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Stanford, California
Published by the University
# UNIVERSITY CALENDAR

## AUTUMN QUARTER, 1974

<table>
<thead>
<tr>
<th>Date</th>
<th>Day(s)</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept. 23-24</td>
<td>Monday-Tuesday</td>
<td>Registration</td>
</tr>
<tr>
<td>Sept. 25</td>
<td>Wednesday</td>
<td>Instruction begins</td>
</tr>
<tr>
<td>Sept. 26</td>
<td>Thursday</td>
<td>Conferring of degrees</td>
</tr>
<tr>
<td>Sept. 29</td>
<td>Sunday</td>
<td>Matriculation Sunday</td>
</tr>
<tr>
<td>Oct. 15</td>
<td>Tuesday</td>
<td>Last day for registration</td>
</tr>
<tr>
<td>Oct. 22</td>
<td>Tuesday</td>
<td>Last day for filing advanced degree applications: A.M., M.S., Engineer for April conferral; Ph.D. for June</td>
</tr>
<tr>
<td>Nov. 28-Dec. 1</td>
<td>Thursday-Sunday</td>
<td>Thanksgiving Recess</td>
</tr>
<tr>
<td>Dec. 2</td>
<td>Monday</td>
<td>Last day for filing A.B. and B.S. applications for January conferral</td>
</tr>
<tr>
<td>Dec. 9</td>
<td>Monday</td>
<td>Last day for filing A.M., M.S., Engineer theses, and Ph.D. Dissertations</td>
</tr>
<tr>
<td>Dec. 9-13</td>
<td>Monday-Friday</td>
<td>End-quarter examinations</td>
</tr>
</tbody>
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## WINTER QUARTER, 1975

<table>
<thead>
<tr>
<th>Date</th>
<th>Day(s)</th>
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<tbody>
<tr>
<td>Jan. 6</td>
<td>Monday</td>
<td>Registration</td>
</tr>
<tr>
<td>Jan. 7</td>
<td>Tuesday</td>
<td>Instruction begins</td>
</tr>
<tr>
<td>Jan. 9</td>
<td>Thursday</td>
<td>Conferring of degrees</td>
</tr>
<tr>
<td>Jan. 14</td>
<td>Tuesday</td>
<td>Last day for filing Fellowship and Graduate Scholarship applications</td>
</tr>
<tr>
<td>Jan. 27</td>
<td>Monday</td>
<td>Last day for registration</td>
</tr>
<tr>
<td>Jan. 31</td>
<td>Friday</td>
<td>Last day for filing A.B. and B.S. applications for April and June conferral</td>
</tr>
<tr>
<td>Feb. 3</td>
<td>Monday</td>
<td>Last day for filing advanced degree applications: A.M., M.S., Engineer for June conferral; Ph.D. for September</td>
</tr>
<tr>
<td>Feb. 17</td>
<td>Monday</td>
<td>Observance of Washington’s Birthday (Holiday)</td>
</tr>
<tr>
<td>March 9</td>
<td>Sunday</td>
<td>Observance of Founders’ Day</td>
</tr>
<tr>
<td>March 17</td>
<td>Monday</td>
<td>Last day for filing A.M., M.S., Engineer theses, and Ph.D. Dissertations</td>
</tr>
<tr>
<td>March 17-21</td>
<td>Monday-Friday</td>
<td>End-quarter examinations</td>
</tr>
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## SPRING QUARTER, 1975

<table>
<thead>
<tr>
<th>Date</th>
<th>Day(s)</th>
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<tbody>
<tr>
<td>March 31</td>
<td>Monday</td>
<td>Registration</td>
</tr>
<tr>
<td>April 1</td>
<td>Tuesday</td>
<td>Instruction begins</td>
</tr>
<tr>
<td>April 3</td>
<td>Thursday</td>
<td>Conferring of degrees</td>
</tr>
<tr>
<td>April 18</td>
<td>Friday</td>
<td>Last day for filing Undergraduate Scholarship applications, matriculated undergraduates</td>
</tr>
<tr>
<td>April 21</td>
<td>Monday</td>
<td>Last day for registration</td>
</tr>
<tr>
<td>April 28</td>
<td>Monday</td>
<td>Last day for filing advanced degree applications: A.M., M.S., Engineer for September conferral; Ph.D. for January</td>
</tr>
<tr>
<td>May 19</td>
<td>Monday</td>
<td>Last day for filing Ph.D. Dissertations</td>
</tr>
<tr>
<td>May 26</td>
<td>Monday</td>
<td>Observance of Memorial Day (Holiday)</td>
</tr>
<tr>
<td>June 5</td>
<td>Thursday</td>
<td>Last day for filing A.M., M.S., Engineer theses</td>
</tr>
<tr>
<td>June 6-11</td>
<td>Friday-Wednesday</td>
<td>End-quarter examinations</td>
</tr>
<tr>
<td>June 14</td>
<td>Saturday</td>
<td>Senior Class Day</td>
</tr>
<tr>
<td>June 15</td>
<td>Sunday</td>
<td>Commencement</td>
</tr>
</tbody>
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## SUMMER QUARTER, 1975

<table>
<thead>
<tr>
<th>Date</th>
<th>Day(s)</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>June 23</td>
<td>Monday</td>
<td>Registration</td>
</tr>
<tr>
<td>June 24</td>
<td>Tuesday</td>
<td>Instruction begins</td>
</tr>
<tr>
<td>July 4</td>
<td>Friday</td>
<td>Independence Day (Holiday)</td>
</tr>
<tr>
<td>Aug. 15-16</td>
<td>Friday-Saturday</td>
<td>Eight-week term examinations</td>
</tr>
<tr>
<td>Aug. 16</td>
<td>Saturday</td>
<td>Eight-week term closes</td>
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<tr>
<td>Sept. 2</td>
<td>Tuesday</td>
<td>Quarter closes</td>
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Leland and Jane Stanford founded Stanford University in 1885 to honor the memory of their only child, Leland, Jr., who had died of typhoid fever just before reaching college age. Their magnificent gift, completed over several decades marked by the death of Senator Stanford in 1893 and of Mrs. Stanford in 1905, included the 8,800-acre Palo Alto Farm that became the University campus, the Inner and Outer Quadrangles and other buildings, and approximately $20,000,000 in endowment.

But to these material riches must be added their enlightened concept of the purposes to be served by the new University.

The Stanfords were a young couple of modest means when they settled in California in the 1850’s. Their life was one of practical hard work leading eventually to great wealth when Senator Stanford became one of the builders of the first transcontinental railroad. So it is no wonder that their early thoughts were for a university “where boys and girls can . . . grapple successfully with the practicalities of life.” But after they talked with the presidents of Harvard, Cornell, MIT, and Johns Hopkins, their sights were lifted.

In the Founding Grant the objectives of the University were stated to be “to qualify students for personal success and direct usefulness in life; and to promote the public welfare by exercising an influence in behalf of humanity and civilization, teaching the blessings of liberty regulated by law, and inculcating love and reverence for the great principles of government . . . .” The Grant further called for “a University of high degree,” offering “Studies and exercises directed to the cultivation and engagement of the mind.”

The brilliant young president of the University of Indiana, David Starr Jordan, was chosen by the Stanfords to be the first president of their university. In a long letter setting forth educational ideals to Jordan, Senator Stanford emphasized the need for study of literature, music, and the arts along with the sciences, mathematics, and law. “The imagination needs to be cultivated and developed to assure success in life,” he wrote.
and research university was achieved. Geography, demography, and the federal government's recognition of its stake in graduate education, based on wartime experience, were contributing factors. In 1930 Stanford granted 41 Ph.D. degrees. By 1950 the number was 100, and in 1973 it was 546.

Since 1957 Stanford has moved from thirteenth to third in the overall excellence of its graduate programs in the humanities, sciences, and engineering, according to surveys of the American Council on Education. Its education, business, and medical schools were each ranked among the top three nationally in a 1974 survey of deans. Stanford ranked second only to MIT as the choice of National Science Foundation scholars in 1973–74.

A measure of undergraduate distinction is found in the increase in applicants, now running at about ten applicants for each one admitted to the freshman class. Forty Stanford students have been elected Rhodes Scholars since World War II, three in 1973. Less than one percent of the freshman class is suspended for academic causes, and more than three-fourths of graduating seniors attend graduate or professional schools.

Among the approximately 1,000 faculty members who make up the Academic Council there are six Nobel laureates, 13 Pulitzer Prize winners, 45 members of the National Academy of Sciences, 77 members of the National Academy of Arts and Sciences, 14 members of the National Academy of Engineering, and four members of the National Academy of Education. Faculty in 30 departments out of 32 judged were rated "Strong and distinguished" in the most recent rating of graduate programs published by the American Council on Education.
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 September, but all diplomas are awarded in June. 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.

UNDERGRADUATE DEGREES

The undergraduate curriculum at Stanford allows considerable flexibility. The student plans an individual program of study, in consultation with his or her faculty adviser. The first two years may be spent primarily in pursuing a liberal education, or the student may begin specializing early, carrying both major and general courses over the four years. A variety of majors is offered, and within most majors there is considerable latitude. Honors programs are offered in a number of departments or cooperatively among several departments. These permit individualized study for the very capable student. Students whose academic goals cannot be met in a standard, departmental major may propose an individually designed program as described elsewhere in this bulletin (see Individually Designed Majors).

Entering freshmen may be allowed up to 45 units of credit toward graduation for superior work completed in high school. Such advanced credit will be awarded on the basis of scores achieved on College Board Advanced Placement Examinations, subject to University approval, or on departmental placement tests administered after the student arrives on campus.

Good English is required in all University course work, and is one consideration in grading. The expectation that students will express themselves literately and effectively in speech and writing is held by all instructors and forms the rationale for the Writing Requirement described below.

GENERAL REQUIREMENTS

Writing Requirement — Each candidate for the Bachelor's degree must complete, ordinarily in the freshman year, two quarters of instruction in written composition, or an equivalent. This requirement may be met by courses in written composition offered by the English Department, the Undergraduate Writing Program, or other appropriate courses designated by the Advisory Committee on the Writing Requirement.

Students scoring 4 or 5 on the CEEB advanced placement test in English literature are automatically exempted from the writing requirement. In addition, students whose score on the CEEB achievement test in English composition is 700 or above are also exempted from the requirement. Students demonstrating sufficient skill in writing in the first quarter may be exempted from the second quarter on certification by the instructor. These automatic exemptions apply only to freshmen; transfer students will be individually informed of their status vis-a-vis the Requirement at matriculation.

Distribution Requirement — Every candidate for the Bachelor's degree must complete at least three courses, each of at least three units, in all three of the following broad areas: (a) humanities and fine arts, (b) social sciences, and (c) mathematics, natural sciences, and technology. Students attending Stanford Overseas Studies Centers can work toward meeting this distribution requirement in humanities and fine arts, but courses meeting the requirement in mathematics, natural sciences, and technology are not ordinarily offered at the Centers. Some courses may be used toward satisfying the requirement in more than one area, and it is the student's responsibility to obtain such information in advance from the Academic Information Center, insofar as it affects his or her program. Extradepartmental courses (e.g. Undergraduate Specials, SWOPSI, SCIRE) may not be applied toward fulfilling Writing or Distribution requirements nor may units received for advanced placement tests.

Fulfillment of the Writing and Distribution Requirements is the student's respon-
sibility, and students should confirm their status at the Academic Information Center two or three quarters before graduation.

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.

The school or department offering 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 students may freely choose any course which previous studies have prepared them 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 the candidates recommended by the Subcommittee on Academic Standing, Petitions, and Exceptions who have:

1. Applied in advance for graduation and who have fulfilled the following requirements. (See deadlines in Time Schedule calendar.)
2. Completed 180 (quarter) units of University work.
3. Completed Writing and Distribution requirements.
4. Completed curriculum requirements of the major department and received the recommendation of that department. (Curriculum and other special requirements are listed under each department in Courses and Degrees.)
5. Completed at least 45 units (including the last 15) at Stanford. (In special cases, students who have obtained at least 135 units in resident work and have completed major and Writing and Distribution requirements may petition for a waiver of the last 15 quarter units work-in-residence requirement.)
6. Completed three quarters in resident study.

An undergraduate is limited to a total of twelve (12) courses or thirty-six (36) units of Undergraduate Specials and Student Center for Innovation in Research and Education (SCIRE) courses combined to count toward graduation. SCIRE courses may total twenty-seven (27) of these thirty-six (36) units. There is no limit for either Undergraduate Special or SCIRE courses per quarter. An undergraduate is also limited to a total of twelve (12) units of Physical Education activity courses and twenty-four (24) units of ensemble Music courses to count toward graduation. There is no limit for either of these per quarter.

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

If a student fails to meet requirements, he or she must reapply to graduate.

The degree is conferred at the end of the quarter in which the requirements are met, but diplomas are issued and commencement exercises are held only in June.

SECOND BACHELOR DEGREE

The holder of a Bachelor of Arts degree from Stanford may apply to the Subcommittee on Academic Standing, Petitions, and Exceptions for admission to candidacy of a Bachelor of Science degree, and the holder of a Bachelor of Science degree may apply for candidacy for a Bachelor of Arts degree. Application must be filed prior to entry into the Graduate Division, and the recommendation of the major school or department to be entered is required. A student approved for this program may reregister as
an undergraduate and will be subject to the
usual rules and regulations affecting under-
graduates. Specific requirements may be ob-
tained at the Registrar's Office.

CO-TERMINAL A.B. AND
B.S. DEGREE PROGRAMS

A Stanford undergraduate may work si-
multaneously toward an A.B. and a B.S.
degree. A statement of intention should be
filed in the Recorder's Office, Room 130, Old
Union, during the student's tenth or elev-
enth quarter. This statement should be in
the form of a petition and should have the
favorable recommendation of the appropri-
ate representatives of the two departments
in which the student expects to receive de-
grees.

In order to qualify for both degrees a stu-
dent must (1) complete the stated University
requirements and the departmental require-
ments for each degree; and (2) complete 15
full-time quarters, or three quarters after
completing 180 units.

COTERMINAL BACHELOR'S AND
MASTER'S DEGREES

In University Division, the coterminal
plan makes it possible for a student to take
some graduate level courses that apply to-
ward a Master's degree in the fourth year
and to defer some undergraduate require-
ments to the fifth year, thus earning a Bach-
elor's degree and a Master's degree simul-
taneously.

To qualify for both degrees, a student
must:

1. Petition for admission to the program
after the beginning of the eighth quarter of
undergraduate work and before the end of
the eleventh quarter. This petition is to be
signed by the department(s) in which he or
she seeks the two degrees.

2. Include in the petition a listing of the
program from the current quarter through
the final quarter, showing all courses and
units by quarter.

3. Complete fifteen full-time quarters or
the equivalent, or three full quarters after
completing 180 units.

4. Complete, in addition to the 180 units
required for the Bachelor's degree, the num-
ber of units required by his or her depart-
ment for the Master's degree (not fewer than
the University minimum of 36 units) as
shown on the formal application for Master's
candidacy.

5. Apply for each degree at the appro-
priate time and complete the requirements
for each degree.

A student should count only on personal
sources or loans for financial assistance in
the last year of a coterminal program. Uni-
versity graduate fellowships or assistantships
are rarely given to students in this program.
Undergraduate fellowships are reserved for
students in the first four years of study at
Stanford. Further, most private and federal
graduate fellowships require the applicant
to have received the baccalaureate degree.

For further information, students in the
School of Engineering are advised to go to
the office of the Dean of the School of En-
gineering. Students in other areas should
submit their petitions to the Graduate Study
Office (118 Old Union).

ADVANCED DEGREES

General University requirements for ad-
vanced degrees are stated in terms of time
devoted to graduate study, as measured by
full tuition or partial tuition registrations,
rather than in terms of units of credit. If 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 each advanced degree there is a mini-
imum requirement of one academic year
(three quarters—at least 36 quarter units) of
work as a graduate student at Stanford. The
final units of credit toward any advanced
degree must be earned at Stanford.

In addition each student should consult
his or her major department and examine
its section in this bulletin regarding specific
departmental requirements for advanced de-
grees. Opportunities for advanced study of
a single region or other special interests in-
volving more than one department are de-
scribed under Graduate Division Special
Programs.

Candidacy for A.M., M.S., Engineer, and
Ph.D. degrees must be approved by the Uni-
versity Committee on Graduate Studies.
Candidacy is valid for five years from date of
such approval (if it has not been terminated
earlier by the major department because of
unsatisfactory progress) and may be re-
newed by the submission and approval of
a new application, or extended upon the rec-
ommendation of the major department. All
applications or petitions to the University Committee on Graduate Studies must be submitted to the major department for approval before being filed with the Graduate Study Office, Room 118, Old Union, Stanford University, Stanford, California 94305.

Advanced degree candidates are reminded that in addition to conventional registration for half or full tuition, two other forms of registration are open to eligible graduate students:

(1) Terminal Graduate Registration (TGR) for University services only, at much reduced tuition but with no course credit.

(2) Unit Basis Registration when only a few units or a fractional amount of tuition remain to complete the student's advanced degree requirements. Eligibility for these forms of registration can be determined by the student at the Graduate Study Office.

MASTER OF ARTS OR MASTER OF SCIENCE

Upon recommendation to the Senate of the Academic Council by the faculty of the major department and the University Committee on Graduate Studies, 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 work as a graduate student at this University, presented an acceptable thesis (unless this requirement is waived), and fulfilled such other requirements as may be prescribed by the school or department concerned. In no case will the degree be conferred unless the candidate has been registered at Stanford University for at least 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 requirement of 36 graduate units at Stanford may be reduced to 30 on condition that at least 6 quarter units earned elsewhere as a graduate be validated by the department as the equivalent of specific Stanford courses. Such courses must be reported on the application for candidacy, with the name and number of each Stanford course, the number of Stanford units given for it, 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 payment of the equivalent of at least three full quarters’ tuition at Stanford as a graduate. Students are reminded that payment for a minimum of 12 units is considered full tuition during Autumn, Winter, and Spring Quarters, but that payment for a minimum of 15 units is considered full tuition during Summer Quarter.

Admission to candidacy is granted by the University Committee on Graduate Studies 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 Office 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 (if it has not been terminated earlier by the major department because of unsatisfactory progress), after which it may be renewed by the approval of a new application by the major department and the University Committee, or extended upon the recommendation of the major department.

If a thesis is a degree requirement, three bound copies, each bearing the approval of the instructor under whose supervision it was prepared, must be submitted to the Graduate Study Office on or before the last day of instruction in the final quarter of candidacy. If this date falls on Saturday, the deadline will be the following Monday. These copies are to be typed (or reproduced by an approved method) on paper of standard size and weight, with title and signature pages in the form prescribed by the University Committee on Graduate Studies. 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 Graduate Study Office, Room 118, Old Union.
MASTER OF BUSINESS ADMINISTRATION

Upon recommendation to the Senate of the Academic Council by the faculty of the Graduate School of Business and the University Committee on Graduate Studies, 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 Graduate School of Business Bulletin.)

ENGINEER

General Regulations—Upon recommendation to the Senate of the Academic Council by the faculty of the major department and the University Committee on Graduate Studies, the degree of Engineer is conferred on candidates who have satisfactorily completed six quarters of approved work as a graduate (of which a minimum of three quarters—36 quarter units—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 Studies on the basis of an application formally approved by the student’s major department and filed with the Graduate Study Office 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 (if it has not been terminated earlier by the major department because of unsatisfactory progress) and may be renewed by the approval of a new application by the major department and the University Committee, or extended upon the recommendation of the major department.

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 Office on or before the last day of instruction in the final quarter of candidacy. If this date falls on Saturday, the deadline will be the following Monday. These copies are to be typed (or reproduced by an approved method) on paper of standard size and weight, with title and signature pages in the form prescribed by the University Committee on Graduate Studies, 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 Graduate Study Office, Room 118, Old Union.

MASTER OF FINE ARTS

General Regulations—Upon recommendation to the Senate of the Academic Council by the faculty of the major department and the University Committee on Graduate Studies, the degree of Master of Fine Arts (M.F.A.) is conferred on candidates who have satisfactorily completed at least the minimum number of quarter units of graduate work required by the major department (of which a minimum of three quarters—36 quarter units—must be in residence at Stanford as a graduate) and fulfilled such other requirements as may be prescribed by the major department. At least two academic years are necessary for the completion of the degree work.

MASTER OF JURISPRUDENCE

The Master of Jurisprudence (J.M.) is a nonprofessional degree. Its requirements include successful completion of the first year of law school plus an additional academic year of full-time law study. The J.M. degree terminates a course of study at the Law School. Candidates may elect to take the degree in the early spring of their second year. Holders of the J.M. degree who at a later date wish to apply for admission to complete the J.D. program may do so, but re-admission is not automatic.

DOCTOR OF EDUCATION

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Education and the University Committee on Graduate Studies, 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 copies of the dissertation, four copies of an approved abstract of the dissertation (maximum length 600 words), and one signed copy 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 candidacy.

(Further information concerning these requirements will be found elsewhere in this bulletin and may be secured from the School of Education Doctoral Study Office, Room e24.)

DOCTOR OF MUSICAL ARTS

Upon recommendation to the Senate of the Academic Council by the faculty of the Department of Music and the University Committee on Graduate Studies, the degree of Doctor of Musical Arts (D.M.A.) is conferred on candidates who have satisfied the requirements laid down by the faculty of the Department of Music and the University. This degree offers advanced professional training in composition, performance (including conducting), or music education parallel to the musicological studies leading to the Ph.D. degree in music. A minimum of three years of graduate study (or two years following a Master's degree) is required of each candidate. A final project appropriate to the area of concentration is also required.

Further information concerning the requirements will be found in this bulletin and may be obtained from the office of the Chairman of the Department of Music.

DOCTOR OF JURISPRUDENCE

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Law and the University Committee on Graduate Studies, the degree of Doctor of Jurisprudence (J.D.) 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 the number of units required under the current Faculty Regulations of the School of Law after devoting not less than three academic years thereto, and who otherwise have satisfied the requirements of the University and of the School of Law.

MASTER OF THE SCIENCE OF LAW

Admission to candidacy for the degree of Master of the Science of Law (J.S.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 professional 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 the completion, with distinction, of one academic year (26 term units) of work in this School in accordance with the rules of the University and of the School of Law. Upon his or her admission to candidacy, each student must present for the approval of the School of Law Committee on Graduate Study the program which he or she wishes to pursue for this degree.

