission.
   4 to 12 units, any quarter, (Staff), by arrangement

380. Seminar in Hearing—Material will vary from year to year; hence, may be repeated for credit.
   4 units, winter, (Newby), by arrangement

400. Doctoral Research.
   1 to 15 units, any quarter, (Staff), by arrangement

ANATOMY

Emeriti: Charles Haskell Danforth, Arthur William Meyer (Professors)

Executive Head: William Walter Greulich
Professors: David Lee Bassett, Donald James Gray, William Walter Greulich, Hadley Kirkman, Robert Stuart Turner
Associate Professor: Malcolm Ray Miller
Assistant Professors: F. Thomas Algard, Donald L. Stilwell, Jr.
Instructors: Ariel S. Compton, Stanley Howard Weitzman. Acting: Harriett B. Peckham
Research Associate: Philip E. Smith

OFFERINGS AND FACILITIES

Instruction in the Department of Anatomy is planned primarily to meet the needs of students in medicine but, in so far as facilities permit, all of the courses are open to other properly qualified third and fourth year undergraduate and graduate students. Those who are not registered in medicine but wish to take work in the Department should make arrangements in advance with the instructors concerned.

Facilities are available for a limited number of doctors of medicine, or others with equivalent training, who may wish to do special dissections or pursue work on problems within the scope of the Department. Graduate study may be undertaken in such aspects of anatomy as are indicated by the courses listed. Programs combining work in anatomy and other fields of biology or medicine may be arranged.

ADVANCED DEGREES

Students desiring to become candidates for advanced degrees in anatomy should consult the general University regulations regarding such degrees which are summarized in the section "Degrees" in this Bulletin. Candidates for the degree of Doctor of Philosophy will be expected to have done the equivalent
of at least the basic work offered in the Department. All programs leading to an advanced degree in anatomy must be worked out individually and approved by the Department faculty. It is expected that an average grade of B will be maintained. Approval must also be obtained by graduate students in other departments who wish to elect anatomy as a minor.

COURSES

REQUIRED

121. Dissection of the Human Body—Each student dissects one side of the body. Lectures, demonstrations. A few nonmedical students may be admitted by special arrangement.

21 units (462 hours), autumn, winter, spring, (Algard, Bassett, Gray, Greulich, Stilwell, Weitzman)
9 units (198 hours), autumn, MTWThFS 9-12
6 units (132 hours), winter, MWFS 9-12
6 units (132 hours), spring, MTWTh 9-12

122. Normal Histology and Microscopic Anatomy—Elementary structure, activities of the animal cell; histology, development of tissues, their combination into the organs of vertebrates, with special reference to man.

8 units (198 hours), autumn, winter, (Greulich, Kirkman, Miller, Turner, Algard, Compton)
4 units (99 hours), autumn, WThF 1-4
4 units (99 hours), winter, WThF 1-4

123. Neuroanatomy—Structure of central nervous system of man; dissections, prepared slides, dissections of central nervous systems of other mammals. Prerequisite: 122.

5 units (110 hours), spring, (Miller, Stilwell, Turner, Compton), M 1-5, TTh 1-4

ELECTIVE

112. Mammalian and Human Embryology—Detailed laboratory study of early embryogenesis and organogenesis; lectures on normal, abnormal development. For senior and graduate students. Prerequisites: Biology 22, 23, permission of instructor.

5 units, spring, (Algard), MWF 11, W 1-4

114. Practical Anatomy—Brief survey of human body by dissection, study of anatomical preparations. Lectures, demonstrations. For students of nursing, physiotherapy, hygiene, physical education, or others similarly qualified. Cannot be substituted for any part of Anatomy 121.

5 units, autumn, (Peckham, Williams), TWThF 1-4

142. Introduction to Endocrinology—Lectures on anatomy, physiology of endocrine glands. For senior and graduate students. Prerequisites: Biology 1, 2, 3, 22, or equivalents, permission of instructor.

2 units, autumn, (Miller), W 4-5

145. Individual Work—When circumstances warrant, work not specifically provided for in scheduled courses may be carried on under supervision of one or more members of staff.

Any quarter, (Staff), by arrangement

201. Topographical Anatomy—Laboratory study of fetal, infantile, adult cadavers; dissected and specially injected preparations, student reports relevant to this material. Prerequisites: 121, 122.

2 to 5 units, autumn, (Bassett), by arrangement

203. Research—By individual arrangement, approved by Department faculty.

Autumn, (Staff), by arrangement
204. Dissection of the Fetus—General introduction to fetal anatomy, or review and intensive study of selected regions. Enrollment limited. Ordinarily, prerequisites: 121 and a course in embryology.
   Autumn, winter, or spring, (Gray, Algard), by arrangement

207. Histological and Cytological Technique—General principles of microtechnique, practice in their application. Introduction to some of the more precise cytological techniques. Enrollment limited. For medical and graduate students only.
   3 to 6 units, autumn or winter, (Kirkman), by arrangement

208. Special Cytology—Practical laboratory introduction to special phases of nuclear, cytoplasmic cytology. Chief emphasis on use of technical methods for study of cytoplasmic organoids, inclusions. Enrollment limited. Prerequisites: 122, and 207.
   3 to 6 units, autumn or winter, (Kirkman), by arrangement

MEDICAL MICROBIOLOGY

Emeriti: Wilfred Hamilton Manwaring, Edwin William Schultz (Professors)

Executive Head: Sidney Raffel
Professors: Charles Egolf Clifton, Windsor C. Cutting, Sidney Raffel
Associate Professor: Carlton E. Schwerdt
Associate Clinical Professor: Emmett L. Durrum
Assistant Professor: Robert J. Roantree
Assistant Clinical Professor: Edward A. Custer
Instructor: Helen Sharp Thayer

OFFERINGS

The Department of Medical Microbiology offers, in addition to the courses required of students of medicine, a group of courses intended to cover the basic needs of students who wish to specialize in bacteriology. An undergraduate program leading to the degree of Bachelor of Arts in Medical Microbiology is offered to seniors who have completed all of the required premedical sciences, as well as Quantitative Analysis (Chemistry 110, 111). Undergraduates desiring to enroll in this program should, if possible, take Course 101, General Bacteriology, in their junior year. Students who fall below an average grade of C in bacteriological subjects completed will become ineligible for more advanced courses.

ADVANCED DEGREES

Master of Arts—Candidates for the degree of Master of Arts in Medical Microbiology will be expected to have completed the premedical requirements and Quantitative Analysis (Chemistry 110, 111), and to complete the following courses: Medical Microbiology 101, 225, 226, 231, 232, 238, 240, 314, 315; Biochemistry 141, 142, 143, 144, together with at least 15 units of research work bearing on the thesis subject. The latter may be in the form of a literature review acceptable to the Department faculty. A grade average of B in bacteriological subjects is required for admission to thesis work. Each candidate is expected to pass an oral examination of about two hours’ duration covering the fundamentals of bacteriology, immunology, and virology. A reading knowledge of French or German is required.

Doctor of Philosophy—Candidates for the degree of Doctor of Philosophy
must meet the same preliminary requirements as listed for the Master's degree, and will follow such courses as are approved by the major professor and the Department faculty, subject to general University regulations covering this degree. The following courses should be included in the first year or two of graduate work, if the equivalents were not included in the undergraduate program: Biology 20, 21, 23, 25, 29, 103, 124, 148; Biochemistry 141, 142, 143, 144, 145; Psychology 60 or Statistics 50; completion of the foreign language requirements. The following courses are strongly recommended, depending upon the field of major interest of the candidate: Anatomy 114, 122, 123, 142; Chemistry 171, 173, 175, 177, 246; Mathematics 10, 11, 22, 23; Pathology 201 (autumn quarter).

The following courses in the Department are normally covered during the first year of graduate work: Medical Microbiology 225, 226, 231, 232, 238, 240, 250, 314, 315. A grade average of B in bacteriological and related subjects is required for admission to research work. In addition to this required grade average the student is expected to pass an oral examination covering the fundamentals of general and medical bacteriology, immunology, and virology before being admitted to research work bearing on his dissertation. Students who enter the Department with advanced standing in bacteriology from other institutions are expected to take the final examination in Course 225, and in such other courses as may be stipulated, at the earliest time these examinations are regularly scheduled. In addition, such students are also required to pass the oral examination prior to admission to research activities.

COURSES

101. General Bacteriology—Survey of fundamental aspects of bacteriology. Prerequisites: Biology 1, 2, 3, and Chemistry 1, 2, 3.
5 units, spring, (Clifton and assistants), MWF 1; lab. MWF 2-4

225. Medical Microbiology—Lectures on fundamentals of pathogenic bacteriology; particular reference to bacteria, viruses of importance in infectious diseases of man. Discussion of essential aspects of immunology, serology; of practical laboratory diagnosis; of preventive measures. Must be accompanied by M.M. 226. Prerequisites: required premedical sciences.
4 units (44 hours), autumn, (Staff), MTThF 9-10

225a. Medical Microbiology—Continuation of 225. Must be accompanied by M.M. 226a.
1 unit (11 hours), winter, (to be given in San Francisco), by arrangement

226. Medical Microbiology—Laboratory exercises paralleling Course 225; emphasis on procedures in diagnosis of bacterial, viral infections, and on public health laboratory methods. Must be accompanied by M.M. 225.
4 units (121 hours), autumn, (Staff), MTThFS 10-12; lec. S 9-10

226a. Medical Microbiology—Continuation of 226. Must be accompanied by M.M. 225a.
1 unit, winter, (to be given in San Francisco), by arrangement

231. Immunology and Serology—Advanced lectures, demonstrations, laboratory exercises covering infection, immunity, antigen-antibody reactions. Prerequisites: Biology 103, M.M. 225 and 226.
6 units, winter, (Raffel, Roantree, Thayer), MWF 10; lab. MTW 1-4

232. Advanced Medical Microbiology—Lectures, laboratory exercises concerned especially with isolation, identification of bacteria, viruses. Prerequisites: M.M. 225, 226, and 231.
4 units, spring, (Staff), by arrangement

238. Bacterial Physiology—Lectures on physical, chemical aspects of bacterial growth, behavior. Prerequisites: M.M. 101, or 225 and 226, or equivalents.
5 units, winter, (Clifton), MTWThF 9
240. **Virology**—Lectures, demonstrations, laboratory exercises on general nature of plant, animal viruses, their relationships with their hosts. Prerequisites: M.M. 225, 226, and 231, or equivalents.

*5 units, spring, (Schwerdt, Thayer), MWF 9; lab. TTh 1-4*

242. **Hematology**—For students who are completing the year’s program in this department. This course will deal with clinical laboratory methods in hematology and urinalysis.

*3 units, spring, (Staff), W 1; lab. TW 2-5*

250. **Advanced and Special Work**—Students who have completed necessary basic courses with satisfactory grade average may be admitted by instructor to advanced work on informal basis in: (a) general bacteriology, including bacterial physiology; (b) medical bacteriology; (c) immunology and serology; or (d) virology.

*5 to 10 units, any quarter, (Clifton, Raffel, Roantree, Schwerdt), by arrangement*

300. **Research**—Students who have satisfactorily completed necessary foundation courses may elect research work in: (a) general bacteriology, including bacterial physiology; (b) pathogenic bacteriology; (c) immunology and serology; or (d) virology. Grade average of B in bacteriological subjects required for admission to research or thesis work.

*5 to 10 units, any quarter, (Clifton, Raffel, Roantree, Schwerdt), by arrangement*

314. **Current Literature**—Weekly conference on current articles in field of bacteriology. Required of all graduate students.

*1 unit, spring, (Clifton), by arrangement*

315. **Seminar**—Reports, discussions on selected topics. Required of all graduate students.

*1 unit, autumn, winter, spring, (Staff), by arrangement*

316. **Literature Reviews**—Review of literature on special topics assigned by instructor.

*3 to 5 units, any quarter, (Clifton, Raffel, Roantree, Schwerdt), by arrangement*

400. **Experimental Therapeutics**—For third- and fourth-year medical students. Systematic review of therapeutic agents with emphasis on mechanism of action of drugs. Given as a continuous course, but any quarter may be taken separately.

*1 unit, any quarter, (Cutting), W 12*

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**PHARMACOLOGY**

*Emeritus:* Leon Kolb (Associate Clinical Professor)

*Executive Head:* Avram Goldstein

*Professors:* Robert Hastings Dreisbach, Arthur Furst (Medicinal Chemistry), Avram Goldstein

*Assistant Professor:* Sumner Myron Kalman

*Instructors:* Lewis Aronow, John D. Gabourel

**OFFERINGS AND ADVANCED DEGREES**

The principal instruction offered by the Department of Pharmacology is for students in medicine. However, the required course for medical students (Pharmacology 201) and elective courses are also open to qualified graduate students.
students not registered in medicine. Programs leading to the degree of Doctor of Philosophy must be worked out by each student with the Department faculty. Candidates for the degree of Master of Arts are not accepted. Research opportunities are available for qualified students and for postdoctoral fellows. Prospective candidates for an advanced degree should consult the University’s general requirements described in the section “Degrees” in this Bulletin.

COURSES

201. Pharmacology—The principles of drug action, illustrated by discussions of the major groups of drugs. The laboratory exercises are designed to acquaint the student with experimental approaches to the study of pharmacology.

9 units (198 hours), continuous course winter, spring, (Staff), given in San Francisco

Winter, M 8-9, F 8-5
Spring, F 8-9, M 8-5

202. Active Transport—Selected topics relating to the transport of electrolytes and other substances across cell membranes of animal tissue. Open to medical students and to graduate students in the fields of biology, chemistry, and physics. Given at Stanford.

1 unit, autumn, (Kalman), T 4-5, alternate years; to be given in 1959–60

203. Protein Biosynthesis—Critical review of the current state of knowledge about the biochemical mechanisms of protein synthesis in microorganisms and higher animals. Given at Stanford.

2 units, autumn, (Goldstein), W 2-4

204. Medicinal Chemistry—Open only to fourth-year medical students. Given in San Francisco.

1 unit (11 hours), autumn, (Furst), T 12-1, alternate years; to be given in 1959–60

205. Chemical and Cellular Basis of Pharmacology—A series of lectures intended primarily for second-year medical students, reviewing basic topics in cellular physiology and biochemistry in relation to the actions of drugs. Given at Stanford.

1 unit, autumn, (Staff), S 8-9

300. Research—With the approval of the Department qualified students may elect research work in any area of pharmacology. Given at Stanford.

Any quarter, (Staff), by arrangement

PHYSIOLOGY

Emeriti: James Percy Baumberger, George Daniel Shafer, Frank Walter Weymouth (Professors)

Executive Head: Jefferson Martineau Crismon
Professors: Jefferson Martineau Crismon, Frederick A. Fuhrman, Ronald Grant
Associate Professor: George A. Feigen
Clinical Instructor: Joseph Erskine Welsh
Lecturers: Erling Wilbur Fredell, Alfred Dean Storey

OFFERINGS

Appropriate courses of study leading to the degree of Bachelor of Science will vary somewhat depending upon the major field of interest and should
be determined in consultation with the Department, preferably before comple-
tion of General Studies requirements so that full advantage may be taken
of opportunities for elective studies. In general, the requirements and rec-
ommendations for students contemplating application for admission to the School
of Medicine may be used as a guide in planning an appropriate course of study.

All programs leading to advanced degrees in physiology must be worked
out individually and approved by the Department faculty. In addition to the
procedures described elsewhere in this Bulletin for admission to candidacy for
advanced degrees, graduate students in physiology who plan to work toward
a Master of Arts or Doctor of Philosophy degree must prepare an adequate
statement of their proposed research. This statement, in the form of a proto-
thesis, is prepared by the student after consultation with his major professor.
Approval of the protothesis by the major professor and one other member of
the Department faculty is required before formal application for candidacy
is permitted. Acceptance of the protothesis will ordinarily be required before
the student begins the laboratory work upon which the thesis will be based.

The following courses are required of all candidates for advanced degrees:

152, 153, 253. Human Physiology.
200. Introduction to Research in Physiology.
201. Colloquium in Physiology.
210. Techniques in Mammalian Physiology.

In addition to the above, all candidates for the degree of Master of Arts
ordinarily take any three of the courses in the 300 series. Candidates for the
Ph.D. degree will ordinarily take six courses of the 300 series.

Advanced courses and research are offered to qualified students from other
departments. Permission of the instructor concerned should be secured before
registration. Students electing physiology as their major field of study in
graduate work should consult the Information Bulletin for an outline of the
procedure for admission to graduate standing. Students whose grade average
for graduate courses falls below C+ will be denied further registration in
physiology.

Courses

Required

152. Human Physiology—Systematic, detailed survey of mammalian phy-
siology; particular emphasis on man. Lectures, conferences, laboratory exer-
cises. (First of three quarters; see also 153, 253.)
2 units (66 hours), winter, (Staff), ThS 9-12

153. Human Physiology—Continuation of 152.
6 units (110 hours), spring, (Crismon, Staff), MTWTh 12, F 9-12, 1-4

253. Human Physiology—Continuation of 153.
6 units (110 hours), autumn, (Crismon, Staff), MTWTh 8; lab. TTh 1-4

Elective

90. Elementary Human Physiology—Survey primarily for students in pre-

nursing, physical education.
4 units, winter, (———), MWF 1; lab. T 1-4

101. Principles of Human Physiology—Intensive consideration of physi-
cal, chemical bases of mammalian physiology; special emphasis on mechanisms
of neuromuscular action, integration by central nervous system, cardiovascular
function, excretion, respiration, energy exchange. Open to qualified students
including majors in biology, premedicine, physical therapy, biochemistry, bac-
teriology, psychology, physical sciences. Prerequisites: completion of one year each of college chemistry, college biology with passing grade (Chemistry 1, 2, 3, Biology 1, 2, 3 at Stanford or equivalent). College courses in physics or mathematics may be substituted in lieu of two quarters of chemistry. Physiology 90 may not be substituted for above prerequisites.

5 units, winter, (Feigen), MWF 9; lab. MW 1-4

113. Physiology of Adaptation—Physiological responses of man to change in environment. Muscular exercise, heat, cold, altitude, nutritional problems, high pressure. Prerequisite: 101 or equivalent. Adequately prepared advanced students lacking this prerequisite may be admitted with permission of instructor. (Physiology 90 not acceptable as substitute for Physiology 101.)

3 units, autumn, (Crismon), MWF 9

167. Undergraduate Problems—Advanced exercises in physiology.

Any quarter, (Staff), by arrangement

200. Introduction to Research in Physiology—Basic techniques of research in physiology, including preparation of theses. Required of all candidates for advanced degrees.

2 units, autumn, (Staff), by arrangement

201. Colloquium in Physiology—Reports on current literature; presentation, discussion by graduate students, faculty. Required of all graduate students in physiology.

1 unit, autumn, winter, spring, (Staff), by arrangement

207. Research—Advanced course open to graduate students who have had one or more third- and fourth-year undergraduate courses in physiology. Opportunity for further study of selected subjects in physiology or writing of theses. Work planned for individual.

Any quarter, (Staff), by arrangement

210. Techniques in Mammalian Physiology—Instrumentation and methods for recording physiological variables; experimental surgery. Required for advanced degrees, open to others by arrangement.

2 units, winter, (Grant), by arrangement


1 unit, autumn, (Crismon, Staff), F 8

Advanced, for Graduate Students

301. Physiology of Water and Electrolytes—Metabolism of water and electrolytes especially in mammals. Detailed consideration of mechanisms of water and electrolyte economy and distribution.

2 units, autumn, (Crismon), M 1-3, alternate years, to be given in 1958-59

302. Circulation and Related Topics—Advanced consideration of selected topics in the physiology of the circulation and its relations to metabolism, temperature regulation, respiration, and the like. Lectures and discussions.

2 units, winter, (———), M 1-3, alternate years, to be given in 1958-59

303. Advanced General Physiology—Interpretation of physiological phenomena in terms of physical chemistry. Topics as, for example, oxidation-reduction, hydrogen ion concentration, colligative properties, diffusion, conduction, and energy transformations will receive special emphasis. Potentiometric, polarographic, spectrophotometric, calorimetric, and manometric methods will be discussed. Lectures and demonstrations.

2 units, spring, (———), M 1-3, alternate years, to be given in 1959-60

304. Metabolism of Tissues—Metabolism of mammalian tissues, organs; survey of fundamental mechanisms of action of hormones, other physiologically active compounds. Special methods.

2 units, autumn, (Fuhrman), M 1-3, alternate years, to be given in 1959-60
305. **Physiology of the Central Nervous System**—Physiology of the central nervous system. Recent advances in CNS physiology; new investigative techniques.

*2 units, winter, (Grant), M 1–3, alternate years, to be given in 1959–60*

306. **Current Problems in Muscle Physiology**—Discussion of selected biophysical, pharmacological, immunological aspects of muscular contraction; evaluation of modern theories of contractility.

*2 units, spring, (Feigen), M 1–3, alternate years, to be given in 1958–59*
SCHOOL of MINERAL SCIENCES

Dean: Charles Frederick Park, Jr.
Associate Dean: Konrad Bates Krauskopf

The aims of the School of Mineral Sciences are threefold: (a) to train men for responsible positions in industry, government, education, and research in the fields of geology, paleontology, geochemistry, geophysics, mineral engineering, metallurgical engineering, and petroleum engineering; (b) to conduct original investigations including the development of new principles, techniques, and procedures for the discovery, technology of production, conservation, and utilization of the nation’s mineral resources; (c) to give general instruction in the mineral sciences as part of a well-rounded education.

UNDERGRADUATE PROGRAM

Faculty Adviser—A student may enter the School of Mineral Sciences when he selects one of the Mineral Sciences fields for his major program. Upon entering the School, a student should report to the head of his department, who will designate a member of the faculty to act as his adviser. The adviser will aid the student in the selection of courses and will serve as consultant during his scholastic career. The adviser’s approval of the study plan must be obtained before registration is completed at the beginning of each quarter.

ROTC—Reserve Officers’ Training Corps are maintained at Stanford by the Army, the Navy, and the Air Force (see Air, Military, and Naval Science and Tactics in this Bulletin). Students enrolled in the School of Mineral Sciences who are also enrolled in an ROTC program will usually require more than four years (twelve quarters) in the University to obtain a baccalaureate degree. These air, military, and naval science courses require 36 units of credit in addition to the mineral science course requirements, and the additional time required will vary from one to three quarters depending upon the circumstances in each case.

GRADUATE PROGRAM

The undergraduate curricula offered by the School of Mineral Sciences are designed to give broad training, with emphasis on fundamental science. These curricula do not include sufficient specialization to prepare directly for professional work. The School offers graduate programs planned to prepare the student for responsible positions in industry, research, governmental work, and education. These programs lead to the advanced degrees of Master of Science, Engineer, and Doctor of Philosophy.

Admission to the Graduate Program—A student who wishes to enroll for graduate work in the School must be qualified for graduate standing in the University and in addition must be accepted by the School of Mineral Sciences. With the limited facilities available, it is not possible to accept all who apply for admission.

Faculty Adviser—Upon entering a graduate program the student should report to the head of his department, who will arrange with a member of the faculty to act as the student’s adviser. The student, in consultation with the
adviser, then arranges a course of study for the first quarter, and ultimately
a complete plan of study for the degree sought.

Opportunities for Original Investigation—Stanford University is situated
in a region that invites geologic field research at all seasons of the year.
The California Coast Ranges, Sierra Nevada, Cascade Mountains, Columbia
Plateau, and the Basin Ranges are all within easy reach, and their complex
geology offers many unsolved problems in all branches of the science. Lab-
oratories are available for research in the various branches of geology, in-
cluding paleontology and micropaleontology, mineralogy, petrology, geomor-
phology, economic geology, ground water, geochemistry, and geophysics. Fa-
cilities are also available for investigation and research in physical and process
metallurgy and in mineral and petroleum engineering, including laboratories
for the following purposes: chemical analysis; physicochemical measurements;
spectrography; X-ray diffraction; mineral dressing; metallurgical analysis;
physical testing; metallography; pyrometry; electrometallurgy; petroleum en-
gineering studies.

The proximity of mines, oil fields, petroleum laboratories, and refineries,
and a variety of metallurgical industries facilitates field work and industrial
cooperation on engineering research projects.

Financial aid—Scholarships, fellowships, and research grants are available
to students in the School of Mineral Sciences. Detailed information is avail-
able from the Dean's Office. Applications should be filed by February 15 for
awards which become effective in autumn quarter for the following year.

Normally about fifteen teaching assistantships are awarded to qualified
students to assist in laboratory instruction.

GEOLOGY

Emeritus: Eliot Blackwelder (Professor)

Executive Head: Benjamin Markham Page

Professors, Geology: Arthur David Howard, Siemon William Muller, Ben-
jamin Markham Page, Charles Frederick Park, Jr., Hubert Gregory
Schenck.

Visiting: Hans Ernst Thalmann. Consulting: Adolph Knopf

Professor, Geochemistry: Konrad Bates Krauskopf

Professor, Mineralogy: Colin Osborne Hutton

Associate Professors, Geology: Robert Ross Compton, Joseph J. Graham

Assistant Professors, Geology: Stanley Nelson Davis, John W. Harbaugh.

Acting: William R. Dickinson

Assistant Professor, Mineralogy: Kurt Servos

Assistant Professor and Curator, Paleontology: Myra Keen

Research Associates (by courtesy): Weston Bourret, Curt Dietz, Ekrem
Göksu, George Leavitt Harrington, Donnel Foster Hewett, Eleanora
Bliss Knopf, Ottmar F. Kotick, Chester R. Longwell, Earl Leroy Pack-
ard, Virginia M. Page, Hans Karl Stauffer, Gerald Ashley Waring

Bachelor of Science

The following requirements for the degree of Bachelor of Science in
geology and geochemistry are in addition to the University requirements in
general studies.
It should be noted that the Department of Geology has a specific requirement in foreign language. The general University requirement is completion of *either* Mathematics 23 *or* a course numbered 23 in a foreign language, but the Department of Geology requires completion of a language sequence whether or not Mathematics 23 is taken. Any modern language is accepted in fulfillment of this requirement, but German is recommended.

A student entering Stanford with credits for two years of high school language and four years of mathematics will normally have 17 units of free electives in the Geology curriculum, in addition to the University requirements and the requirements listed below (based on an average load of 15 units per quarter). If his preparation is less good, the number of electives is correspondingly smaller. In the Geochemistry curriculum the number of required courses is slightly greater, so that a student with inadequate preparation may find it necessary to take an additional quarter or more in order to complete the required courses for graduation.

The order in which courses are taken may be adapted somewhat to suit individual needs, but is restricted by the fact that some courses are prerequisites for others. It is strongly recommended that students intending to major in the Department of Geology take Chemistry 1, 2, 3 and Geology 1 or 1a during their first year; since these courses are required as preparation for many of the more advanced courses. A student should work out his schedule of courses with his adviser well in advance, so that he can be sure to arrange the courses in proper sequence.

Substitution of other courses for some of the requirements listed below is possible in exceptional cases. In particular, students specializing in paleontology may take advanced biology courses in place of calculus and geochemistry, and may substitute Physics 21, 23, 29, for Physics 51, 53, 55. Such changes in requirements should be arranged in consultation with the adviser and must be approved by the faculty of the Department.

### Geology Curriculum

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Subject</th>
<th>Quarter Given</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 1, 2, 3</td>
<td>General chemistry</td>
<td>AWS</td>
<td>13</td>
</tr>
<tr>
<td>Mathematics 10, 11, 21, 22</td>
<td>Analytical geometry, calculus</td>
<td>Any</td>
<td>12</td>
</tr>
<tr>
<td>Mechanical Engineering 9</td>
<td>Descriptive geometry</td>
<td>Any</td>
<td>4</td>
</tr>
<tr>
<td>Civil Engineering 20</td>
<td>Elementary surveying</td>
<td>A or S</td>
<td>3</td>
</tr>
<tr>
<td>Physics 51, 53, 55</td>
<td>Elementary physics</td>
<td>WSA</td>
<td>15</td>
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<tr>
<td>German through G23 (Note 1)</td>
<td>German</td>
<td>Any</td>
<td>0-18</td>
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<tr>
<td>Geology 1 or 1a</td>
<td>Physical geology</td>
<td>Any</td>
<td>5</td>
</tr>
<tr>
<td>Geology 2</td>
<td>Historical geology</td>
<td>W or S</td>
<td>5</td>
</tr>
<tr>
<td>Geology 25</td>
<td>Elementary mineralogy</td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>Geology 51</td>
<td>Elementary petrology</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>Geology 70</td>
<td>Introduction to Geochemistry</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>Geology 105</td>
<td>Structural geology</td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>Geology 107</td>
<td>Field techniques</td>
<td>S</td>
<td>2</td>
</tr>
<tr>
<td>Geology 112</td>
<td>Elementary paleontology</td>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>Any 1 of the following: Geology 113, 123, 126, 134, 170 or 190</td>
<td></td>
<td>Any</td>
<td>3-5</td>
</tr>
<tr>
<td>Geology 133</td>
<td>Geomorphology</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Any 1 of the following courses in economic geology: 181, 182, 183, 184, or 185</td>
<td></td>
<td>Any</td>
<td>5</td>
</tr>
<tr>
<td>Geology 108, 109</td>
<td>Field geology (Note 2)</td>
<td>Summer</td>
<td>15</td>
</tr>
</tbody>
</table>
Geochemistry Curriculum

Same as Geology Curriculum, except delete Geology 112 and 133 and add:

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Subject</th>
<th>Quarter Given</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 20,</td>
<td>Qualitative analysis</td>
<td>A</td>
<td>4</td>
</tr>
<tr>
<td>Chemistry 110, 111,</td>
<td>Quantitative analysis</td>
<td>A or W</td>
<td>5</td>
</tr>
<tr>
<td>Chemistry 171, 173,</td>
<td>Physical chemistry</td>
<td>AW</td>
<td>6</td>
</tr>
<tr>
<td>Mathematics 23,</td>
<td>Calculus</td>
<td>Any</td>
<td>3</td>
</tr>
<tr>
<td>Physics 57,</td>
<td>Atomic physics</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Geology 70, 170,</td>
<td>Geochemistry</td>
<td>AW</td>
<td>6</td>
</tr>
</tbody>
</table>

Note 1: German is recommended, but any modern foreign language may be substituted. In any language, completion of the course numbered 23 or the equivalent is required.

Note 2: A student who takes Geology 108 and 109 during the summer following his junior year will normally graduate at the end of winter quarter in his senior year.

Master of Science

Objectives—To round out the student's training for professional work in geology or geochemistry, through the completion of fundamental courses, both in the major field and in related sciences, and by obtaining a start on independent work and specialization.

Requirements for the Degree—The candidate must fulfill the following requirements:

1. Be registered in the graduate school for at least three quarters.
2. Complete 45 units with at least a B average. At least 6 of these units must be independent work on a research problem.
3. Make up deficiencies in previous training. Not more than 10 units of such work may be counted as part of the minimum total of 45 units. Geology 123 and 124 or equivalent are required of all Master of Science candidates.
4. Demonstrate by examination his ability to read geologic literature in a foreign language. The examination must be passed no later than the date of filing for the Master of Science degree.
5. Demonstrate in one of the following ways his knowledge of basic principles, and research methods in his general field of study: (a) By writing a thesis, as may be recommended at the discretion of individual advisers. (b) By preparing a report, ordinarily a term paper written for the 6 units of research, to be submitted to at least three faculty members.

Courses taken for the Master of Science degree must include at least 5 units in each of four of the following fields:

- Petroleum engineering
- Metallurgy
- Mining
- Geophysics
- Geomorphology, photo geology, and structural geology
- Mathematics and statistics
- Civil and industrial engineering
- Mechanical engineering and engineering mechanics
- Electrical engineering
- Economic geology
- Paleontology and stratigraphy
- Mineralogy
- Petrology
- Physics
- Chemistry and geochemistry
- Biology
- Geography
- Business
- Law
These courses must be junior, senior, or graduate courses (courses numbered 100 or higher) with the following exceptions: Biology 20; Physics 57, 87, 89. The courses must not include seminars or problems courses.

**Doctor of Philosophy**

*Objectives*—The degree of Doctor of Philosophy is conferred upon evidence of high attainment in a particular field of Geology, and ability to conduct an independent investigation and to present the results of such research.

*Requirements for the Degree*—A minimum of three years (nine quarters) of graduate study must be satisfactorily completed. At least one of these years, ordinarily the last, must be spent as a registered student at Stanford. The candidate must demonstrate by examination his ability to read German and one other foreign language. His record must indicate outstanding scholarship and deficiencies in previous training must be removed. He must pass the Departmental oral examination. He must fulfill the requirements of the minor department, if a minor is elected. He must pass the University oral examination, which is essentially a defense of the dissertation problem. He must prepare under faculty supervision a dissertation which is a contribution to knowledge and the result of independent work expressed in satisfactory form.

The Ph.D. dissertation must be submitted in its final form within five calendar years from the date of admission to candidacy by the University Committee on Graduate Study. Candidates for the degree who fail to meet this deadline will be required to reapply for admission to candidacy and retake the Departmental and the University oral examinations. They will be given an additional one year in which to submit their dissertations.

**General Geology**

(Courses in the 200, 300, and 400 series ordinarily are not open to undergraduates. Courses in the summer quarter are offered for a ten-week period unless otherwise noted.)

1. **Physical Geology**—Elementary study of the earth, particularly materials, structure, internal condition, physical and chemical processes at work upon it. Lectures, laboratory, field study. One three-hour laboratory period per week, two field excursions per quarter arranged to conform to student's schedule. (Students who have taken Physical Science 3 will receive only 3 units credit for Geology 1 or la.)
   
   5 units, autumn, (Krauskopf), MTWTh 8; lab., field trips by arrangement
   or winter, (Page), MTWTh 8; lab., field trips by arrangement
   or summer (8 weeks), (―――), MTWThF 10; lab., field trips by arrangement

1a. **Geology for Engineers**—Physical Geology modified with special reference to needs of engineers, but open to others. Lectures, discussions, laboratory, field work. One three-hour laboratory period per week, two field trips per quarter arranged to conform to student's schedule. Prerequisite: elementary chemistry.
   
   5 units, spring, (Davis), MWF 8; lab., field trips by arrangement

2. **Historical Geology**—Evolution of continents, oceans, mountain systems, other features of the earth; development of its animal, plant inhabitants. Prerequisite: 1 or 1a.
   
   5 units, winter, (Graham), MWF 8; lab., field trips by arrangement
   or spring, (Harbaugh), MWF 8; lab., field trips by arrangement

103. **Geologic Problems**—Supervised reading, written reports thereon.

   1 to 10 units, any quarter, (Staff), by arrangement
105. Structural Geology — Folds, faults, other structural features in outer part of the earth. Prerequisites: 1 or 1a, and 51. Recommended: 2, Mechanical Engineering 9.

3 units, autumn, (Page), MWTTh 9; one lab., field trips by arrangement

107. Geologic Field Techniques—Introduction to geologic field methods, instruments.

2 units, spring, (Compton, Dickinson), by arrangement

108. Field Geology I—First half of summer (mid-June to mid-July) will be spent in an area consisting mainly of sedimentary rocks, generally in one of the California coast ranges. Geology will be plotted on topographic maps and aerial photographs. A report, prepared at Stanford during the latter half of August, will include a complete stratigraphic and structural description of the entire area covered by the class. (For second half of summer field work, see 109.) Prerequisites: 1, 2, 25, 51, 105, 107, and Civil Engineering 20. (Not open to women students.)

8 units, summer, (first half), (Staff)

109. Field Geology II—Second half of field season (mid-July to mid-August) will be spent in Nevada or eastern California, in an area of metamorphic and igneous rocks. Mapping will be mainly on aerial photographs, but will include control surveying and plane table methods. If possible, underground (mine) geologic methods will be presented briefly. Prerequisite: 108. (Not open to women students.)

7 units, summer, (second half), (Staff)

133. Principles of Geomorphology—Land forms, processes which create, modify them. Several field trips. Prerequisites: 1, 2, and 51.

4 units, autumn, (Howard), MWF 10; lab. W 2-5; field trips by arrangement

134. Map Interpretation—Topographic maps in interpretation of geologic structures, analysis of local and regional geomorphic development. Prerequisite: 133.

4 units, winter, (Howard), MWF; lab. by arrangement

135. Photogrammetry and Photogeology—Photogrammetric principles, practices applicable to geology; geologic interpretations from air photos. Registration limited. See instructor before enrolling.

5 units, spring, (Howard), MWF 10; lab. W 2-5, one lab. by arrangement

210. Geology of California.

3 units, spring, (Muller), TTh 11, F 1-4

301. Problems in Various Fields of Geology and Geochemistry.

Each quarter, (Staff), by arrangement

320. Advanced Structural Geology—Lectures and reading on significant topics of structure and orogenesis. Prerequisite: 105 or equivalent.

2 units, autumn, (Page), TTh 4

337. Seminar in Geomorphology.

2 units, any quarter, (Howard), by arrangement

361. Permafrost (Geocryology)—Engineering problems in permanently frozen ground. Open to graduate students, others by permission of instructor.

2 units, winter, (Muller), T 2-4, alternate years, given in 1958-59

377. Seminar in Structural Geology.

2 units, spring, (Page), by arrangement

400. Research in Various Fields of Geology and Geochemistry.

Each quarter, (Staff), by arrangement

Mineralogy, Petrology, and Geochemistry

25. Elementary Mineralogy and Crystallography—Symmetry, the rudiments of crystal morphology and structure; approximately 100 of the common
ore-forming and rock-forming minerals. Prerequisites: 1 or 1a and Chemistry 1 (the latter may be taken concurrently).

5 units, autumn, (Servos), TTh 10; lab. TTh 1-4, one lab. by arrangement

51. Elementary Petrology—Origin, occurrence, classification of more common rocks; emphasis on hand lens identification. Prerequisites: 25 and 70.

4 units, spring, (Dickinson), MW 9; lab. MW or TTh, field trips by arrangement

57. Sedimentary Petrology—Occurrence, characteristics of sedimentary rocks in relation to environment, processes of formation; work with petrographic microscope not included. Prerequisites: 2 and 51.

3 units, winter, (Dickinson), MW 9; lab. T 1-4, field trips by arrangement

70. Introduction to Geochemistry—Application of elementary chemical principles to geologic problems. Prerequisites: 1 or 1a, Chemistry 3, and Geology 25; the last may be taken concurrently.

2 units, autumn, (Krauskopf), TTh 9

123. Optical Mineralogy—(a) Elementary study of optical properties of crystals; emphasis on polarizing microscope as instrument of research. (b) Systematic study of important silicate minerals, their determination by optical methods. Prerequisites: 25 and Physics 55, or equivalents.

5 units, autumn, (Hutton), TTh 11; lab. (I) TTh 1-4; (II) MW 1-4, one lab. by arrangement

124. Petrography—Use of petrographic microscope in identifying, classifying rocks, determining origin, geologic history of rocks, rock masses. Prerequisites: 51 and 123.

5 units, winter, (Compton), TTh 11; lab. TTh 1-4, one lab. by arrangement

126. Crystallography and Intermediate Mineralogy—Systematic study of the thirty-two classes, including work with reflecting goniometer; introduction to crystal structure, its effect on external form of crystals. Prerequisites: 25, and permission of instructor.

4 units, winter, (Servos), MW 9; lab. F 1-4, one lab. by arrangement

170. Geochemistry—Application of physical chemistry to geologic problems, distribution of chemical elements in geologic environments. Prerequisites: 51 and 70, or 1 and Chemistry 171.

4 units, winter, (Krauskopf), TTh 9; lab. T 1-4 or W 1-4

207. Sedimentology—Characteristics, origin of sedimentary rocks as deduced from petrographic and field studies. Individual research is encouraged. Prerequisite: 124.

3 units, spring, (Thompson), lab. and seminar by arrangement

223. Mineralogy of Sediments—(a) Laboratory methods for fractionating sediments. (b) Systematic study of mineral particles, with special reference to those of high density. Prerequisites: 124, and permission of instructor.

5 units, spring, (Hutton), FI 1; lab. TTh 1-4, two labs. by arrangement

224. Advanced Petrology—Advanced topics of igneous and metamorphic petrology. Prerequisites: 105 and 124.

6 units, spring, (Compton), TWTh 11; lab. W 1-4, two labs. by arrangement

225. Advanced Mineralogy—(a) Survey of methods for mineral diagnosis. (b) Systematic study of more important rock-forming and ore minerals. Prerequisites: 124, Chemistry 110, 111, and permission of instructor.

7 units, winter, (Hutton), MW 10-12; lab. MW 1-4, one lab. by arrangement

270. Geochemistry of Ore Solutions—Prerequisites: 170 and 183.

2 units, spring, (Krauskopf), by arrangement

327. Seminar in Petrology—Selected topics on igneous, metamorphic rocks.

2 units, spring, (Compton), by arrangement
SCHOOL OF MINERAL SCIENCES

347. Seminar in Mineralogy.
   2 units, any quarter, (Hutton), by arrangement

407. Seminar in Geochemistry.
   2 units, spring, (Krauskopf), by arrangement

Spectrographic Analysis—See Mineral Engineering 205.

PALEONTOLOGY AND STRATIGRAPHY

111. Curatorial Methods in Paleontology.
   1 unit, spring, (Keen), by arrangement

112. Elementary Paleontology—Prerequisite: 2.
   5 units, autumn, (Muller), MWF 11; lab. W 2-5, one lab. by arrangement

113. Systematic Invertebrate Paleontology—Selected phyla. Prerequisite: 112.
   5 units, winter, (Keen), TTh 9; lab. W 2-5, one lab. by arrangement

118. Introduction to Micropaleontology—Principles, techniques of preparation, classification of various fossil plants and animals. Prerequisites: 113 or equivalent.
   5 units, autumn, (Graham), TTh 1-2; Lab. TTh 2-5, one lab. by arrangement

119. Stratigraphic Micropaleontology—Identification and interpretation of stratigraphically important microfossils.
   4 units, winter, (Thalmann), by arrangement

160. Elementary Stratigraphy—Classification of stratigraphic units, facies, unconformities, and principles of correlation. Prerequisite: 105. Recommended: 112.
   3 units, winter, (Muller), TTh 10; lab. M 1-4

218. Research in Micropaleontology—Prerequisite: 118.
   5 units, spring, (Graham), by arrangement

260. Stratigraphy—Scientific method applied to regional stratigraphic problems. Field investigations (4 days) of sedimentary rocks in Coast Ranges. Preparation of cross section and column, written report. One period weekly for outside reading. Prerequisites: 108 and 109 or equivalents. Open to undergraduates by arrangement.
   5 units, autumn, (Schenck), TTh 10; lab. and field trips by arrangement

262. Stratigraphic Analysis—Conference discussions. Field trips. Prerequisite: 260.
   3 units, spring, (Schenck), by arrangement

314. Seminar in Micropaleontology.
   2 units, each quarter, (Graham, Thalmann), by arrangement

316. Palynology—Introduction to study of fossil spores and pollen.
   3 units, spring, (Thalmann), M 3-4; lab. TTh 1-4

   2 units, each quarter, (Staff)

Paleobotany—See Biology 170.
Biogeography—See Biology 174.
Quantitative Methods in Biology—See Biology 189.