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 hold a J.D. or its equivalent. Such candidacy is limited to students of exceptional distinction and promise.

The degree of Doctor of the Science of Law is conferred upon applicants so admitted to candidacy who spend one full academic year in residence and as a result of independent legal research 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.
DEGREES

DOCTOR OF MEDICINE

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Medicine and the University Committee on Graduate Studies, 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 School of Medicine Bulletin.)

DOCTOR OF PHILOSOPHY

General Regulations

Upon recommendation to the Senate of the Academic Council by the faculty of the major department and the University Committee on Graduate Studies, 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.

Each candidate is required to complete a minimum of three years of graduate registration (nine full quarters, or part-time registrations equivalent thereto, as calculated on tuition payments). Acceptable work completed elsewhere as a graduate may be accepted in lieu of part of this requirement, up to a maximum of six full quarters. In any event, the requirements which must be completed as a graduate at Stanford are a minimum of 36 quarter units and a minimum of three full quarters (or the equivalent in part-time registrations as calculated on tuition payments). These minimum requirements will apply only if the candidate has earned no other advanced degree at Stanford and has completed at least two years of acceptable work elsewhere as a graduate.

Admission to Candidacy

When a student has completed the major department’s required preliminary procedures, the major department may certify him or her to the University Committee on Graduate Studies 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 or her application must show at least three units of work taken (or to be 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 Office (Room 118, Old Union) not later than the last day of class in the student’s sixth quarter of graduate registration at Stanford, summer quarters not included. Candidacy, when approved by the University Committee, is valid for five years (if it has not been terminated earlier by the major department because of unsatisfactory progress) and may be renewed by the submission and approval of a new application, or extended upon the recommendation of the major department.

Foreign Language Requirement

The requirement of the reading knowledge of one or more foreign languages is left to the option of individual departments or schools. A candidate who has a foreign language requirement must meet his or her department’s deadlines as shown on the back of his G34 form, “Completion of Requirements.” Date of fulfillment of the requirement should be noted on this form and the signature of the department chairman is needed to complete the report. No other language report need be submitted to the Graduate Study Office.

University Oral Examination

Recommendation for the degree will be made only after the University oral examination has been passed. When a candidate has been admitted to candidacy, and has shown special ability in his or her field of study and proved his or her capacity for independent investigation to the satisfaction of the schools or departments concerned, he or she may arrange through the Graduate Study Office for the University oral examination. This examination will not exceed three hours in length. It will not be held during the first two weeks in any quarter or after the last day of instruction in any quarter. The request for an oral examination must be submitted to the Graduate Study Office 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 or her fields of study and to confirm his or her fitness for scholarly pursuits. The examining committee is to be composed of (1) the chairman, appointed by the
Dean of Graduate Studies, presiding, (2) four or more faculty members appointed by the Dean of Graduate Studies to represent the major and minor departments (upon the departments' recommendation), (3) 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 will be certified as having passed the examination.

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

Dissertation

Recommendation for the degree will 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. At an appropriate point in the preparation of the dissertation, the department chairman will take responsibility for appointing (on Form G81) a faculty reading committee consisting of the candidate's principal research adviser (who must be a member of the Academic Council), a second member from within the major department, and a third member chosen from the major or another department. At least one other member in addition to the principal adviser must belong to the Academic Council. In cases in which the dissertation topic makes advice from outside the department useful, the appointment of an appropriate outside reader should be made early, and he or she should be encouraged to follow and advise on the progress of the research. Each member of the reading committee will certify by signature on the final copies of the dissertation that he or she has read the dissertation, and that in his or her opinion it is of a scope and quality acceptable in fulfillment of this requirement for the degree. At least one member of the committee will read the dissertation in its final submitted form and so certify on Form G82.

Four copies of the dissertation must be submitted to the Graduate Study Office on or before the last day of instruction in the final quarter of candidacy if autumn, winter, or summer quarter; or by the end of the seventh week if the final quarter of candidacy is a spring quarter.

After its final acceptance, the dissertation will be microfilmed and bound at the direction of the Graduate Study Office. A negative microfilm copy of the dissertation will be kept on file by University Microfilms (in Ann Arbor, Michigan), from whom positive microfilm copies may be ordered. When bound, one copy will be sent to the author, two copies to the Stanford University Library, and one copy to the major department.

Directions regarding the preparation of the dissertation, title and signature pages, and the abstract may be obtained from the Graduate Study Office, Room 118, Old Union. The abstract (600 words or fewer in length) will be published in *Dissertation Abstracts International* by University Microfilms. The candidate will 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.
Note—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.

Summer Session

The Summer Session of 1975 will be eight weeks in length, except in certain schools which will offer ten-week courses.

This announcement includes, for the Summer Session of 1975, only those courses which can be tentatively scheduled at this time by each department. For the complete list of courses and faculty, requests should be made for the special Summer Session Bulletin to be issued in February 1975.
GRADUATE SCHOOL OF BUSINESS


Dean: Arjay Miller

Associate Deans: James R. Miller, Samuel A. Pond, James C. Van Horne

Assistant Deans: Carol A. Friedman, Paul R. Johnson, William L. Lowe, Robert W. Simon, Gary G. Williams


The Graduate School of Business, since its founding in 1925, has provided graduate education for careers in business management, research, and teaching. The two-year Master of Business Administration degree program is designed for the student who seeks preparation for a professional career in management. No specific undergraduate major or courses are required for admission, although prospective applicants are encouraged to include one year of college level mathematics in their undergraduate programs.

Those interested in college teaching and research are served by the Doctor of Philosophy program.

For detailed information on programs, curricula, and faculty write to the Graduate School of Business, Stanford University, Stanford, California 94305, for its current bulletin.
SCHOOL OF EARTH SCIENCES

Dean: Richard H. Jahns
Associate Deans: Konrad B. Krauskopf, Fredrick C. Kruger, Ernest I. Rich

The School of Earth Sciences includes the Departments of Applied Earth Sciences, Geology, Geophysics, and Petroleum Engineering.

The aims of the School are threefold: (a) to train individuals for responsible positions in industry, government, education, and research in the fields of geology, paleontology, geochemistry, geophysics, petroleum engineering, hydrology, environmental studies, and exploration, evaluation, recovery, and management of earth resources; (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 earth sciences as part of a well-rounded education.

UNDERGRADUATE PROGRAM

Faculty Advisor—A student may enter the School of Earth Sciences when he or she selects one of the Earth Sciences fields for his or her major program. Upon entering the School, a student should report to the chairman of his or her department, who will designate a member of the faculty to act as his or her advisor. The advisor will aid the student in the selection of courses and will serve as consultant during his or her scholastic career. The advisor's approval of the study plan must be obtained before registration is completed at the beginning of each quarter.

Requirements—Specific requirements for the Bachelor of Science degree are listed under each department.

GRADUATE PROGRAM

The undergraduate curricula offered by the School of Earth 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. Graduate degrees also are offered in special programs such as Hydrology, Mechanical Processes and Earth Materials, Environmental Earth Sciences, Economic Geology, and Mathematical Geology. See appropriate sections in this bulletin.

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 Earth Sciences.

Faculty Advisor—Upon entering a graduate program the student should report to the head of his or her department, who will arrange with a member of the faculty to act as the student's advisor. The student, in consultation with the advisor, then arranges a course of study for the first quarter, and ultimately a complete plan of study for the degree sought.

Financial Aid—Scholarships, fellowships, and research grants are available to students in the School of Earth Sciences. Detailed information is available from the Dean's Office. Applications should be filed by January 15 for awards which become effective in autumn quarter for the following year. Normally teaching assistantships are awarded to qualified students to assist in laboratory instruction.

SPECIAL PROGRAMS

PROGRAMS IN ECONOMIC GEOLOGY

The programs in Economic Geology are under the jurisdiction of the School Committee on Economic Geology whose responsibilities include admissions, assignment to departments, advising, counseling, and tracking of students whose expressed desires include activities in the broad areas of Economic Geology. Establishment of curricula designed for specific objectives (programs) within Economic Geology will also be within its charter.

Economic Geology spans department boundaries and hence students interested in these areas should direct their application
for admission or for information to the Chairman, Programs in Economic Geology, School of Earth Sciences, describing their interest as succinctly as possible.

Typical programs include:
- Ore Genesis
- Ore Deposits
- Mineral Exploration
- Petroleum Exploration
- Applied Geomathematics

**Program in Mathematical Geology**

The graduate program in Mathematical Geology is intended to stimulate the application of mathematical methods in geological teaching and research. It provides participating students with training in the application of useful mathematical tools to field, laboratory, and theoretical geological problems.

**Master of Science and Doctor of Philosophy**

At the discretion of the Committee in Charge, students will be required to meet the basic requirements for the degree of Bachelor of Science in Geology at Stanford with emphasis placed upon field geology. Equivalent course work will be awarded graduate credits at the discretion of the Committee.

Each student is urged to develop capabilities in mathematical and statistical analysis, in computer technology and in operations research. He or she must select an area of application in geology as for example in rock mechanics, hydrogeology, sedimentation, tectonophysics, or palentology. The remainder of the program can be devoted to obtaining the analytical capabilities and associated technical knowledge required for successful analytical work in the chosen area of geology.

In addition to courses listed in other Schools, the following offerings in the School of Earth Sciences may be of interest:

- Appl. Earth Sci. 308. Rock Mechanics
- Geol. 190. Introduction to Probability and Statistics in Geology
- Geol. 214. Physical Processes in Geology
- Appl. Earth Sci. 304. Computer Applications in Earth Sciences
- Geol. 290. Applications of Probability and Statistics in Geology
- Geol. 232. Numerical Methods in Hydrogeology
- Geophysics 283. Geophysical Simulation

**Applied Earth Sciences**

*Emeriti:* Welton J. Crook, Evan Just, Charles F. Park, Jr. *(Professors)*

*Chairman:* Fredrick C. Kruger


*Associate Professor:* Arvid M. Johnson*

*Acting Associate Professor:* Robert N. Anderson


*Visiting Associate Professor:* Eric S. Cheney*

The Department of Applied Earth Sciences programs are designed to develop scientific and technological competence in a variety of fields, including:

- Applied Geomathematics
- Economic Geology
  - Students interested in aspects of Economic Geology should direct their attention to the description of the School of Earth Sciences Programs in Economic Geology, above.
- Engineering Geology
- Environmental Earth Sciences
- Environmental Geochemistry
- Extractive Metallurgy and Materials Processing
- Hydrogeology
- Land Resources Planning
- Metallurgy
- Mineral Economics
- Mineral Exploration
- Mining Engineering
- Ore Deposits
- Petroleum Exploration

Programs leading to the B.S., M.S., Engineer, and Ph.D. degrees are available with the "special field" designation of the program on the diploma. Moreover, a general degree in Applied Earth Sciences is available for students with specialized objectives consistent with the scope of the Department, e.g., petroleum geology, mineral industry management, etc. At the graduate level, the Depart-

* Joint appointment with Geology
ment welcomes applicants from any scientific or engineering discipline, who are interested in using their training in Applied Earth Sciences.

Detailed curricula for the B.S. and M.S. degrees are listed below for a few of the more commonly elected options.

**Undergraduate Programs of Study**

Undergraduate curricula are arranged to stress basic science, basic engineering, and cultural education to provide the knowledge to meet new conditions in a rapidly changing world.

**Courses Taken by All Undergraduates**

<table>
<thead>
<tr>
<th>University Requirements</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>University requirements</td>
<td></td>
</tr>
<tr>
<td>English Composition</td>
<td>6</td>
</tr>
<tr>
<td>Humanities and Fine Arts</td>
<td>9</td>
</tr>
<tr>
<td>Social Science</td>
<td>9</td>
</tr>
<tr>
<td>Natural Science (satisfied by Departmental requirements below)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
</tr>
</tbody>
</table>

**Environmental Earth Sciences**

The undergraduate program of study in Environmental Earth Sciences is designed to be pre-professional. Former students have entered graduate programs of study in city and regional planning, engineering, landscape architecture, law, and science.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>University requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 130, 131, 132. Environmental Earth Sciences</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Biol. Sci. 1. Introductory Biology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>One course in ecology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chem. 4, 5 or 31, 33. General Chemistry</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>(A Civ. Engr. course in Water Quality may replace one course in Chem.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civ. Engr. 170. Man and His Environment</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Comp. Sci. 105. Introduction to Computing</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 1. Interpreting the Earth</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 2. Earth History</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 101. Framework of Geology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 102. Introduction to Field Geology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math. 10, 11, 21, 22, 23 or 41, 42, 43. Analytical Geometry and Calculus</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Physics 21, 23 (or part of 51, 53, 54, 55, 56). Elementary Physics</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td></td>
</tr>
</tbody>
</table>

**Metallurgy**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>University requirements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 173. Applied Chemical Kinetics and Diffusion</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 203A. Mineral Processing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 207. Metal Refining and Liquid Metals</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 225. Surfaces and Interfaces, or A.E.S. 227. Applied Aqueous Thermodynamics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 234. Metallurgical Reaction Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Any 10 units of the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 101. Elements of Mining</td>
<td>3-5</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 105. Extractive Process Metallurgy or A.E.S. 150. Introduction to Extraction Processes</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Chem. 4, 5. General Chemistry</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Chem. 171. Physical Chemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Comp. Sci. 106. Introduction to Computing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Engr. 50. Introductory Science of Materials</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 1. Geoscience or Geol. 101. Framework of Geology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 161. Crystal Chemistry and Mineralogy or A.E.S. 284. Engineering Geology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Math. 10, 11, 21, 22, 23 or 41-43</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Math. 130. Ordinary Differential Equations</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Physics 51-56. Engineering Physics</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>
### Electives

Total ................. 74

### Mining Engineering

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>University requirements</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Chem. 4, 5. General Chemistry</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Phys. 51–56. Engineering Physics</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Math. 10, 11, 21, 22, 23 or 41–43</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Geol. 1. Interpreting the Earth</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 101. Framework of Geology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 110. Structural Geology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 161. Crystal Chemistry and Mineralogy</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 180. Petrology I</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 100. Industrial Report</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 101. Elements of Mining</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 105 or 105A. Extractive Process Metallurgy</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 118. Mining Methods</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 219. Mine Exploration</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 281. Introduction to Ore Deposits</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 308. Rock Mechanics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Engr. 11. Stress Analysis</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Engr. 12. Dynamics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Engr. 21. Fluid Mechanics</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Engr. 41, 42. Circuits, Electronics, and Electromagnetics</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Engr. 161. Engineering Economy</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 40. Elementary Surveying</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 145. Construction Equipment &amp; Methods</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 180. Elementary Structural Analysis</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Comp. Sci. 106. Introduction to Computers</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>42</td>
<td></td>
</tr>
</tbody>
</table>

Total .................. 180

### Ore Deposits

The undergraduate program in Ore Deposits is designed to fit the B.S. graduate for professional experience and also is designed as a starting point in other graduate programs in the School.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>University requirements</td>
<td>24</td>
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</tr>
<tr>
<td>Chem. 4, 5. General Chemistry</td>
<td>8</td>
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<tr>
<td>Physics 51–56. Engineering Physics</td>
<td>14</td>
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</tr>
<tr>
<td>Math. 41–43 or 10, 11, 21–23. Mathematics</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Geol. 1, Geoscience 1, or Geol. 101. Framework of Geology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Plus any 15 units of the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 101. Elements of Mining</td>
<td>3–5</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 118. Mining Methods</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 150. Introduction to Mineral Extraction Processes</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 151. Sedimentary Geology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 214. Physical Processes in Geology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 221. Photogeology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 222. Geomorphology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 250. Marine Geology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Core:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 164. Opaque Mineralogy</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 281. Introduction to Ore Deposits</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 282. Ore Deposits</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Comp. 106. Introduction to Computing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 102. Introduction to Field Geology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 103A,B. Advanced Field Geology</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Geol. 110. Structural Geology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geol. 161. Crystal Chemistry and Mineralogy</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 171. Introduction to Geochemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 172. Geological Thermodynamics, or Mat. Sci. &amp; Eng. 181. Thermodynamics and Phase Equilibria</td>
<td>3–4</td>
<td></td>
</tr>
<tr>
<td>Geol. 180. Petrology I—Igneous Rocks</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 181. Petrology II—Metamorphic Rocks</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 190. Introduction to Probability and Statistics in Geology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 272. Advanced General Geochemistry</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 273. Ore Genesis</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geophys. 190. General Geophysics</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>124–125</td>
<td></td>
</tr>
</tbody>
</table>

Total .................. 180

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**GRADUATE PROGRAMS OF STUDY**

The Department of Applied Earth Sciences offers graduate programs designed to prepare students for careers focused on application of the earth sciences in mining, petroleum and metallurgical industries, in government, in private practice and in education. The programs lead to the advanced degrees, Master of Science, Engineer and Doctor of Philosophy. Diplomas indicate the program, e.g., an M.S. earned in Extractive Metallurgy and Materials Processing leads to a diploma labeled M.S. in A.E.S.: Extractive Metallurgy and Materials Processing. Typical curricula are described below but individually tailored, interdisciplinary curricula are encouraged. The M.S. degree requires at least one year, the Engineer degree two years, and the Ph.D. degree at least three but normally not more than four years of graduate study.

The Department offers two basic program options for M.S. and Engineer degrees, one emphasizing management and the other emphasizing basic sciences and engineering. The management options include courses in the Graduate School of Business, the Department of Civil Engineering, and the Department of Industrial Engineering in order to complement technological competence with educational experience in some of the skills requisite for executive positions.

Candidates for the degree of Doctor of Philosophy in Applied Earth Sciences are normally those preparing for careers in education or basic research. Department programs at this level are very flexible but place
emphasis on advanced study in the basic sciences and on creative research.

Graduate students must maintain a B average in the School of Earth Sciences and equivalent status in other schools.

The Honors Cooperative Program

A number of industrial firms, government laboratories, and other organizations participate in the Honors Cooperative Program (HCP), a plan which permits qualified professional employees to register for Stanford graduate courses on a part-time basis. The HCP is now augmented by the Stanford Instructional Television Network, a four-channel network which enables students to enjoy live lectures with talk-back privileges at their company plants.

Master of Science

The University’s requirements for M.S. degrees and M.S. theses are described in the section “Advanced Degrees” of this Bulletin. The student should be guided by the following additional Department requirements.

1. At least 45 units of course work are required, of which at least 6 but not more than 24 units must represent independent work on a comprehensive project or research program. Not more than 10 of the required 45 units may be undergraduate courses (numbered lower than 200).

2. Students must complete one core curriculum from Group A and one of the options, either research or management, from Group B. Special core curricula may be formulated by the student in consultation with his or her research adviser. Special core curriculum must be approved by the Curriculum Committee of the Department.


Curricula Recommended for the Master’s Degree

GROUP A

Applied Geomathematics

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 190</td>
<td>Introduction to Probability and Statistics in Geology</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 290</td>
<td>Applications of Probability and Statistics in Geology</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 304</td>
<td>Computer Applications in Geology and Applied Earth Sciences</td>
<td>4</td>
</tr>
</tbody>
</table>

A.E.S. 306. Quantitative Exploration Decision Making | 3 |
Math. 101. Linear Algebra and Differential Equations I | 3 |
Math. 102. Linear Algebra and Differential Equations II | 3 |
Statistics 116. Theory of Probability | 4 |
Geophys. 190. General Geophysics | 4 |
Geophys. 280. Data Analysis | 3 |

Total ............................................ 30

Engineering Geology

All students in the Engineering Geology Program are expected to have taken courses approximately equivalent to those of the Undergraduate Core Sequence in Geology as well as Geol. 222—Geomorphology; Geoph. 190—General Geophysics; and either Geol. 214—Physical Processes in Geology or Engr. 11—Statics.

The following courses must be taken for credit:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 284. Engineering Geology</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 285. Engineering Geologic Mapping</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 286. The Practice of Engineering Geology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 386A. Seminar in Engineering Geology</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 386B. Seminar in Engineering Geology</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Geol. 230. Hydrogeology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geophys. 270. Environmental Seismology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 190. Geotechnical Engineering</td>
<td>4</td>
<td></td>
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<tr>
<td>Electives</td>
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<td></td>
</tr>
</tbody>
</table>

Total ............................................ 30

In addition, three of the following courses must be audited or taken for credit:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 308. Rock Mechanics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 203. Environmental Fluid Mechanics II</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 207. Open channel hydraulics and sedimentation problems</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 282B. Earthquake Engineering II</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 290. Soil Mechanics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 291. Earth Structures</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 293. Experimental soil mechanics</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Geophys. 262. Rock Mechanics</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Total ............................................ 8-12

In addition to course work, M.S. candidates are required to do an M.S. research project, normally engineering geologic mapping, and prepare a thesis.

Environmental Earth Sciences

All students in the Environmental Earth Sciences Program are expected to have completed a prior degree in one of the science or engineering disciplines, including courses in elementary biology, chemistry, and physics, analytical geometry and calculus, computer science, and geology.
**Environmental Geochemistry**

All students in the Environmental Geochemistry Program are expected to have completed a prior degree in one of the science or engineering disciplines, including courses in elementary chemistry and physics, analytical geometry and calculus, computer science, mineralogy, petrology, field geology, and physical chemistry.

**Extractive Metallurgy and Materials Processing**

This is a joint program of the Department of Applied Earth Sciences and the Department of Materials Science and Engineering. Students whose career objectives lie primarily in mineral processing, metal production, refining and alloying should enter the program through the Department of Applied Earth Sciences. Those whose interests are closer to solid fabrication, e.g., electronic materials, are advised to enter through the Materials Science Department. Options available are general course option, research option, and management option. Generous substitutions are allowed to suit the interest of the student.

**Mineral Processing and Hydrometallurgy**

Stanford encourages specialization in these areas only for students with degrees in the same field from other schools who wish to broaden their background in Extractive Metallurgy, environmental control, geochemistry, or economic geology. Specialized programs are encouraged.

**Pyrometallurgy**

High temperature extractive metallurgy covers all aspects of reduction, refining, alloying, and ingot making.

**Metallurgical Engineering Management**

This option includes mineral and metallurgical economics and management courses in this department in conjunction with a group of courses from the Business School and other departments.

**Hydrogeology**

All students in the Hydrogeology Program are expected to have completed a prior degree in one of the science or engineering disciplines, including courses in elementary chemistry, physics and fluid mechanics, analytical geometry and calculus, computer science and geology.