ECONOMIC GEOLOGY

181. Nonmetallic Deposits—Principles of geologic occurrence of economic mineral resources, excluding metallic ores and petroleum and ground water. Prerequisites: 105 and 123.
   5 units, spring, (Page), MTWTh 8; lab., field trips by arrangement
182. Geology of Petroleum—Principles of occurrence, accumulation of petroleum. Laboratory consists of practice in modern techniques. Three-day field trip to Ventura Basin required. Prerequisites: 51 and 105.
5 units, winter, (Harbaugh), MWF 11; lab. TTh 9

183. Ore Deposits—Principles of occurrence, processes of deposition, structure of ores. Prerequisites: 51 and 105.
5 units, autumn, (Park), MTWTh 10; lab., field trips by arrangement

184. Engineering Geology—Application of geology to engineering practice in construction of dams, highways, foundations, etc. Prerequisite: 1 or la. Recommended: 25, 51, and 105.
3 units, autumn, (Davis), TTh 8; lab. by arrangement

185. Geology of Ground Water—Chemical composition, movement, utilization of underground water. Prerequisites: 1 or la, and Physics 21 or 51, Mathematics 22. Recommended: 2, 105.
5 units, winter, (Davis), MWF 8; sem. M 1–3; lab. W or Th 1–4

186. Development of Ground-Water Resources—Numerical, graphical analysis of pumping tests; interpretation of well hydrographs; field techniques used in ground-water surveys. Prerequisite: 185.
3 units, spring, (Davis), TTh 11; lab. by arrangement

206. Paleogeology—Regional studies of geologic history by use of isopach, paleogeologic, facies maps.
5 units, autumn, (Harbaugh), by arrangement

263. Foreign Oil Fields.
3 units, autumn, (Thalmann), TTh 8–9

3 units, winter, (Dickinson), Th 9; lab. MW 1–4

2 units, spring quarter, (Harbaugh), by arrangement

383. Genesis of the Metallic Ores—Advanced study of mineral, district collections; emphasis on genesis, localization control. Prerequisite: 283.
6 units, spring, (Park), MW 10; lab. MWF 1–4

387. Seminar in Ore Deposits—Conference discussion of current problems, ideas in economic geology.
2 units, autumn, (Park), Th 4

487. Seminar in Ground Water or Engineering Geology.
2 units, autumn, (Davis), by arrangement

Minerals in World Affairs—See Graduate Division Special Programs 287.

GEOPHYSICS

Executive Head: Joshua Lawrence Soske
The Henry Salvatori Professor of Geophysics: Joshua Lawrence Soske
Professor, Consulting: Carl Heinz Becker
Associate Professor: George Albert Thompson
Research Associate (by courtesy): William Earl Bell

OFFERINGS AND FACILITIES

Geophysics relates to that phase of earth science dealing with exploration for economic mineral resources and studies of the physics of the earth. The undergraduate and graduate programs are designed to provide (1) the back-
ground of fundamentals necessary to the study of geophysics and (2) course work in geophysics to coordinate and organize the required background with the principles of geophysics. The four-year undergraduate program leads to the degree of Bachelor of Science. Qualified students are encouraged to take some graduate study because the broad scope of geophysics includes fundamentals of geology, mathematics, physics and engineering. The objectives of the graduate program are to prepare students for positions in the exploration industry, geophysical research programs, governmental work and education. The physical facilities for graduate study include the Henry Salvatori Laboratory of Geophysics. Graduate programs lead to the degree of Master of Science, and Doctor of Philosophy.

**Bachelor of Science**

The following requirements for the degree of Bachelor of Science in geophysics are in addition to the University requirements in general studies.

**Curriculum**

_Same as Geology Curriculum except delete Geology 114 and 133 and add:_

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Subject</th>
<th>Quarter Given</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics 23, Calculus</td>
<td>Any</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Mathematics 24, Calculus</td>
<td>A or S</td>
<td>3</td>
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<tr>
<td>Mathematics 130, Ordinary differential equations</td>
<td>A or W</td>
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<tr>
<td>Mathematics 131, Partial differential equations</td>
<td>W</td>
<td>3</td>
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<tr>
<td>Physics 57, Atomic physics</td>
<td>A</td>
<td>3</td>
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<tr>
<td>Physics 61, Optics and Wave Motion</td>
<td>S</td>
<td>3</td>
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<td>Physics 87, 89, Mechanics</td>
<td>WS</td>
<td>6</td>
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<tr>
<td>Physics 101, Intermediate Electricity and Magnetism</td>
<td>A</td>
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<td>Geophysics 190, 191</td>
<td>AW</td>
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</table>

_As electives in the Geophysics Curriculum, the following courses are recommended: Geology 123, 124, 170._

**Master of Science**

**Objectives**—To round out the student’s training for professional work in geophysics through the completion of fundamental courses, both in the major field and in related sciences, and by obtaining a start on independent work and specialization.

**Requirements for the Degree**—The candidate must fulfill the following requirements:

1. Be registered in the graduate school for at least three quarters.
2. Complete 45 units with at least a B average. At least 6 of these units must be independent work on a research problem.
3. Make up deficiencies in previous training. Not more than 10 units of such work may be counted as part of the minimum total of 45 units.
4. Demonstrate by examination his ability to read geologic literature in a foreign language. The examination must be passed no later than the date of filing for the Master of Science degree.

**Doctor of Philosophy**

**Objectives**—The degree of Doctor of Philosophy is conferred upon evidence of high attainment in geophysics, and ability to conduct an independent investigation and to present the results of such research.
Requirements for the Degree—A minimum of three years (nine quarters) of graduate study must be satisfactorily completed. At least one of these years, ordinarily the last, must be spent as a registered student at Stanford. The candidate must demonstrate by examination his ability to read German and one other foreign language. His record must indicate outstanding scholarship and deficiencies in previous training must be removed. He must pass the Departmental oral examination. He must fulfill the requirements of the minor department, if a minor is elected. He must pass the University oral examination, which is essentially a defense of the dissertation problem. He must prepare under faculty supervision a dissertation which is a contribution to knowledge and the result of independent work expressed in satisfactory form.

The Ph.D. dissertation must be submitted in its final form within five calendar years from the date of admission to candidacy by the University Committee on Graduate Study. Candidates for the degree who fail to meet this deadline will be required to reapply for admission to candidacy and retake the Departmental and the University oral examinations. They will be given an additional one year in which to submit their dissertations.

COURSES

190. General Geophysics—General study of gravitational, magnetic, seismic, electrical, and thermal properties of the earth. Elementary potential theory is emphasized. Prerequisites: Geology 105, Mathematics 22, Physics 55; any or all of these courses may be taken concurrently with 190.

3 units, autumn, (Thompson), MW 11; lab. by arrangement


3 units, winter, (Soske), TTh 10; lab. by arrangement


3 units, autumn, (Soske), two lecs.; 3-hour lab. by arrangement


3 units, winter, (Soske), two lecs.; 3-hour lab. by arrangement, alternate years, to be given in 1958-59

293. Electrical Measurements in Exploration—Prerequisites: Geology 107, 182, Mathematics 23, and Physics 55.

3 units, winter, (Soske), two lecs.; 3-hour lab. by arrangement, alternate years, to be given in 1959-60


4 units, spring, (Soske), two lecs.; two 3-hour labs. by arrangement

328. Theoretical Structural Geology—Structural deformation studied as a physical process: elastic, nonelastic properties of rocks; theories of flow, rupture; stress analysis; scale models; geophysical, geological evidence bearing an origin of major earth structures. Prerequisites: 190 and Geology 105 or equivalent.

5 units, winter, (Thompson), MWF 9; lab., seminar by arrangement

397. Seminar in Geophysics.

2 units, any quarter, (Soske, Thompson), by arrangement
METALLURGICAL ENGINEERING

Emeritus: Welton J. Crook (Professor)

Executive Head: O. Cutler Shepard
Professor: O. Cutler Shepard
Associate Professors: Robert A. Huggins, Oleg D. Sherby
Assistant Professors: Victor G. Macres, David A. Stevenson

OFFERINGS AND FACILITIES

The Department of Metallurgical Engineering provides courses in chemical extractive metallurgy and in physical metallurgy. An undergraduate program leads to the Bachelor of Science degree in Metallurgical Engineering. Able students are encouraged to take at least one year of graduate study to extend their course work and to obtain training in research. Graduate programs lead to the degrees of Master of Science, Engineer, and Doctor of Philosophy.

UNDERGRADUATE METALLURGICAL ENGINEERING CURRICULA

Undergraduate Metallurgical Engineering curricula are designed to provide a course of study suited to the individual interests and objectives of each student. The curricula consist of a core of essential subjects supplemented by a wide choice of elective programs.

Essential courses which are taken by all metallurgical students appear in the table below. Typical supplementary courses for elective programs in General Metallurgy, Extractive Metallurgy, Physical Metallurgy, or Metallurgical Science are also presented. In addition, elective programs can be devised for students having dual interests in fields such as Metallurgy and Administration, Metallurgy and Nuclear Engineering, or Metallurgy and Mechanical Engineering.

Courses Taken by All Metallurgical Students

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 1, 2, 3</td>
<td>General Chemistry</td>
<td>13</td>
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<tr>
<td>Math. 10, 11, 21, 22, 23, 24</td>
<td>Analytic Geometry and Calculus</td>
<td>18</td>
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<tr>
<td>English 1, 2, 3</td>
<td>Freshman English</td>
<td>9</td>
</tr>
<tr>
<td>Hist. 10, 11, 12</td>
<td>History of Western Civilization</td>
<td>12</td>
</tr>
<tr>
<td>Physics 51, 53, 55</td>
<td>Mechanics, Sound, Electricity, Light, and Heat</td>
<td>15</td>
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<tr>
<td>M.E. 9</td>
<td>Engineering Drawing</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 171, 173, 175, 176</td>
<td>Physical Chemistry</td>
<td>12</td>
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<tr>
<td>Phys. 57</td>
<td>Atomic Physics</td>
<td>3</td>
</tr>
<tr>
<td>I.E. 130</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>Met. E. 2</td>
<td>Metals and Metallurgy</td>
<td>1</td>
</tr>
<tr>
<td>Met. E. 104</td>
<td>Principles of Physical Metallurgy</td>
<td>3</td>
</tr>
<tr>
<td>Met. E. 105</td>
<td>Principles of Extractive Metallurgy</td>
<td>3</td>
</tr>
<tr>
<td>Met. E. 107</td>
<td>High Temperature Process Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>Met. E. 120</td>
<td>Industrial Report</td>
<td>1</td>
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<tr>
<td>Met. E. 122</td>
<td>Metallurgical Thermodynamics</td>
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<td>Met. E. 123</td>
<td>Physical Metallurgy Laboratory</td>
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<tr>
<td>Course No.</td>
<td>Subject</td>
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<tr>
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</tr>
<tr>
<td>M.E. 1</td>
<td>Forging and Welding</td>
<td>2</td>
</tr>
<tr>
<td>M.E. 2</td>
<td>Foundry Practice</td>
<td>2</td>
</tr>
<tr>
<td>Geology 1a</td>
<td>Geology for Engineers</td>
<td>5</td>
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<tr>
<td>C.E. 99, 100, 101</td>
<td>Engineering Mechanics</td>
<td>9</td>
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<tr>
<td>C.E. 110, 112</td>
<td>Mechanics of Materials</td>
<td>5</td>
</tr>
<tr>
<td>E.E. 100</td>
<td>Principles of Circuits</td>
<td>3</td>
</tr>
<tr>
<td>Met. E. 121</td>
<td>Process Engineering Calculations</td>
<td>3</td>
</tr>
<tr>
<td>Met. E. 124, 125, 126</td>
<td>Physical Metallurgy I, II, III</td>
<td>11</td>
</tr>
<tr>
<td>Chem. E. 110, Mathematics Applied to Chemical Engineering</td>
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<tr>
<td>Statistics 110, Statistical Methods in Engineering and Science</td>
<td>4</td>
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<tr>
<td>Other electives</td>
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**Extractive Metallurgy Option**

<table>
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<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Geology 1a</td>
<td>Geology for Engineers</td>
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<tr>
<td>Chem. 20</td>
<td>Qualitative Analysis</td>
<td>4</td>
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<tr>
<td>Geology 25</td>
<td>Mineralogy and Crystallography</td>
<td>5</td>
</tr>
<tr>
<td>Min. E. 102</td>
<td>Elements of Mineral Processing</td>
<td>3</td>
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<tr>
<td>Min. E. 106</td>
<td>Mineral Processing Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>Met. E. 121</td>
<td>Process Engineering Calculations</td>
<td>3</td>
</tr>
<tr>
<td>Met. E. 229</td>
<td>Steelmaking Processes</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 99, 100, 101</td>
<td>Engineering Mechanics</td>
<td>9</td>
</tr>
<tr>
<td>C.E. 106</td>
<td>Mechanics of Fluids</td>
<td>4</td>
</tr>
<tr>
<td>E.E. 100</td>
<td>Principles of Circuits</td>
<td>3</td>
</tr>
<tr>
<td>Statistics 110, Statistical Methods in Engineering and Science</td>
<td>4</td>
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</tr>
<tr>
<td>Chem. E. 110, Mathematics Applied to Chemical Engineering</td>
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**Physical Metallurgy Option**

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<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
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<tr>
<td>C.E. 99, 100, 101</td>
<td>Engineering Mechanics</td>
<td>9</td>
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<tr>
<td>C.E. 110, 112</td>
<td>Mechanics of Materials</td>
<td>5</td>
</tr>
<tr>
<td>Met. E. 124, 125, 126</td>
<td>Physical Metallurgy I, II, III</td>
<td>11</td>
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<tr>
<td>Met. E. 130</td>
<td>Mechanical Behavior of Metals</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 1</td>
<td>Forging and Welding</td>
<td>2</td>
</tr>
<tr>
<td>M.E. 2</td>
<td>Foundry Practice</td>
<td>2</td>
</tr>
<tr>
<td>E.E. 100</td>
<td>Principles of Circuits</td>
<td>3</td>
</tr>
<tr>
<td>Statistics 110, Statistical Methods in Engineering and Science</td>
<td>4</td>
<td></td>
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<tr>
<td>Chem. E. 110, Mathematics Applied to Chemical Engineering</td>
<td>3</td>
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<tr>
<td>Other electives</td>
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55
Metallurgical Science Option

<table>
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<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
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<tr>
<td>Math. 113</td>
<td>Vector Analysis</td>
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<tr>
<td>Math. 130</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Math. 131</td>
<td>Partial Differential Equations I</td>
<td>3</td>
</tr>
<tr>
<td>Math. 132</td>
<td>Partial Differential Equations II</td>
<td>3</td>
</tr>
<tr>
<td>Physics 87, 89</td>
<td>Intermediate Mechanics</td>
<td>6</td>
</tr>
<tr>
<td>Physics 101, 102, 103</td>
<td>Intermediate Electricity and Magnetism</td>
<td>12</td>
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<tr>
<td>Met. E. 124, 125, 126</td>
<td>Physical Metallurgy I, II, III</td>
<td>11</td>
</tr>
<tr>
<td>Statistics 110</td>
<td>Statistical Methods in Engineering and Science</td>
<td>4</td>
</tr>
<tr>
<td>Other electives</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

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Graduate Metallurgical Engineering Program

The demand for men with graduate metallurgical training greatly exceeds the supply. The Department of Metallurgical Engineering is endeavoring to meet this problem with a strengthened graduate program. Superior students are particularly encouraged to extend their training. Every effort is made to design a graduate program to meet the needs of each student, both with regard to his academic background and eventual goals. Individual program planning is of particular importance for the increasing number of students with training in other fields who transfer to metallurgy for graduate work.

One year of graduate study in Metallurgical Engineering ordinarily leads to the degree of Master of Science. This degree is commonly taken by students on the way to a more advanced degree, or it can be a terminal degree for those desiring to enter industry at this stage of their training.

The degree of Engineer requires a comprehensive two-year program of graduate study. It is intended primarily for students who desire more training at the graduate level than is represented by the Master of Science degree and who are planning to follow a career that emphasizes engineering practice rather than teaching or fundamental research.

Men aiming at teaching or research would normally work for the degree of Doctor of Philosophy and possibly, but not necessarily, obtain the degree of Engineer as an intermediate step.

Laboratory Facilities

The Metallurgical Engineering Laboratories occupy an area of 12,700 square feet and include modern facilities for research in all branches of physical and extractive metallurgy. The equipment includes ordinary melting and heat treatment furnaces as well as furnaces equipped for vacuum and inert gas work, X-ray diffraction machines for both film and direct recording techniques, an X-ray fluorescent analysis unit, an emission spectrograph, complete metallographic equipment, and facilities for creep and rupture testing at elevated temperatures in controlled environments. In addition, the School of Engineering laboratories for foundry, welding, forging, and materials testing are nearby and their facilities are available to metallurgical students.

Master of Science

The University’s basic requirements for the Master’s degree (residence, thesis, etc.) are discussed in the section “Degrees” in this Bulletin. The following are Departmental requirements:
1. Completion of the equivalent of the courses required for the B.S. degree in Metallurgical Engineering. Deficiencies in previous training must be made up, and not more than 10 units of such work may be counted as a part of the minimum total of 45 units.

2. Completion of 45 units of an approved program with at least a B average. This program should contain 20 units of graduate courses in metallurgy which will include 6 units of advanced work on some special problem. Graduate students are expected to enroll in Met. E. 230, Metallurgy Seminar, each quarter. Courses to complete the program will be selected with the objective of broadening the scientific and technical outlook of the student.

3. During the third quarter of graduate work, passing a comprehensive examination to test the candidate’s proficiency in metallurgical and related fields of knowledge.

Engineer

The University’s basic requirements for the degree of Engineer (residence, thesis, etc.) are discussed in the section “Degrees” in this Bulletin. The following are Departmental requirements:

1. Completion of the substantial equivalent of the requirements for the Master of Science degree in Metallurgical Engineering.

2. Completion of an acceptable thesis and 30 units of approved advanced course work beyond the requirements for the Master of Science degree. A minimum scholastic average of B must be maintained in course work.

Doctor of Philosophy

The degree of Doctor of Philosophy in Metallurgical Engineering is offered under the general regulations of the University. This program requires a minimum of nine quarters of graduate study, at least one year of which must be at Stanford. The first year is represented by the Master of Science program. The completion of an acceptable dissertation may occupy most of the third year of study. During the second year of graduate study the candidate is expected to have passed an examination in one foreign language. He then prepares an “Application for Department Oral.” The Department Oral Examination is given in two parts: the first to test the candidate’s proficiency in his particular field, and the second to test his range of knowledge in other fields. High scholastic standing is required. A University oral examination is given near the completion of the doctoral program.

Courses

2. Metals and Metallurgy—Elementary survey of metallurgical engineering, 1 unit, autumn, (Staff), T 10
   or spring, (Staff), T 11

104. Principles of Physical Metallurgy—Nature, properties of metals; phases in alloy systems; effect of composition, heat, mechanical treatment upon structure, physical properties of metals, alloys. Prerequisite: Chemistry 2.
   3 units, autumn, (Shepard), MWF 10
   or winter, (Shepard), MWF 9
   or spring, (Shepard), MWF 10

105. Principles of Extractive Metallurgy—Introduction to various processes used in production of metals from ores, concentrates. Prerequisite: Chemistry 3 or 4.
   3 units, winter, (Stevenson), MWF 11

2 units, spring, (Stevenson), WTh 1-4

120. Industrial Report — Student required to submit report covering at least two consecutive months of industrial experience related to metallurgy.

1 unit, any quarter, (Staff), by arrangement


3 units, spring, (Stevenson), TThS 9

122. Metallurgical Thermodynamics — Theory, applications of chemical thermodynamics in metallurgy. Prerequisites: 105, and Chemistry 173.

3 units, autumn, (Stevenson), MWF 9

123. Physical Metallurgy Laboratory — Introduction to laboratory techniques used in modern physical metallurgy; their application to selected metallurgical problems. Prerequisite: 104.

3 units, autumn, (Macres), Th 10; lab. TTh 1-4

124. Physical Metallurgy I — Structure of metals: ideal crystals; imperfections in crystals; structure of actual metals. Introduction to thermodynamic approach to metals: free energy relations in alloy systems; equilibrium diagrams. Liquid-solid, solid state reactions: thermodynamics, kinetics, mechanisms, resulting structures. Effects of structural features on mechanical, electrical, magnetic behavior. Application of principles of physical metallurgy to binary and multicomponent alloy systems. Prerequisites. 123 (can be taken concurrently), familiarity with thermodynamics, and differential equations.

3 units, autumn, (Huggins), MWF 10

125. Physical Metallurgy II — Continuation of 124. Prerequisite: 124.

4 units, winter, (Macres), TTh 10; lab. MT 1-4

126. Physical Metallurgy III — Continuation of 125. Prerequisite: 125.

4 units, spring, (Macres), TTh 10; lab. MT 1-4

127. X-ray Metallurgy — Introduction to radiography, fluorescent spectroscopy, diffraction methods for study of metallurgical materials. Prerequisites: 123 and Physics 57.

3 units, autumn, (Shepard), TTh 8; lab. W 1-4

130. Mechanical Behavior of Metals — Plastic deformation of single crystals, polycrystalline metals. Mechanisms of deformation, dislocation theory. Factors affecting mechanical properties of metals. Prerequisite: 104 or 150.

3 units, spring, (Sherby), MWF 10


3 units, winter, (Huggins)

152. Electric and Magnetic Properties of Materials — Introduction to the physical basis of conduction of electricity, dielectric and magnetic properties. Review of atomic theory, molecular and atomic polarization, metallic conduction, band theory, semiconductors, physical processes in transistors, magnetic
materials, magnetic resonance phenomena. (Enroll in Engineering 152.) Pre-
requisites: Physics 57, and Engineering 150.

200. Special Problems.

Autumn, winter, spring, (Staff), by arrangement

226. Electrometallurgy and Corrosion — Electrochemistry applied to
metallurgy. Electrolysis as used for refining, metal recovery. Electrochem-
istry in corrosion problems. Prerequisites: 105, and Chemistry 175.

2 units, winter, (Stevenson), MWF 9

229. Steelmaking Processes — Topics covering theory, practice of steel-
making reviewed in assigned reading, class discussions. Prerequisite: 122.

2 units, autumn, (Macres), TTh 9

230. Metallurgy Seminar—Weekly meeting for review of current metal-
lurgical literature.

1 unit, autumn, winter, spring, (Staff), M 4

231. Nuclear Reactor Metallurgy—Review of principles governing struc-
ture, properties of metals, alloys. Special attention to metallurgical problems
in fabrication, use of metallic materials in nuclear reactors, heat transfer
systems. Prerequisites: 104 and Mechanical Engineering 171.

3 units, autumn, (Shepard)

236. Advanced X-ray Metallurgy—X-ray methods for study of equilibrium
diagrams, transformations, texture of metallic structures. Prerequisites: 126
and 127.

3 units, winter, (Shepard), T 11; lab. TTh 1-4

237. Physics of Metals—Current status of theory of crystalline imperfec-
tions, their effects on mechanical, electrical, magnetic behavior of metals; brittle
fracture. Prerequisite: 126.

3 units, autumn, (Sherby), MWF 8

240. Reaction Kinetics in Solids—Mechanism and kinetics of diffusion,
heterogeneous liquid-solid and solid state reactions. Prerequisite: 237.

3 units, spring, (Huggins), MWF 9

250. Seminar in Advanced Physical Metallurgy—Detailed study of se-
lected topics. Prerequisite: 240.

2 units, autumn, (Huggins), W 3

or winter, (Sherby), W 3

or spring, (Macres), W 3

300. Research.

Autumn, winter, spring, (Staff), by arrangement

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MINERAL ENGINEERING

Acting Executive Head: Charles F. Park, Jr.
Associate Professor: Fred L. Humphrey (on leave 1958-59)
Visiting Professor: Philip J. Shenon
Instructor: Frank M. Hruz

Offerings and Facilities

Mineral Engineering includes the two allied options of mining engineering
and mineral processing. The program offers fundamentals of exploration, de-
velopment and mining of mineral deposits, and the fundamentals of physical and
chemical mineral separation, mineral concentration, and mineral purification.
The program leads to the Bachelor of Science degree in Mineral Engineering.
### UNDERGRADUATE MINERAL ENGINEERING PROGRAM

**Courses Taken by All Students of Mineral Engineering**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Chem. 1, 2, 3, General Chemistry</td>
<td>13</td>
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<tr>
<td>Math. 10, 11, 21, 22, 23, Analytical Geometry and Calculus</td>
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<tr>
<td>Physics 51, 53, 55, Engineering Physics</td>
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<td></td>
</tr>
<tr>
<td>M.E. 9, Machine Drawing and Descriptive Geometry</td>
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<tr>
<td>English 1, 2, 3, English Composition</td>
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<tr>
<td>History 10, 11, 12, History of Western Civilization</td>
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<tr>
<td>Social Sciences, (General Studies Requirement)</td>
<td>10</td>
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<tr>
<td>Humanities, (General Studies Requirement)</td>
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<tr>
<td>Group Activities, (General Studies Requirement)</td>
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<tr>
<td>C.E. 99, Engineering Mechanics</td>
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<td>C.E. 100, Engineering Mechanics</td>
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<td>C.E. 110, 112, Mechanics of Materials</td>
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<td>C.E. 106, Mechanics of Fluids</td>
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<td>C.E. 180, Elementary Structural Analysis</td>
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<tr>
<td>E.E. 100, Principles of Circuits</td>
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<td>E.E. 102L, Principles of Machines</td>
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<tr>
<td>I.E. 130, Engineering Economy</td>
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<tr>
<td>Min. E. 1, Introduction to Mining and Mineral Processing</td>
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<td>Geol. 1 or 1a, Physical Geology</td>
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<td>Geol. 25, Mineralogy and Crystallography</td>
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<td>Min. E. 101, Principles of Mining</td>
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<td>Min. E. 102, Elements of Mineral Processing</td>
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<td>Met. E. 105, Elements of Mineral Processing</td>
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<td>Min. E. 106, Mineral Processing Laboratory</td>
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<td>Min. E. 109, Ore Testing Laboratory</td>
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**Mining Option**

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<tr>
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<th>Subject</th>
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<td>Geol. 51, Elementary Petrology</td>
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<td>Geol. 105, Structural Geology</td>
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<td>Geol. 107, Geologic Field Techniques</td>
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<td>Geol. 183, Ore Deposits</td>
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<td>Min. E. 100, Industrial Report</td>
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<tr>
<td>Min. E. 114, Problems in Mining Engineering</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Min. E. 115, Prospecting and Development</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Min. E. 117, Mine Mapping</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>C.E. 20, Elementary Surveying</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 125, Advanced Surveying</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 135, Construction Equipment and Methods</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>
### Mineral Processing Option

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. E. 100, Industrial Report</td>
<td>1</td>
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<tr>
<td>Met. E. 104, Principles of Physical Metallurgy</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Met. E. 121, Metallurgical Calculations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Met. E. 122, Metallurgical Thermodynamics</td>
<td>3</td>
<td></td>
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<tr>
<td>Chem. 20, Qualitative Analysis</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Chem. 112, Quantitative Analysis</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chem. 114, Quantitative Analysis</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Chem. 171, 173, 175, Physical Chemistry</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Chem. 176, Physico-Chemical Measurements</td>
<td>3</td>
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<tr>
<td>Math. 24, Analytical Geometry and Calculus</td>
<td>3</td>
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<tr>
<td>Electives</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>53</strong></td>
<td></td>
</tr>
</tbody>
</table>

### GRADUATE PROGRAM

The Department of Mineral Engineering offers graduate programs planned to prepare the student for responsible positions in industrial research, governmental work, and education. These programs lead to the advanced degrees of Master of Science, Engineer, and Doctor of Philosophy.

#### Master of Science

The Department of Mineral Engineering recommends at least one year of graduate study to all students specializing in either of the two options. Specialized programs are available to suit the interests of individual students and to round out their training for professional work.

Specific requirements:

1. Be registered in the graduate school for at least three quarters.
2. Complete 45 units with at least a B average. At least six of these units must be independent work on a research program.
3. Overcome deficiencies in previous training. Not more than ten units of such work may be counted as part of the minimum total of 45 units.

#### Engineer

A minimum of two years (six quarters) of graduate study is required. At least one of these years, ordinarily the last, must be spent as a registered student at Stanford. The candidate must complete 90 units of course work, no more than 10 of which may be applied to overcoming deficiencies in undergraduate training. At least 30 units must be taken in advanced work, that is, work beyond the undergraduate requirements, in engineering and closely allied fields. The student must have a B average in courses given by the School of Mineral Sciences. He must prepare a thesis meeting the approval of the supervising instructor and the University Committees on Graduate Study.

#### Doctor of Philosophy

The degree of Doctor of Philosophy is conferred upon evidence of high attainment in mineral engineering, and ability to conduct an independent investigation and to present the results of such research.

A minimum of three years (nine quarters) of graduate study must be
satisfactorily completed. At least one of these years, ordinarily the last, must be spent as a registered student at Stanford. The candidate must demonstrate by examination his ability to read German and one other foreign language. His record must indicate outstanding scholarship. He must pass the Departmental oral examination. He must fulfill the requirements of the minor department, if a minor is elected. He must pass the University oral examination, which is essentially a defense of the dissertation problem. He must prepare under faculty supervision a dissertation which is a contribution to knowledge and the result of independent work expressed in satisfactory form.

The Ph.D. dissertation must be submitted in its final form within five calendar years from the date of admission to candidacy by the University Committee on Graduate Study. Candidates for the degree who fail to meet this deadline will be required to reapply for admission to candidacy and retake the Departmental and University oral examinations. They will be given an additional one year in which to submit their dissertations.

**Undergraduate Courses**

1. **Introduction to Mineral Engineering**—Orientation course to acquaint student with duties of mineral engineer.
   1 unit, winter, (Staff), T10

100. **Industrial Report in Mineral Engineering**—Student required to submit report covering at least two consecutive months of industrial experience in mining or mineral process plant work. Required for graduation in mineral engineering.
   1 unit, autumn, winter, spring, (Staff), by arrangement

101. **Principles of Mining**—Introduction to metal mining. Prospecting, development, mine plant and equipment, mining methods, mine-engineering problems in a condensed course as basis for advanced courses that follow. Serves needs of engineering student who seeks general knowledge of mining.
   3 units, autumn, (Shenon), MWF 8

102. **Principles of Mineral Processing**—To acquaint mineral, metallurgical, general engineering and geological student with unit operations, processes currently used to beneficiate crude ores for production of industrial minerals, mineral products, metal concentrates. Sampling, marketing of ores, concentrates; crushing, grinding (comminution); liberation, sizing; gravity separations, dry plant separations (magnetic and electrostatic), flowsheet integration of operations, economics of beneficiation. Prerequisites: Chemistry 3 or 4, Geology 1 or 1a, and Physics 53, 55, or equivalent.
   3 units, autumn, (Hruz), MWF 11

106. **Mineral Processing Laboratory**—Basic unit experiments in sampling, mineral liberation, comminution, concentration. Prerequisites: 102, and Geology 25.
   2 units, winter, (Hruz), W 1-4 and by arrangement

109. **Ore Testing Laboratory**—Design of an ore treatment flowsheet based on testing of an actual ore by microscopic study of mineral liberation, comminution size relationships; followed by laboratory scale testing, using appropriate concentration methods. Prerequisites: 102 and 106.
   2 units, spring, (Hruz), W 1-4 and by arrangement

114. **Elementary Problems in Mining Engineering**—Problems involving principles of mining, designed to supplement 101 as added work for those whose major interest is mining. Open to those concurrently registered in 101.
   2 units, autumn, (Staff), TTh 8

115. **Prospecting and Development**—Lecture, seminar, problems. Geologi-
cal aspects; placer prospecting: prospecting for deposits in place; methods, costs; engineering features; boring methods; development plans; methods, costs of shaft sinking, drifting, raising; engineering records. Prerequisites: 101, and Geology 51.

4 units, spring, (Shenon), TTh 8; seminar by arrangement

117. Mine Mapping—Lecture, laboratory, problems. Methods of mapping as used by mining companies; plan maps; geologic maps; stope maps; surface maps; sections, models. Prerequisites: Civil Engineering 20, and Geology 105.

2 units, spring, (Staff), TTh 1-4

180. Field or Laboratory Study and Report in Mineral Engineering.

1 or 2 units, autumn, winter, spring, (Staff), by arrangement

GRADUATE COURSES

204. Problems in Mine Economics—Application of principles of mining economy.

1 or 2 units, autumn, (Staff), by arrangement

205. Spectrographic Analysis—Fundamentals of spectroscopy, its application to study of rocks, minerals, metals.

4 units, autumn, (Servos), TTh 10; lab. TTh 1-4


2 units, spring, (Staff), TTh 11


5 units, winter, (Shenon), TTh 8; seminar by arrangement


5 units, winter, (Staff), MW 10; seminar by arrangement

225. Flotation Processing of Metallic and Nonmetallic Ores—Lectures, class discussions. Review of surface chemistry applied to flotation phenomena. Theoretical, practical aspects of flotation process in modern mineral treatments. Flowsheet design, economics. Prerequisites: 102, 106, 109, and Chemistry 20, and 171, or equivalents.

2 units, autumn, (Hruz), TTh 10

227. Hydrometallurgy and Ion Exchange in Mineral Processing—Lectures, class discussions. Review of ionic aqueous chemistry used in mineral process plants. Theoretical, practical aspects of leaching purification, precipitation, including ion exchange applications in uranium ore processing. Prerequisites: 102, Metallurgical Engineering 105, and Chemistry 20, or equivalents.

2 units, spring, (Hruz), TTh 10

300. Advanced Work in Mineral Engineering—Individual work on a research problem in mining or mineral processing.

Each quarter, (Staff), by arrangement

Minerals in World Affairs—See Graduate Division Special Programs 287.
PETROLEUM ENGINEERING

Emeritus: Frederick George Tickell (Professor)

Executive Head: Frank G. Miller
Professor: Frank G. Miller
Associate Professor: Sullivan S. Marsden, Jr.
Assistant Professor: Edward J. Lynch
Research Associate (by courtesy): Graham B. Moody

Offerings and Facilities

Petroleum engineering relates to four major phases of the petroleum industry: exploration and development, production and reservoir engineering, field processing, and appraisal. The undergraduate and graduate programs of the Division are designed to provide a background of fundamentals for work in these phases of the industry. The four-year undergraduate program leads to the degree of Bachelor of Science. The scope of petroleum engineering is so broad that qualified students are encouraged to take at least one year of graduate study. The objective of the graduate programs is to prepare students for responsible positions in industry, governmental work, and education. Graduate programs lead to the degrees of Master of Science, Engineer, and Doctor of Philosophy.

Undergraduate Curriculum

The four-year program provides a foundation for a career in petroleum engineering. Engineering and mineral sciences are stressed. Breadth is provided through courses in the social sciences and humanities.

Courses Taken by All Petroleum Engineering Students

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 1, 2, 3</td>
<td>General Chemistry</td>
<td>13</td>
</tr>
<tr>
<td>Math. 10, 11, 21, 22, 23, 24</td>
<td>Analytical Geometry and Calculus</td>
<td>18</td>
</tr>
<tr>
<td>English 1, 2, 3</td>
<td>Freshman English</td>
<td>9</td>
</tr>
<tr>
<td>History 10, 11, 12</td>
<td>History of Western Civilization</td>
<td>12</td>
</tr>
<tr>
<td>Physics 51, 53, 55</td>
<td>Mechanics, Sound, Electricity, Light, and Heat</td>
<td>15</td>
</tr>
<tr>
<td>M.E. 9</td>
<td>Engineering Drawing</td>
<td>4</td>
</tr>
<tr>
<td>M.E. 118</td>
<td>Differential Equations in Engineering or Ch.E. 110, Mathematics Applied to Chemical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 131</td>
<td>Elementary Engineering Thermodynamics</td>
<td>5</td>
</tr>
<tr>
<td>Chem. 171</td>
<td>Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 20</td>
<td>Elementary Surveying</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 99</td>
<td>Engineering Mechanics Statics</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 100</td>
<td>Engineering Mechanics (Dynamics)</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 101</td>
<td>Engineering Mechanics (Dynamics)</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 106</td>
<td>Mechanics of Fluids</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 110</td>
<td>Mechanics of Materials</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 112</td>
<td>Mechanics of Materials Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>E.E. 100</td>
<td>Principles of Circuits</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 1</td>
<td>Physical Geology</td>
<td>5</td>
</tr>
</tbody>
</table>
Graduate Curriculum in Petroleum Engineering

The petroleum industry is interested particularly in engaging petroleum engineers having a broad training in fundamentals. A well-rounded curriculum in this field of study is generally recognized to require a minimum of five years of college study. The demand for men with the desired training far exceeds the supply. As a result, there are many attractive employment opportunities.

The program leading to the Master of Science degree in petroleum engineering usually can be completed in five academic years. In the fifth or graduate year the student increases his knowledge of fundamental subjects such as mathematics and geology and he becomes familiar with the problems of research.

The degree of Engineer requires a comprehensive two-year program of graduate study. This degree emphasizes professional practice rather than research.

The degree of Doctor of Philosophy is awarded primarily on the basis of accomplishments in research. Normally a minimum of three years of graduate work is required for the degree.

Laboratory Facilities

The Department occupies the Lloyd Noble Petroleum Engineering Building, devoted exclusively to petroleum engineering and which contains a suite of five laboratories including the A. L. Peake and Will J. Reid Laboratories. Two of these are for classroom instruction and pertain to petroleum and natural gas testing, and formation evaluation. The remaining three are used primarily for graduate work. In one of these laboratories experimental studies of the properties of gas and oil under conditions of high pressure and temperature are conducted. These conditions simulate those existing in natural underground petroleum-bearing reservoirs. Detailed investigations of the flow behavior of gas, oil, and water in porous reservoir rocks are made. Capillary phenomena relating to the distribution of gas, oil, and water in underground rocks also are studied. Overall the building comprises about 7,000 square feet. In addition to the five laboratories it includes a classroom, a seminar and library room, office space for graduate students, and a drafting room.
Master of Science

The objective is to round out the student's training for professional work in petroleum engineering through the completion of fundamental courses, both in the major field and in related sciences, and by obtaining a start on independent work and specialization.

The candidate must fulfill the following requirements:

1. Be registered in the graduate school for at least three quarters.
2. Complete 45 units with at least a B average. At least 6 of these units must be independent work on a research problem.
3. Make up deficiencies in previous training. Not more than 10 units of such work may be counted as part of the minimum total of 45 units.
4. Demonstrate his knowledge of basic principles and research methods in his general field of study by preparing a report, ordinarily a term paper written for 6 units of research, to be submitted to at least two faculty members.

Courses Required for the Master's Degree

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 130</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Math. 131, 132</td>
<td>Partial Differential Equations</td>
<td>6</td>
</tr>
<tr>
<td>Chem. 177</td>
<td>Surface Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>Pet. E. 267</td>
<td>Economics of Oil Production</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 270a</td>
<td>Elements of Oil Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 270b</td>
<td>Applications of Oil Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 270c</td>
<td>Applications of Oil Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 271</td>
<td>Advanced Production and Reservoir Engineering Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>Pet. E. 272</td>
<td>Seminar in Oil and Gas Production</td>
<td>3</td>
</tr>
<tr>
<td>Electives*</td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

* Electives may be selected from among the following courses with the approval of the student's adviser: Public Speaking I, English 129, Business Law I, Industrial Engineering 100, Geology 182, 187, Geophysics 190, Mechanical Engineering 133, and other advanced courses in Physics, Chemistry, School of Engineering, Graduate School of Business, and School of Mineral Sciences.

Engineer

The objective is to round out the student's training through additional work in engineering and related sciences and by additional specialization.

A minimum of two years (six quarters) of graduate study is required. At least one of these years, ordinarily the last, must be spent as a registered student at Stanford. The candidate must complete 90 units of course work, no more than 10 of which may be applied to overcoming deficiencies in undergraduate training. At least 30 units must be taken in advanced work, that is, work beyond the undergraduate requirements, in engineering and closely allied fields. The student must demonstrate by examination his ability to read one foreign language. He must have a B average in courses given by the School of Mineral Sciences. He must prepare a thesis meeting the approval of the supervising instructor and the University Committee on Graduate Study.

Doctor of Philosophy

The degree of Doctor of Philosophy is conferred upon evidence of high attainment in Petroleum Engineering, and ability to conduct an independent investigation and to present the results of such research.
PETROLEUM ENGINEERING

A minimum of three years (nine quarters) of graduate study must be satisfactorily completed. At least one of these years, ordinarily the last, must be spent as a registered student at Stanford. The candidate must demonstrate by examination his ability to read German and one other foreign language. His record must indicate outstanding scholarship. He must pass the Departmental oral examination. He must fulfill the requirements of the minor department, if a minor is elected. He must pass the University oral examination, which is essentially a defense of the dissertation problem. He must prepare under faculty supervision a dissertation which is a contribution to knowledge and the result of independent work expressed in satisfactory form.

The Ph.D. dissertation must be submitted in its final form within five calendar years from the date of admission to candidacy by the University Committee on Graduate Study. Candidates for the degree who fail to meet this deadline will be required to reapply for admission to candidacy and retake the Departmental and University oral examinations. They will be given one additional year in which to submit their dissertations.

COURSES

103. Survey of the Petroleum Industry—Introduction to whole subject of development, exploitation of an oil field, arranged to give student comprehensive view of the industry. Meets needs of general student. Properties, origin, accumulation, occurrence of petroleum; valuation, development, production of oil properties; storage, transportation of petroleum, its products. Prerequisite: Junior standing or consent of instructor.

3 units, autumn, (Marsden), MWF 11

108. Physical Testing of Petroleum—Laboratory, lectures, demonstrations. Tests commonly made on crude petroleum, its products, including distillation, fractionation, gravity, viscosity, surface tension, heat of combustion. Prerequisite: 103.

3 units, winter, (Marsden), W 1; lab. W 2–5, Th 1–4

150a. Formation Evaluation—Lectures, problems. Techniques, methods in evaluating commercial significance of rock formations penetrated in development or exploratory drilling operations. Electrical, radioactivity logging; drilling fluid, cuttings analysis logging; coring, formation testing practices, well completion methods, gun perforating. Prerequisite: 103.

3 units, autumn, (Lynch), MWF 10


3 units, winter, (Lynch), by arrangement


3 units, autumn, (Miller), by arrangement


3 units, winter, (Miller), MWF 10

152. Development and Production Technology—Lectures, demonstrations, field trips. Oil field equipment for drilling, production. Prerequisite: 103.