**Recommended technical electives:**

- A.E.S. 173, 201, 203B, 206, 215, 222, 225, 226, 227A, 227B, 228, 229, 232, 236, 281, also various Mat. Sci. and Engineering courses 8–9

The remaining 15 required units are taken under either the Research-Technical Option or the Management Option described under Group B.
Geol. 232. Numerical Methods in Hydrogeology 2  
Subtotal ........................................... 19

**Mineral Economics**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 215</td>
<td>Mineral Economics</td>
<td>5</td>
</tr>
<tr>
<td>A.E.S. 230</td>
<td>Case Histories</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 231</td>
<td>Valuation of Mineral Properties</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 300</td>
<td>Advance Work</td>
<td>6</td>
</tr>
<tr>
<td>A.E.S. 387</td>
<td>Resource Management</td>
<td>2</td>
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<tr>
<td>Electives from following list</td>
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<td>10</td>
</tr>
<tr>
<td>Total</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 101</td>
<td>Elements of Mining</td>
<td>3-5</td>
</tr>
<tr>
<td>A.E.S. 150</td>
<td>Introduction to Mineral Extraction Processes</td>
<td>3</td>
</tr>
<tr>
<td>Pol. Sci. 207</td>
<td>Seminar in Government and Natural Resources</td>
<td>5</td>
</tr>
<tr>
<td>Indus. Engr. 229</td>
<td>Engineering Economy</td>
<td>3</td>
</tr>
<tr>
<td>Engr.-Econ. Sys. 231A</td>
<td>Decision Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Oper. Res. 232</td>
<td>Operations Research</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

**Mining Engineering**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 308</td>
<td>Rock Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 215</td>
<td>Mineral Economics</td>
<td>3-5</td>
</tr>
<tr>
<td>A.E.S. 230</td>
<td>Case Histories</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 231</td>
<td>Valuation of Mineral Properties</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 300</td>
<td>Advanced Work</td>
<td>6</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>8-10</td>
</tr>
<tr>
<td>Total</td>
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<td>30</td>
</tr>
</tbody>
</table>

**Mineral Exploration**

Previous training should include courses that are judged approximately equal to those of the Undergraduate core requirements in Ore Deposits, leading to the B.S. degree in A.E.S. at Stanford. This program is flexible, and students who wish to make substitution for core requirements may petition the faculty with a statement of the justifications. The student is also required to make up deficiencies in previous training, as indicated by a Counseling Examination taken immediately prior to initial registration.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 276</td>
<td>Ore Deposits Field Trip, or A.E.S. 277. Field Mapping of Mineral Deposits, or A.E.S. 285. Engineering Geological Mapping</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 295</td>
<td>Structural Setting of Major Mineral Deposits (Metalllic and Oil)</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 304</td>
<td>Computer Applications in Geology and Applied Earth Sciences</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 306</td>
<td>Quantitative Exploration Decision Making, or A.E.S. 296. Airborne Exploration—Advanced Photogeology and Radar</td>
<td>3-4</td>
</tr>
<tr>
<td>Geol. 210</td>
<td>Tectonics, or Geol. 311B. Seminar in Structural Geology, or A.E.S. 294. Plate Tectonics and Ore Deposits</td>
<td>1-3</td>
</tr>
<tr>
<td>Geol. 290</td>
<td>Advanced Statistics</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 371</td>
<td>Geochemistry of Ore-Forming Solutions</td>
<td>2</td>
</tr>
<tr>
<td>Geophys. 191</td>
<td>Geophysical Field Techniques, or A.E.S. 288. Geochemical Prospecting</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>35</td>
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</tbody>
</table>

**Petroleum Exploration**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 210</td>
<td>Seminar in Petroleum Geology</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 290</td>
<td>Legal Aspects of Geology</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 306</td>
<td>Quantitative Exploration Decision Making</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 388</td>
<td>Offshore Exploration Seminar</td>
<td>2</td>
</tr>
<tr>
<td>Geophys. 191</td>
<td>Geophysical Field Techniques</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 255</td>
<td>Sedimentary Basins</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 278</td>
<td>Organic Geochemistry</td>
<td>2</td>
</tr>
<tr>
<td>Pet.Engr. 150A</td>
<td>Formation Evaluation</td>
<td>3</td>
</tr>
<tr>
<td>Pet.Engr. 150B</td>
<td>Formation Evaluation</td>
<td>3</td>
</tr>
<tr>
<td>Pet.Engr. 267</td>
<td>Engineer Valuation and Appraisal of Oil and Gas Properties</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

Highly recommended:

A.E.S. 390. Geology of Energy Sources 2

**Special Applied Earth Sciences Program**

A program with 30 units of courses approved by the Department and the School curriculum committee.

**GROUP B**

**Research Option**

Select 15 or more units, which may include additional courses or original research. These courses should amplify the academic base from which research is done and provide experience with the practice and techniques of research.

Total ........................................... 15

**Management Option**

Select a minimum of 15 units from the following courses:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus. 200-01</td>
<td>Economic Analysis and Policy</td>
<td>8</td>
</tr>
<tr>
<td>Bus. 210-11</td>
<td>Management Accounting or Indus. Engr. 133. Industrial Accounting</td>
<td>4-8</td>
</tr>
<tr>
<td>Bus. 220-21E</td>
<td>Business Finance</td>
<td>8</td>
</tr>
<tr>
<td>Bus. 261-62</td>
<td>Decision Analysis</td>
<td>8</td>
</tr>
<tr>
<td>Bus. 270</td>
<td>Organizational Behavior or Indus. Engr. 100. Theory and Management</td>
<td>4-6</td>
</tr>
<tr>
<td>C.E. 245</td>
<td>Advanced Construction Equipment and Methods</td>
<td>4</td>
</tr>
</tbody>
</table>
Engineer's Degree

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 prepare a thesis meeting the approval of the supervising instructor and the University Committee on Graduate Studies.

Doctor of Philosophy

Objectives—The degree of Doctor of Philosophy is conferred upon candidates who have demonstrated substantial scholarship, high attainment in a particular field of knowledge, and ability to do independent investigation.

Requirements—The University's requirements are described in the section "Advanced Degrees" in this Bulletin. A brief summary of additional Departmental requirements follows. A complete statement of requirements may be obtained from the office of Applied Earth Sciences.

Students are admitted to the Department for graduate study, not for a particular degree. The Department faculty may invite the student to pursue Ph.D. work at the end of the student's first year. This is the first step in the qualifying procedure. After completion of the qualifying procedures, the Department may recommend that the student apply to the University for Ph.D. candidacy. Passing of the University Oral Examination and acceptance of a dissertation by the Graduate Division of the University complete the academic requirements for the degree.

The Department qualifying procedures involve four steps: completion of core course sequence, faculty recommendation, departmental oral examination and proposal of research project. The first three steps must be completed within the first eighteen months after initial registration.

Courses—The student must pass the M.S. core courses required for his or her option with an average grade of "B" or higher, or demonstrate that he or she has done the equivalent elsewhere. In addition, the student must select a minor program of courses or must take a series of courses, approved by the Department Curriculum Committee, consisting of three or more units of graduate work under the direction of each of four Stanford faculty members.

Department Oral Examination—The student must pass the Department oral examination, which is a test of mastery of the major option and at least one related area. Mastery is expected at levels of breadth and sophistication sufficient to support Ph.D. work.

Research Proposal Seminar—Before the end of the second year of graduate work, the student must present a short, written, dissertation research proposal and present a seminar to members of his or her faculty Research Advisory Group. The seminar will be followed by a question period lasting about two hours.

University Oral Examination—After a student has been admitted to candidacy, shown special ability in his or her field of study and proven capacity for independent investigation to the satisfaction of his or her Research Advisory Group, the student may arrange through the Graduate Study Secretary for the University oral examination. The examination is a defense of the dissertation, based on a complete manuscript, and administered by a representative of the Graduate Division of the University and four or more faculty members representing the major and minor departments. The examination begins with a short talk in which the candidate presents the essential features of his or her dissertation.

Scheduling—Detailed scheduling of all events is left to the student. With diligence the degree may be earned in three years (9 quarters) of full-time enrollment. Normally, a maximum of 4 years of graduate study is allowed and a further year is allowed only if the Department Curriculum Committee is satisfied that the work can be completed in that time.

UNDERGRADUATE COURSES

100. Industrial Report—Student required to submit a report covering at least two conse-
ctive months of industrial experience in economic geology, engineering geology, mining engineering, mineral processing, or metallurgical plant work.

1 unit, Aut, Win, Spr (Staff) by arrangement

101. Elements of Mining—Introduction to prospecting, development, mining methods, mine plant and equipment. Emphasis on the close inter-relationship of geological conditions and mining problems. Optional supplementary paper on problems in mining. Prerequisite: consent of instructor.

3 to 5 units, Aut (Kruger) MWF 8

105. Extractive Process Metallurgy—Introduction to the thermodynamics and fundamentals of metal production processes. Unit process types are dealt with under the following major headings: (a) concentration of minerals, (b) preparation for reduction, (c) reduction to the metal, (d) refining and alloying, and (e) casting. The course also surveys integrated processes, flowsheets and the general industrial field as applied to important metals. Prerequisite: Chemistry 4.

2 to 3 units, Aut (Parlee) MWF 2:15

105A. Introduction to Metallurgy—Designed for non-metallurgy majors. Lectures and reading assignments in all phases of metallurgy: Extractive, process and physical metallurgy.

2 to 3 units, Aut (Parlee) MWF 2:15

107. Introduction to Probability and Statistics in Geology—(Enroll in Geology 190.)

3 units, Win (Switzer) TWTh 3:15

118. Mining Methods—Seminar using case histories to illustrate methods, equipment, and costs. Prerequisite: 101.

2 units, Win (Kruger) TTh 8, alternate years, given 1973-74

130. Environmental Earth Sciences I—First of a three-course sequence investigating the relationship of the environmental earth sciences to city and regional planning. General earth science and planning background is presented throughout the sequence by earth scientists and a city planner, supplemented by laboratories and field trips. Background and techniques acquired in the first two quarters are applied to the preparation of a land-use plan for a selected location in the San Francisco Bay Area in the third quarter.

First-quarter topics include: environmental data, non-renewable resources, geologic constraints to development, weather and climate, emergence of the urban environment, factors affecting the use of land. Laboratories include: data projection, climatic water balance, use of maps and air photos in planning, land use, population, economics and mineral resources. Seminars and field trips relate to local problems.

4 units for graduates; 5 units for undergraduates, Aut (Dickenson, Mader, Remson) MWF 11; labs., seminars, and field trips by arrangement

131. Environmental Earth Sciences II—See course sequence description under 130. Topics include: geologic constraints to development, stream and air pollution, shoreline processes, reconnaissance studies for planning, selected urban analyses, urban responses to earth sciences. Laboratories on: computer storage system for environmental data, stream pollution, community site selection, environmental transport. Reconnaissance study of environmental and planning factors for an area selected for the course land-use planning project. Prerequisite: 130 or consent of instructor.

5 units, Win (Dickinson, Mader, Remson) MWF 11; labs., seminars, and field trips by arrangement

132. Environmental Earth Sciences III—See course sequence description under 130. Lectures on: land capability studies and evaluation systems, environmental impact studies, general plan preparation, location and space requirements for land uses, waste disposal and sanitary landfill, geologic hazards. Laboratory devoted to preparation of land use plans for selected project area. Prerequisite: 131 or consent of instructor.

5 units, Spr (Dickinson, Mader, Remson) MWF 11; labs., seminars, and field trips by arrangement

133. Remote Sensing of the Environment—Survey course covering the methods of rapid reconnaissance of the environment stressing those techniques suited to change-detection. Emphasis will be placed on detection of various types of pollution of water and air, potential landslide areas, and evaluating the condition of coastal wetland environments. Test sites on the Campus or Baylands can be studied for extra credit.

3 units, Spr (Lyon), by arrangement
143. Materials: Non-Renewable Earth Resources and Man—(Enroll in V.T.S. 143.)
Abundance, location, and elementary geology of non-renewable energy and mineral resources in the earth’s crust, including the probable extent of undiscovered deposits. Patterns of usage, population trends, industrial development, and future demand. Limitations that specific resource scarcities will eventually impose on living standards. Economic and environmental costs of extracting resources. Recycle technology and ultimate recycle limits. International mineral trade. Perspectives of developed resource consuming countries and under-developed resource supplying countries. The economics of conservation. Non-renewable resource policy and population policy of the United States: actual and optimum.
3 units, Spr (Just) MWF 11

150. Introduction to Mineral Extraction Processes—Elements of mineral extraction processes for geology, mining, and other students not majoring in process metallurgy. The relationships between process technology, economics, ecology, and the mineralogical characteristics of ore deposits are stressed.
3 units, Aut (Staff) MWF 2:15

171. Introduction to Geochemistry—(Enroll in Geology 171.)
3 units, Aut (Krauskopf, Parks) MWF 9

172. Geological Thermodynamics—(Enroll in Geology 172.)
3 units, Win (Dickson) MWF 9

173. Applied Chemical Kinetics and Diffusion—Introduction to applied chemical kinetics with emphasis on solid/fluid and solid/solid chemical reactions in metal/mineral systems. Phenomenological diffusion with emphasis on mass transport problems associated with metal/mineral reactions. Atomic diffusion mechanisms in solids.
3 units, Win (Anderson) MWF 3:15

180. Field or Laboratory Study and Report in Mining or Metallurgical Engineering.
1 to 2 units, Aut, Win, Spr (Staff) by arrangement

190. General Geophysics — (Enroll in Geophysics 190.)
4 units, Aut (Thompson, Cox) MWF 11 lab. by arrangement

191. Geophysical Field Techniques — (Enroll in Geophysics 191.)
4 units, Spr (Kovach, Thompson, Lyon) by arrangement

GRADUATE COURSES

201. Principles and Methods of Crystal Growth—(Enroll in Materials Science and Engineering 201.)
3 units lec; 2 units lab. Spr (Tiller)
TTh 2:15–4:30

203A. Mineral Processing—Detailed study of mineral and solid-solid separation techniques and auxiliary operations with emphasis on practical use of principles in preliminary process feasibility appraisal. Topics include sizing, solid-liquid separations, and gravity, magnetic, electrical, and flotation methods of solid-solid separation. Prerequisite: 150 or equivalent.
3 units, Aut (Parks) MWF 10, alternate years, given 1974–75

203B. Topics in Mineral Processing and Hydrometallurgy—Independent study of any topic in Mineral Processing or Hydrometallurgy, including all topics listed under 203A, and their use in integrated processes from theoretical, design, or operational points of view. May be repeated for credit. Open to undergraduates by consent. Students must submit a proposal — and secure approval, prior to registration. Prerequisite: 203A or equivalent.
1 to 4 units, Aut, Win, Spr (Parks) by arrangement

205. Applications of Probability and Statistics in Geology—(Enroll in Geology 290.)
3 units, Spr (Switzer) TWTh 3:15

3 units, Aut (Anderson) MWF 3:15, alternate years, given 1975–76

207. Metal Refining and the Nature of Liquid Metals—Metal refining processes and the physical chemistry underlying them. A systematic treatment of unit processes based on types of impurity phases; deals ef-
fectively with the fundamentals of such widely different methods as the zone refining of semiconductors, the industrial refining of copper, steelmaking, and the vacuum refining of high temperature alloys. Structures and properties of liquid metals.

3 units, Win (Parlee) MWF 2:15


3 units, Aut (Harbaugh) MWF 11

214. Metallurgical Reaction Engineering—Mass transport in fluids and applications of kinetic and transport data in the design of metallurgical unit operations: rotary kilns, shaft furnaces, fluidized bed reactors, leaching, slag/metal refining, converter processes, flotation. Recommended prerequisite 173 or equivalent.

3 units, Spr (Anderson) MWF 3:15

215. Mineral Economics—Lectures, discussions on mineral importance, property acquisition, valuation, financing, marketing, prices, geography, accounting, taxation, conservation, stabilization, government activities, international affairs, future supplies, environmental problems, foreign investment, energy problems, and labor relations pertaining to minerals, including petroleum, natural gas, and coal; surveys of individual minerals as commodities. Extra credit for individual studies.

3 to 5 units, Spr (Just) by arrangement

219. Mine Exploration — Lectures, discussion. A survey of how mines are found, including prospector, geological, geochemical and geophysical methods, organization and economic aspects. Extra credit for individual studies. Prerequisites: 281, or equivalent.

3 to 5 units, Win (Just, Guest Lecturers) by arrangement

222. Statistical Thermodynamics — (Enroll in Materials Science and Engineering 222.)

3 units, Spr (Stevenson) MWF 10

225. Surfaces and Interfaces — Detailed study of the influence of surfaces and interfaces on chemical equilibria in water systems, emphasizing particle size effects on solubility, emphasizing particle size effects on solubility, adsorption on solids, and stability of suspensions. Useful in geochemistry, water chemistry, hydrology, chemical oceanography, water pollution abatement, etc. Purpose is to provide background necessary for interpretation of observed phenomena and, where possible, for quantitative prediction of effects.

3 units, Spr (Parks) 3 lecs. by arrangement, alternate years, given 1974–75

226. Corrosion and Electrometallurgy — (Enroll in Materials Science and Engineering 226.)

3 units, Win (Stevenson) MWF 10, alternate years, given 1974–75

227A. Problems in Applied Aqueous Thermodynamics—A systematic self-study review of the ideas and principles needed for solving quantitative problems in applied aqueous geochemistry or hydrometallurgy at temperatures near 25° and atmospheric pressure, and a series of applied problems which test your understanding of principle and your ability to use it. There will be one weekly class meeting. It is intended for those who have had some exposure to aqueous thermodynamics but are unsure of their ability in problem solving. A second unit can be earned with a term project. Prerequisite: Geology 271 or equivalent.

1 to 2 units, Win (Parks) by arrangement

227B. Advanced Topics in Aqueous Thermodynamics — Lectures and problems on roughly nine topics such as sources, determination and selection of thermodynamic data, determination of selection of non-ideality corrections, ion-exchange equilibria, distribution equilibria (e.g. solvent extraction). Prerequisite: 227A or Geol. 271.

3 units, Win (Parks) by arrangement

228. Extractive Metallurgy Seminar—Lectures, student seminars, and report preparation on selected topics in extractive process metallurgy designed to (a) satisfy the special interests of the student, (b) fill out areas not covered by formal courses, and (c) survey the field of extractive and process metallurgy from several broad points of view.

2 to 3 units, Spr (Parlee) by arrangement

229. Principles of Steelmaking—Systematic development of the physical chemistry underlying ironmaking and steelmaking pro-
cess. Treatment generalized to promote understanding of the physical chemistry of other metals as well. Seminar treatment of important processes and new developments.

2 to 3 units, Spr (Parlee) by arrangement, alternate years, given 1974-75

230. Case Histories in Exploration, Mining, and Metallurgy — A seminar to which industry leaders are invited to lay out a problem that faced their company, outline what was needed to solve it, give the prognosis for the future, and engage in lively discussion. A paper on selected topics is prepared by each student for distribution to the class.

3 units, Aut (Kruger, Guest Lecturers)

T evening

231. Valuation of Mineral Properties — Valuation, mineral law, ethics, organization, decision making, and management. Lectures, problems, discussion and class projects.

4 units, Win (Kruger) TTh 8–10

232. Mineral Project Financial Analysis and Optimization — Introductory course on mineral project feasibility, planning and optimization of the project design. Calculating profitability; cost estimation; determining project size; failure tolerance, equipment redundancy, ore blending and stockpiling; structure of systems-design alternatives; search for optimum conditions; brief survey of linear programming and suboptimization.

3 units, Aut (Staff) MWF 3:15, given 1974-75

267. Engineering Valuation and Appraisal of Oil and Gas Properties — (Enroll in Petroleum Engineering 267.)

3 units, Win (Miller) S 9–12, alternate years, given 1973–74

272. Geochemistry — (Enroll in Geology 272.)

3 units, Win (Krauskopf) TTh 9; lab. T 1:15–4:05 or W 1:15–4:05

276. Field Trip — A ten-day field trip to various mining and metallurgical operations, including Ruth and McGill in Nevada; Bingham, Garfield, Tintic and Price in Utah, or in alternate years, San Manuel, Ray, Magma, Mission, Pima, Twin Buttes, Silver Bell, Siera- rita and Old Dick in Arizona, and Eagle Mountain, Boron, Vanderbilt and Mountain Pass in California. Each student is required to prepare one chapter for the trip guidebook. During winter quarter this report will be presented orally to group meetings.

Transportation is provided but living expenses are the student's responsibility. May be repeated for credit.

3 units, Win plus Spr vacation (Lyon) by arrangement

277. Field Mapping of Mineral Deposits — A seven-day field trip to a specific mineral district in California or Nevada, emphasizing largescale, surface mapping of mineralized ground, dumps, adits and (where possible) underground workings. Students (in Spring quarter) will prepare the maps and produce a report suitable for presentation to management or for publication.

3 units, Spr vacation (Lyon), alternate years, given 1974-75

281. Introduction to Ore Deposits — The nature, classification, mineral associations and origin of ore deposits. Historical development of ore genesis theory. Magmatic, metamorphic, sedimentary and surficial processes and their role in the formation of ore deposits. Laboratory study of ore minerals, including crystal chemistry and hand-specimen mineralogy. Prerequisites: Introductory Mineralogy (e.g. Geol. 161) and Petrology (e.g. Geol. 181).

5 units, Aut (Cheney), TTh 9, labs. and additional lectures by arrangement

282. Ore Deposits — Study of case histories of the principal types of ore deposits, with emphasis on economics, ore genesis, and control of mineralization. Descriptive geometry applied to ore deposit problems. Course is designed to develop exploration thinking. Prerequisite: 281 or equivalent.

4 to 5 units, Win (Park) TTh 10; one lec., lab. by arrangement

283. Reflected Light Microscopy — (Enroll in Geology 164.)

4 units, Spr (Taylor) by arrangement

284. Engineering Geology — Application of geologic and hydrologic factors in location, design, and construction of engineering works. Emphasis on solution of real problems through effective interaction among geoscientists and engineers. Lectures, seminars, and field trips.

4 units, Aut (Jahnfs) TTh 10; field trips and seminars by arrangement

285. Engineering Geologic Mapping — Detailed field work and preparation of an engineering-geologic map and a stability-anal-
ysis map of one of the many fascinating areas of ground instability near Stanford. Mostly independent work, requiring about 8 hours of field time per week. Some prior field experience is desirable but soils engineers without field experience are welcome.