3 units, spring, (Miller), T 9–11, Th 9


3 units, spring, (Marsden), W 1; lab. WTh 2–5

160. Report on Oil Field Training—Student required to submit report
covering at least two consecutive months of industrial experience related to petroleum engineering.

1 unit, any quarter, (———), by arrangement

267. Economics of Oil Production—Seminar, problems. Methods in appraising oil lands; estimation of productive capacity, reserves; operating costs, depreciation of materials, salvage, value of future profits, tax returns. Prerequisites: 151b and 152.

3 units, winter, (———), W 7-10 p.m.


3 units, autumn, (Miller), MWF 11

270b. Applications of Oil Reservoir Engineering—Lectures, problems, seminar. Fundamental fluid production processes of oil reservoirs, well performance applications, predictions of reservoir performance, methods of analysis, other topics relating to primary recovery of petroleum. Prerequisite: 270a.

3 units, winter, (Miller), MWF 11


3 units, spring, (Miller), MWF 11

271. Advanced Production and Reservoir Engineering Laboratory—Capillary pressure-desaturation tests, pore size distribution measurements, Klinkenberg Effect, relative permeability, pressure-volume-temperature relations of crude oil-natural gas mixtures, model studies. Prerequisite: 153 (270a should be taken concurrently).

3 units, autumn, (Lynch), 1 hour lec., 6 hours lab. by arrangement

272. Seminar in Oil and Gas Production—Group study for graduate students. Subject will pertain to fundamental aspects of field development, oil and gas production. Prerequisite: Consent of instructor.

3 units, spring, (Lynch), by arrangement


Each quarter, (Marsden, Lynch), by arrangement
FOOD RESEARCH INSTITUTE

Emeriti: Joseph Stancliffe Davis (Director), Vladimir P. Timoshenko, Professors.

Director: Merrill Kelley Bennett
Associate Directors: Karl Brandt, Holbrook Working
Professors: Merrill Kelley Bennett, Karl Brandt, Helen Cherington Farnsworth, William Orville Jones, E. Louise Peffer, Boris Cyril Swerling, Vernon D. Wickizer, Holbrook Working
Associate Professors: Roger Winks Gray, Bruce Foster Johnston
Acting Economist: S. Daniel Neumark
Consultants: Joseph Stancliffe Davis, Vladimir P. Timoshenko
Associate Statistician: Rosamond H. Peirce
Cartographer and Editorial Assistant: P. Stanley King

OFFERINGS AND FACILITIES

The Food Research Institute was established in 1921 under a grant from Carnegie Corporation of New York for study of production, distribution, and consumption of food. Its staff, while primarily engaged in research, offers to limited numbers of students instruction and guidance leading to the degrees of Master of Arts and Doctor of Philosophy, as indicated below. The Institute has its own special library designed to supply the needs of students of world problems of food and agriculture.

The products of research are currently published in the Institute's Studies in Commodity Economics and Agricultural Policy, Studies in Tropical Development, Studies on Food, Agriculture, and World War II, and Miscellaneous Publications; and in articles in professional journals.

ADVANCED DEGREES

For admission to the program of graduate study in the Institute, the student must present evidence of high ability and appropriate undergraduate training, usually a Bachelor's degree in economics or agricultural economics. Well-prepared students should be able to complete the program for the Master of Arts degree within one year, and for the degree of Doctor of Philosophy within three years.

Master of Arts

The Master's program of the Food Research Institute is designed to give training in commodity-economics research and to introduce students to the particular fields of investigation of the Institute.

To be recommended to the University Committee on Graduate Study for the degree of Master of Arts the student must complete with an average grade of B or better a program of study approved in advance by the Institute's Committee on Instruction and amounting to not less than 45 units of credit. Students are required to write several short research papers as part of their course work and to attend the weekly staff seminar.

Doctor of Philosophy

The Food Research Institute's program leading to recommendations for the degree of Doctor of Philosophy gives an important place to theoretical
economic analysis, but it emphasizes empirical investigation of economic aspects of food and agriculture, focusing upon primary commodities. The program of study is designed to prepare the student for a career of research such as may be found in various branches of the United States Government, particularly in the Department of Agriculture; in agencies of the United Nations, notably the FAO; in specialized research departments in agricultural and food industries; and in universities.

The Food Research Institute recommends candidates to the University Committee on Graduate Study for the degree of Doctor of Philosophy when they have satisfied the requirements listed below. Before a student can be recommended for admission to candidacy the faculty of the Food Research Institute must have certified that he is qualified to pursue the program for the degree of Doctor of Philosophy. This decision will be based in part on a comprehensive written examination in the spring quarter of the student's first year in the Institute's program.

1. Completion of at least two years in the program of the Institute.
2. Completion of a dissertation, prepared with a view to early publication, acceptable to the faculty of the Institute and to the University Committee on Graduate Study. The subject of the dissertation should be chosen within the first year of the candidate's work.
3. Demonstration of scholarly proficiency in Institute examinations and in an examination administered by the University Committee on Graduate Study. Such examinations will cover the dissertation subject and three fields of study, ordinarily from the following list: General Commodity Analysis (required of all doctoral candidates); Economics of Agriculture; Agricultural Geography; Agricultural Policy and Regulation; Commodity Prices; Statistical Research; Economics of Food Consumption; Economics of Tropical Agriculture; Agricultural History and Land Policy; and International Commodity Trade and Policy. Other fields may be offered by arrangement with the Committee on Instruction.
4. Completion of either a minor in Statistics or Economics, or courses outside the Food Research Institute so chosen as to supplement the candidate's work on his dissertation and on the Institute's fields listed above.
5. Demonstration of such degree of competence in statistics as is afforded by at least two courses of instruction beyond an elementary level.
6. Participation in weekly staff seminars.

COURSES

101. The World's Food—Human food requirements; national diets and the major food groups; food problems during World War II and the postwar period; interrelations of population, food, and economic progress. 5 units, autumn, (Johnston), MTWThF 10

112. Readings in Problems of African Food and Agriculture. 3 units, autumn, winter, (Johnston, Jones), by arrangement

120. American Agricultural Policy—The economic background of American agricultural policy. Prerequisite: Economics 1. 5 units, spring, (Jones), MTWThF 2, alternate years, to be given in 1958-59

130. Economics of Agriculture—The role of agriculture in economic development. Increasing productivity of labor and land. Dynamic theory of farm income and prices, location, land tenure, land value, rent, and farm finance. Selected chapters of economics of the farm and ranch enterprise. Five obligatory field trips to diversified and specialized farms and ranches. Permission of the instructor required. 5 units, spring, (Brandt), MW 4–6, alternate years, to be given in 1959–60

135. Price Determination for Agricultural Commodities—Illustrations
of the principles of price determination drawn from various agricultural commodities; characteristics of the behavior of agricultural prices; price determination in various settings and market structures. Prerequisite: Economics 1.

5 units, winter, (Gray), MTWThF 11, alternate years, to be given in 1958–59

140. International Trade in Agricultural Commodities—World trade patterns; economic characteristics of selected traded commodities; impact on exporting regions; national marketing controls and international commodity arrangements. Prerequisite: Economics 1.

5 units, winter, (Swerling), MTWThF 2

201. National Food Production and Consumption—Construction and interpretation of national food-balance sheets; analysis of evidence from dietary surveys; methods of evaluating and adjusting available production and consumption data; special problems of production—consumption measurement in underdeveloped countries (current food patterns, current levels of nutrient availability, and changes over time). Prerequisites: Economics 1 and Food Research 101 or 250.

3 units, spring, (Farnsworth), by arrangement, alternate years, to be given in 1959–60


3 units, spring, (Wickizer), by arrangement, alternate years, to be given in 1958–59


3 units, spring, (Neumark), by arrangement, alternate years, to be given in 1959–60


3 units, spring, (Wickizer), by arrangement

220. Seminar: American Agricultural Policy—Examination of peculiarities of the agricultural sector of the American economy that might make it desirable to formulate federal policies specific to it. Prerequisite: Food Research 120.

3 units, spring, (Jones), by arrangement, alternate years, to be given in 1958–59

227. Agricultural Expansion in the Americas—Factors influencing the course and rate of agricultural and pastoral expansion in the United States, Canada, and selected Latin-American countries.

5 units, winter, (Peffer), MTWThF 8, alternate years, to be given in 1959–60

231. Geography of Farinaceous Food Plants—Characteristics of climatic zones; climatic requirements of major crops; competition of crops for land between and within climatic zones. Permission of the instructor required.

3 units, autumn, (Bennett), by arrangement

232. Commodities Produced in Agriculture—Economic survey of chemical, biological, and industrial interrelationships between major agricultural commodities and problems of production, transportation, storage, processing, and utilization. Competition under the impact of chemistry. Price relationships. Trends in production and consumption. Five obligatory field trips to processing plants and commodity-marketing firms. Permission of the instructor required.

5 units, spring, (Brandt), TTh 4–6, alternate years, to be given in 1959–60

235. Economics of Futures Trading—Organization of speculative commodity markets; price characteristics; economic merits and demerits; attempts at regulation; the alternative of government price control.

4 units, autumn, (Working), MTWTh 11, alternate years, to be given in 1959–60
236. Seminar: Speculative Prices.
   3 units, autumn, (Working), by arrangement, alternate years, to be given in
   1959-60

240. Seminar: International Trade in Agricultural Commodities—Selected topics in the composition of trade, price movements, and commodity policy.
   3 units, winter, (Swerling), by arrangement

250. General Commodity Analysis—Methods used in analyzing economic problems related to the production, marketing, trade, utilization, and prices of specific commodities. Discussion of selected Wheat Studies as examples of various types of commodity-research problems and methods. Prerequisites: Economics 1 and 7.
   5 units, spring, (Farnsworth), MW 7-9 p.m., alternate years, to be given in
   1959-60

325. Readings in Agricultural History.
   3 units, winter, (Peffer), by arrangement, alternate years, to be given in
   1959-60

330. Readings in Economics of Agriculture.
   3 units, spring, (Brandt), by arrangement, alternate years, to be given in
   1959-60

331. Readings in Agricultural Geography.
   3 units, autumn, (Bennett), by arrangement

400. Advanced Directed Reading and Research—Advanced individual work leading to final preparation in fields of study listed above, or to theses and dissertations.
   Any quarter, (Staff), by arrangement
GRADUATE DIVISION SPECIAL PROGRAMS

Dean of the Graduate Division: ———

The Graduate Division Special Programs make provision for students whose plans for study toward the Ph.D. degree do not fall within the province of any one department. Such programs are individually planned for unusually well-qualified students.

A graduate student with a well-considered program not now provided for in the existing departments or special programs of the University may approach a professor qualified to give him guidance. The professor, if he believes the program desirable, will gather a special committee consisting of at least three other members of the Academic Council who represent the student’s various fields of interest. Included in the advisory committee must be professors from at least two departments of the University. Before the student embarks on the program, this committee will address a Declaration of Intention (Form G54) to the University Committee on Graduate Study:

1. defining the area of the special program, showing that the University is qualified to offer it, and proposing a title for the degree;
2. outlining the program of study and research contemplated;
3. indicating, if possible, the nature of the dissertation contemplated.

If this Declaration is approved by the University Committee on Graduate Study, the special committee will supervise the candidate’s work and sign the forms ordinarily transmitted by major departments. The chairman of the special committee will normally direct the dissertation.

GRADUATE DIVISION SPECIAL COURSES

For graduate students of all departments

As part of breadth of training at the graduate level, the following special courses are provided. There are no specific prerequisites for any of these courses:

287. Minerals in World Affairs—Mineral resources of the world; their political, economic effects.
   3 units, winter, (Park), MWF 9
301a. Introduction to History of Science I.
   3 units, autumn, (Koenig), to be given in 1959–60
301b. Introduction to History of Science II.
   3 units, winter, (Koenig), to be given in 1959–60
301c. Introduction to History of Science III.
   3 units, spring, (Koenig), to be given in 1959–60
303. Science and Human Affairs—Basic ideas of twentieth-century physics presented in an elementary way; emphasis on effects these ideas may have on philosophical, social questions. Discussion of these topics with considerable student participation. Enrollment limited to 15.
   3 units, spring, (Alvarez-Tostado), MWF 11
305. Introduction to Contemporary American Life—For new students from abroad who wish to study contemporary American life in light of historical developments. Readings on American history, class discussions about organization, practices of American university and community. Primarily for new graduate students from abroad.
   2 units, winter, (Warmbrunn), M 7–10 p.m.
308. Introduction to American Higher Education—For those planning careers in teaching, research, or administration in American higher education. Explores European, American historical backgrounds, to the end of comprehending current scene, planning for future.

4 units, autumn, (Cowley), TTh 2-4

310. The Philosophy of Language—Introduction to study of the nature, uses of symbols. Such concepts as meaning, syntax, ambiguity, vagueness, definition. Among topics are: place of semantics in study of language; criteria for selection of a language-system; differences, relations between scientific, poetic, philosophic use of language. Does not presuppose training in philosophy.

3 units, autumn, (Davidson), to be given in 1959-60

313. The Nature of Music—Illustration, discussion of possibilities, values in musical expression.

3 units, winter, (Crosten), M 3-6

322. Cultural Dynamics—Contributions of Anthropology to study of cultural stability and change including present world-wide contacts between differing cultural systems.

4 units, spring, (Siegel), MTWTh 1

323. The Nature of American Society—Analysis in terms of sociological concepts and methods of American society, its distinctive character, its major problems.

3 units, spring, (LaPiere), MTW 9

325. Economics and the Social Sciences—This course will survey the subject matter of economics and explore its relation to other branches of the social sciences, such as history, sociology, politics, and psychology.

3 units, autumn, (Baran), T 4-6

328. Geography and Contemporary World Problems—Effects of physical pattern of nations on modern economic, political development.

3 units, spring, (Williams), M 2-5

334. Seminar on the Bhagavadgita—Study of this central text of Hindu philosophy. Comparison of Gita—commentaries through the ages give a history of Indian philosophical thinking from Shankara and Ramanuja down to Gandhi, Aurobindo, and Radhakrishnan. Emphasis on discussions of the Gita's contributions to universal ethical doctrine and the relation of its metaphysics and psychology to modern systems in the West. Impact of the Gita on Indian art, illustrated with slides of mythological scenes.

4 units, spring, (Spiegelberg), WF 2-4

338. Research in National and International Affairs—Analysis of research organization in inter-disciplinary study of national and international affairs; review of most important projects in universities of United States and Europe, including Iron Curtain countries. Guest speakers from major universities.

2 units, winter, (Hilton), M 7-9 p.m.

340. The Human Potentiality—Group discussion of views on nature of man, his potentialities, means for their realization as found in dynamic psychology, literature, philosophy, religious teachings. Objective to help individual seek out new points of view, aid him in integrating these into sound approach to living. Enrollment limited to 15.

2 units, autumn, (Harman), TTh 4-6

355. Logic of Discovery—General patterns of problem-solving; views of Pappus, Descartes, and others. General patterns of plausible reasoning; inductive and circumstantial evidence. Illustrated mainly, but not exclusively, by elementary mathematical examples.

3 units, spring, (Polya), MWF 4

360. Seminar in Water Resources—Discussions by faculty, students, and outside speakers covering many facets of water-resources studies including
water-resources planning, hydrology, ground-water geology, limnology, water-resources administration, agricultural economics, geochemistry, and stream sanitation.

1 unit, autumn, winter, spring, (Linsley), by arrangement

375. Physical Basis of Music—Demonstration of the experiments of Pythagoras, the resulting circle of fifths, and related theories of scale construction. Experiments of Galileo, Rameau, Tartini, and Helmholtz, establishing the nature of musical sounds; related theories of consonance, dissonance, and harmony. Physical characteristics of modern musical instruments. Discussion of recording techniques and proper use of microphones, insofar as these affect the musician.

2 units, autumn, (Jaynes), MW 1

See also the courses listed by the Hoover Institution. The Food Research Institute and many departments offer non-prerequisite courses and seminars that are open to graduate students. Examples are:

Classics T160. The Classical Epic.
English 303. Tragedy.
Food Research 212. African Agricultural Development.
Food Research 231. Geography of the Farinaceous Food Plants.

COURSES FOR PH.D. CANDIDATES IN GRADUATE DIVISION SPECIAL PROGRAMS

400. Research.
   By arrangement

   By arrangement

COMMITTEE ON EAST ASIAN RESEARCH

The Committee on East Asian Research is an interdepartmental committee which has as one of its functions the advising of graduate students who have particular interests in the study of China or Japan. Most graduate degree programs are worked out by the student's departmental adviser. This Committee can assist in the development of supporting programs with a regional concentration in Eastern Asia. The Committee also stands ready to advise the exceptional student in the development of an interdepartmental program leading to the Ph.D. under Graduate Division Special Programs. The Committee sponsors a regular research seminar on East Asian Thought and Society which graduate students with interests in this area are invited to attend.

Inquiries concerning Stanford's resources for the graduate study of China or Japan may be directed to the Chairman of the Committee on East Asian Research, Professor Arthur F. Wright, Department of History.
HOOVER INSTITUTION

Emeriti: Harold H. Fisher (Chairman); Nina Almond (Librarian and Consultant in Research); Joseph S. Davis, Edgar E. Robinson, Graham H. Stuart (Councilors).

Director: C. Easton Rothwell
Librarian: Philip T. McLean
Assistant Director: Witold S. Sworakowski
Professors: C. Easton Rothwell, Christina Phelps Harris, Anthony E. Sokol
Associate Professors: Nobutaka Ike, Witold S. Sworakowski, Mary C. Wright
Curators: ——— (Middle Eastern Collections), Nobutaka Ike (Japanese Collections), ——— (African Collections), Inez G. Richardson (Ray Lyman Wilbur Collection on Social Problems), Witold S. Sworakowski (Eastern European Collections), Mary C. Wright (Chinese Collections)
Area Specialist: Agnes Fischer Peterson (Western European Collections)
Associate Librarian: David W. Heron
Consultant: Arthur Kemp
Executive Assistant: Inez G. Richardson
Administrative Assistant: Winifred A. Teague
Head, Reference Department: Arline B. Paul
Head, Catalog Department: Ina E. Nelson
Archivist, Herbert Hoover Archives: Thomas T. Thalken
Research Secretary: Dare Stark McMullin

The purpose of the Hoover Institution is to foster greater understanding of the twentieth-century world. Since its founding by Herbert Hoover in 1919 as a special collection dealing with the causes and consequences of World War I, the Institution has grown into one of the important centers for the study of this troubled era. The function of the organization is to preserve and organize for use materials gathered world wide on contemporary international affairs, to conduct research and instruction in problems related to the major fields of the Institution's interest, to publish the results of such research, and thus to increase and deepen understanding of the issues that face this nation and the world in these times.

By area, the major collections are those on Central and Western Europe, especially Germany, France, and the Benelux countries; those on Eastern Europe, especially Russia, Poland, Czechoslovakia, and Yugoslavia; Africa south of the Sahara; the Middle East, especially Turkey and Egypt; and the Far East, especially Japan and China—both Nationalist and Communist. All or parts of these collections are without parallel elsewhere. The materials are abundant on the causes and consequences of twentieth-century war; on peace aims, peace plans, and peace movements; on military government; on principal revolutionary developments; on international organization and administration; and on propaganda and public opinion.

The Institution's collections include government documents, files of newspapers and serials, manuscript memoirs, diaries and personal papers of men and women important in world affairs, publications of ephemeral societies and of resistance and underground movements, and the publications and records of national and international bodies, both official and unofficial, as well as books and pamphlets, many of them rare and irreplaceable.
The Hoover Institution offers a number of seminars and several departments offer courses using the Institution's materials. Members of the faculty of the University engaged in active academic work in the social sciences and the humanities are also directing research work in the Institution in those fields in which they are concerned.

SEMINARS

114. International Organization and World Politics—To examine influence of world politics on development and activities of international organizations, and reciprocal effects of the organizations on world politics. Seniors and graduate students by permission.

5 units, spring, (Rothwell)

131. The German Expellee Problem—A study of population shifts in Central Europe after World War II and their relation to the political, social, and economic developments in present-day Germany. The relation of the refugee problem to regional and international organizations of the post-war era. Reading of German newspapers published by expellee groups, documents issued by Federal Ministry for Expellee Affairs, and publication of various organizations in Western Germany concerned with this problem. Seniors and graduate students, by permission. Reading knowledge of German recommended.

5 units, winter, (Boeninger)

141. Eastern Europe since 1945—Analysis of events in the "Soviet sphere" since the collapse of Nazi domination; patterns of Communist conquest, domination of the area; comparative study of most important political, social, economic problems of the area. Prerequisites: two background courses in modern European history or international relations. Seniors and graduate students by permission.

5 units, autumn, (Sworakowski)

189. Reform and Revolution in Twentieth Century China and Japan—Changes, particularly in values and ideologies, produced in China and Japan through foreign influences. An effort will be made to relate Western and Soviet impacts to internal developments in these countries. Prerequisites: History 113 and 114. Seniors and graduate students.

5 units, winter, (Ike, North, M. Wright)

233. Problems of National and Collective Security—Emphasis on Europe and problems such as NATO and European integration. Limited to 10 graduate students by permission. (Enroll in Political Science 233.)

5 units, autumn, (Sokol)

234. Problems of National and Collective Security—Emphasis on Asia. Limited to 10 graduate students by permission. (Enroll in Political Science 234.)

5 units, winter, (Sokol)

235. Problems of Sea Power—Nature, composition, and history of sea power. Limited to 10 graduate students by permission. (Enroll in Political Science 235.)