3 units, Spr (Johnson) by arrangement

294. Plate Tectonics and Ore Deposits — Seminar consideration of possible relationships between plate tectonics and the distribution of different kinds of metallic ore deposits in space and time.

3 units, Win (Dickinson and Lyon), seminar by arrangement, alternate years, given 1974–75

295. Structural Setting of Major Mineral (Metal and Oil) Districts—Seminar presentation and discussion of the structural environments of mines and mineral deposits. Integration of regional tectonics, major and minor lineaments, jointing and other rock fabric elements to assess the structural setting and to define search models in exploration. Each student will prepare and present a detailed report for class distribution on the structural style of a district, using all the available literature, maps, and aerial photography. Prerequisite: Geology 221 or consent of instructor.

3 units, Spr (Lyon) seminar TTh 1:15–3:05, alternate years, given 1975–76

296. Airborne Exploration: Advanced Photogeologic and Radar Techniques — Advanced photographic and radar interpretation of larger-scale structures, for rapid reconnaissance, as in the initial search for mineral districts. Particular emphasis is placed upon understanding ultraviolet, visible (and photographic infrared), and radar electromagnetic spectral signatures of rocks, soils, vegetation, and oceans. The effect on geological (and geobotanical) interpretation, with varying sun angles and radar look-directions, of flight altitudes, scales, and scenes and of film-filter combinations and radar wavelengths will be evaluated. Includes laboratory and field study. Term paper for fourth unit. Prerequisite: Geology 221 or consent of instructor.

3 to 4 units, Win (Lyon) lec. TTh 1:15; lab. TTh 2:15–4:05, alternate years, given 1975–76

297. Atmospheric Hydrology—Intensive study of the water cycle and the effects of various factors and meteorological events on the pattern of atmospheric hydrologic flux. Emphasis is placed upon the physical processes involved. Prerequisite: Airborne Exploration: Advanced Photogeologic and Radar Techniques

3 units, Win (Johnson) by arrangement

298. Airborne Exploration: Remote Sensing—Introduction to photogeologic methods of airborne remote sensing. Emphasis is placed upon the photogeologic interpretation of various electromagnetic spectral band combinations. Detailed interpretation of remote sensing data and report of single project.

3 units, Win (Johnson) by arrangement

299. Special Problems in Applied Earth Sciences — Individual research or guided reading on special problems.

Any quarter (Staff) by arrangement

300. Advanced Work in Applied Earth Sciences—Individual work on a dissertation or Master's report in economic geology, engineering geology, mining, mineral processing, or metallurgy.

Any quarter (Staff) by arrangement
303. Computer Programming in Geology and Applied Earth Sciences—An introduction to digital computing and FORTRAN in a geological and applied earth sciences context. No previous knowledge of computing is assumed. The course includes elements of FORTRAN, matrix algebra, least squares surface fitting, machine contouring, calculation of correlation matrices and their treatment by cluster analysis, and digital graphic display.

3 units, Aut (Harbaugh) MWF 10

304. Computer Applications in Geology and Applied Earth Sciences—Use of digital computers and associated mathematical techniques in selected applications to structural geology, petrology, sedimentology, palaeontology, ore deposits, and petroleum geology. Methods include surface and space fitting, harmonic analysis, numerical classification, contour mapping and statistical map analysis. Additional emphasis is placed on development of dynamic simulation models of geologic processes, including representation of space and materials, random variables, Markov chains, fluid flow, diffusion, and mass balance. Work in the course consists largely of developing and using computer programs associated with problem sets, plus assigned reading. Fluency in FORTRAN programming is assumed at the outset of the course. Persons who are familiar with computer languages other than FORTRAN are urged to take a FORTRAN short course during a preceding quarter. Persons with little or no computing experience should enroll previously either in A.E.S. 303, or in Computer Science 105 or 106 plus a FORTRAN short course.

4 units, Win (Harbaugh) MWF 11

305. Research Topics in Computing and Mathematical Applications—Course provides a forum for persons who wish to develop and apply computational and mathematical methods to their thesis research or other research projects. Credit given can be adjusted to the magnitude of the project.

2 to 8 units, Spr (Harbaugh) MW 10

306. Quantitative Exploration Decision Making—Seminar and review of the literature in the use of mathematics and digital computers in making economic decisions in exploration for petroleum and metals. Methods of map analysis, statistical petroleum and metals occurrence models, search strategy models, and formalized economic decision methods will be considered. A term paper is required.

3 units, Spr (Harbaugh) TTh 10

308. Rock Mechanics—Application of theory and laboratory studies to the determination of underground stress fields, the design of underground structures, and the design of large open excavations.

3 units, Spr (Staff or Visiting Professor) by arrangement, alternate years, given 1973-74

327. Topics in Environmental Geochemistry—Independent study of any topic in the general field of environmental geochemistry, including further study of topics listed under 227A,B. Students must submit a proposal and secure approval prior to registration. Prerequisite 227B.

1 to 3 units, Aut, Win, Spr (Parks) by arrangement

372. Organic Geochemistry and the Geochemical Environment of Life—(Enroll in Geology 278.)

2 units, Spr (Kvenvolden) by arrangement

383. Studies of Metallic Ores—Advanced study of mineral suites from the district collections, with emphasis on genesis and localization control. The studies will be designed for individual needs and for independent work. Students will be encouraged to use modern methods of microscopy, X-ray diffractometry and spectrography, optical spectrography, and electron microprobe analysis. Prerequisite: 282 or consent of instructor.

6 units, Spr (Staff) seminar and labs. by arrangement

386A,B. Seminar on Literature of Engineering Geology.

1 unit, Win (Johnson) Spr (Jahns) by arrangement

387. Resource Management: A Seminar in Ore Deposits—Class is organized as a board of directors to which exploration, mining, or investment proposals are made by each student as "Chief Geologist" for the company, for critical discussion and decision. Exploration case histories are discussed.

2 units, Spr (Kruger) by arrangement

388. Offshore Exploration Seminar—Lectures, discussions, student papers covering geological, geophysical, and production
problems of exploration for oil, gas, and solid minerals in the marine environment.

2 units, Win (Crandall) T 3–5, alternate years, given 1973–74

390. Geology of Energy Sources — Course will touch on supply, demand, and other oil, gas, oil shale, tar sands, nuclear fuels, geothermal energy, and water power, but will also touch on supply, demand, and other economic considerations as well as environmental and social factors.

3 units, Win (Crandall, Visiting Lecturers) TTh Ill; W 1


2 units, Win (Kruger) by arrangement, alternate years, given 1974–75

392. Survey of Selected Industrial Minerals — Lectures by specialists on the geology, specifications, and economics of selected industrial minerals.

2 units, Spr (Kruger and guests) by arrangement, alternate years, given 1973–74

393. Nuclear Metallurgy — An introductory course covering the materials and metallurgical aspects of nuclear reactors. Course topics will include reactor fuel materials, effects of burn-up, fuel reprocessing, radiation effects on materials, and liquid metal technology.

3 units, Win (Anderson) alternate years, given 1975–76

GEOLoGY

Emeriti: Arthur D. Howard, A. Myra Keen, Charles F. Park, Jr. (Professors)
Chairman: Konrad B. Krauskopf
Associate Chairman: Frank W. Dickson


* Joint appointment with Applied Earth Sciences.


Assistant Professors: Gordon E. Brown, John G. Liou

PROGRAMS OF STUDY

BACHELOR OF SCIENCE

The program leading to the degree of Bachelor of Science in Geology provides a high degree of flexibility for each individual student. Of the total of 180 units required for the bachelor's degree, not more than 120 are in the form of formal requirements, permitting the student to take elective courses totaling at least 60 units, or one-third of his undergraduate program. The required courses for a student majoring in geology can be grouped into three categories: (1) required courses offered within the Department of Geology, (2) courses in chemistry, physics, and mathematics that are essential to the geology curriculum but are taught in departments other than the Department of Geology, and (3) the University's requirements pertaining to courses in subjects other than science.

Core Course Sequence in Geology

The geology courses that are required form an integrated core course sequence totaling a maximum of 57 units. All undergraduate geology majors are expected to complete the core course sequence, regardless of their intended subsequent specialization in geology. The core course sequence is as follows:

<table>
<thead>
<tr>
<th>Courses</th>
<th>Quarter</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>1. Interpreting the Earth</td>
<td>Aut, Win, Spr</td>
<td>5</td>
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<tr>
<td>2. Earth History</td>
<td>Spr</td>
<td>4</td>
</tr>
<tr>
<td>101. Framework of Geology</td>
<td>Spr</td>
<td>4</td>
</tr>
<tr>
<td>102. Introduction to Field Geology</td>
<td>Sum</td>
<td>3</td>
</tr>
<tr>
<td>103A,B. Advanced Field Geology</td>
<td>Sum</td>
<td>12</td>
</tr>
<tr>
<td>110. Structural Geology</td>
<td>Spr</td>
<td>5</td>
</tr>
<tr>
<td>151. Sedimentary Geology</td>
<td>Win</td>
<td>4</td>
</tr>
<tr>
<td>152. Stratigraphic Geology and Paleontology</td>
<td>Spr</td>
<td>4</td>
</tr>
<tr>
<td>161. Crystal Chemistry and Mineralogy</td>
<td>Aut</td>
<td>5</td>
</tr>
<tr>
<td>180. Petrology I</td>
<td>Win</td>
<td>3</td>
</tr>
<tr>
<td>181. Petrology II</td>
<td>Spr</td>
<td>3</td>
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</tbody>
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In addition to the courses noted above the student is required to take one of the following courses of his choosing:

143. Principles of Paleontology  Win  5
163. Optical Microscopy  Aut  4
171. Introduction to Geochemistry  Aut  3
214. Physical Processes of Geology  Aut  5
Geophys. 190. General Geophysics  Aut  3

Total core course units  Max.  57  
min.  55

The core course sequence places emphasis on problem solving, and it provides an early introduction to field geology in Geology 102 which is conducted during a period of about two weeks immediately preceding autumn quarter and would normally be taken just before Geology 161. A student can enter the core course sequence as early as the freshman year, but entry in the sophomore or junior year is also feasible. If the student enters as late as the beginning of the junior year, it is imperative that he or she have completed most of the requirements in mathematics, chemistry, and physics, as well as having taken courses equivalent to Geology 1 and 2, to avoid possible delay in obtaining the bachelor's degree.

The minimum number of required courses in mathematics, physics, and chemistry for the Bachelor of Science in Geology varies with a student's high school preparation in the three subjects, general quantitative ability, and the speed at which he or she desires proficiency. Students with interests in analytical aspects of geology should plan on completing mathematics courses through differential equations as well as taking courses in statistics (such as Geology 190). The following course sequences describe the minimum requirements:

**Mathematics**  **Units**

1. For students entering Stanford with only high school algebra and trigonometry: Mathematics 10, 11, 21, 22, and 23 or Mathematics 41, 42, 43 (Analytical Geometry and Calculus)  15
2. For students entering Stanford with credit in analytical geometry: Mathematics 41A, 42A, and 43A (Calculus)  12

**Physics**

1. For students with average interest and ability in physics and with mathematical preparation through Mathematics 11 or 41 and concurrent registration in

Mathematics 21 or 42: Physics 51 (Mechanics), 53 ( Electricity), and 55 (Light and Heat)  12

2. For students with exceptional ability and interest in physics, advanced placement in mathematics, and concurrent registration in Mathematics 44: Physics 59 and 60 (Advanced Freshman Physics)  8

**Chemistry**

1. For the majority of students majoring in geology and with mathematical preparation equivalent to (or concurrent registration in) Mathematics 10 or 41: Chemistry 4 and 5 (General Chemistry for students in engineering and science)  8

2. In some instances the following sequence may be substituted for Chemistry 4 and 5 with consent of the adviser: Chemistry 31 and 33 (General Chemistry for students in chemistry, biology, and medicine).  8

Maximum possible required units in mathematics, physics, and chemistry  35
Minimum possible required units in mathematics, physics, and chemistry  28

**Electives**

A student entering Stanford with credit in high school algebra, trigonometry, and natural science normally will have a minimum of 60 units of free electives in addition to the core curriculum in geology and requirements of the University. These elective units afford an opportunity to acquire substantial strength in one or more of the many subdisciplines in geology and allied earth sciences at the undergraduate level. Alternatively, elective units can be utilized to complete requirements for a Standard Teaching Credential or to acquire depth in a discipline outside the earth sciences such as civil engineering or marine biology. Appropriate electives that are in accord with the interests of a student can be selected in conference with the adviser. There are no constraints on elective courses, and they may be taken in the Department of Geology or any other department of the University.

All courses numbered in the 100's and 200's are open to qualified undergraduate students. The number of courses offered within a given subdiscipline of Geology com-
monly exceeds the number of elective units available to a student.

COTERMINAL B.S. AND M.S. PROGRAM

A Stanford undergraduate majoring in Geology may be admitted to the University Division for the purpose of working simultaneously toward bachelor's and master's degrees, provided:

1. The student applies after the beginning of the 8th quarter of undergraduate work and before the end of the 11th quarter;
2. Admission is recommended by the school or department in which the student seeks a master's degree, that department applying the same standards for admission that it would to an applicant for the Graduate Division.

Both degrees may be granted simultaneously, provided:

1. The student completes 15 full-time quarters or the equivalent (or 3 full quarters after completing 180 units). (Partial tuition registration is possible after the completion of 12 quarters),
2. The student applies for each degree at the appropriate time and to the appropriate agency,
3. The student completes all the requirements for the baccalaureate degree and is recommended for the degree by the Subcommittee on Graduation; and
4. The student completes all the requirements for the master's degree and is recommended for that degree by the University Committee on Graduate Studies.

GRADUATE PROGRAMS

Opportunities for advanced studies and original research leading to the M.S. and Ph.D. degrees are available in the Geology Department. Graduate studies involve academic courses and independent research. Current course requirements for the M.S. and Ph.D. programs are available in the Department Office for the following graduate Core programs:

General Geology
Structural Geology
Geomorphology
Hydrogeology and Environmental Geology
Sedimentary Geology and Paleontology
Mineralogy
Geochemistry
Petrology
Mathematical Geology

Each Core Program is directed by a Core Group consisting of four or more faculty members, some of whom are in other departments of the School of Earth Sciences. Course work contained in the various programs involves offerings in other departments of the School of Earth Sciences as well as other parts of the University. Programs in Engineering Geology and Environmental Earth Sciences may be pursued by students enrolled in the Department of Geology. Core courses for these programs are listed under the Department of Applied Earth Sciences in this bulletin.

Students interested in Economic Geology, Ore Deposits, Ore Genesis, and Mineral Exploration should direct their attention to the description of the School of Earth Sciences Programs in Economic Geology.

For admission to graduate work in the department, the applicant must have taken the Aptitude Test (Verbal and Quantitative) of the Graduate Record Examination.

Graduate programs will vary from student to student. For the typical well-qualified student with a background equivalent to that of a Stanford geology undergraduate, completion of the requirements for the M.S. normally takes from four to six full-time quarters and for the Ph.D. no longer than twelve full-time quarters including both academic course work and research.

MASTER OF SCIENCE

Objectives—The primary purpose of the Masters program in geology is to train professional geologists for work of high quality in industry, private practice, and government. The Masters program also may serve to continue a student's training in general geology or to help in formulating a Ph.D. program.

Procedures — A written Counseling Examination will be given during the week prior to initial registration, in order to test the student's background in geology and the supporting basic sciences and mathematics at the undergraduate level. The purpose of this examination is to define weaknesses and strengths in past training so that the former may be rectified and the latter enhanced through a wisely planned academic program. This program will be developed by
the student and his or her Academic Advisor with appropriate consideration of the student's background, interests, and professional goals.

As early as possible, preferably during the first quarter at Stanford, the student is encouraged to select a Core Program. The appropriate faculty Core Group then supervises completion of the departmental requirements for the M.S. program, as outlined below.

**Requirements**—The University’s requirements for the Masters degree are stated in the section “Advanced Degrees” of this bulletin. The student also should be guided by the following Department requirements:

1. The student is to make up deficiencies in previous training, as indicated by the Counseling Examination. Previous training should include courses that are approximately equivalent to those of the Undergraduate Core Curriculum leading to the B.S. degree in geology at Stanford.

2. The student is to complete a minimum of 45 units of course work.
   a. Not more than 15 of the 45 units may comprise research (Geol. 4X9 series) and special problems (Geol. 3X9 series).
   b. The courses are to be junior, senior or graduate level (courses numbered 100 or higher).
   c. The courses either are to include one of the sequences of M.S. courses established by faculty Core Groups, or they are to include those designated by an ad hoc Core Group, comprising three or more faculty members selected by the student in consultation with his or her M.S. academic adviser. Each ad hoc Core Group and course sequence must be approved by the Graduate Committee of the Department.

3. The student must complete a manuscript describing his or her research before the end of the sixth quarter of graduate work at Stanford. The manuscript normally is expected to be based on about 10 to 15 units of research. The research and manuscript should demonstrate that the student has developed proficiency in at least one area of geology and hence is prepared to begin a professional career in at least that area.

4. The student is to make a public presentation of his or her results. The presentation should be approximately 30 minutes long.

5. Members of the faculty Core Group will determine whether the manuscript is acceptable for the M.S. degree in the Department of Geology and will determine whether the manuscript is ready to be submitted either as an M.S. thesis or as a journal article. The group will notify the Department Graduate Committee of their decision. A copy of the manuscript is to be placed in the student’s file.

6. The manuscript must either be accepted as an M.S. thesis by the Graduate Division of the university or accepted for publication in an appropriate journal.

**Doctor of Philosophy**

**Objectives**—To develop the skills needed to conduct original geologic investigations, to interpret the results, and to present the data and conclusions in a clear and concise manner.

**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, Colorado Plateau, 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. Laboratories are available for research in the various branches of geology, including paleontology and micropaleontology, sedimentology, mineralogy, petrology, geomorphology, photogeology, ore and mineral genesis, ground water, geochemistry, structural geology, rock mechanics, and geophysics.

**Procedures and Requirements**—The University’s requirements are described in the section “Advanced Degrees” in this bulletin. A brief summary of additional Department procedures and requirements follows. A complete statement may be obtained in the Geology office.

Two groups of faculty are primarily responsible for guiding Ph.D. students, the Core Groups and the Research Advisory Committees. The faculty Core Groups are responsible for establishing a student's Core Course program and reviewing the student's progress to the time of advancement to Ph.D. candidacy. Subsequently, a Research Ad-
visory Committee is to be selected by a student in consultation with his or her research adviser. The committee is to be made up of three to five members, at least two of whom must be geology faculty. The primary responsibility of the Research Advisory Committee is to aid in establishing and accomplishing the research program of the student.

Upon entering Stanford, a Ph.D. student is to take the Counseling Examination and to select an Academic Advisor, who helps the student design a course schedule. Before the end of the second quarter the student selects a Core Program and before the end of the third quarter selects a Research Advisor.

The Department qualifying procedures for Ph.D. candidacy involve five steps: completing the Core Course sequence, preparing the Ph.D. research proposal, establishing the Research Advisory Committee, passing the Core Program examination, and passing the Research Examination. These five steps, by University regulation, must be completed before the end of the student’s sixth quarter at Stanford. If the student is unable to meet this deadline, an explanatory petition requesting an extension must be filed with the Dean of the Graduate Division.

Courses—The student is to satisfy the Core Course requirements in his or her program. The courses include a minimum of four courses of at least three units each from four different faculty members at Stanford.

Research Proposal—Each student is to prepare a research proposal describing the scientific goals of the intended Ph.D. research, the relevant literature, other resources, and the time required to complete the program. The proposal normally is to be completed before the end of the student’s fifth quarter at Stanford. In general, the student will select a Research Advisory Committee at the time he or she prepares a research proposal.

Core program Examination—The Core Group will review a Ph.D. student’s course program and research proposal and certify that the student is prepared to take the Departmental Examination. The first examination is the Core Program Examination which is either written or oral, according to the procedure of the student’s Core Group, and which is designed to assess breadth and depth of background in the general core area.

Research Examination—The second Departmental Examination is the Research Examination, conducted by the Research Advisory Committee. This examination is an oral examination based on the Ph.D. research proposal prepared by the student.

Demonstration of foreign language proficiency may be required of the candidate at the discretion of the Research Advisory Committee.

Upon satisfactory completion of the Core Program Examination and the Research Examination, the Department will certify to the University Committee on Graduate Studies that the student has successfully completed the preliminary procedures required for admission to candidacy for the Ph.D. degree. Responsibility for the remainder of the student’s Ph.D. program passes from the Academic Advisor and the Core Group to the Research Advisor and other members of the Research Advisory Committee.

Under the supervision of the Research Advisory Committee, the candidates must prepare a doctoral dissertation which is a contribution to knowledge and is the result of independent research. The dissertation will be reasonably concise and prepared in a format suitable for publication in part or as a whole.

The candidate is to pass the University Oral Examination which involves an oral defense of the dissertation. The University Oral Examination Committee will normally consist of the members of the Research Advisory Committee and a Chairman who is not a member of the Geology Department, and is appointed by the Graduate Studies Office.

The Ph.D. dissertation is to be submitted in its final form within five calendar years from the date of admission to candidacy by the University Committee on Graduate Studies. In case of unusual circumstances a candidate for the degree who fails to meet this deadline may receive an extension of one year provided that the Research Advisory Committee is satisfied that the dissertation can be completed in that time.

Courses

Note — Courses in the 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.

The student is urged to examine the course offerings listed by other departments. Of particular importance are those in: Applied Earth Sciences, Geophysics, Petroleum Engineering, Chemistry, Physics, Materials Science, Mathematics, and Statistics.

1. Interpreting the Earth—Presentation and discussion of some Earth studies, especially those relating the Earth's present-day processes to its materials and internal constitution. The basis of observations and measurements will be introduced by field trips and labs, and the logic of actual investigations will be examined. Implications for human activities will be evident. Lectures, one three-hour laboratory period per week, and one or two field trips required. A transportation fee will be charged for field trips. High school chemistry and physics or Physical Science 1 and 2 strongly recommended. (Students who have studied geology in Physical Science 3 will receive only 3 units credit for Geology 1.)