5 units, spring, (Sokol)

270. The Great Powers in the Middle East in the Twentieth Century—Conflicting interests of Britain, France, and Russia in the Middle East to 1914. The reaction of the Middle East peoples to Great Power pressures and to westernization. Concurrent development of Arab, Turkish, and Persian nationalism. The First World War precipitated the modern era in the Middle East. The seminar will consider the inter-war years to 1939, with emphasis on British and French mandates and developments in the Arab world.

5 units, winter, (C. Harris)
274. Background and Causes of the Egyptian Revolution of 1952—Analysis of the contemporary reform movement. Prerequisites: two background courses in (a) history of Europe in 19th, 20th centuries; or (b) history of Europe in 19th century and modern international relations; or equivalent background work. Graduate students by permission.

5 units, spring, (C. Harris)

283. Modern Chinese Documents—Introduction to the types and uses of Chinese sources of the late Imperial, Republican, and Communist periods.

5 units, spring, (M. Wright)

299. Directed Reading and/or Special Research in Hoover Library Fields—Advanced individual work by arrangement on subjects or areas not listed for current year.

Any quarter, (Staff)

See also Senior Colloquia.
Emeriti: Elizabeth Hadden, William Owens, Minna Stillman (Associate Librarians); Alice Charlton (Chief Catalog Librarian); Jeannette M. Hitchcock (Chief of Division of Special Collections); Margaret Wells (Education Librarian)

Consultant in Bibliography: Frederick E. Brasch
Honorary Curators: George T. Keating, Musical Bibliography; Irving Whitmore Robbins, Jr., Rare Books and Manuscripts; Elmer E. Robinson, Americana; Albert Sperisen, Typography

Director: Raynard C. Swank
Associate Director: Elmer M. Grieder
Assistant to the Director: Fred John Priddle

Division Chiefs: Joseph A. Belloli, Humanities and Social Sciences; J. Terry Bender, Special Collections; Frederick M. Falconer, Science; Gustave A. Harrer, Acquisition; Jack Plotkin, Circulation; Clara S. Manson, Lane Medical Library

Principal Librarians and Heads of Departments: Irene Barquist, Exchange Department; Edward E. Colby, Music Library; Kathryn Nell Cutler, Branner Library; Edith Hanson Falconer, Assistant Chief, Acquisition Division; Reginald Gordon, Serials Cataloger; Charles R. Gorham, Gift Department; Mary Elizabeth Hughes, Document Library; Harold E. Korf, Humanities; Emily Olson, Education Library; Ruth Scibird, Stanford Collection; Grace E. Stillson, Assistant, Catalog Division; George E. Vdovin, Assistant Chief, Science Division; Madeline G. Wilkinson, Serials Department

Law Librarian: John Henry Merryman
Librarian, Hoover Institution: Philip T. McLean
Director, Jackson Library of Business: Marion McGill Smith

The University Library is open Mondays through Fridays from 8:00 a.m. to 10:00 p.m. On Saturdays the hours are 8:00 a.m. to 4:00 p.m., and on Sundays 1:00 p.m. to 5:00 p.m. These hours do not apply to the Reserved Book Room, which is open Monday through Saturday from 8:00 a.m. to 10:00 p.m. and Sundays from 1:00 p.m. to 10:00 p.m. Books not on reserve or otherwise restricted may be borrowed by those entitled to Library privileges.

The University Library may be used by all registered students. Alumni of the University may obtain Library privileges upon securing the Director's approval and the payment of an annual fee of five dollars. Other qualified persons will be entitled to use of the Library upon obtaining the Director's approval and the payment of an annual fee of ten dollars.

Including the Hoover collections on war, revolution, and peace and the Lane Medical Library, the University Libraries contain more than 1,400,000 catalogued volumes and 1,900,000 uncatalogued books and pamphlets which are organized for use.

The Document Library brings together the Library's collection of municipal, state, federal, and international documents. It is especially strong in the publications of the United States, Great Britain, Canada, Australia, and the United Nations.

The Hoover collections on war, revolution, and peace are housed in a separate building. The main floor provides administrative offices and public reading rooms. The great tower, rises to a height of 281 feet, contains 14 stack
levels for the book collections and quarters for the Herbert Hoover Archives.

These growing collections, founded by Herbert Hoover at the close of World War I, deal with the causes and the conduct of wars, the revolutionary movements of the twentieth century, the peace settlements following the two world wars, and present-day international relations. The use of unrestricted materials is open to undergraduates, graduates, and faculty of Stanford University, to graduate students and faculty of other universities and colleges, and to other qualified investigators.

The Division of Special Collections, whose office and main reading room are in the Albert M. Bender Room, maintains and makes available the Library's rare and valuable books and manuscripts, and administers a number of specialized research collections. Among the most important of these are the Charlotte Ashley Felton Memorial Library, which is devoted to British and American literature of the nineteenth and twentieth centuries (published works, first editions, variant editions, bibliographies, criticisms, and biographical material of selected authors, supplemented where possible with manuscripts, proofs, letters, and association items); the Sir Isaac Newton Collection, covering a full history of several branches of the physical sciences centering around the life and thought of Newton; the Typographical Collection, composed of examples of fine modern printing and books on the history and the making of the printed book; the Memorial Library of Music, devoted to musical manuscripts and first issues of important and rare musical scores; the Elmer E. Robinson Collection on American History and Constitutional Law; the Borel Collection of contemporary California political manuscript material; and other collections of a similar nature. All of this material is available for use to qualified persons in the Bender Room. Such materials do not circulate and must be used in this room.

The Law School and Crothers Hall Law Libraries contain about 98,000 volumes. In addition to extensive holdings in Anglo-American law there are important special collections of French, British Commonwealth, and early State laws. The International Legal Studies Collection of international law and organization and foreign and comparative law is of increasing importance.

The Law Libraries are primarily intended for use by students, faculty, and research staff of the Law School, although other faculty, attorneys, and visiting scholars are welcome. Students not enrolled in the Law School whose course work or research requires access to the Law Libraries should ask their professors to make appropriate arrangements with the Law Librarian.

The Lane Medical Library was founded by the directors of Cooper Medical College in accordance with the bequest of Mrs. L. C. Lane. It is located at Sacramento and Webster Streets, San Francisco, adjoining the School of Medicine. The Library contains about 140,000 volumes, and is particularly rich in periodicals. Over 1,900 journals are currently received.

Important special collections are the Barkan Library of Ophthalmology and Otolaryngology, and the Medical History Collection, both endowed by Dr. Adolph Barkan.

The Jordan Library of Zoology is a collection consisting largely of works on ichthyology, to a considerable extent made up of author's separates, accumulated by Chancellor Jordan and members of the Department of Zoology, bound, indexed, and cataloged. The more voluminous publications such as the works of Cuvier, Lacépède, Bloch, Bleeker, Günther, and others are well represented. These, supplemented by the proceedings of various societies and institutions, make a collection of books of great value to advanced students and investigators. The Library is conveniently located in the Natural History Museum, near the laboratories and collections.

The Biology Library, housed in Jordan Hall, is a combination of the former departmental libraries of botany, physiology, zoology, and entomology, with
some works on general biology, and now comprises about 23,000 volumes, together with current files of 235 periodicals. Its aim is to further the efforts of students and research workers, and when complete, it should cover the literature of all phases of biological science represented in the courses and research activities of the University.

The Engineering Library, opened in 1942, serves the School of Engineering. It includes material in civil, electrical, mechanical, and mining engineering and related materials from the main Library. It is located on the first floor of the University Library building and has its own reading room.

The Branner Geological Library includes material relating to geology, paleontology, mineralogy, mining, and metallurgy. Its files of journals, transactions of scientific societies, and state government reports are exceptionally complete.

The Food Research Institute Library, although intended primarily for the use of the staff of the Food Research Institute, is now one of the University Libraries and available to properly qualified readers.

The Hopkins Marine Station Library provides an adequate working collection in the fields of marine biology and related subjects.

The Cubberley Library, with its three reading rooms and bookstacks located on the second floor of the School of Education building, houses about 100,000 books, periodicals, and pamphlets in the field of education. In the south reading room is the curriculum library, a collection of approximately 20,000 elementary and secondary school textbooks, curriculum guides, and graphic materials. Other special collections include college catalogs and state and city school reports.

The Jackson Library of Business is primarily a working laboratory available to business students in the daily preparation of their assigned work. It contains in excess of 156,000 volumes, pamphlets, and reports, including more than 22,000 of the more important books relating to business. The Library also receives regularly in excess of 900 trade, financial, labor, and general business periodicals. In addition, it subscribes to the leading labor, financial, marketing, and business research services.

**INSTRUCTION**

1. **Use of the Library**—Introduction to the Library; emphasis on major types of material and use of catalogs, bibliographies, indexes, abstracts, other aids to study. Primarily for freshmen and sophomores.

   1 unit, autumn, winter, or spring, (Plotkin), T II
AIR SCIENCE

Professor of Air Science: Arthur S. Blum, Jr. (Colonel, USAF)
Assistant Professors: Walter L. Bollinger (Major, USAF), Thomas J. McGrath (Captain, USAF), Charles B. Knudson (Captain, USAF), W. J. Gallaway (Captain, USAF)

GENERAL

The National Security Act of 1947 established the United States Air Force as a separate military establishment under the Department of Defense, and in July 1949 a separate four-year Air Force Reserve Officers' Training Corps program was inaugurated at Stanford under the Department of Air Science.

A basic expectation of this program is the commissioning of a high percentage of Air Force officers interested in and qualified for flying training in the USAF.

OBJECTIVES

The AFROTC program is designed to fulfill required academic standards in order that cadets may receive credit in proportion to their academic load; to provide that fundamental training, both personal and professional, which will best fit the cadet to become a well-rounded junior Air Force officer possessing a high growth potential; and to develop and stimulate a growing desire on his part to enter the Air Force flight training program. Specific objectives are as follows:

1. To select students for the advanced course, and where practicable, for the basic course, who are potentially best qualified to serve as officers of the USAF.
2. To arouse in the cadets a desire to serve as officers of the USAF.
3. Develop in the cadets those attributes of character, personality, and leadership which are essential to an officer of the USAF.
4. To provide the cadets with the knowledge and understanding which will enable them to serve as junior officers of the USAF. This objective recognizes the need today for officers with a wide purview of social and scientific problems and an understanding of national, international, and global concepts.

The practical training in organization, leadership, and discipline is of value also in industrial or professional careers. The courses have a content of general educational value, complementing and supplementing related courses offered by other departments of the University.

DEFERMENT

Under the provisions of Public Law 51, 82d Congress (Universal Military Training and Service Act) and pertinent Air Force regulations, selected students of the basic AFROTC courses may be granted deferment from Selective Service induction. Those selected will sign an agreement to accept a commission as an officer of the United States Air Force, if tendered; and to serve as such on active duty for a period of not less than three years, if called; and to remain a member of the service in a reserve status for a total period of six years. Selection is limited by quotas allotted to Stanford by the Air Force.
Those students who satisfactorily complete the Basic Course are then considered by a board of officers for selection to enroll in the Advanced Course. Enrollment in the Advanced Course is again limited by a quota. Deferment is automatically extended for students who are selected.

Selection for the Advanced Course is competitive and only those cadets who are above average academically and in leadership qualities will be eligible for continued enrollment. Constant cumulative evaluation of each cadet is maintained during the Advanced Course. Deferment must be canceled immediately upon withdrawal or discharge from the program for any cause during either the Basic or Advanced Course.

**BASIC COURSE**

**Conditions for Enrollment**

Eligibility for membership in the AFROTC is limited to regularly enrolled students of Stanford University who are not less than 14 years of age nor more than 23 years of age, who are citizens of the United States, whose physical condition is such that they are fit for military service or will be upon attaining military age, who meet established moral and character requirements, who successfully complete such general survey or screening tests as may be prescribed, and who have at least 12 quarters (exclusive of summer work) remaining at the time of enrollment. Freshmen who do not enter the program their first quarter cannot always be admitted later.

**Course Work**

Three hours per week (two hours theoretical and one hour practical) during the first six quarters of the Air Science program. Two hours of academic credit are allowed for each quarter.

The Basic Course is designed specifically to arouse an interest in the Air Force, giving desirable citizenship training in an air age appropriate to a student's edification whether or not he continues his Air Force reserve training. The first-year course is one of orientation to the AFROTC and to the field of aviation, followed by geographical, political, and historical concepts considered essential to understanding the role of the Air Force in world affairs. The second-year offering is designed to acquaint the cadet with Air Force activities and officer career fields.

**ADVANCED COURSE**

**Conditions for Enrollment**

Eligibility for enrollment in the Advanced Course is based on satisfactory completion of the Basic Course, or on credit granted at the discretion of the Professor of Air Science and the President of the University, for previous training either in active military service, or in an AFROTC unit at another college, or in one of the service academies. In addition, the student must:

1. Be selected, within assigned quotas, to pursue the Advanced Course by the Professor of Air Science and the President of the University.
2. Be a citizen of the United States.
3. Not have reached 25 years of age.
4. Agree in writing to complete the AFROTC University program and the prescribed summer training, contingent upon his remaining in college.
5. Be accepted by the University as a regularly enrolled student.
6. Be physically qualified under standards prescribed.
Course Work

The Advanced Course years require five hours per week of instruction (including one hour of drill) and students are allowed four hours of academic credit for each quarter. The categories under which students are enrolled in the Advanced Course are as follows:

- Flight Training
  - Category 1, Pilot Training
  - Category 1a, Navigator Training
- Category 2, Scientific, Technical, or Engineering Field
- Category 3, Non-flying, non-technical
- Category 4, Veterans

In the Advanced Course the aim is to develop personal qualifications of the cadet officer by widening his background of experience and strengthening his character and those qualities of leadership essential to a young officer. Such a subject as Military Aspects of World Political Geography, for illustration, stresses Air Force application in which the geographic bases of power and its strategic aspects are considered. Subjects taught to develop personal qualifications include the Air Force Commander and Staff, Problem-Solving Techniques, Career Guidance, Leadership Seminar, and Briefing for Commissioned Service. The remainder of the subjects fortify leadership training, supplementing previous information, and provide orientation to the Air Force.

Cadets normally attend training for four weeks in the summer that follows completion of their first advanced year. It is desired through the summer training to make practical application of the information and techniques learned in the classes and leadership laboratories. Also, it is felt advantageous to acquaint the student with military life through some flying experience. Familiarization flying, whether the cadet intends to attend flying school or not, introduces the officer candidate to the operational phases of the air fighting force. These familiarization flights are accomplished as part of field trips to Air Force bases and in local flights with detachment personnel.

AIR FORCE R.O.T.C.
FLIGHT INSTRUCTIONAL PROGRAM

This program provides 35 hours of flight training for each Category 1 senior during his last year in the AFROTC program. Flight instruction is provided by a CAA-approved civilian flying school which is under subcontract by Stanford University to conduct this program. AFROTC instructors conduct the required 35 hours of ground school instruction within the regular AFROTC program. The Civil Aeronautics Administration (CAA) is responsible for the administration of the AFROTC Flight Instructional Program.

EMOLUMENTS, ADVANCED COURSE

Advanced students are issued a complete uniform. They are paid (as commutation of subsistence) at the rate of approximately $27 per month, and during summer training receive the pay of airmen of the first pay grade, $78 per month. A travel allowance of five cents per mile for travel to and from camp is authorized.

DISTINGUISHED GRADUATES

Under provisions of federal law, advanced students who are outstanding, both academically and in leadership, in military courses and in campus activities are designated Distinguished AFROTC Graduates upon the concurrent
recommendation of the Professor of Air Science and the President of the University. Such graduates are given special consideration and may apply for regular commissions in the Air Force prior to graduation. *Note:* Other graduates may apply for a regular commission after 18 months' service in a commissioned status.

**DAYS AND HOURS OF INSTRUCTION**

Announcement of days and hours for the following courses will be found in the *Time Schedule* each quarter:

**FIRST-YEAR COURSES**

10. Introduction to AFROTC and to Aviation.
   2 units, autumn

   2 units, winter

   2 units, spring

**SECOND-YEAR COURSES**

34. Careers in the Air Force; Elements of Aerial Warfare, I (Targets and Weapons).
   2 units, autumn

35. Elements of Aerial Warfare, II (Aircraft)—Continuation of A.S. 34.
   2 units, winter

36. Elements of Aerial Warfare, III (Air Bases, Operations)—Continuation of A.S. 35.
   2 units, spring

**THIRD-YEAR COURSES**

122. Air Force Commander and His Staff; Creative Problem-Solving.
   4 units, autumn

123. Communicating and Instructing in the Air Force; Military Justice System—Continuation of A.S. 122.
   4 units, winter

   4 units, spring

**FOURTH-YEAR COURSES**

142. Principles of Leadership and Management (Seminar).
   4 units, autumn

143. Military Aspects of World Political Geography—(Same as Geography 143.)
   4 units, winter

144. Military Aviation and the Evolution of Warfare; Briefing for Commissioned Service.
   4 units, spring

199. Leadership Laboratory—Open only to Advanced Course cadets on the Wing and Group Staffs and Squadron Commanders with the concurrence of the Professor of Air Science; directed by the Tactical Section.
   1 unit, any quarter
MILITARY SCIENCE and TACTICS

**Professor:** Frederic H. Chaffee (Colonel, Artillery)
**Assistant Professors:** Emery M. Hensley (Lt. Colonel, Infantry), Frank J. Riordan, Jr. (Major, Artillery), Alfred L. Sanderson (Captain, Infantry), William A. Hudson (Captain, Infantry)

**Objective.**—The objective of the Army ROTC program is to produce junior officers who by their education, training and inherent qualities are suitable for continued development as officers in the United States Army. Instruction at Stanford will cover military fundamentals common to all branches of the service. The aim is to provide a basic military education and in conjunction with other University disciplines to develop individual character and attributes essential to an officer. The Army ROTC training is designed to develop and perfect the qualities of leadership required in both military and civilian life and to give the student an opportunity to reinforce his knowledge with actual practice in the techniques of leadership. In this respect, then, the ROTC is the training ground for tomorrow's leaders not only in the armed forces but also in private enterprise and government.

**Curriculum.**—The curriculum embraces subjects common to all branches of the Army including psychology of leadership, personnel management, military administration, military history, map and aerial photograph reading, military operations and logistics, teaching methods, weapons and their employment and command and staff procedures. The course in Army ROTC consists of four years of academic work and six weeks at summer camp between the junior and senior years. The University grants a total of 36 units for successful completion of the entire course. For the first two years this consists of two classroom hours and one drill period per week and for the last two years, four classroom and one drill period per week. Military science courses are accepted in lieu of the University physical education requirements and as the fulfillment of the Group Activity requirement of the General Studies Program. Upon graduation and successful completion of the four-year program a student is commissioned a Second Lieutenant in the U.S. Army Reserve and outstanding graduates are offered direct commissions in the Regular Army.

**Deferment.**—Enrollment in the ROTC program can insure completion of schooling including advanced degrees before performing military service. Students in the Army ROTC are granted, when required, deferment from selective service induction. Deferments must be canceled immediately upon withdrawal or discharge from the program.

**Enrollment in the ROTC.**—Courses are open only to citizens of the United States who meet certain physical requirements. Conditions for enrollment, except for veterans, are as follows:
1. Be selected, within assigned quotas, by the PMST
2. Be not less than 14 years of age nor more than 23
3. Have at least 12 quarters (exclusive of summer work) remaining at time of enrollment.

Paramount criterion is that every enrolled cadet has the potential of becoming an effective Army officer. Classification tests will be given periodically to test the progress of cadets, but principal reliance for selection and retention in the program will be placed on the judgment of the Professor of Military Science and Tactics and his assistants.

Selection for the advanced course is competitive and only those cadets who are above average in leadership qualities can feel assurance of continued en-
Enrollment. At Stanford the vast majority of those entering the Army ROTC program aspire to complete the entire four-year course.

Emoluments, Uniforms and Texts.—A monetary allowance of approximately $27.00 per month for the last two years of the course is made to students in good standing. Uniforms and texts are supplied without cost to the student for use while enrolled in the course. The student also receives travel expenses to and from Summer Camp and further receives an allowance of $78.00 per month during attendance at Summer Camp. Students discharged for reasons other than for the convenience of the government must refund monetary allowances paid to them.

Length of Army Service.—Department of Defense has announced that every effort will be made to grant commissions as Second Lieutenants in the USAR to all qualified graduates of the Army ROTC course. Upon commissioning as officers two alternative programs of military service are available: one of six months active duty followed by 7½ years in the active reserve and the other of two years active duty followed by three years active reserve and one year inactive. Assignment to the various branches of the service with length of active duty therein are made by the Department of the Army before the final quarter of enrollment for each student. These assignments are based upon requirements of the Army and upon recommendations of a board which convenes at Stanford University during the autumn quarter of the senior year. Board recommendations are based on the following: preferences indicated by student, academic achievement, leadership potential, adaptability, ROTC personal data forms, report from summer camp, and information submitted by the PMST.

COURSES

Drill

Drill is held every Tuesday from 3:15 to 4:15; attendance is compulsory for all Army ROTC students. Here students have the opportunity to practice their ability to command. Advancement to command positions in the cadet corps depends to a large degree on individual performance on the drill field. A number of awards for distinction are made each year including the Distinguished Military Student award to those who excel in the entire military program. The Army Stanford Award wrist watch is presented each year to the pre-eminent ROTC graduate.

First-Year Courses

11. Organization of the Army and ROTC and Individual Weapons and Marksmanship.
   2 units, autumn
   2 units, winter
   2 units, spring
   Each course normally has six sections meeting at the following hours:
   Sec. I, MW 9; Sec. II, MW 10; Sec. III, MW 1:15; Sec. IV, TTh 9; Sec. V, TTh 10; Sec. VI, TTh 1:15

Second-Year Courses

   2 units, autumn
   2 units, winter

   2 units, spring

   Each course normally has six sections meeting at the following hours: Sec. I, MW 8; Sec. II, MW 11; Sec. III, MW 2:15; Sec. IV, TTh 8; Sec. V, TTh 11; Sec. VI, TTh 2:15

THIRD-YEAR COURSES

131. Leadership and Military Teaching Principles.
    4 units, autumn

132. Branches of the Army and Small Unit Tactics.
    4 units, winter

133. Small Unit Tactics and Communications and Leadership, Drill and Command.
    4 units, spring

   Each course normally has three sections meeting at the following hours: Sec. I, MTWTh 8; Sec. II, MTWTh 10; Sec. III, MTWTh 1:15

FOURTH-YEAR COURSES

141. Operations.
    4 units, autumn

142. Operations and Army Administration.
    4 units, winter

143. Army Administration and Military Justice and Service Orientation and Leadership, Drill and Command.
    4 units, spring

   Each course normally has three sections meeting at the following hours: Sec. I, MTWTh 9; Sec. II, MTWTh 11; Sec. III, MTWTh 2:15

199. Command and Staff Procedures—Theory, practice of developing and supervising execution of training programs. Prerequisites: completion of basic courses and permission of PMST.
    1 unit, any quarter, (Hudson), by arrangement

NAVAL SCIENCE

Executive Head: Douglas B. Brokenshire (Captain, USN), Commanding Officer
Professor: J. Wesley Hughes (Commander, USN), Executive Officer
Associate Professor: J. Wesley Hughes (Commander, USN)
Assistant Professors: Wilton Holmgren (Lt. Commander, USNR); Robert E. Klee (Lieutenant, USN); Harry F. Painter (Major, USMC); Ballard W. Tebo (Lieutenant, USN)

OFFERINGS AND FACILITIES

The Naval Science Department affords the opportunity for selected male students to receive instruction in essential Naval subjects which, in conjunction with a baccalaureate degree earned through undergraduate work in fields of their own choice, will qualify them for a commission in the U.S. Naval Service.

The Regular NROTC Midshipman is chosen in nation-wide competition
and attends the University under Navy sponsorship. In addition to payment for tuition, books, and fees, he draws retainer pay of $50 per month. Contract NROTC students are selected by the Professor of Naval Science at the beginning of the academic year from among applicants of the incoming freshman class. During the last two years of their undergraduate work, Contract students are paid at the rate of $27 per month. Applicants for the Contract NROTC program should communicate directly with the Professor of Naval Science, Stanford University.

Upon successful completion of the required courses in Naval Science, together with the University requirements for a baccalaureate degree, NROTC students are appointed Ensigns and serve on active duty with the Fleet as commissioned officers. Qualified students who so desire may pursue Marine Corps professional studies during the last two years of attendance. Upon completion they may be appointed Second Lieutenants.

Regular Midshipmen must complete three summer cruises with Fleet units. Contract students must complete one such cruise, normally between their junior and senior year.

Requirements for commissioning:

a. All NROTC students must complete 36 units of Naval Science.

b. Regular NROTC Midshipmen must satisfactorily complete one year of college physics, including laboratory, by the end of their second year. Contract students should complete this requirement if their schedule permits.

c. Regular NROTC Midshipmen must have completed one year of mathematics by the end of their second year. Contract students must complete mathematics through trigonometry (in secondary school or college) prior to the end of their second year.

d. All NROTC students must take such instruction in swimming as is necessary to achieve proficiency equal to that of a First Class swimmer prior to graduation.

COURSES

There are no Naval Science courses offered in the summer quarter; Naval Science courses are three quarter courses. Those courses ending with (1) are offered in the autumn quarter, (2) in the winter quarter, and (3) in the spring quarter. Those with M as a suffix are for candidates for a Marine Corps commission. The course numbers are assigned by the Navy Department and do not correspond to the general University plan of numbering courses, i.e., none are graduate courses.)

111, 112, 113. Evolution of Sea Power and Naval Orientation—Introduction to Navy nomenclature, customs, traditions. Concept of sea power, its historical effects on national power.

9 units, autumn, winter, spring, (Holmgren), MWF 9, 1; lab. Th 9

211, 212, 213. Naval Weapons—Naval armament of ships, air, submarines; associated fire control systems.

9 units, autumn, winter, spring, (Tebo), MWF 8, 11, 12; lab. Th 8, 11, 12


9 units, autumn, winter, spring, (Klee, ———), MWF 9, 10, 1; lab. Th. 9, 10, 1

311M, 312M. Evolution of the Art of War—Development of strategy and tactical applications by historic influence of technological development, geographic considerations.
6 units, autumn, winter, (Painter), MWF 9, 10; lab. Th 9, 10

313M. Modern Basic Strategy and Tactics—Rationale of basic strategic concepts; offensive, defensive combat in light of past, present U.S. foreign, military policies.

3 units, spring, (Painter), MWF 9, 10; lab. Th 9, 10

411, 412, 413. Naval Administration and Operations—Organizational, administrative aspects of Naval establishment including Uniform Code of Military Justice. Fleet operations.

9 units, autumn, winter, spring, (Klee, ———), MWF 8, 10, 1; lab. Th 8, 10, 1

411M, 412M. Amphibious Warfare—Historical development of amphibious warfare, current doctrine.

6 units, autumn, winter, (Painter), MWF 11, 1; lab. Th 11, 1


3 units, spring, (Painter), MWF 11, 1; lab. Th 11, 1

Naval Science Laboratory—Two hours a week of Naval Science Laboratory required of all NROTC students. Monday session held on Drill Field at 3:15 p.m. Thursday session practical work conducted in regular classroom.
PHYSICAL EDUCATION (MEN)

PHYSICAL EDUCATION for MEN

Emeriti: Ernst Brandsten, Allen Henry Elward, Henry W. Maloney, Edward M. Twiggs, Harry Meiggs Wolter (Directors); Ernest Paul Hunt (Associate Professor)

Executive Head and Director of Athletics: Alfred R. Masters
Assistant Director of Athletics: Charles A. Taylor
Directors: Jack Curtice (Football), Howard Dallmar (Basketball), William Paul Fehring (Baseball), Charles Finger (Golf), Thomas G. Haynie, Jr. (Swimming), Payton Jordan (Track), Raymond E. Lunny, Jr. (Boxing), Robert Renker (Tennis), Colonel Alex P. Sysin (Equitation)
Assistant Directors: Andrew S. Everest (Football), Peter G. Kmetovic (Football), Herman Meister (Football), Floyd Strain (Track)
Associate Professors: John E. Nixon, Wesley K. Ruff
Assistant Professor: Elwyn Bugge
Associate Director: C. Myron Sprague (Physical Education)

OFFERINGS AND FACILITIES

Athletics

Stanford University is a member of the Pacific Coast Intercollegiate Athletic Conference and the National Collegiate Athletic Association, and as such competes with other major universities and colleges in most generally recognized collegiate sports. It is also a member of the United States Golf Association, the Pacific Association of the Amateur Athletic Union, the Northern California Rugby Union, the Northern California Intercollegiate Soccer Association, the Western Intercollegiate Fencing Conference, the Northern California Tennis Association, the Northern California Golf Association, the California Intercollegiate Baseball Association, the Pacific Coast Intercollegiate Wrestling Association, and the Pacific Coast Intercollegiate Boxing Association. Major sports, for which the University awards the Block Letter S, are football, basketball, track and field, baseball, swimming, golf, and tennis. Minor sports, for which the University awards the Circle S, are water polo, boxing, fencing, wrestling, gymnastics, rugby, soccer, and cross-country running. On an informal basis University teams compete with other institutions in skiing, crew, polo, and rifle shooting. By action of the student governing body the competitors in these sports may also be awarded the Circle S. Policy governing the University's participation in intercollegiate athletics is determined by the Stanford Athletic Board, composed of student, administration, and alumni members, and by the faculty committee on athletics.

Physical Education:

Activity courses for men, the men's intramural sports program, and intercollegiate competition for men are administered by the Department of Athletics and Physical Education. Women's activities are conducted by the Department of Physical Education for Women. There are a few coeducational activity courses, such as equitation, folk and square dancing, ski conditioning, and archery.

Both men and women preparing for professional careers in physical education are under the jurisdiction of the School of Education.
The intramural program for men includes seven-man touch football, two-man volleyball, six-man volleyball, bowling, table tennis, horseshoes, handball, wrestling, basketball, softball, tennis, swimming, and track and field. Instruction is given by the Department in swimming, diving, golf, tennis, equitation, fencing, boxing, wrestling, basketball, baseball, gymnastics, weight lifting, track and field, crew, soccer, rugby, football, rifle marksmanship (for ROTC students), officiating methods for various sports, and several courses in physical education theory.

Facilities:

Abundant space has been a factor in the development of an extensive athletic plant. Included in the facilities for men are:

The Stadium, seating 90,000 and enclosing a standard American football field encircled by a quarter-mile track with a 220-yard straightaway. It was opened in 1921.

Angell Field, named for Dr. Frank Angell, pioneer member of the University faculty who devoted much time and interest to the development of athletics. It is a specialized facility for track and field, and its quarter-mile track also has a 220-yard straightaway.

Sunken Diamond, a turfed baseball field laid out in the larger area from which was taken the fill for the Stadium embankments. Its bleachers seat 3,000.

Harry Maloney Field, a turfed field for soccer, rugby, football practice, and other field sports. It is named for the former director of minor sports at Stanford, an active member of the faculty for 36 years.

Two other turfed fields for football and rugby, an enclosed football practice turf, a polo field, an intramural sports field, and the freshman baseball diamond.

Three varsity tennis courts, hard-surfaced, with stands for spectators, and practice tennis courts.

Encina Gymnasium, including a basketball floor, three bleacher-flanked swimming pools, offices, rooms for gymnastics, fencing, and other indoor sports, and an athletics goods store.

The Pavilion, 2,700-seat structure housing the basketball floor used for varsity and freshman intercollegiate competition.

Facilities used jointly by men and women include the riding stables and an 18-hole championship golf course on the campus.

The Department of Athletics, adjoining the Gymnasium and the Pavilion, which contains offices of the director, his staff, and all coaches, and is also headquarters for the Military, Air, and Naval Science programs.

ACTIVITY COURSES

Students except veterans are required to participate in organized activities, to a total value of 6 non-credit units, no more than 2 of such units to be taken in any one quarter. During the freshman and sophomore years at least 2 units of the requirement, 1 each year, must be devoted to a physical activity, including varsity teams, organized physical education classes, and other physical activity offerings as listed in the Time Schedule. The remaining 4 units may be fulfilled either in physical activity offerings or in organized group activities such as chorus, band, choir, orchestra, and dramatic productions. After a student has satisfactorily completed his 6-unit activity requirement, he receives one unit of credit for each additional quarter of physical education. Such a student may participate in two physical education courses during one quarter and receive credit for both. No student may receive more than 12 units of credit for activity courses in Physical Education. Enrollment in ROTC will be accepted, quarter for quarter, in satisfaction of all or part of this requirement.
PHYSICAL EDUCATION (MEN) 375

COURSES

2. Modified Programs—Health-habit programs adapted to fit special needs of individual student for whom usual class activities are not suitable. Admission on recommendation of Director of Physical Education and Athletics.

1 unit, autumn, winter, spring, (Masters and Staff), three periods a week

11. Elementary Basketball.
   1 unit, autumn and winter, (Dallmar), TWTh 11; MTWThF 2; MWTh 4:15 and spring, (Dallmar), TWTh 11; MWTh 4:15

12. Elementary Boxing.
   1 unit, autumn, winter, spring, (Lunny), MWF 10, 11, 3

   1 unit, autumn and spring, (Bugge), TTh and by arrangement 4; and summer, (Bugge), TTh and by arrangement 5

   1 unit, autumn, winter, spring, (Ruff), MWF 3:15

17. Volleyball.
   1 unit, autumn, winter, spring, (Lunny), MWF 2, 4

   1 unit, autumn, winter, spring, (Bugge), MWF 11, 2

20. Elementary Swimming.
   1 unit, autumn, (Sprague), TTh and by arrangement 11; and winter, (Sprague), TTh and by arrangement 11, 4 and spring, (Sprague), TTh and by arrangement 11; MWF 4; and summer, (Sprague), TTh and by arrangement 11, 4

   1 unit, autumn, winter, spring, (Bugge, Renker), MWF 10, 11, 2, 4; and summer, (Bugge), MWF 2, 4

22. Elementary Track.
   1 unit, autumn and spring, (Jordan), MTWThF 4 and winter, (Jordan), MTWThF 3–6

23. Elementary Wrestling.
   1 unit, autumn, winter, spring, (Ruff), MWF 3:15

   1 unit, autumn, winter, spring, (Sprague), MTTh 3; and summer, (Sprague), MTTh 4

27. Elementary Crew.
   1 unit, autumn, (Staff), MTWThF 3:15, 4:15; and winter, spring, (Staff), MTWThF 4:15

30. Elementary Baseball.
   1 unit, autumn, winter, spring, (Fehring), MTWThF 3:30–5

111. Advanced Basketball.
   1 unit, autumn, winter, (Dallmar), MTWThF 4:15

112. Advanced Boxing.
   1 unit, autumn, winter, spring, (Lunny), MTTh 4

113. Advanced Fencing.
   1 unit, autumn, winter, (Bugge), MWF 4; and spring, summer, (Bugge), MWF 5

114. Varsity Football.
   1 unit, autumn, spring, (Curtice), MTWThF 4

114f. Freshman Football.
   1 unit, autumn, (Staff), MTWThF 4
115. Golf.
   1 unit, autumn, spring, (Finger), MF or TTh 11 or 1, and 9 holes additional; varsity and freshman golf teams MTWThF 3:15; advanced golf MTWThF by arrangement.
   or winter, summer, (Finger), MF or TTh 11 or 1:15, and 9 holes additional. Golf MTWThF by arrangement.

   1 unit, autumn, winter, spring, (Ruff), MWF 4:15

118. Life Saving.
   1 unit, autumn, spring, (Haynie), MWF 5

   1 unit, autumn, winter, spring, summer, (Sprague), MWF 3

120. Advanced Swimming.
   1 unit, autumn, winter, spring, summer, (Sprague), MWF 10, 11, 4

120a. Varsity Swimming.
   1 unit, autumn, winter, spring, (Haynie), MTWThF 4

121. Advanced Tennis.
   1 unit, autumn, winter, spring, (Renker), MWF or TTh and by arrangement 1:15, 3:15; varsity and freshman Tennis teams MTWThF 2-5; or summer, (Bugge), MWF 3

122. Advanced Track.
   1 unit, autumn, spring, (Jordan), MTWThF 4; or winter, (Jordan), MTWThF 3-6

123. Advanced Wrestling.
   1 unit, autumn, winter, spring, (Ruff), MTTh 4:15

124. Advanced Diving.
   1 unit, autumn, winter, spring, (Sprague), MTTh 2; or summer, (Sprague), MTTh 3

124a. Varsity Diving.
   1 unit, autumn, winter, spring, (Haynie), MTWThF 3

127. Varsity Crew.
   1 unit, autumn, winter, spring, (Staff), MTWThF 4:15

130. Advanced Baseball.
   1 unit, autumn, winter, spring, (Fehring), MTWThF 3-5

139. Soccer.
   1 unit, autumn, (Priddle), MTWThF 4:15; or winter, spring, (Priddle), MTTh 4:15

140. Advanced Rugby.
   1 unit, winter, (Kmetovic), MWThS 4

151. Rifle Marksmanship (open only to ROTC, Naval ROTC and AFROTC students).
   1 unit, autumn, winter, spring, MTWThF and by arrangement 1, 2, 3

153. Weight Lifting.
   1 unit, autumn, winter, spring, (Ruff), MWF 2:15, 3:15, 4:15

192, 193, 194. Techniques of Athletic Management.
   1 unit, autumn, winter, spring, (Masters and Staff), by arrangement

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CO-EDUCATION PROGRAMS IN PHYSICAL EDUCATION

Certain sections of various activities are open to both men and women. See Time Schedule for registration procedure.
PHYSICAL EDUCATION for WOMEN

Emeritus: Sylvia Potter Cain (Instructor)

Acting Director: Luell W. Guthrie
Professor: Maud L. Knapp
Assistant Professors: Margaret C. Barr, Luell W. Guthrie, Miriam B. Lidster (on leave 1958-59), Marian S. Ruch. Acting: Pamela L. Strathairn

Instructors: Margaret P. Duggar, Carroll Gordon, Georgia Ray Williams

Assistant Director of Riding School: Margaret Sysin

Physical Education for Women provides a curriculum based on the aims of the General Studies Program of the University. The physical education activity classes, through instructional and recreational experience, are designed to:

a) contribute to the total fitness of the individual,
b) develop skills in sports, aquatics, and dance,
c) provide participation in activities with other students of similar ability,
d) provide skills for recreation.

Co-educational classes are offered as indicated below.

GROUP ACTIVITIES REQUIREMENT

1. General Studies Program Requirement.

a) Six quarters of participation in group activities are required within the four-year program. No units of credit toward graduation are given for this participation.
b) Participation in a physical activity is required during one quarter of the freshman year and one quarter of the sophomore year.
c) Students may enroll in no more than two group activities each quarter.

2. Physical Education courses as related to the requirement.

a) Physical education courses listed in the Time Schedule may be used to satisfy the group activity requirement.
b) Students who have not yet fulfilled the General Studies Program requirement who enroll in two physical education courses may receive one unit of credit toward graduation for one of the courses.
c) Students enrolling in one physical education course may receive one unit of credit toward graduation if also enrolled for no credit in a group activity course offered by another department.
d) After the General Studies Program requirement (six quarters of group activity) has been completed, students may receive one or two units of credit per quarter in physical education courses toward graduation.
e) A maximum of 12 units credit in physical education will be accepted toward graduation. This maximum does not apply to those students planning to major in physical education.

Costumes—Gym suits, leotards, and swim suits are provided and laundered for the students.

Equipment—The student provides tennis shoes, tennis racquet, badminton racquet, swimming cap, and golf clubs. (Golf clubs and ski equipment may be rented.) Other equipment is provided for the student.
Physiotherapy—Additional fees are charged for bowling, equitation, and figure skating.

3. Facilities.

The Women's Gymnasium, consisting of four main units grouped around a central court.

The Women's Swimming Pool, an outdoor pool west of the Gymnasium.

Eight tennis courts, and a large turfed field for hockey, archery, golf practice, softball, and other field sports.

Facilities used jointly with the men include the riding stables and an 18-hole championship golf course.

4. Intramural and Intercollegiate Recreation Activities.

Intramural and intercollegiate recreational activities are offered in cooperation with the Women's Recreation Association. This program includes archery, badminton, basketball, bowling, equitation, fencing, modern dance, swimming, tennis, and volleyball; and co-recreational badminton, fencing, folk dance, square dance, social dance, and tennis.

5. Major in Physical Education.

Physical Education for Women offers a major in physical education in the School of Education (see School of Education section) leading to

a) the bachelor of arts degree,

b) the secondary teaching credential,

c) advanced degrees in education.

Professional Physical Education courses are available for students majoring in elementary education, physical therapy and other fields.

COURSES

Any of the activities below may be taken to fulfill the group activity requirement. Each student should consult the activity course list in making her selection. Some are offered each quarter, while others, because of seasonal interest or climatic limitations, are offered only in the quarters indicated.

I. CO-EDUCATION CLASSES

Certain sections of various activities are open to both men and women. See Time Schedule for registration procedure.

Co14. Sport Skills—(Elementary education majors.)
   Autumn, (Staff)

Co15. Rhythms—(Elementary education majors.)
   Spring, (Duggar, ———, Staff)

   Autumn, winter, spring, (Duggar)

Co22. Square Dance.
   Autumn, winter, spring, (———)

Co24. Folk Dance, Elementary.
   Autumn, winter, spring, (———)

Co25. Folk Dance, Intermediate.
   Autumn, winter, spring, (———)

   Autumn, winter, (———)

Co46. Archery, Elementary.
   Autumn, spring, (Barr)

Co68. Ski Conditioning.
   Autumn, (Williams)

Co69. Figure Skating.
   Winter, (———)
   Autumn, winter, spring, (Duggar)
Co122. Square Dance, Intermediate.
   Winter, (______)
Co124. Folk Dance, Advanced.
   Autumn, winter, spring, (______)
   Autumn, winter, (______)
   1 unit, autumn, winter, spring, (Sysin)
Co169. Figure Skating, Advanced.
   Winter, (______)

II. CLASSES OFFERED FOR WOMEN STUDENTS

W1. Posture.
   Autumn, winter, spring, (Ruch)
W7. Recreational Games.
W8. Individual Assignment.
   Autumn, winter, spring, (Ruch)
   Autumn, winter, (Staff)
   Autumn, (Staff)
   Spring
   Autumn, winter, spring, (Duggar)
   Autumn, winter, spring, (Duggar)
W22. Square Dance, Elementary.
   Autumn, winter, spring, (______)
W24. Folk Dance, Elementary.
   Autumn, winter, spring, (______)
W25. Folk Dance, Intermediate.
   Autumn, winter, spring, (______)
W27. English Country Dance.
   Winter, (Barr)
Social Dance, Elementary—(See Co28).
   Autumn, spring, (Ruch, Strathairn, Staff)
   Autumn, spring, (Ruch, Strathairn, Staff)
   Autumn, spring, (Strathairn)
   Autumn, spring, (Ruch, Strathairn)
W37. Diving.
   Spring, (Staff), by arrangement
W38. Synchronized Swimming, Elementary.
   Autumn, spring, (Ruch, Strathairn)
W40. A.R.C. Water Safety Instructor's Course.
   Autumn, spring, (Strathairn)
W46. Archery, Elementary.
   Autumn, spring, (Barr)
W47. Archery, Intermediate.
   Autumn, spring, (Barr)

W52. Badminton, Elementary.
   Autumn, winter, spring, (Strathairn, Williams, Staff)

   Autumn, winter, spring, (Strathairn, Williams, Staff)

   Autumn, winter, spring, (Gordon)

   Autumn, winter, spring, (Gordon)

W62. Tennis, Elementary.
   Autumn, winter, spring, (Guthrie, Williams)

W63. Tennis, Intermediate.
   Autumn, winter, spring, (Guthrie, Williams)

Ski Conditioning—(See Co68).