5 units, Aut (Compton) MWF 8; lab. and field trips by arrangement
Win (Page) MWF 9; lab. and field trips by arrangement
Spr (Staff) MWF 8; lab. and field trips by arrangement

2. Earth History — Evolution of the major features of the Earth's surface. Topics will include the history of ocean basins, continents, and mountain belts related to current theories of sea-floor spreading and continental drift; the development of life on Earth as a cause and effect of physical geologic phenomena; and indications from Earth history of Man's dependency on the Earth and its finite resources. Lectures and one three-hour laboratory discussion session per week. Field trips are scheduled in lieu of some laboratory discussion sessions. Prerequisite: 1.

4 units, Spr (Silberling) MWF 9; lab. discussion sessions and field trips by arrangement

3. Man's Natural Environment—A brief survey intended to instill an appreciation of man's natural environment and an understanding of natural processes and the ways in which they affect or may be affected by man's activities. Topics include the Earth in time and space; the Earth as a dynamic system; the materials of the Earth; earthquakes; vulcanism; landscape; the oceans; the atmosphere; organization and evolution of life; energy and mineral resources.

4 units, Sum (Staff) MTWTh 9

10. Field Seminar—The principal component of this course is a week-long trip through the Grand Canyon, Death Valley, or other region in which rocks and earth structures are exceptionally well exposed and where there is an interesting history of man's activities. The trip, scheduled for the spring recess, is followed by one or more discussion sessions during the early part of the spring quarter. Students who wish to extend their trip experience into a modest library or laboratory research project may register for 3 units rather than 2. Transportation by automobile caravan; meals prepared in the field from group-purchased food. Prerequisites: 1 and 2 (recommended but not required) and consent of instructor.

2 units, Spr (Staff) by arrangement

101. Framework of Geology—Introduction to the dimensional, physical, and chemical features and materials of the earth's crust, with analysis of some space and time relationships among geologic units and features. Emphasis is placed on developing an understanding of the kinds of problems handled by an earth scientist and the methods he uses to define, attack, and solve these problems. Laboratory and field trips are designed to provide the student with a basic appreciation of field observations, and their translation into maps, cross-sections, diagrams, and interpretations. Prerequisites: 1 and 2 recommended.

4 units, Spr (Dickinson and Jahns) MWF 10; lab. and field trips by arrangement

102. Introduction to Field Geology — Instruction and practice in the basic methods of geologic investigation and recording in the field. Primary emphasis is placed upon techniques of systematic observation on the outcrop and the construction of a geologic map from the data obtained. The field area studied may vary from year to year, but each site used will be selected to display a variety of rock types and landforms related to clearly defined structures. The course is conducted from a tent camp during the two-week in-
terval preceding the beginning of the Autumn Quarter. Details of the schedule each year are given in the Summer Sessions Bulletin. Prerequisite: 101 or consent of instructor.

3 units, Sum (Dickinson) Sept. 6–20

103A, B. Advanced Field Geology — This course provides an opportunity for junior- and senior-level students to become involved in a substantial field investigation of professional scope and assumes familiarity with elementary techniques of field mapping and a proficiency in basic geologic concepts. The aim of the course is to provide an in-depth exposure to independent analysis of relatively complex geologic problems in the field and the presentation of research results in the form of a professional geologic report. The course is conducted from a tent camp at one or more localities in the western states and involves a coordinated field study involving mapping, description, and interpretation of a relatively unknown field area. Emphasis in the field is placed on observation of lithologic and structural features, measurement of stratigraphic and structural sections, application of various survey methods, and plotting of geologic data on topographic maps and aerial photographs. Graduate students must obtain the permission of the instructor(s) to enroll. Prerequisites: 1, 2, 101, 102, 110, 151 and 181; or enrollment by consent of instructor(s).

103A. Introduction to advanced field techniques; detailed stratigraphic and structural mapping; description and interpretation of lithologic features; conducted from a field camp in California or Nevada.
8 units (Staff) June 18–July 26

103B. Preparation of comprehensive geologic report on field area studied during 103A; work done on campus.
4 units (Staff) July 29–Aug. 12

105. Geologic Problems — Supervised reading, field and/or laboratory work, written reports thereon.
1 to 10 units, any quarter (Staff) by arrangement

110. Structural Geology — Introduction to types, occurrences, and origins of structures in sedimentary, metamorphic, and plutonic rocks. Examples from various parts of the world. Applications of graphic solutions and mechanics to the analysis of folds and faults. Prerequisites: 1 and calculus; Recommended: 101, 102, 181.

5 units, Spr (Page, Johnson) MWF 9; lab. and field trips by arrangement

141. Geologic Record of Life — A survey of life on earth during 3 billion years, designed for the non-geology major. Illustrated lectures will cover: where fossils are found, how collected and how studied; the record of earliest life and the evolution of the earth's atmosphere; important fossils preserved in unusual ways; microscopic fossils; conspicuous evolutionary successes; coral and other reefs during the last 600 million years; products of ancient life in the service of man. Term report. No prerequisites.

3 units, Win (Evitt) MWF 11; alternate years, given 1974–75

142. Vertebrates of the Past — A survey for nonspecialists, exploring through readings and illustrated lectures the distinctive characters, specializations for particular modes of life, evolutionary history and distribution in space and time of major vertebrate groups. Term report. No prerequisites.

4 units, Aut (Evitt) MTWTh 11; alternate years, given 1975–76

143. Principles of Paleontology — Fossils and how they are studied; emphasis on principles. Reading and lectures on the nature of the fossil record, the use of fossils for geologic dating and correlation, the record of evolution, and the interpretation of ancient environments. Laboratory introduction to several major groups of fossil organisms. Term project or report. Prerequisite: 2 or consent of instructor.

5 units, Aut (Evitt) MWF 10; lab.
T 1:15–4:05

150. The Oceans: An Introduction to the Marine Environment — This course provides an insight into the science of oceanography including the nature of sea water, the interplay between circulation of the oceans and atmosphere, the tides, waves, sea floor topography, and history of the major ocean basins. Particular attention is paid to the interface between continents and ocean basins; beaches, estuaries, and the continental shelves. Lectures and discussions include a broad view of the biology of the oceans emphasizing the sympathetic interaction between the distribution of inorganic constituents, oceanic circulation, and biologic pro-
ductivity. The course closes by examining real and potential marine resources together with attendant legal conflicts. Lectures, occasional laboratory demonstrations, one afternoon coastside field trip, and one shipboard field trip required. A term paper on a marine topic is also required; students are encouraged to undertake and complete an independent investigation of a marine problem in the field rather than a library research problem. No prerequisites.

4 units, Win (Ingle) MWF 10; laboratory demonstrations, research conferences, and field trips by arrangement; alternate years, given 1976-77

151. Sedimentary Geology — Inquiry into sedimentary and geomorphic processes; study of the petrology of sedimentary rocks and the morphology of landforms. Topics explored include source provenance and weathering, development of erosional and depositional surfaces, mechanics of sediment transport and deposition, lithification and diagenesis of sediments, textures and structures of sedimentary rocks, classification and nomenclature of rocks and landforms. Prerequisite: 102 or consent of instructor.

4 units, Win (Dickinson) TTh 9; lab. M 1:15-4:05 includes field exercises

152. Stratigraphic Geology and Paleoecology—Rudiments of interpreting sedimentary rocks with emphasis placed on the utility of integrating paleontologic, sedimentologic, and geochemical evidence to reconstruct paleoenvironments. Characteristic variations of modern and ancient biofacies and lithofacies are traced in time and space. Concepts of biostratigraphy are interwoven with discussions of the dynamics of the marine ecosystem and evolution at the species, population, and community level. An independent and original investigation of a modern or fossil sedimentary environment serves as a basis for a required term paper. Lectures and discussions are supplemented by extensive reading from classic and current scientific literature. Prerequisites: 1, 2, 101 and 102.

4 units, Spr (Ingle) MWF 10; one three-day field trip is required; additional field trips and research conferences by arrangement

161. Crystal Chemistry and Mineralogy — Introduction to the crystallographic groups and the theory of x-ray diffraction. Principles of crystal chemistry. Factors affecting the stability of minerals and the solid contaminants of our environment. Systematic examination of the structures, chemistry, physical properties and paragenesis of the major rock-forming minerals with emphasis on silicates. Introduction to the principles of optical mineralogy. Laboratories will be concerned with determinative mineralogy including hand specimen, optical and x-ray methods. One field trip. Prerequisites: 1, 101, 102 and Chemistry 31 or 4 (may be taken concurrently).

4 units, Aut (Brown) TTh 9; lab. MW 1:15-4:05

163. Optical Microscopy — A course provided for students who are interested in using the polarizing microscope as an instrument of research. It covers the fundamental concept of optical properties of crystals and systematic study of the rock-forming minerals. Prerequisites: 161, Physics 55 or equivalent.

4 units, Aut (Liou) TTh 11; lab. TTh 1:15-4:05

164. Reflected Light Microscopy — Introduction to the use of the reflected light microscope in the study of mineral assemblages. Emphasis is placed on identification and textural relations of opaque minerals as well as non-opaque minerals. Instruction in quantitative measurement of reflectivity and hardness as well as qualitative identification techniques. Selected specimens and suites of specimens are studied utilizing both polished section and polished thin section formats. This course is designed as a continuation of 163. Prerequisite: 163 or consent of instructor.

4 units, Win (Taylor) lec. MW 1:15-2:15; lab. W 2:15-5:15 plus one lab. by arrangement

171. Introduction to Geochemistry—Application of elementary chemistry to geologic problems, such as weathering, sedimentation, formation of sedimentary ores and evaporites, origin of petroleum, and magmatic differentiation. Introduction to thermodynamic functions and the phase rule. Lecture, discussion, problems sets. Prerequisites: 1, 181, Chemistry 5 or 33. 181 may be taken concurrently.

3 units, Aut (Krauskopf) MWF 9

172. Geological Thermodynamics and Phase Equilibria — Development of ele-
ments of thermodynamics and phase equilibria important to the understanding of chemical processes in nature. Principles governing the distribution of chemical elements among crystalline, liquid, and gaseous phases. Selected topics from the geological and geochemical literature that illustrate applications of thermodynamics to geologic problems. Prerequisite: 171.

4 units, Win (Dickson, Luth) MWF 9

180. Petrology I—Introduction to the occurrence, classification, and genesis of the igneous rocks. Topics covered include: crystallization of igneous minerals; chemistry of the igneous rocks and minerals; igneous rock suites in space and time; origin and development of magmatic systems. Laboratory exercises include both hand lens and petrographic study of common igneous rocks and minerals. Prerequisites: 102, 161.

3 units, Win (Luth) TTh 11; lab. T 1:15–4:05

181. Petrology II—Introduction to the occurrence, classification, and genesis of the metamorphic rocks. Topics covered will be textures and structures of metamorphic rocks; physical chemistry and crystallization of metamorphic minerals; concept of metamorphic facies; magmatic and metamorphic belts and crustal evolution. Laboratory exercises include both hand lens and petrographic study on common metamorphic rocks. Two one-day field trips to local areas that display rocks of special interest. Prerequisite: 180 or consent of instructor.

3 units, Spr (Liou) TTh 11; lab. W 1:15–4:05

182. Igneous and Metamorphic Rocks—Interpreting origins of rocks by studying the relationships among their mineral grains and by comparing them to chemical data and to field occurrences. Petrographic study of thin sections is the principal laboratory method. Field relations and chemical analyses are gained from papers in journals and from lectures. Prerequisites: 181, 163.

4 units, Win (Compton) MW 10; lab. TTh 1:15–4:05

190. Introduction to Probability and Statistics in Geology—Discrete and continuous probability theory; applications of probability to model-building; the role of probability in sampling and experimentation; statistical techniques in the analysis of sample data; statistical verification of models and statistical estimation of model parameters. Prerequisite: concurrent registration in Mathematics 22 or 42.

3 units, Win (Switzer) given 1974–75

201. Fall Field Geology—A course for students wishing to study geological problems by field and laboratory methods. During weekends students will prepare a geologic map in a selected area of diverse rock types and structures. During the field work each student will choose a problem illustrated in the area for more advanced study by laboratory or other techniques. The results are to be presented in a report that frames the special problem in the context of the geology. Suitable for undergraduate students desiring an extension of field geology beyond 103B, and for graduate students in Earth Sciences desiring enhanced training in field geology. Prerequisite: consent of instructor. Generally some experience in field geology will be required.

3 units, Aut (Dickson) Th 8; one day per week in field

210. Tectonics—Modern ideas of crustal deformation. Examination of structural record on land in relation to ocean floor spreading and plate tectonics. New views of mountain building. Two lectures and one seminar per week, plus reading and term paper. Prerequisite: 110 or equivalent.

3 units, Aut (Page) TTh 9; Seminar Th 4:00–5:30

212. Natural Strain in Rocks—Measurement of rock deformation, especially that produced by solid-state flow. Rock fabrics will be plotted by using a universal stage and analyzed in light of mapped folds and faults. Stress fields that affected marbles and associated quartzites will be deduced from petrofabric data, giving a basis for interpreting causes of deformation. Prerequisites: 182 and 110 or equivalent.

3 units, Spr (Compton) W 11; lab. MW 1:15–4:05

214. Physical Processes of Geology—Studies of physical geologic processes such as igneous intrusion, folding, faulting and jointing and flow of ice, lava and debris. Emphasizes the application of elementary engineering mechanics to the solution of
problems in structural geology and geomorphology. Prerequisite: Calculus.
5 units, Aut (Johnson) MTWThF 10; field trip by arrangement

221. Photogeology—Introduction to principles and practices of obtaining geologic data from air photographs. Particular emphasis is placed on the geologic interpretation of air photos for use in surficial, stratigraphic, and structural geology and in environmental analysis. Characteristics of the various commonly used films and filters and the geometry of the resultant imagery are examined. Simple photogrammetric equipment is employed to obtain quantitative data from photos as an aid to geologic interpretation. Prerequisite: 110; 222 recommended but not required.
3 units, Aut (Rich) TTh 1:15-4:05; alternate years, given 1975-76

222. Geomorphology — A general inquiry into the origin and evolution of landforms. Stress is placed on the evolutionary development of some of the chief landform patterns in various climatic regions and on semi-quantitative study of the physical processes that modify the land surface. Particular emphasis is placed on landform analysis as related to bedrock geology and the environmental changes resulting from the various natural processes. Prerequisites: 110 or consent of instructor; general course in sedimentary geology is recommended.
4 units, Aut (Rich) TTh 10; lab. W 1:15-4:05; field trips by arrangement, alternate years, given 1974-75

230. Hydrogeology — Theory of underground water, analysis of field data and pumping tests, geologic groundwater environments, solution of problems. Prerequisites: elementary calculus and physics.
5 units, Win (Remson) MWF 8; seminar M 2:15-4:05; lab. by arrangement

231. Groundwater Resources — Continuation of 230 with emphasis on practical applications, field techniques used in groundwater surveys and exploration, well development, groundwater law, chemistry of underground waters. Prerequisite: 230.
3 units, Spr (Remson) TTh 9; lab. by arrangement

232. Numerical Methods in Hydrology—Supervised self study of numerical methods with illustrative examples chosen from hydrology. Prerequisite: consent of instructor.
2 units, any quarter (Remson) by arrangement

241. Introduction to Micropaleontology—Study of microscopic marine fossils including diatoms, ostracods, and radiolarians with emphasis on foraminifera. Detailed study of principles of classification, evolutionary trends, common genera, and ecology of foraminifera. Application of planktonic and benthonic foraminifera to problems of paleoecology, paleoceanography, and correlation of marine sediments. An original quantitative investigation of a fossil or a modern foraminiferal fauna serves as a basis for required term paper. Instruction in laboratory and field techniques. Prerequisite: 152, with 143 highly recommended.
5 units, Aut (Ingle) MWF 11; two lab. discussion periods by arrangement, alternate years, given 1975-76

242. Introduction to Palynology—Study of microfossils smaller than 200 micra, especially spores, pollen, dinoflagellates, and acritarchs. Techniques of recovery and microscopy, morphology and classification, geologic distribution, application to stratigraphic problems. Prerequisite: 143 or consent of instructor.
5 units, Spr (Evitt) 3 lecs., 2 labs. by arrangement, alternate years, given 1974-75

243. Stratigraphic Palynology — Detailed laboratory study of assemblages of microfossils smaller than 200 micra, from Cambrian and younger strata, supplemented with lectures and discussions. Prerequisite: 242.
Spr (Evitt) units and hours by arrangement, alternate years, given 1974-75

250. Introduction to Marine Geology—General survey of the topography, structure, sediments, and geologic history of the ocean basins and submerged continental margins. Review of selected topics in physical oceanography including deepwater and shallow water waves and major current systems. Discussion of marine sedimentary processes, characteristic patterns of sediment distribution, and the interaction between sediments, water, and organisms. Paleoceanographic and paleoclimatologic analysis of deep-sea
cores and deep-sea biostratigraphy. Extensive reading from the current scientific literature. An independent and original investigation of a marine problem serves as a basis for a required term paper. Prerequisites: 151, 152 or consent of instructor.

5 units, Win (Ingle) MWF 11; coastal and shipboard field trips and research conferences by arrangement, alternate years, given 1974–75

253. Sedimentary Petrology—Examination and interpretation of clastic sediments and sedimentary rocks. Lectures emphasize processes that control the compositions, textures, and structures of sediments and sedimentary rocks; aspects of provenance, transport, deposition, and diagenesis or incipient metamorphism are treated. Laboratory work emphasizes examination with the petrographic microscope but includes staining techniques, separation of heavy minerals, examination with the binocular microscope, and modal point counting. Emphasis is placed on sandstones of all kinds including calcarenites, but study of conglomerates, lutites and cherts, and volcanioclastic rocks is included; systematic carbonate petrology is not covered. Prerequisite: 163.

4 units, Spr (Dickinson) TTh 9; lab. TTh 1:15–4:05

254. Carbonate Sedimentology—Petrography, classification, and field relations of carbonate rocks with emphasis on interpreting those formed in shelf environments. Lectures, reading, and petrographic laboratory study will treat the significance of skeletal and inorganic carbonate grains; interpretation of textures, fabrics, and megascopic structures; diagenetic and epigenetic alteration processes; dolomitization; associated evaporate and siliceous rocks; organic influence on facies patterns; distribution through time; and recent carbonate environments as analogs for interpreting ancient examples. Prerequisite: 163.

4 units, Win (Silberling) TTh 9; lab. WF 1:15–4:05

255. Sedimentary Basins—Analysis of the depositional framework, tectonic evolution, and economic potential of sedimentary basins, both marine and continental. Topics covered include the plate tectonic settings of different kinds of sedimentary sequences, tectonic and environmental controls on facies relations, analysis of paleocurrent and paleo-slope patterns, and synthesis of basin development through time in tectonic context. A term paper is required.

4 units, Aut (Dickinson) MWF 9; seminar and field trip by arrangement

257. Geochronology—General review of paleontologic, radiometric, and paleomagnetic methods of dating and correlation with emphasis on stratigraphic applications. Consideration of basic assumptions, utility, and resolution of techniques based on different groups of fossil organisms and on physical and chemical approaches as applied to different parts of the geologic record. Prerequisites: 152 and 181.

3 units, Aut (Silberling) MWF 9; alternate years, given 1975–76

261. Advanced Mineralogy—Crystal chemical principles and current theories of chemical bonding as applied to minerals. Spectroscopic properties of minerals. Systematic examination of the structures, chemistry, physical properties and paragenesis of the major rock-forming silicates and related mineral groups. Silicate glass and melt structures. Introduction to the mineralogical literature. Prerequisite: consent of instructor.

3 units, Win (Brown) MWF 11

262. Structural Mineralogy—Matrix-algebraic development of the crystallographic groups. Theory of x-ray diffraction from crystals and amorphous solids; powder and single-crystal diffraction techniques; elements of crystal structure analysis and refinement. Statistics in crystallography. High-temperature x-ray techniques. Neutron diffraction and inelastic scattering. Geologic applications. Laboratories will consist of single-crystal and powder x-ray investigations of metamorphic and igneous minerals. Prerequisite: consent of instructor.

4 units, Spr (Brown) TTh 10; labs. TTh 1:15–4:05; alternate years, given 1975–76

271. Low Temperature Aqueous Geochemistry—A systematic study of ideas and principles needed for solving quantitative problems in aqueous geochemistry at temperatures near 25°C and atmospheric pressure. The use of thermodynamics in predicting the feasibility and extent of chemical processes such as dissolution and precipitation, hydrolysis and complexation, oxidation and reduction. Emphasis on resolution of general
questions into tractable problems and on problem solving and graphical representation of results. Course is based on lectures, problem sets, and discussion of problem solutions. Prerequisites: 171, 172 or C.E. 273 or equivalent experience with chemical thermodynamics.

3 units, Aut (Parks) MWF 10

272. Advanced General Geochemistry—Application of physical chemistry to problems of igneous and metamorphic rocks and ore deposits. Distribution of the rarer elements in geologic environments. Prerequisites: 171, 181, or 1 and Chem. 171.

3 units, Win (Krauskopf) TTh 9; lab. T or W 1:15–4:05

273. Geochemistry of Ore Formation—The modes of origin of ore and gangue mineral associations. Lectures on: characteristic associations of minerals; chemical factors of ore component transport and mineral deposition; genetic implications of equilibrium studies of chemical systems pertinent to ore genesis; and isotopic, trace element, and other geochemical properties of ore and gangue minerals. Prerequisite: 171 or 172, or consent of instructor.

3 units, Spr (Dickson) MWF 10


3 units, Aut (Luth) MWF 9; alternate years, given 1974–75

278. Organic Geochemistry and the Geochemical Environment of Life — Course unites aspects of geology and chemistry in study of origin and occurrence and fate of organic materials in geological environments. Principles of organic geochemistry are applied to sedimentology, paleontology, petroleum geology, chemical evolution of life, and environmental science. One field trip and one term paper are required. There are no formal prerequisites although introductory courses in geochemistry and organic chemistry are helpful.

2 units, Win (Kvenvolden) TTh 11

279. Microprobe and X-ray Fluorescence and Analysis—Principles of x-ray emission spectrography, with emphasis on the electron microprobe. Classroom discussions of instrument design and operation, basic theory and analytical correction procedures. Laboratory use of the microprobe to develop sufficient skills for independent operation.