Figure Skating—(See Co69 and Co169).

W75. Fencing, Elementary.
   Autumn, winter, (Barr)

W79. Softball.
   Spring, (Williams)

W83. Basketball, Elementary.
   Winter, (Strathairn, Williams)

   Winter, (Strathairn, Williams)

W86. Field Hockey, Elementary.
   Autumn, (Barr, Williams)

W87. Field Sports.

W89. Volleyball.
   Autumn, winter, (Staff)

W91. Gymnastics and Tumbling.
   Autumn, winter, (Ruch, Duggar, Staff)

W100. Horsemanship (for P.E. Majors).
   (Sysin)

   Autumn, winter, spring, (Duggar)

W122. Square Dance, Intermediate.
   Winter, (-----)

W124. Folk Dance, Advanced.
   Autumn, winter, spring, (-----)


   Autumn, spring, (Ruch, Strathairn)

   Autumn, spring, (Ruch, Strathairn)

W146. Archery, Advanced.
   Autumn, spring, (Barr)

Equitation—(See Co148).

W152. Badminton, Advanced.
   Autumn, winter, spring, (Williams)

W158. Golf, Advanced.
   Autumn, winter, spring, (Gordon)

W162. Tennis, Advanced.
   Autumn, winter, spring, (Guthrie, Williams)

W165. Tournament Tennis.
   Autumn, winter, spring, (Guthrie)
W175. Fencing, Advanced.
   Autumn, winter, (Barr)
W183. Basketball, Advanced.
   Winter, (Strathairn, Williams)
W186. Field Hockey, Advanced.
   Autumn, (Barr)
W189. Volleyball, Advanced.
   Autumn, winter, (Staff)
SENIOR COLLOQUIA

Committee on General Studies: Robert A. Walker (Chairman), Friedrich W. Strothmann (Vice Chairman), William C. Bark (Executive Secretary), Albert H. Bowker, Willis W. Harman, Philip H. Rhinelander, Robert R. Sears

Under the new General Studies Program, Senior Colloquia will be required of all seniors who are candidates for the A.B. degree, with a few exceptions, beginning with students who are seniors during the academic year 1959–60. The exceptions are those students entering the Schools of Law or Medicine at the end of their third year, and those enrolled in interdepartmental honors programs. Before 1959–60, however, Colloquia are being offered to senior students as electives in order to make available this important part of the new Program. In 1958–59 juniors may also register for Colloquia if space is available, but seniors will be given preference; a Colloquium thus taken by juniors in this year will count toward satisfaction of the senior requirement. Those listed below will be offered during 1958–59 unless otherwise indicated.

The Senior Colloquia are limited to 15 students each and are built around subjects or issues of continuing importance, or a basic document of enduring significance. They are designed to stimulate serious thought rather than to impart information for its own sake. Thus the emphasis is on discussion and analysis, not lectures.

In most cases students are not admitted to a Colloquium being taught by a staff member of their major department. This can be determined by consulting the Time Schedule.

SC100. Henry Adams and His America—This is an excursion into the past, an effort to see American society at the turn of the century through the eyes of Henry Adams, and his brother, Brooks.
2 units, winter, (Cotter, Political Science)

SC101. Germany Between East and West.
2 units, (Sokol, Political Science)

SC102. Modern Marxism.
2 units, (North, Political Science)

SC103. Main Currents in American Politics.
2 units, (——, Political Science)

SC104. World Population, Level of Living, and Industrialization—This colloquium considers whether the earth is now overpopulated, whether the low level of living in the underdeveloped lands can be raised appreciably, and whether the current general acceptance of industrialization as the panacea for the ills of underdeveloped countries is tenable.
2 units, autumn and spring, (White, Geography)

SC105. Geography and World Affairs—Topics include an analysis of the relationships, opportunities and relative strengths of population blocks which determine the decision-making regions of today.
2 units, autumn, (Williams, Geography)

SC106. Knowledge and Belief—Some contemporary writings (e.g., R. B. Braithwaite, John Hick) on the worth of language, especially on "religious" language concerning knowledge, belief, etc.
2 units, autumn, (Miller, Religion), W 4–6

SC107. Gandhi—His Life and Thought—The course will begin with a reading and discussion of Louis Fischer's Gandhi, His Life and Message for the World, in order to determine those issues that are most crucial and those areas
most interesting to members of the class. Each student will then undertake a
specialized study of some aspect of Gandhi's life and thought.

2 units, winter, (Smith, Humanities), Th 2-4

SC108. Life as Dialogue: The Thought of Martin Buber—Using a selec-
tion of Buber's works, The Writings of Martin Buber. Discussion will center
on Buber's understanding of human relationships, and its implications for
various areas of life, secular and religious.

2 units, autumn, (Good, Religion), M 2-4

SC109. The Revolt Against Reason and Democracy—European critics
of rationalism and egalitarianism from Nietzsche to the present; impact of
these ideas on the intellectual and cultural temper of twentieth century Europe.

2 units, spring, (G. Wright, History), W 2-4

SC110. Man as a Factor in Evolution—A critical examination of man
(himself a product of evolution) as a factor in the evolution of other animals
and of plants; the role of man in determining his own past and future evolu-
tion will also be discussed.

2 units, winter, (Holm, Biology), W 2-4

SC112. The Social Development of Conscience—An exploration of the
forms and functions of conscience in a social milieu.

2 units, winter, (McCord, Sociology)

SC113. Essential Nature of Tragedy—Various ancient and modern dramas,
including some “comedies,” will be read and analyzed to illustrate the various
aspects of tragedy.

2 units, winter, (Harsh, Classics), W 2-4

SC114. Thucydides: A Greek Classic—A reading of Thucydides' History
(in English translation) with discussion of the major issues which it raises.

2 units, autumn, (Pearson, Classics), Th 2-4

SC115. Marxist Ethics—Ethical implications of current Soviet and Chinese
theory as well as of classical Marxism.

2 units, winter, (———, Philosophy), T 2-4

SC116. Contemporary Philosophical Ideas—A study of a selected group
of contemporary philosophers.

2 units, winter, (Goheen, Philosophy), F 2-4

SC117. Economic Liberalism—A discussion of the liberal tradition in eco-
nomics, beginning with Adam Smith.

2 units, (Hilton, Economics), M 2-4

SC118. The Myth of East and West—An examination of the widely preva-
lent fiction that there is an Occident and an Orient and that philosophies, cul-
tures, economies and polities can be interpreted through comparing and con-
trasting Western and Eastern varieties.

2 units, spring, (A. Wright, History), T 2-4

SC119. Pseudoscience in Modern Society—An analysis of selected pseudo-
scientific systems and practices such as astrology, deluge apologetics, water
witching, and mineral-water therapeutics.

2 units, autumn, (Davis, Geology), Th 2-4

SC120. Characterization, Self-Revelation, and Disguise in Biographi-
ical Writing—A study of the various forms of biographical writing (diaries
and journals, autobiographies, biographies, letters), particularly those of the
Restoration and Eighteenth Century, and their effectiveness in creating and
revealing character and personality.

2 units, autumn, (Fifer, English), T 2-4

SC121. Form and Technique in Modern Drama—Studies of ten or twelve
plays which illustrate the Twentieth Century tendency toward broad experi-
mentation with dramatic construction.

2 units, autumn, (Goldstein, English), T 2-4
SC122. William Faulkner—A study of the development of ideas, character-types, and fictional techniques in the Yoknapatawpha novels.
   2 units, autumn, (Moser, English), M 4-6
SC123. Samuel Johnson—Discussion of Dr. Johnson as a spokesman for the English Enlightenment.
   2 units, winter, (Loftis, English), M 4-6
SC124. The Existentialist Theme in Modern Literature—Works of the Nineteenth and Twentieth Century will be examined in the light of the writings of Soren Kierkegaard and the followers of his existentialist point of view.
   2 units, winter, (Ruotolo, English), W 4-6
SC125. The Living Novel—A discussion of the “frontiers” of the novel: do they exist, have they been reached, where does the novel go from here?
   2 units, winter, (Scowcroft, English), W 4-6
SC126. Style and Intention in Poetry and Poetic Theory—The classical resolutions of the conflict between content and expression will be related to Renaissance poetry and rhetorical theory, and the nature and persistence of some of the problems, implicit in these resolutions, in later poetry and criticism will be examined.
   2 units, winter, (Trimpi, English), W 2-4
SC127. The Rise of Literary Impressionism in the Nineteenth Century—A reading of Hume’s Essay, as an example of philosophical impressionism, and of texts in Wordsworth, Coleridge, Shelley, Keats, Byron, and Browning, as examples of literary impressionism.
   2 units, spring, (Irvine, English), W 2-4
SC128. The Natural Man in American Fiction—The colloquium will consider the relationship between the hero and traditional society in several major novels of the nineteenth and twentieth centuries.
   2 units, spring, (Levin, English), W 2-4
SC129. Life and Manners in the Italian Renaissance—The impact of the Renaissance upon both the secular and religious life of Italy and the consideration of the meaning of Renaissance, Italian humanism, the new ideals of education and the formation of the “universal man.”
   2 units, winter, (O’Malley, History), Th 2-4
SC130. Studies in Russian Revolt—Analysis of revolts occurring at various periods in Russian history. Each episode will be carefully examined as to its origins, general nature, aspiring goals, failures and causes of failure.
   2 units, (Mazour, History), T 2-4, to be given in 1959–60
SC131. Karl Marx and the Soviet Union—An examination of the Soviet Union through the eyes of Karl Marx.
   2 units, (Tarshis, Economics)
SC132. The Progress of Underdeveloped Areas—An examination of the problems of economic development with some attention to the varieties of policy that have been followed.
   2 units, (Chenery, Economics)
SC133. The Confessions of St. Augustine—The purpose of this colloquium will be a close reading of St. Augustine’s Confessions in the light of the problems of its author in an attempt to relate these problems to some of our own.
   2 units, winter, (Locke, Modern European Languages)
SC135. The American Middle Class—There is growing evidence that the structure of American society is undergoing rapid and profound change.
   2 units, (LaPiere, Sociology)
SC136. Population, Pressure and Natural Resources—Present trends in the growth of the world’s population will be analyzed. Are the resources of the world in food, water, energy, and minerals adequate for the fast expanding population? How much more land can be brought into cultivation? To what
extent can the productivity of the soil be increased? More food from the oceans?

2 units, winter, (Luck, Chemistry and Chemical Engineering)

SC137. The Progress of Underdeveloped Areas—Study of economic and social problems characteristic of the economically less developed areas and of the prospects of these countries for future economic growth.

2 units, (Chenery, Economics), to be given in 1959–60


2 units, (Thompson, Architecture)

SC139. Form and Content in Modern Art—The problems of form and content in art, with special reference to the art of the last hundred years, will be critically considered. Although painting will be emphasized, such other arts as architecture, sculpture and industrial design will be studied.

2 units, (Faulkner, Art)

SC150. Discovery, Invention, and Creation—The creative process by which man as an artist, thinker, scientist, in some cases attains exceptional heights is the work of genius.

2 units, autumn, (Tuttle, Electrical Engineering)

SC153. Freedom of Speech—Discussions on freedom, responsibility, propriety in public address as found in theory, practice. Recordings of speeches by Bryan, Roosevelt, Wilson, Churchill, Truman, Stevenson, Eisenhower and a number of demagogues will be used to illustrate elements of delivery as contrasted with written script of selected speeches.

2 units, winter, (Chapin, Donner, Speech and Drama), T 4–6, to be given in 1959–60

SC154. Kafka—The aim will be to come to an understanding of the often baffling aspects in Kafka's writing through close analysis.

2 units, winter, (Boeninger, Modern European Languages), to be given in 1959–60

SC155. Karl Barth.

2 units, (Reinhardt, Modern European Languages), to be given in 1959–60

SC156. Plato's View of the Ideal Society—Principal text Plato's Republic, which will be read in its entirety.

2 units, autumn, (Rhinelander, Philosophy)

SC157. Mass Communication in the United States—Rapid survey of current media for mass communication and their influence; newspapers, magazines, television, radio, motion pictures, books, lecture platform, etc.

2 units, winter, (Bliven, Communication and Journalism)


2 units, (Sterling)

SC159. Conservatism in the West and in Asia—Comparative study of political philosophy of modern conservatism, with emphasis on England, the United States, China.

2 units, autumn, (M. Wright, Hoover Institution)

SC160. Man and the State in Modern Drama—Discussion of struggle between private conscience and public duty in man's relations to social order.

2 units, spring, (Cole, Dierlam, Speech and Drama)

SC161. Science, Values, and Anti-intellectualism—Important conclusions, theories of modern science; methods of science; relation of science to value judgments; current attitudes, opinions regarding science.

2 units, spring, (Krauskopf, Geochemistry), W 2–4

SC162. Problems in International Understanding: Japan as a Case Study.

2 units, (Ike, Hoover Institution)
SC163. Nationalism and Internationalism—The changing nature and role of nationalism during the last century and a half; the growth of internationalism; and the interaction between these two forces.
   2 units, spring, (Rothwell, Hoover Institution)

SC165. Comparison of Cultural, Psychological, and Biological Explanations of Human Behavior—Analysis, interpretation of selected studies related to satisfaction of human needs—nutrition, sociality (or groupness), handling of anxiety.
   2 units, spring, (Siegel, Anthropology), to be given in 1959-60

SC166. Crime, Guilt, Responsibility: The Orestes Myth from Aeschylus to Sartre—Changes, content of the myth in different historical periods, intellectual climates; theme from Greek dramatists through Racine,Jeffers, O'Neill, to The Flies of Sartre; discussion of both ethical-social, psychological-personal aspects.
   2 units, spring, (Sullwold, Classics and Humanities), W 4-6

   2 units, spring, (Brower, Asian Languages)

SC168. The Great Novels of China—The aim of the colloquium is to give the student an opportunity to read in English translation three of China's greatest novels, All Men Are Brothers, Chin P'ing Mei, and Dream of the Red Chamber, and to gain an adequate knowledge of Chinese life and thought in the periods during which these novels were written.
   2 units, winter, (Chan, Asian Languages), M 2-4

SC169. Experimental Background of Transfer of Training—The topic of the seminar will be concerned primarily with the principles of transfer of training, i.e., the conditions determining when learning of one type will facilitate or hinder learning and performance in a new situation.
   2 units, spring, (Lawrence, Psychology), W 4-6

SC170. Another Form of Communication—Linguistic Possibilities of Music—The colloquium will consider the linguistic possibilities of music, i.e., music's semantic potentialities. Treatment will be given the type of story music can tell and the variety of emotional expressions it can elicit.
   2 units, spring, (Farnsworth, Psychology), W 2-4

SC171. The Psychology of William James—The purpose of the colloquium is to acquaint the student with a psychological classic, and to note the development of contemporary psychology from this promising starting point. The class operates through student reports and class discussions.
   2 units, winter, (Hilgard, Psychology)

SC172. The Psychology of Mark Twain—I propose that we examine Mark Twain from two standpoints; one, as a reflector of Nineteenth Century American values and social influences, and the other, as a developing personality.
   2 units, winter, (Sears, Psychology), W 2-4

SC173. Destiny of Europe—What is Europe? Geographically, the term has little meaning. Culturally, the name is more significant, but Europe shares that culture with the Americas. Are Europeans disillusioned with America and turning to Eurafica?
   2 units, spring, (Hilton, Modern European Languages)

SC174. Soren Kierkegaard, Attack upon "Christendom"—Soren Kierkegaard, Attack upon "Christendom." This is one of the most important, provocative, and controversial of Kierkegaard's works. It records his final conflict with the established Lutheran church of Denmark.
   2 units, (Reinhardt, Modern European Languages)
SC175. Hitler.
   2 units, winter, (Blauth, Modern European Languages), to be given in 1959-60

SC176. Problems of Morality and Censorship in German Drama.
   2 units, winter, (McCluney, Modern European Languages), to be given in 1959-60

SC177. The Search for Conformity or Individuality—Through a reading of both fiction and non-fiction the student’s attention is focused on the following points: (1) The significance and responsibility inherent in being an individual; (2) The delusory aspect of being a conformist and its unyielding rewards.
   2 units, winter, (Linsalata, Modern European Languages)

SC178. The Existentialism of Albert Camus—An analysis and discussion of the concept of “existentialism,” of his major works, and of the main problems presented by the writing of Camus in the light of the contemporary philosophical and religious scene.
   2 units, spring, (Locke, Modern European Languages)

SC179. The Artist and Society.
   2 units, spring, (Naughton, Modern European Languages), to be given in 1959-60

   2 units, winter, (Sworakowski, Hoover Institution), M 2-4

SC181. Friedrich Schiller, On the Aesthetic Education of Man—The main thesis of On the Aesthetic Education of Man is that man, in order to reach his full rational and moral stature, must rise from the physical and pass through the aesthetic stage.
   2 units, autumn, (Reinhardt, Modern European Languages)

SC182. Nicolas Cusanus, Of Learned Ignorance—The main thesis of the book, Of Learned Ignorance is that absolute being is the reconciliation of all opposites; it is accessible only to an “enlightened ignorance” which—as “negative theology”—envisages God as infinitely transcending any positive knowledge.
   2 units, winter, (Reinhardt, Modern European Languages)

SC183. Modern Science and Modern Man—A critical appraisal of the nature, promise, and limitations of modern physical and social science.
   2 units, winter, (Harman, Electrical Engineering), to be given in 1959-60

SC184. Chemistry and the Standard of Living—A consideration of the elementary chemistry of the processes on which economic wealth depends, and of natural resources on the economic and political life of the world’s population.
   2 units, (Hutchinson, Chemistry)

SC185. Galileo’s Two New Sciences—Reading of this classic with special reference to the history of the experimental method.
   2 units, spring, (Koenig, Chemistry), W 2-4

SC186. The English Language in America—The aim of the colloquium is to give the student, first, an elementary understanding of the nature of language, with particular reference to the relationship between spoken and written language; and, second, some general notion of the ways in which transplanted dialects of England have developed in this country from the time of the first settlers to the present day.
   2 units, (Ackerman, English)
SC187. Faith and Scepticism in English Writers.
2 units, autumn, (Ford, English), W 4-6, to be given in 1959-60

SC188. Concepts of Man in Western Drama.
2 units, autumn, (Whitaker, English), T 4-6, to be given in 1959-60

SC189. Genesis and Geology—History of the controversy between theological and geological ideas about the development of the earth; modern repercussions of the controversies as exhibited by the Scopes trial and recent pseudo-scientific books.
2 units, autumn, (Davis, Mineral Sciences), T 2-4

SC190. The Psychology of Motivation: Its Implications for the Social Sciences—Consideration of approaches of each of the social sciences to certain theoretical issues in the psychology of human motivation. Discussions directed toward definition, analysis, and synthesis.
2 units, autumn, (——, Social Science)

SC191. As Others See Us: Foreign Views of America—The readings, discussions, and essay will be directed toward some of the major evaluations of the American experience by foreign authors written during the nineteenth and twentieth centuries.
2 units, spring, (Knoles, History), W 2-4

SC192. Communism and Islam in the Modern World—An examination of the interaction of Islam and Communism in the social, political and cultural life of some contemporary Muslim peoples.
2 units, winter, (Vucinich, History), M 2-4

SC193. Personalities and Politics in East Asia—The human equation as a contributing factor to progress and tensions in internal and external affairs in the Far East.
2 units, autumn, (Buss, History), M 2-4

SC194. The Ethical System of Thomas Aquinas—Selected readings from the Summa Theologica in the English translation.
2 units, winter, (Strothmann, Modern European Languages)

SC195. Criticism and Satire of Modern Society—Critical views of democracy, dictatorships, and utopias by Ortega y Gasset, Mann, Kafka, Lewis, Saint Exupéry, Capek, Orwell, and others.
2 units, autumn, (Weinstein, Modern European Languages)

SC196. Man the Tool-Maker—Man is distinguished from other animals by his ability to manufacture a wide variety of tools, which permit him to roam widely over an expanding world and provide a protective screen against the natural environment. Techniques and material culture vary from society to society, and they are in large measure the end products of past creativity and historical contact. This course will examine cross-culturally a number of basic techniques which have marked man's increasing control of his environment.
2 units, winter, (Gerow, Anthropology)

SC197. Organization Man—Investigation into the psychological problems of adjustment associated with modern society and large business organizations.
2 units, spring, (Romney, Anthropology)

2 units, spring, (Chapin, Speech and Drama), W 2-4

SC199. The Political Ideas of George Bernard Shaw—A discussion of Shaw's political and social ideas, in relation to the conditions of his lifetime. A critical assessment of his leading ideas will be attempted, by comparing them with ideas put forward by contemporary social theorists.
2 units, winter, (Buck, Political Science)
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