4 units, Spr (Staff) two lecs. and lab. by arrangement

281. Igneous Petrology—Analysis of the crystallization and recrystallization history of the igneous rocks using field, petrographic, mineralogic, and chemical data. Estimation of intensive parameters, such as pressure and temperature, at the time of origin, emplacement, and crystallization on the basis of these data. Interpretation of chemical variation in suites of related rocks in terms of fractional and equilibrium melting and crystallization processes. Laboratory studies on mineral separation and x-ray powder diffraction techniques in conjunction with petrographic studies. Prerequisites: 171, 172, 182.

4 units, Win (Luth) TTh 11; lab. M 1:15–4:05; alternate years, given 1974–75

282. Metamorphic Petrology—Physical and chemical aspects of metamorphic processes. Emphasis on (1) thermodynamic and graphic approaches to construct phase diagrams; (2) methods to determine the externally imposed conditions for metamorphic recrystallization; and (3) role of C,O,H,F, in metamorphic processes (theoretical and experimental approaches). Laboratory work will emphasize examination of suites of rocks from metamorphic terrains such as Franciscan, Abukuma, and Barrovian types. Introduction to the use of conventional hydrothermal apparatus and of the electron microprobe. Prerequisite: 172 or 182 or consent of instructor.

4 units, Spr (Liou) 2 lecs., 1 lab. by arrangement; alternate years, given 1975–76

290. Applications of Probability and Statistics in Geology—A variety of techniques will be presented along with their applications to geological problems. Students will then be expected to offer critical reviews of selected published research papers with respect to the appropriateness and correctness of sta-
tical usage. Prerequisite: 190 or consent of instructor.

3 units, Spr (Switzer) alternate years, given 1974–75

311A,B,C. Seminar in Structural Geology—
Group discussions of most important research papers in structural geology. Purpose is to become familiar with classic ideas in structural geology. Prerequisites: 210, 212, 214.

1 unit, Aut (Page) T 4:15; 2 units, Win (Johnson, Thompson); 1 unit, Spr (Crompton) by arrangement

312. Theories of Folding—In-depth studies of mechanical theories of folding. Begins with classic, single-layer theories of Smoluchowski, Ramberg, and Biot and ends with modern theories of folding of multilayers. Includes theory of characteristics as applied to faulting, monoclinal flexuring, kinking, concentric folding and sinusoidal folding. Prerequisite: 214.

3 units, Spr (Johnson) TTh 10; seminar by arrangement, alternate years, given 1975–76

313. Theory of Finite Strain — Systematic development of theories of infinitesimal strain and of applications of theories to measurement of strain in rock.

3 units, Spr (Johnson) TTh 10; seminar by arrangement, alternate years, given 1974–75

322. Advanced Geomorphology — A systematic quantitative evaluation of the physical processes and geomorphic agents (water, ice, and air) that modify the land surface. Principles of fluid flow and theories of sediment transport are used in an effort to understand the origin and modification of a wide variety of destructive and constructive landforms. Topics will include, but are not limited to, river mechanics, dynamic equilibrium theories, movement and deposition of sediment by water, wind, and ice. Classroom discussions will be augmented by a review of actual field observations. Prerequisites: 222, and C.E. 107 or 207 or consent of instructor.

3 units, Win (Rich, Johnson) MWF 10; field trips by arrangement, alternate years, given in 1974–75

325. Seminar in Geomorphology—An analysis of current problems in geomorphology, with emphasis on new data and concepts based on review of classic and modern literature pertaining to the various topics discussed.

2 units, Spr (Rich) by arrangement

361. Seminar in Mineralogy.

1 unit, Win (Staff) by arrangement

371. Seminar in Geochemistry.

1 unit, Aut (Staff) by arrangement

381. Seminar in Igneous Petrology—Analysis of current problems, concepts, and research in igneous petrology and closely allied fields, with emphasis on newly available data. Topics for discussion are selected mainly on the basis of interests expressed by the course participants.

2 units, Win (Jahns) by arrangement

382. Advanced Petrology — Fundamental topics in petrology, the selection of which will be announced at least one quarter in advance. Students will read papers, prepare written abstracts, and make oral presentations before the class. Emphasis will be on logical analysis, internal consistency, and contribution to geological thought. The range of subject matter is to be kept sufficiently compact to permit in-depth investigation. Prerequisite: 172 or equivalent, or consent of instructor.

3 units, Spr (Dickson) T 2:15–4:05

383. Seminar in Metamorphic Petrology—Discussion of selected topics in the area of physical chemistry of metamorphic processes, research problems and methods of study of metamorphic rocks on their origin and relationships in time and space. Prerequisite: 281 or 282 or consent of instructor.

1 unit, Spr (Liou) by arrangement, alternate years, given 1974–75

Problems in Various Fields of Geology —

Units, quarter and time by arrangement (Staff).

309. Problems in General Geology.

319. Problems in Structural Geology and Physical Processes.

329. Problems in Geomorphology and Photogeology.

339. Problems in Environmental Earth Sciences and Hydrogeology.

349. Problems in Paleontology, Palynology, and Paleoecology.

359. Problems in Sedimentary Geology.

369. Problems in Mineralogy.

379. Problems in Geochemistry.
389. Problems in Petrology.
399. Problems in Geomathematics.

Research in Various Fields of Geology —
Units, quarter and time by arrangement (Staff).

409. Research in General Geology.
419. Research in Structural Geology and Physical Processes.
429. Research in Geomorphology and Photogeology.
439. Research in Environmental Earth Sciences and Hydrogeology.
449. Research in Paleontology, Palynology, and Paleoecology.
469. Research in Mineralogy.
479. Research in Geochemistry.
489. Research in Petrology.
499. Research in Geomathematics.

GEOPHYSICS

Chairman: George A. Thompson


Associate Professors: Jon F. Claerbout, Amos M. Nur

Assistant Professor: David M. Boore

Research Associates: John P. Burg, Naoyuki Fujii, James G. Moore

OFFERINGS AND FACILITIES

Geophysics is the branch of earth science concerned with exploration of the earth and its history by physical measurements. The undergraduate and graduate programs are designed to provide (1) the background 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. The objectives of the graduate program are to prepare students for positions in the exploration industry, geophysical research programs, governmental work, and education. The Department of Geophysics is housed in the Ruth Wattis Mitchell Earth Sciences Building and the Henry Salvatori Laboratory of Geophysics. The Department has a number of research facilities among which are a seismic observatory, a rock-magnetism laboratory, time-sharing computer facilities, a microbarograph array, a high pressure and temperature rock deformation laboratory, and various instruments for field measurements. Some current research activities in the Department include analysis of lunar seismic data, geophysical monitoring of the San Andreas fault and paleomagnetic investigations. Graduate programs lead to the degree of Master of Science and Doctor of Philosophy.

PROGRAMS OF STUDY

BACHELOR OF SCIENCE

The following course requirements for the degree of Bachelor of Science in Geophysics are in addition to the University requirements in general studies. An undergraduate thesis is also required. Normally this will be undertaken as part of the student's participation in three quarters of Research Seminar (Geophysics 185, Sections A, B, C, D, E, or F) during the senior year. Seniors in Geophysics who expect to do graduate work are urged to take the Graduate Record Examination as early as convenient in their terminal undergraduate year.

Curriculum

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Quarter</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 4, 5. General Chemistry</td>
<td>Aut,Win</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Math. 10, 11, 21, 22, 23 and 44 or 41, 42, 43 and 44. Analytical Geometry and Calculus</td>
<td>Any</td>
<td>18</td>
<td></td>
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<tr>
<td>Math. 130. Ordinary Differential Equations</td>
<td>Aut or Win</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geology 161. Mineralogy</td>
<td>Aut</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Geophysics 185 (A, B, C, D, E, or F)</td>
<td>Aut,Win,Spr</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Geophysics 190. Elementary Geophysics</td>
<td>Aut</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Physics 51, 53, 54, 55 and 56. Elementary Physics</td>
<td>Win,Spr,Aut</td>
<td>14</td>
<td></td>
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<tr>
<td>Physics 110, 111. Mechanics</td>
<td>Win,Spr</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Physics 120. Electricity and Magnetism</td>
<td>Aut</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geology 101. Framework of Geology</td>
<td>Sum</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geology 102. Intro. to Field Geology</td>
<td>Spr</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geology 110. Structural Geology</td>
<td>Sum</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

As electives in the Geophysics Curriculum the following courses are recommended: Geophysics 102, 191, Geology 103A and B or 201, Geology 181, Physics 57, 58, 100, 101, 121, Mathematics 131, 132, and Electrical Engineering 41A, 41B.
**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. Normally this research will be undertaken as part of the candidate’s participation in three quarters of Research Seminar (Geophysics 385, Sections A, B, C, D, E, or F).

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. Background in field geology should be at the level of Geology 201 or 103A and 103B.

Students who do not meet the standard course requirements (see undergraduate curriculum) but who have unusual competence in other areas, such as environmental geophysics or space physics, may petition the Geophysics faculty to arrange individual programs.

**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 university graduate study must be satisfactorily completed. At least one of these years, ordinarily the last, must be spent as a registered student at Stanford. During his first year the candidate will take three quarters of Research Seminar (Geophysics 385, Sections A, B, C, D, E, or F). Ph.D. candidates in Geophysics are required to complete Physics 121 and Electrical Engineering 261 and two of the following: Physics 210, 211, Applied Physics 213, 215, Mathematics 220A, 220B. Additional advanced courses are to be selected from the following topics: Applied Physics, Astrophysics, Atomic and Nuclear Physics, Communications Theory, Electromagnetic Theory, Engineering Mechanics, Geology, Geophysics (200 level or higher), Materials Science, Physics of Solids, Thermodynamics. Students who wish to waive any of the required courses can petition the department in writing. Petitions must state a well-reasoned plan for the substitute requirements. Applied Mechanics 203A and 203B are recommended for students interested in studies of theoretical wave propagation. In addition, students without practical electronics experience are strongly encouraged to take a laboratory course such as Engineering 41A, 42A, or 44. The candidate’s record must indicate outstanding scholarship, and deficiencies in previous training must be removed. The student must pass the Departmental qualifying examination; fulfill the requirements of the minor department, if a minor is elected; pass the University oral examination, which is essentially a defense of the dissertation problem, and 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 Studies. Candidates for the degree who fail to meet this deadline will be required to re-apply 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**

13. **Earthquakes and Man**—Earthquakes occur daily in California with the prospect that a large earthquake in the San Francisco Bay area is a distinct possibility during our lifetime. This course provides an insight into the science of seismology, the study of earthquakes. Topics to be discussed include why and where earthquakes occur, the nature of earthquake motions, earthquake effects on buildings and other construction and earthquake risk and protective measures.

The course closes by examining the effect of man’s activities on determining the environment in which earthquakes occur, raising the tantalizing possibility that earthquakes can be controlled. Lectures, occa-
sional laboratory demonstrations and several Saturday field trips.

3 units, Aut (Kovach, Boore) TTh 10, lab., field trips by arrangement

35. Great Earthquakes of the West — This seminar will focus on a detailed study of an earthquake of particular historical, scientific, and social significance. Prerequisite: permission of the instructor. Class enrollment will be limited to 10. No auditors.

2 units, Spr (Boore) by arrangement; alternate years, given 1974–75

51. Physics of the Earth—This course is directed toward science, engineering, and mathematics majors interested in obtaining a general understanding of the origin of the earth, geomagnetism, earthquakes, and related geophysical phenomena. Recent developments in the theory of sea floor spreading will provide the framework for considering the following subjects: north-south reversals in the direction of the geomagnetic field; the use of magnetic reversals to determine the rate of sea floor spreading; continental drift; polar wandering; the world wide distribution of earthquakes and volcanoes; how to determine the magnitude, energy, location, and depth of earthquakes; earthquake prediction. Prerequisites: Mathematics 41 or 11, and enrollment in Mathematics 42 or 21.

4 units, Win (Cox, Thompson) MWF 9; discussions by arrangement


3 units, Aut (Cox) MWF 8

185A,B,C,D,E,F. Research Seminars—The research seminar provides the undergraduate an opportunity to participate directly in one of the ongoing research projects in the Geophysics Department. Participation will consist of helping with experimental and computational work; joining in reading and study groups; giving seminar papers; and doing original research for the undergraduate thesis. Enrollment limited to Geophysics undergraduates and coterminal master candidates. Prerequisite: consent of instructor.

185A. Research Seminar: Geophysical Computations—Discussion of current departmental research and current journal articles on geophysical computational techniques, especially seismology and exploration. Prerequisite: Geophysics 280 or concurrent registration in 280.

2 units, Aut, Win, Spr (Clairboult) by arrangement

185B. Research Seminar: Geomagnetism —Current research in paleomagnetism, geomagnetism, and plate tectonics.

2 units, Aut, Win, Spr (Cox) by arrangement

185C. Research Seminar: Seismology — Current research in seismology, seismicity, and earthquake source mechanisms.

2 units, Aut, Win, Spr (Kovach) by arrangement

185D. Research Seminar: Tectonophysics—Research in areas of current interest in rock mechanics, tectonophysics, and related problems. Content varies from quarter to quarter.

2 units, Aut, Win, Spr (Nur) by arrangement

185E. Research Seminar: Tectonics—Research topics on the origin, major structures, and tectonic processes of the earth's crust.

2 units, Aut, Win, Spr (Thompson) by arrangement

185F. Research Seminar: Environmental Seismology — Current research concerning earthquake hazards and hazard reduction. Topics drawn from research in seismology, geology, and engineering.

2 units, Aut, Win, Spr (Boore) by arrangement


4 units, Aut (Thompson, Cox) MWF 11; lab. by arrangement
191. Geophysical Field Techniques—Geophysical field investigations in a region of geologic interest using seismic refraction, gravity, magnetic and electrical field techniques. Students engage in all phases of program, interpret the data, and prepare a final report. Prerequisite: consent of the instructor.

4 units, Spr (Kovach, Thompson, Boore, Lyon) by arrangement

195. Elementary Seismology — Study of earthquakes. Topics to be discussed include: principles of seismographs, seismicity, earthquake magnitude and energy, construction of travel-time tables, general theory of elastic waves, interpretation of seismograms, source mechanisms, earthquake prediction.

3 units, Aut (Thatcher, Boore) TF 2:45–4:00

196. Seismology Laboratory — Practical exercises in seismology using records from local and teleseismic events. Required for those taking Geophysics 195.

2 units, Aut (Boore) W 2-5

250. Geomagnetism — Magnetic anomaly fields; secular variation; spherical harmonic analysis of geomagnetic field; elements of rock magnetism; history of geomagnetic field. Prerequisite: Physics 53.

3 units, Win (Cox) MWF 1:15

260. Tectonophysics I — Theories of elasticity, viscoelasticity, friction and fracture as related to geotectonic processes. Application of dislocation theory to crustal and mantle deformation, faulting and creep. Special emphasis on current problems such as earthquake prediction and modification. Prerequisite: differential equations.

3 units, Win (Nur) MWF 11


3 units, Spr (Nur) MWF 11

262. Rock Mechanics — Physical properties and physical processes in rocks as related to geophysical processes. Emphasis on (1) mechanical behavior of rocks as a function of stress, temperature, time and water pressure; and (2) non-linear processes in rocks such as stress dependence of electrical resistivity on hydraulic permeability, and their applications to earthquake mechanics and prediction, and mantle deformation. Includes regular laboratory work.

3 units, Spr (Nur) MWF 11, alternate years, given 1975–76


3 units, Win (Boore) MWF 9, alternate years, given 1974–75

271. Elastic Wave Propagation—Basic concepts: equations, wave motion, polarization, energy, intensity. Representation theorems, dislocation-body force equivalences. Reflection, refraction, Propagation in layered media. Group and phase velocity. Synthesis of waveforms, including finite difference techniques and the Cagniard-De Hoop method. Although mainly concerned with elastic media, the material is applicable to any type of wave propagation. Prerequisite: Applied Physics 213 or equivalent.

3 units, Win (Boore) MWF 9, alternate years, given 1975–76

273. Topics in Seismology—Continuation of 271, plus an introduction to linear inverse theory.

2 units, Spr (Boore) alternate years, given 1975–76

280. Data Analysis—The objective is to prepare students to do computer analysis of geophysical data. Fourier transforms and matrices are reviewed. Model building by least squares. Principles of filter theory and wave propagation by means of rays are formulated in terms of sampled time. Special attention is paid to causality, prediction, time-frequency-statistical resolution, multichannel observations and waves in layered structures.
No prerequisite but Electrical Engineering 261 is helpful.

3 units, Aut (Claerbout) MWF 9

283. Geophysical Simulation — A broad class of useful mathematical models of the earth are characterized by material variations along only the depth coordinate. This reduces the various equations of classical physics to a similar mathematical form. Examples from ocean acoustics, electromagnetic prospecting, and seismology. Use of a computer to simulate geophysical situations by means of difference approximations to the partial differential equations of classical physics. Special emphasis on the scalar wave equation in two dimensionally inhomogeneous material, reflection seismology, and petroleum prospecting.

3 units, Win (Claerbout) MWF 10

295. Physics of Planetary Interiors — A study of the available data of seismology, geodesy, heat flow, high pressure laboratory work and solid state physics for developing an up-to-date understanding of the properties and processes of the interiors of the earth and other terrestrial planets. Emphasis is placed on current unresolved problems in geophysics. Prerequisite: consent of the instructors.

3 units, Aut (Kovach, Nur) MWF 10, alternate years, given 1974-75

301. Problems in Geophysics.

Any quarter (Staff) by arrangement

311. Seminar in Structural Geology — enroll in Geology 311B.

2 units, Win (Johnson, Thompson) by arrangement

385A,B,C,D,E,F. Research Seminars — The research seminar serves several purposes for the graduate student. It gives the master's candidate an opportunity to frame and pursue his thesis research within the context of one of the ongoing research projects in the department. It gives the first-year Ph.D. candidate a chance to participate directly in advanced research prior to making his final commitment concerning a thesis subject, which he normally does during his second year. It gives the advanced graduate student a regular opportunity to present progress reports on his thesis research before a critical audience. Prerequisite: consent of the instructor.

385A. Research Seminar: Geophysical Computations — Discussion of current departmental research and current journal articles on geophysical computational techniques, especially seismology and exploration. Prerequisite: Geophysics 280 or concurrent registration in 280.

2 units, Aut, Win, Spr (Claerbout) by arrangement

385B. Research Seminar: Geomagnetism — Current research in paleomagnetism, geomagnetism, and plate tectonics.

2 units, Aut, Win, Spr (Cox) by arrangement

385C. Research Seminar: Seismology — Current research in seismology, seismicity, and earthquake source mechanisms.

2 units, Aut, Win, Spr (Kovach) by arrangement

385D. Research Seminar: Tectonophysics — Research in areas of current interest in rock mechanics, tectonophysics, and related problems. Content varies from quarter to quarter.

2 units, Aut, Win, Spr (Nur) by arrangement

385E. Research Seminar: Tectonics — Research topics on the origin, major structures, and tectonic processes of the earth's crust.

2 units, Aut, Win, Spr (Thompson) by arrangement

385F. Research Seminar: Environmental Seismology — Current research concerning earthquake hazards and hazard reduction. Topics drawn from research in seismology, geology, and engineering.

2 units, Aut, Win, Spr (Boore) by arrangement

397. Introduction to Contemporary Geophysics — Seminar on current topics of interest in geophysics with particular emphasis on active research programs within the department. Required for all incoming graduate students.

1 unit, Aut (Staff, Kovach in charge) by arrangement


2 units, Win (van Andel) by arrangement

399. Experimental Rock Mechanics and Geophysical Applications — Symmetry and
the applications of law of cause and effect to geophysical phenomena; fracture mechanics and application to faulting; size effect and problem of scaling; experimental studies of hot and cold creep; progress and problems in the study of plastic flow of rocks.

3 units, Aut (Brace) by arrangement

400. Research in Geophysics.
Any quarter (Staff) by arrangement

PETROLEUM ENGINEERING

Emeritus: Frederick G. Tickell (Professor)
Chairman: Frank G. Miller
Professors: Sullivan S. Marsden, Jr., Frank G. Miller, Henry J. Ramey, Jr.
Associate Professor: William E. Brigham
Senior Lecturers: Fred E. Abbott, Herman Dykstra, Thomas D. Mueller, Jacques Naar, Marshall B. Standing

OFFERINGS

The study programs of the Department of Petroleum Engineering are designed to train graduates competent in the engineering technology of mineral fluids and energy production from the earth. The broad scientific base involved in this field qualifies graduates for wide-ranging professional assignments in areas such as:

- Improved Oil Production
- Natural Gas Engineering
- Geothermal Energy Production
- Mineral Fluid Economics
- Water Production and Reclamation
- Pipeline Transportation
- Environmental Engineering
- Mineral Fluid Production Research

Scientific disciplines involved include geology, geophysics, chemistry, mathematics, physics, and computer science. Depth in engineering disciplines is also encouraged. The rapidly evolving energy and material fluid production industries require professionals of unusual versatility interested in wide-ranging technological, sociological and geographical interests. Qualified students are encouraged to take graduate study because typical assignments often lead to responsible assignments in industrial management and research. Graduate research is conducted in specialties such as geothermal engineering, improved oil recovery, water production and reclamation, natural gas engineering & mineral resource management and development, and mathematical simulation of these systems. Undergraduate participation in both research and industrial practice is encouraged and aided. The main objective of this program is to produce mature engineers of unusually broad scientific base qualified to grow in the evolving fields of energy resource production and environmental and social responsibility of technology. Because of the international nature of this field, special opportunities exist for those persons interested in language, culture, and travel. Participation in the Stanford Overseas Centers is encouraged, and summertime employment in the energy industries is required for at least one summer prior to the Baccalaureate. Graduate programs lead to the degrees of Master of Science, Engineer, Engineer (Management Option), and Doctor of Philosophy.

LABORATORY FACILITIES

The Department occupies portions of the Mitchell Earth Sciences Building, and the Lloyd Noble Petroleum Engineering Building, which is devoted exclusively to the Department. The Lloyd Noble Building contains five laboratories for instruction and research and high temperature fluid flow and geothermal energy research, a classroom, a seminar and library room, a drafting room, a computing room, and office study space for graduate students. Faculty and departmental offices are in the Mitchell Earth Sciences Building. Laboratories and additional student study rooms and research laboratories are also located in the Mitchell Building. Research in natural gas engineering, improved oil recovery, and water reclamation are conducted in both buildings.

PROGRAMS OF STUDY

UNDERGRADUATE

The four-year program leading to the B.S. degree provides a foundation for a career in many facets of the energy industry. The Petroleum Engineering curriculum is fully accredited by the Engineers Council for Professional Development (ECPD). The Department undergoes accreditation inspec-
tions with the School of Engineering, and further information may be found in the School of Engineering portion of this bulletin. Basic sciences and engineering are stressed to provide depth sufficient for the wide spectrum of careers possible in energy and environmental engineering. Breadth is provided through courses in social sciences and humanities. Typical plans of study emphasizing specific career objectives such as pre-law, industrial assignments, or pre-graduate school are available in the Petroleum Engineering departmental office.

**COURSE PROGRAM FOR UNDERGRADUATES**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>6</td>
</tr>
<tr>
<td>Social science</td>
<td>9</td>
</tr>
<tr>
<td>Humanities</td>
<td>9</td>
</tr>
<tr>
<td>Mathematics</td>
<td>21</td>
</tr>
<tr>
<td>Science</td>
<td>36</td>
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<tr>
<td>Engineering breadth</td>
<td>26</td>
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<tr>
<td>Engineering major</td>
<td>33</td>
</tr>
<tr>
<td>Technical electives</td>
<td>6</td>
</tr>
<tr>
<td>Free electives</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>180</strong></td>
</tr>
</tbody>
</table>

**GRADUATE DEGREES**

The energy industries are increasingly interested in engaging petroleum engineers having advanced training. A balanced Master's degree curriculum covering both professional engineering and research requires a minimum of one academic year beyond the baccalaureate. The demand for people with this background far exceeds the supply. As a result, there are many attractive employment opportunities.

The degree of Engineer requires a comprehensive two-year program of graduate study. This degree emphasizes professional practice rather than research.

The degree of Engineer (Management Option) requires two years of graduate study, combining engineering and business administration. This program is conducted in cooperation with the Graduate School of Business.

The degree of Doctor of Philosophy is awarded primarily on the basis of accomplishments in research. A minimum of three years of graduate work beyond the Master's degree is required for the degree.

**MASTER OF SCIENCE**

The objective is to prepare the student 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 and no more than 9 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 or her 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.

Usual research subjects include reservoir engineering, transient well-test analysis, flow of non-Newtonian fluids, geothermal energy, natural gas engineering and energy industry management, pipeline transportation, and certain groundwater hydrology and environmental problems.

**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>Pet.E. 270A. Oil Reservoir Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pet.E. 270B. Oil Reservoir Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pet.E. 270C. Oil Reservoir Engineering</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pet.E. 270D. Applications of Computers in Oil Reservoir Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pet.E. 274. Introduction to Research Methods</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Electives†</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>45</strong></td>
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</tr>
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</table>


† Electives are to be selected with the approval of the student's advisers.
The above course listing is typical, but other specific course listings are available in the department for students interested in concentrating on geothermal energy and environmental engineering, hydrology, oil transportation or improved oil recovery.

**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 including credit for research (Pet.E. 360). No more than 10 of the 90 required units may be applied to overcoming deficiencies in undergraduate training. At least 30 units in engineering and closely allied fields must be taken in advanced work, that is, work beyond the Master's degree requirements and in addition to research (Pet.E. 360). These may be taken from the list below for the Ph.D. degree or may be other approved courses. He or she must maintain a B average in courses given by the School of Earth Sciences. He or she must prepare a thesis representing 15 units of research, meeting the approval of the supervising instructor and the University Committee on Graduate Studies.

**Engineer (Management Option)**

The objective is to round out the student's training in professional engineering and to provide him with a background in business administration.

A minimum of two years (six quarters) of graduate study is required, as a registered student at Stanford. The candidate must complete 90 units of course work, including credit for research (Pet.E. 360), and including all the course requirements of the Department's Master's degree except the research. If the candidate has received unit credit for such research, this credit ordinarily would be transferable to the Engineer degree. No more than 10 of the required 90 units may be applied to overcoming deficiencies in undergraduate training. The candidate is required to take a minimum of 36 units in Industrial Engineering and the Graduate School of Business.

These may be selected from the following:

- **Bus. 200–201. Business Economics**
  - I and II
- **Bus. 210–211. Management Accounting**
  - I and II
- **Bus. 220–221. Business Finance**
  - I and II
  - I and II
  - 3 ea.
- **Bus. 303. Economic Forecasting**
  - 4
- **Bus. 321. Investment Management**
  - 4
- **Bus. 366. Management Information Systems**
  - 4
- **Ind. Eng. 229. Engineering Economy**
  - 3
- **Ind. Eng. 230. Capital Budgeting**
  - 3
  - 4

Additional units needed to make up the required 90 may be electives selected with the consent of the student's adviser. He or she must maintain a C average in Graduate School of Business courses. In all other courses he or she must maintain a B average. He or she must prepare a thesis on a combined engineering and economic study representing 15 units of research. It is to have the approval of the supervising instructor and the University Committee on Graduate Studies.

**Note:** Engineers' theses require only one faculty signature; in practice they are generally read by two faculty members.

**Doctor of Philosophy**

The degree of Doctor of Philosophy is conferred upon evidence of high attainment involving the 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 two of these years, ordinarily the last, should be spent as a registered student at Stanford. He or she is expected ordinarily to take at least 90 units of course work including credit for research (Pet.E. 360) beyond the 45 units required for the Master's degree. Approximately 65 units are generally required, exclusive of research units. The 65 units in question should represent graduate courses in petroleum engineering offered at Stanford, plus courses picked from the following list, and other courses approved by the Department.

**Math and Applied Math**

- **Math. 115. Fundamental Concepts of Analysis**
  - 3
- **Math. 131. Partial Differential Equations**
  - 3
- **Math. 132. Partial Differential Equations**
  - 3
The Ph.D. program is normally a 4-year program. Except in unusual circumstances, the first year is consumed in fulfilling the requirements for the M.S. degree. During the second and third years, the student acquires the foregoing minimum of 65 units of credit in courses approved by the Departmental faculty. During the second and third years, the student also acquires 25 units of research. He or she begins the research work by making a literature survey and by formalizing research objectives. The fourth year the student is enrolled as a Terminal Graduate Registrant (TGR) and spends full time completing his or her research and writing his or her thesis, getting it into final form before the end of the academic year.

The Departmental qualifying examinations usually are taken at the beginning of the second year of graduate study, or at any time mutually agreed upon by the student and the faculty. The qualifying examinations extend over a period of about ten days and consist of a written part and an oral part. The written part consists of three or four two-hour examinations on different subjects. The oral part is a two-hour examination in which the student is questioned by members of the Departmental faculty.

His or her record must indicate outstanding scholarship. He or she must pass the Departmental qualifying examination, fulfill the requirements of the minor department, if a minor is elected, and pass the University oral examination, which is essentially a defense of the dissertation problem. He or she 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 Studies. Candidates for the degree who fail to meet this deadline will be required to reapply for admission to candidacy and retake the Departmental qualifying and University oral examinations. They will be given one additional year in which to submit their dissertations.

103. Survey of the Energy Industries—Arranged to give the students a comprehensive view of organization and operation of energy industries. Exploration; drilling and offshore drilling; development and production methods; transportation and storage; refining and petrochemicals; marketing; geothermal energy.

3 units, Aut, Spr (Abbott) MWF 11

150A. Formation Evaluation — Lectures, problems. Methods for evaluating commer-
cial significance of rock formations penetrated in exploratory drilling. Drilling muds, core analysis, mud logging, electric logging.

3 units, Aut (Brigham) MWF 11

150B. Formation Evaluation — Continuation of 150A: Lectures, problems. Radioactivity, sonic and nuclear magnetism logging; formation evaluation programs.

3 units, Win (Abbott) T 9–11 and Th 10

151A. Underground Earth Fluids — Lectures, problems. Chemical, physical, and thermodynamic properties of underground earth fluids. Gas laws, behavior of liquids, phase equilibria, viscosities of hydrocarbons; properties of subsurface waters and steam. Prerequisite: 103.

3 units, Aut (Miller) T 9, Th 9 and 10


3 units, Win (Miller) MWF 10

151C. Drilling Fluids—Lecture, laboratory. Colloidal behavior and rheology of drilling fluids.

3 units, Spr (Marsden) MW 1:15; lab. MW 2:15–5:05

151D. Reservoir Fluids Laboratory—Physical properties of petroleum and its products, including distillation with fractionation, gravity, viscosity, surface tension. Prerequisites: 103, and 151A (may be taken concurrently).

3 units, Aut (Marsden) M 2:15; lab. WF 2:15–5:05

151E. Core Analysis Laboratory—Porosity, permeability, capillary pressure, relative permeability, formation resistivity factor, analog models. Prerequisite: 151B (may be taken concurrently).

3 units, Win (Marsden) T 1:15; lab. TTh 2:15–5:05

152. Development and Production Technology — Lectures, demonstrations, field trips. Field equipment for drilling, production. Prerequisite: 103.

2 units, Spr (Miller) T 9–11, alternate years, given 1974–75 and 1976–77


1 unit, any quarter (Staff) by arrangement

170. Elements of Reservoir Engineering—Lectures, problems. Description and classification of natural underground oil and gas reservoirs. Engineering calculations of fluid contents of reservoirs and predicted recoveries of geothermal, oil, water, and natural gas reservoirs. Prerequisite: 151B.

3 units, Spr (Miller) MWF 9


3 units, Aut (Ramey) MWF 10


Any quarter (Staff) by arrangement

267. Engineering Valuation and Appraisal of Oil and Gas Properties—Seminar, problems. Methods in appraising oil lands; estimation of productive capacity, reserves; operating costs, depreciation of materials, salvage, value of future profits, tax returns, purchase strategy. Prerequisite: consent of instructor.

3 units, Win (Miller) S 9–12, alternate years, given 1975–76


1 unit, any quarter (Staff) by arrangement

269. Geothermal Engineering—Steam well deliverability measurement, forecasting, and steam reserves determination and forecasting. Vapor and liquid-dominated systems. Field problems and examples.

3 units, Win (Ramey) MWF 10


3 units, Aut (Miller) MWF 9

270B. Advanced Reservoir Engineering — Lectures and problems. Material balance

3 units, Win (Miller) MWF 9

270C. Advanced Reservoir Engineering — Continuation of 270B. Lectures and problems.

2 units, Spr (Miller) Th 9–11

270D. Applications of Computers in Fluid Reservoir Engineering—Lectures, seminar. Advanced group study of reservoir engineering. Applications of electronic computing machinery to reservoir problems. Prerequisite: 270B.

3 units, Spr (Staff) by arrangement

272. Advanced Gas Engineering—Lectures, problems. Transient flow of gas in reservoirs, testing of gas wells, advanced water well testing. Gas reservoir material balances, water-drive (recharge) gas reservoirs, production matching and forecasting, reserve estimation, gas storage reservoirs. Prerequisite: 172, 275, or consent of instructor.

3 units, Spr (Ramey) MWF 10


Any quarter (Staff) by arrangement


3 units, Aut (Marsden) MWF 11


3 units, Win (Dykstra) W 7–10

280A. Modern Fluid Injection — Lectures, problems. Chromatographic transport of mass and heat through porous media. Specific applications to immiscible and miscible displacement of oil. Includes water flooding, gas injection, miscible displacement, thermal oil recovery methods, and other modern fluid injection methods. Prerequisite: 270A (may be taken concurrently).

3 units, Aut (Brigham) MWF 8

280B. Modern Fluid Injection — Continuation of 280A.

3 units, Win (Brigham) MWF 11


3 units, Spr (Brigham) MWF 8


3 units, Spr (Marsden) MWF 11

284. Non-Newtonian Fluids in Production Engineering—Properties and applications of non-Newtonian fluids in drilling, completions, cementing, fracturing, production improvement of wells, transportation, and secondary recovery of energy fluids.

3 units, Win (Marsden) MWF 9

360. Advanced Work in Petroleum Engineering—Graduate level work in either experimental, computational or theoretical research. Advanced technical report writing.

Any quarter (Brigham, Marsden, Miller, Ramey) by arrangement
Emeriti: A. John Bartky, Oliver E. Byrd, W. H. Cowley, Paul R. Hanna, Ernest R. Hilgard, Paul DeH. Hurd, Maud M. James, Maud L. Knapp, James D. MacConnell, Quinn McNemar, Daniel M. Mendelowitz, Wilbur Schramm, Pauline S. Sears, Robert R. Sears, Fannie R. Shaftel, Lawrence G. Thomas, H. Donald Winbigler (Professors); Margaret Barr, Luell Guthrie, Ernest P. Hunt, Marian S. Ruch (Associate Professors)

Visiting Professor Emeritus: Bruno Bettelheim

Dean: Arthur P. Coladarci

Associate Deans: William J. Iverson (Academic Affairs), Richard C. Still (Business Affairs)


Associate Professors: Paul Brest (By courtesy), Martin Carnoy, Elizabeth G. Cohen, Michael W. Kirst, Henry M. Levin, Miriam B. Lidster (By courtesy), Denis C. Phillips, Wesley K. Ruff, Helen W. Schrader (By courtesy), Richard E. Snow, Pamela L. Strathairn (By courtesy), Carl E. Thorsen, Decker F. Walker, Hans N. Weiler


Lecturer: Guy H. Browning

Research Associates: Richard E. Clark, Terry Deal

The School of Education is responsible for the preparation of scholars investigating educational processes, and of teachers, supervisors, guidance workers, administrators, and other educational specialists. Three degrees with specialization in education are granted by the University: Master of Arts, Doctor of Education, and Doctor of Philosophy. The Master of Arts in Teaching degree is offered jointly with several academic departments. Various teaching and educational service credentials are issued by state departments of education upon certification of the School that properly accredited work has been completed by the student. The University recommends to the California Commission for Teacher Preparation and Licensing that credentials be granted.

Acceptance of Work Done Elsewhere — Students transferring with advanced or graduate standing from other universities may have some equivalent training accepted in lieu of the courses required at this University for degree programs. The University offers no correspondence or extension courses.

Summer Session

The full Summer Session 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 full program of study (15 units) for eight weeks may earn a quarter of residence toward degree and credential programs. The number of units for which a student may register in the Summer Session may not exceed 16, unless part of the registration is for thesis or dissertation.

The Summer Session Bulletin, issued each year in February, will contain more definite information about summer offerings.

Programs of Study

Information about programs of study is reported below in relation to degrees and credentials. Many students entering the School of Education are candidates for both degrees and credentials. In that case, both applicable sections should be consulted. Below are listed degrees offered by the School of Education with which credentials may be associated. (There is no necessary association between degrees and credentials. Requirements for degrees and credentials differ
even when the candidate is preparing for both at the same time.)

GRADUATE DEGREES

Students who wish to be candidates for advanced degrees are urged to write to the Admissions Office, School of Education, for full information and application forms. The sections below summarize the requirements for the degrees but do not describe the programs in detail. The details are supplied upon request by the School of Education.

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

The Graduate Record Examination (Aptitude Test) is required for all graduate admissions.

Students working toward graduate degrees should follow the suggestions outlined under each degree. Students applying for the Master's 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 a Master's or Doctor's degree should consult also the University's general requirements described in the section "Degrees" in this bulletin.

Program Areas 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 objectives of the student. The course of study for the various program areas is somewhat flexible, allowing a student, in consultation with the adviser, to emphasize certain aspects of the work, depending on particular interests and professional objectives. Each candidate will have a faculty adviser from his or her program area to assist in planning a program of study and in projecting research plans for the dissertation. Other members of the faculty of the School of Education may also be consulted with regard to the particular area chosen by the student.

The program areas for the Doctor of Education and Doctor of Philosophy degrees are listed below.

Administration and Policy Analysis

Curriculum and Teacher Education, with concentrations in any of the following fields:
- Art
- Design and Evaluation of Educational Programs (General Curriculum, Evaluation, Elementary Education, Secondary Education)
- Foreign Languages (Second Language Learning and Bilingual Education)
- Language Arts or English
- Mathematics
- Music
- Physical Education
- Science
- Social Studies
- Teacher Education

International Development Education

Mathematical Methods in Educational Research

Political and Economic Studies

Psychological Studies:
- Child Development and Early Education
- Counseling Psychology
- Educational Psychology

Socio-Humanistic Studies:
- History of Education
- Philosophy of Education
- Sociological and Anthropological Studies

Other possible program areas may be arranged for applicants with the approval of the Committee for Academic Affairs.

Application for formal admission to doctoral candidacy should be made no later than the sixth quarter of graduate study at Stanford (see School of Education Manual on Advanced Graduate Degrees for procedures).

MASTER OF ARTS

The degree of Master of Arts in Education is offered in the following fields:

Administration and Policy Analysis

Cultural Pluralism in Education

Curriculum and Teacher Education (with
specializations in the following areas: Art, Language Arts or English, Mathematics, Foreign Languages [Second Language Learning and Bilingual Education], Physical Education, Science, Social Studies, Elementary Education, General Curriculum)

Early Childhood Education
Physical Education with Specialization in Dance
Secondary Teacher Education Program *
Social Foundations of Education

Other program areas may be arranged for individual advanced graduate applicants when approved by the Committee For Academic Affairs. Ordinarily candidates for the Master's Degree in the Curriculum and Teacher Education Area will have completed student teaching or other practicum, or have one year or more of teaching experience before entering the M.A. program.

More detailed information about the Master of Arts programs and requirements in specific areas may be obtained from the Master of Arts Secretary, School of Education.

A minimum of 36 quarter units of graduate work is required. At least 30 units must be completed at Stanford. A minimum of 12 of these must be taken for a letter grade. Eighteen units of the program must be in the School of Education. In no case will the degree be granted unless the student has been registered at Stanford for three quarters after the conferring of the Bachelor's degree. One full-time quarter (a minimum of 12 units during the academic year or 15 units for Summer Quarter) is required. The remainder of the work may be carried on a part-time basis. However, University residence requirements must be met. The minimum residence requirement for the Master's degree is “registration at Stanford as a graduate during at least three quarters and the payment of the equivalent of at least three full quarters' tuition at Stanford as a graduate.”

The degree of Master of Arts (A.M.) is conferred by the University, on recommendation of the faculty of the School of Education and the University Committee on Graduate Studies. No thesis is required.

Information on program requirements and the order of procedure for applying for the Master's degree should be obtained from the Master of Arts Secretary, School of Education, during registration in the first quarter of residence.

MASTER OF ARTS IN TEACHING†

The degree of Master of Arts in Teaching is offered jointly by the following academic departments and the School of Education: Art, Biology, Chemistry, Classics, Drama, English, French and Italian, German, History, Humanities, Latin American Studies, Linguistics, Mathematics, Physical Sciences, Physics, Political Science, Slavic Languages and Literature, Sociology, Spanish and Portuguese. In addition to these fields, it is possible for candidates to work out special programs in areas such as the social sciences. General requirements for the degree include these:

1. The applicant must have completed a Bachelor’s degree with an acceptable grade point average to qualify him or her for graduate study. The department of the major teaching field determines the adequacy of this preparation. The School of Education determines the adequacy of the candidate’s background in professional education. The candidate must be admitted to the program both by the department of the teaching major and the School of Education.

2. The candidate must have a teaching credential and/or relevant teaching experience.

3. Three quarters of full-time residence (or equivalent) are a requirement for this degree. This may be satisfied by the candidate’s attending a series of summer quarters.

4. A minimum of 45 quarter units of graduate study is required. At least 36 of these units must be completed at Stanford.

† The degree of Master of Arts in Teaching is ordinarily reserved for experienced teachers or for individuals who have previously completed a program of teacher preparation. Candidates seeking their initial preparation for teaching by way of a teaching internship may prepare for the degree of Master of Arts in Education as well as for a credential. See “Teaching Credential” for pertinent information.
5. A minimum of 25 units of the courses taken for the MAT must be in the teaching field in which the degree is to be given.

6. At least 12 units of the MAT requirements shall consist of graduate courses in the School of Education at Stanford. Certain courses cross-listed in two departments may be used to satisfy requirements in either the academic department or the School of Education, but the same courses may not be used to meet requirements in both departments. Requirements for the School of Education consist of courses in the following areas to supplement the candidate's preparation:
   a) Methods in the candidate's teaching field.
   b) A course in curriculum.
   c) Recent work in Psychological or Social Foundations is required. If both have been completed elsewhere, other work in the foundation fields (History, Philosophy, Comparative Education, etc.) must be selected in consultation with the adviser in the School of Education.

7. Requirements in the major teaching field are determined by the major 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.

8. The candidate must achieve at least a B average in approved Stanford courses in the teaching subject and in professional education or grades in these courses equivalent to those required for the academic department's Master of Arts degree.

9. Approved general background courses outside of the teaching field and professional education may be used to satisfy some of the unit requirements for the degree.

10. Specific course requirements in both the teaching field and professional education will be determined in part by the candidate's previous program of studies.

**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 Studies.

**Residence** — Nine quarters of graduate study (a minimum of 108 units, including relevant and acceptable graduate work taken elsewhere up to a maximum of 36 quarter units) beyond the baccalaureate degree are required for the doctorate, of which at least 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 normally will be required during the course of work to register at Stanford for a minimum of two academic years (six quarters). A minimum of two of these quarters must be in consecutive full-time residence. All requirements for the degree must be completed within five years of the establishment of Ed.D. candidacy. Graduate course work beyond the Master's degree taken seven or more years ago will not ordinarily be included in the doctoral program.

**Organization of Program** — The candidate for the Ed.D. degree will organize a program in conference with advisers relevant to his field of concentration. The program adviser will make recommendations to the area committee in connection with application for candidacy, will aid in planning the program of the individual, and 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 School of Education Doctoral Study Office, Room 24.

**Doctor of Philosophy**

The degree of Doctor of Philosophy (Ph.D.) is conferred by the University on recommendation of the faculty of the School of Education and the University Committee on Graduate Studies. 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 as faculty members of colleges or universities.

**Residence** — Nine quarters of graduate study (a minimum of 108 units, including relevant and acceptable graduate work
taken elsewhere up to a maximum of 36 quarter units) beyond the baccalaureate degree are required for the doctorate, which must include a minor field of study if the candidate does not hold an acceptable Master's degree outside the field of education. Evaluation of Stanford residence is based on tuition payments. Candidates for the degree normally will be required during the course of work to register at Stanford for a minimum of two academic years (six quarters). A minimum of 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 the applicant is admitted to Ph.D. candidacy by the University Committee on Graduate Studies. Time tables showing how the student is expected to progress toward the Ph.D. degree are available for each program area. Graduate course work beyond the Master's degree taken seven or more years ago will not ordinarily be included in the doctoral program.

Organization of Program — Considerable flexibility is allowed in projecting a program for the Ph.D. degree. The candidate will be expected to organize a program of work for the degree in conference with advisers relevant to the field of concentration. All programs require the approval of the School of Education area committee, the Committee for Academic Affairs and the University Committee on Graduate Studies. Complete information may be secured from the School of Education Doctoral Study Office, Room 24.

Foreign Language Requirement — In some specializations in Education foreign language competence is required. Applicants should inquire about this from the specialization chairman.

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 the program, the student who applies for a minor in the School of Education will consult with the Vice-Chairman for Doctoral Programs, Committee for Academic Affairs.

CREDENTIALS FOR PUBLIC SCHOOL SERVICE

The University is authorized to recommend the granting of certain credentials for service in the public schools of California. The course work and teaching experience required for California credentials will in many instances meet the credential requirements of other states.

Note: The State credential structure is being revised. Details about the revision will be available during the year from the Credential Secretary.

Administrative Services Credential

The Stanford School of Education is authorized to recommend the Services Credential with Specialization in Administrative Services. Information about current advisers, programs of study, and application procedures should be obtained from the Credential Secretary in the School of Education on or shortly after registration day in the first quarter of residence.

The Services Credential with specialization in Administrative Services authorizes the holder to serve as superintendent, associate superintendent, deputy superintendent, principal, assistant principal, supervisor, consultant, coordinator, or in an equivalent or intermediate level administration position.

Teaching Credentials*

The Stanford School of Education is authorized to recommend the California Single Subject Teaching Credential for those students who complete the Secondary Teacher Education Program.

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

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.

Secondary Teacher Education Program (Internship)

The Stanford Secondary Teacher Education Program is a twelve-month, fifth-year program which leads to a California Single Subject Teaching Credential and the Master

* Stanford does not offer training for a teaching credential at the elementary level at this time.
of Arts degree in Education. It begins in June with a summer quarter of intensive preparation in the process of teaching and experiences in summer programs in nearby schools. During the academic year, students take courses in their academic fields and in professional education; they also teach part time in local schools.

1. Eligibility. Graduates in the humanities and sciences from colleges and universities of recognized standing are eligible to be considered as candidates for admission to the Secondary Teacher Education Program, if they have maintained at least a B— academic average in undergraduate and graduate courses. Applicants must have an acceptable teaching major and little or NO course work in professional education or experience in supervised teaching. Persons who have been out of college for some time but now seek to prepare to teach, as well as recent graduates, are encouraged to apply. The number of candidates who can be admitted to prepare in a particular subject area is limited by the facilities of the University and by the number of school assignments available in that subject field.

2. Closing date for filing applications. Completed applications (available from the Secondary Teacher Education Office, School of Education) should be filed no later than the first of March. However, candidates who wish to receive consideration for scholarship awards must have their applications filed by January 15.

3. The Graduate Record Examination (Aptitude Test) is required for admission.

4. Notice of admission. Candidates will be notified of their acceptance into the program no later than April 1, 1975. Candidates must reply within two weeks, or no later than April 15.

5. Teaching internship. Each intern must successfully complete a year of teaching at a local cooperating secondary school under the supervision of a Stanford teacher-supervisor and a resident supervising teacher. The intern normally spends a half day in school, including teaching two classes. Some interns receive a small salary, but many candidates complete the requirement of the program through holding non-salaried student teaching positions.

Every effort is made to secure placement for an intern that reflects his preferences and that provides an income. However, no guarantee is made that a salaried internship position can be provided.

6. Requirements. To complete the program in secondary school teaching, the candidate must satisfy the following requirements.

a) A four-year college course and a Bachelor’s degree.

b) A teaching major consisting of a minimum of 36 quarter units (24 semester units) of upper division or graduate courses. Requirements for specific majors may be obtained from the Credential Secretary of the School of Education. Stanford offers the credential in the following major fields only: Art, Biological Sciences, English, Mathematics, a Modern Language, Music, Physical Education, Physical Sciences, Social Sciences.

c) Interns will be responsible for a program, over a four-quarter residence at Stanford, which includes approximately one third of the work in academic courses, one third of the work in professional courses in education, and one third in practical teaching experiences. A minimum of 45 quarter units of graduate study is required. At least 36 of these units must be completed at Stanford.

**How the Program Is Organized**

Summer Quarter—Full-time residence at Stanford University. Courses in the teaching major and in professional education; foundations of education, curriculum and instruction in the teaching major and secondary education.

Academic Year — Part-time teaching responsibilities. Additional course work in the academic major; course work in education to include additional work in the foundations of education, curriculum and instruction, and secondary education; teaching internship.

In light of continuing program development these requirements are subject to revision.
COURSES IN OTHER DIVISIONS OF THE UNIVERSITY

Teachers, administrators, and specialists in other areas of education are expected to have a substantial knowledge of a variety of academic fields outside the areas encompassed by professional education. Students are therefore urged to consider the courses offered in other divisions of the University in planning their programs.

COURSES IN EDUCATION

The School of Education is primarily a professional graduate school. However, upper division undergraduates may enroll in courses numbered 100–299 if given special permission by the instructor or if the course description specifically permits upper division undergraduate enrollment.

Course descriptions are arranged by professional program areas:

- Administration and Policy Analysis
- Curriculum and Teacher Education
- International Development Education (SIDEC)
- Mathematical Methods in Educational Research
- Political and Economic Studies in Education
- Psychological Studies in Education
- Socio-Humanistic Studies in Education
- Anthropology
- Cultural Pluralism
- History
- Philosophy
- Sociology
- Special Courses, Independent Study, Directed Reading, Practica, Research, Dissertation

ADMINISTRATION AND POLICY ANALYSIS

Basic and advanced courses will be offered in 1974–75 in Administration and Organization of Elementary and Secondary Schools. These courses will meet the requirements for administrative credentials in California. New credential policies are now being formulated by the California Commission for Teacher Preparation and Licensing.

110. Introduction to Models in Social Science. (See Socio-Humanistic Studies in Education.)

120. Organizational Decision Making. (See Socio-Humanistic Studies in Education.)


218. Computer Models of Social Behavior. (See Socio-Humanistic Studies in Education.)

220A, B, C. The Social Sciences and Educational Analysis—Addresses itself to the relationships among economics, political science, and sociology and their applications to education in the United States. While the sequence is required of students in the program in Administration and Policy Analysis, the courses are open to all students. Although each quarter focuses on the contribution of a particular social science, an attempt is made to integrate the subjects by stressing their interrelationships. The courses are taught by appropriate specialists from each area with some team teaching. The syllabus relies heavily upon reading assignments in conjunction with case studies. For scheduling information see specific course descriptions for 220A, 220B, and 220C.

220A. The Social Sciences and Educational Analysis: Introduction to the Economics of Education—An overview of the relationship between education and economic analysis. Specific attention is devoted to investment and consumption theories of education as well as the financing of education. Particular topics include the effects of education on economic growth and the distribution of income as well as taxation for educational purposes. Students who lack training in elementary economics will be required to enroll in a parallel course in economic analysis for one additional unit of credit.

4 units, Aut (Levin) MW 11:00–12:30 and by arrangement

220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education—An overview of the relationship between political analysis and policy formulation in education. Specific focus is given to alternative models of the political process, the nature of interest groups, political strategies, community power and the external environment of organizations, and the implementation of policy. Particular applications
to educational settings and problems are emphasized.

4 units, Win (Kirst) MW 11:00–12:30
and by arrangement

220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education — (Same as Sociology 340.) An analysis of the links between education and the stratification system in the United States. Topics include: structure of class systems, theories of the origin of class systems, social mobility and education, barriers to educational and social opportunity with a special focus on race and sex, and the recent debates over the meaning and existence of equality of educational opportunity.

4 units, Spr (Baldridge) MW 9–11

221A,B,C. Administration and Organization of Educational Institutions in Context — An examination of the context within which educational institutions function, the issues they face and how they are organized, governed and administered. One of the three required three-term sequences for all programs in Administration and Policy Analysis open to other students in Stanford University. For scheduling information see specific course descriptions for 221A, 221B, and 221C.

221A. Administration and Organization of Educational Institutions in Context: American Educational Institutions—An examination of the context in which educational institutions function, the salient and emerging issues which educational institutions face and the likely direction of resolution of those issues. A lecture-discussion course, introducing students to different faculty members and requiring students to write intelligently and thoughtfully about each major topic considered.

4 units, Aut (Hatton) MW 3:15–5:05

221B. Administration and Organization of Educational Institutions in Context: Administration and Organization of Post-Secondary Institutions—An analysis of the nature of post-secondary educational institutions, how they are administered and governed and tactics and strategies available in the performance of administrative roles.

4 units, Win (Mayhew) MW 1:15–3:05

221C. Administration and Organization of Educational Institutions in Context: Administration and Organization of Public and Private Schools—An analysis of the nature of local educational agencies, schools and districts, how they are administered and controlled, how leadership is exerted and the tactics and strategies available to administrators.

4 units, Spr (Weiner) MW 1:15–3:05

222A,B,C. Decision Analysis in Education — A three-quarter sequence in the application of quantitative reasoning and decision making in education. For scheduling information see specific course descriptions for 222A, 222B, and 222C.

222A. Decision Analysis in Education: Decision Analysis I—(Same as Statistics 150.) An introduction to decision-making in the face of uncertainty using statistical decision theory. This course is especially designed as an introduction to probability, utilities and risks, descriptive and inferential statistics for non-statistics majors. Emphasis will be placed on the evaluation of alternative courses of action facing the industrialist, administrator, scientist, and layman.

5 units, Aut (Hatton, Sitgreaves) MTWThF 9

222B. Decision Analysis in Education: Decision Analysis II—Considers the problems of optimization and the design and evaluation of decision experience. Marginal analysis, cost-benefit accounting, constrained maximization, mathematical modeling, program evaluation. An introduction to linear models for large-scale data analysis is provided. Particular attention is paid to the sensitivity of implications to model assumptions.

4 units, Win (Levin) MW 8:30–10:00
and by arrangement

222C. Decision Analysis in Education: Decision Analysis III—Deals with the problems of measurement, system modeling, and simulation from the point of view of the educational administrator or policy analyst. The focus is on the formation of administrative inference from numbers and the assessment of expert testimony in quantitative form. The course includes an introduction to computers as aids to educational decision making and to the formation and use of first approximations.

4 units, Spr (March, Weiner) MW 8:30–10:00
and by arrangement

for those preparing for professional roles in communities of color; a primary focus is to address those concerns of particular relevance to the promotion of change within educational institutions to accommodate the diversity presented by persons of color.

4 units, Win (Hatton) Th 1:15-3:05 and by arrangement

227. Schools and Community—An examination of emerging issues in local school reform surrounding the effect of neighborhood on the style and quality of public education. Particular attention will be given to issues of community control and citizen participation in educational decision-making. Alternative proposals for community schools, community school districts, and participation approaches will be presented for discussion and analysis.

4 units, Spr (Hatton) MW 7:00-8:30 p.m. and by arrangement

228. Literature and Research in Higher Education — A review of relevant literature concerning higher education and an in-depth consideration of selected research studies of various elements of higher education. Both historic examples, such as the Flexner Report on Medical Education, and recent reports, such as those dealing with student unrest, will be considered. No prior exposure to the study of higher education is required.

3 units, Aut (Mayhew) M 1:15-4:05

249. College Curriculum and Instruction in Higher Education. (See Curriculum and Teacher Education.)

300. Education and Law. (See Political and Economic Studies in Education.)

313A,B. Economics of Education. (See Political and Economic Studies in Education.)

322. Establishing Higher Educational Policy—An analysis of recent efforts to establish educational policy such as the Carnegie Commission on Higher Education, with special emphasis on implications for institutions and systems of institutions.

3 units, Aut (Mayhew) T 1:15-4:05

323A. Education and Public Policy: Federal Education Policy and Administration — The formulation and administration of federal education policy. Includes federal/state delivery systems and policy evaluation as well as the key actors and coalitions.

4 units, Aut (Kirst) MW 11:00-12:30 and by arrangement


4 units, Aut (Kirst) T 3:15-6:05 and by arrangement

323C. Education and Public Policy: The Governance of Elementary/Secondary Schools — Political behavior of key actors at the local level, including the overall urban political setting. Stresses impact of teacher organizations and research approaches.

4 units, Spr (Weiner) TTh 2:15 and by arrangement

325A. Planning in Educational Administration—A review of current planning practices at the elementary and secondary school level; an analysis of principles, logistics, and problems related to the development and coordination of educational programs; emphasis upon the conceptualization of an educational resources management system.

4 units, Spr (Hatton) MW 4:15-6:05

326A. Topics in Financing Education — Addresses particular applications of economics and political science to issues in financing education. While the topics will differ somewhat from year to year, analyses will be focused on taxation for education, intergovernmental aid, educational vouchers, equity in educational expenditures, and the legal challenges to existing methods of financing education.

4 units, Aut (Levin) M 3:15-6:05 and by arrangement

326B. Seminar in Financing Education — Applications of the economic and political concepts for state and federal school finance reform. Students will work on specific problems in various states and the federal government.

3 units, Win, Spr (Levin, Kirst) M 3:15-6:05

327. Survey Design and Analysis. (See Socio-Humanistic Studies in Education.)

328. Change and Innovation Processes in Complex Organizations — (Same as Sociology 364.) A study of organizational change which focuses both on deliberate and non-deliberate types of change. Particular attention will be paid to administrative strategies
for promoting desired changes in professional organizations, such as schools, universities, welfare agencies. Topics about change will include structural design, human relations strategies, evaluation processes, long-range strategic planning, political dynamics, etc. Prerequisite: Education 329 (Sociology 363) or Sociology 105a or 105b.

4 units, Spr (Baldridge) M 2:5–5:05 and by arrangement

329. Fundamentals of Organization Theory—(Same as Sociology 363.) Deals with sociological theories about complex organizations and bureaucracies. The course is intended as a basic requisite for all advanced courses in organization theory taught in the School of Education and the Department of Sociology and is highly recommended for students intending to work in that area. Topics include: descriptive and normative classical theories of organization; decision-making and choice processes; professionals in organizational settings; organizations and conflict; environmental pressures on organizations; radical critiques of the role of bureaucracies in the larger society; etc.

5 units, Win (Baldridge) MV 9–11 and by arrangement

330. Policy Research in the Social Sciences or Policy Analysis in Education. (See Sociohumanistic Studies in Education.)

331. Financing Higher Education — The evolving nature of higher educational support and financial decision making in the colleges and universities. Specific attention is devoted to the changing role of the state and federal governments in financing higher education and to recent proposals to channel government support of colleges and universities through the use of scholarships, loans and vouchers rather than through the more traditional forms of direct aid to the institutions. The financial status of the independent institutions of higher education is also assessed. The course is organized as a seminar with a limit of 15 students. Participants are expected to have completed either Education 326A or 326B, and permission of the instructor will be required.

4 units, Spr (Levin) W 3:15–3:05 and by arrangement

333. Leadership in Organizations — (Same as Sociology 262 and Political Science 102.) The problems of leadership in complex organizations, such as universities, schools, hospitals, business firms, armies, and public bureaucracies. Special attention to the role of major executives.

4 units, Spr (March) given 1975–76

363. Evaluation and the Educational Policy Making Process—Examines the role of educational evaluation in the policy making process. For students specializing in administration, policy making analysis, and evaluation. Emphasis on the problem of commissioning evaluations and using their results as distinguished from the problems of conducting evaluations. The nature of information actually used in policy making explored and the political context for evaluation stressed. The roles of various types of information in policy making linked to an identification of appropriate evaluative processes and instruments.

4 units, Aut (Weiner) MW 1:15–3:05

364. Collective Bargaining—Considers collective bargaining both as a national and state level policy issue in education as well as an administrative problem in local organizations, and intended for both Ed.D. and Ph.D. students. Topics include the development and current status of employee bargaining groups in education; the regional and urban-rural patterns of influence of such groups; their impact upon the cost of education; trends in the supply of and demand for various types of educational personnel and the resulting implications for the bargaining process; the varying state legal contexts for bargaining; the nature of the issues subject to bargaining with specific attention to the impact of bargaining on local budgetary processes, affirmative action and community participation.

3 to 4 units, Win (Weiner) MW 1:15–3:05

365. Education Policy Formulation and Administration — Open to students who have completed the first year core and is intended for Ed.D. students who desire further experience in applying concepts from the core courses to administrative problems. The course stresses application of a number of concepts introduced in the core curriculum. Extensive case studies of a variety of educational organizations of differing size, region and current conditions provide the basis for analysis of basic policy commitments. Class work will be devoted to discovery of
relevant data in the case studies and the identification of possible solutions, including a written analysis of each case problem.

4 units, Aut (Weiner) given 1975–76

366. Systems Applications in Education—An overview of systems analysis procedures and their applicability to education. This course is intended for students who are interested in extending their knowledge of quantitative analysis for administrative problems. Students will be introduced to categories of problems faced by educational administrators and the relevant tools from the decision sciences for the resolution of these problems. Emphasis will be on how use of such analytical tools can enhance organizational effectiveness through additional input to the decisions processes of educational organizations.

4 units, Win (Hatton) W 7–10 and by arrangement

368. Case and Field Studies in Educational Administration—A seminar for administrative interns which will not only consider their own internship experiences but other case material as well—all in a context of relevant administrative and organizational theory and research.

4 units. To be arranged

369. Educational Personnel Policies and Practice Analysis—This will cover a range of personnel matters including supervision, management, and negotiations. Especial stress will be placed on interpersonal relations.

4 units. To be arranged

418A,B,C. Advanced Research in Organization Theory I, II, III. (See Socio-Humanistic Studies in Education.)

422A,B. Internship Seminar in Higher Education—A seminar especially designed for all students in the higher education program holding field internships. The seminar will have three different types of activities: sharing experience and reflecting on field activities by interns; reading and theoretical discussions on university administration; visiting discussions and/or lectures by practicing university administrators or researchers on higher education.

4 units, Aut, Win (Baldridge) M 7–10 and by arrangement

424A. Structure and Functioning of Institutions of Higher Education—A detailed examination and critique of existing and emerging forms of administration, organization and governance of institutions of higher education. An advanced seminar for second and third year students which will analyze administrative structures of liberal arts colleges, junior colleges, state colleges, universities and multi-institutional organizations. Considerable use will be made of case materials. Although designed for administrative majors, this course should be appropriate for other students interested in understanding how collegiate institutions operate.

3 units, Win (Mayhew) T 1:15–4:05

424B. Technical Problems and Processes in Administration in Higher Education—Detailed examination of such technical concerns as budget preparation and control, management information systems, uses of institutional research and strategies for short and long range planning.

3 units, Spr (Mayhew) M 1:15–4:05

426. Workshop for Dissertation Students in Administration and Policy Analysis—Open to students who have advanced and present proposals for dissertations and who desire to receive assistance in the preparation of dissertations. Students are required to present oral and written reports on their progress and workshop participants will assist one another.

3 to 4 units, Aut (Weiner) M 3:15–5:05 and by arrangement

CURRICULUM AND TEACHER EDUCATION

109A. Cultural Pluralism: Classroom-Curricular Strategies—The primary objective of the course is to examine present educational policy and classroom practices in light of the cultural and social needs of diverse racial and ethnic groups in America. Theoretical concepts from anthropology, sociology, psychology and educational research will form the cognitive content of the course. The students will be encouraged to extract important and meaningful principles and techniques which are useful in the understanding and resolving of everyday classroom problems which revolve around cultural pluralism. A thorough critique of promising classroom strategies will be central to
the course. The course will have maximum benefit for students with little or no teaching experience or contact with minority youngsters in schools. Prerequisite: consent of instructor.

4 units, Aut (Deslonde) TTh 3:15–5:05

109B. Cultural Pluralism: Classroom and Curricular Strategies — This course is designed primarily for those who have had teaching experiences in schools which serve communities of color. The course content will focus on present school and classroom practices addressed to the cultural and social needs of diverse racial and ethnic groups in America. Bilingual education, values education, ethnic studies and teaching strategies for the affective domain will be central to the course content. Theoretical and research constructs from anthropology, sociology, psychology and educational research will be drawn upon for discussion and application to problems of cultural pluralism. Prerequisite: consent of instructor.

4 units, Spr (Deslonde) MW 10–12

140. Evaluation in Education — A survey of evaluation procedures in various components of educational programs and processes. Much of the course will be devoted to case studies. The course is intended for consumers, rather than creators, of evaluation studies. No prerequisites: Enrollment limited.

3 units, Win (Begle) W 3:15–5:05 and by arrangement

146. Practice Teaching in Music in the Elementary School.

1 to 2 units, any quarter (Kuhn)

by arrangement

156. Foundations of Physical Education — Psychological, biological, and sociological bases of physical education, emphasizing basic research from the above disciplines, the body of knowledge of physical education and the development of sound principles from the above sources.

3 units, Aut, Spr (Nixon) MWF 10

159. Evaluation in Physical Education — Theory and principles of evaluation in physical education. Emphasis on test construction, the role of evaluation in physical education curriculum and instruction, and research.

3 units, Win (Nixon) MWF 10

165. Curriculum and Instruction in Elementary School Music — (Same as Music 282.) Methods, techniques of teaching music in elementary school. Examination and evaluation of new curricular trends such as the Kodaly Singing School, the Orff Music for Children, and Suzuki Talent Education.

3 units, Win (Kuhn) by arrangement

177. Physiology of Exercise — Physiological adaptations of the human organism to exercise stress. Limited to those persons who have had or are taking Anatomy.

3 units, Win (Ruff) MW 8–10

184. Literature for Adolescents — Required of credential candidates with a teaching major or minor in English. An opportunity for juniors and seniors to read and discuss ten to fifteen books written for adolescents. Some attention will be given also to the teaching of literature. Open only to experienced teachers and students preparing to teach.

3 units, Aut (Grommon) Th 4:15–6:05

and by arrangement

211B. Classroom Observation — The objectives of this course, which will be taken concurrently with Education 211C, are to provide students with opportunities to observe and discuss classrooms containing substantial numbers of minority students. Attention will be focused on: (1) A variety of commercial and locally (school district) produced curricular materials, e.g., ethnic studies materials, interethnic reading materials, mathematics materials, English-language arts materials, commercial kits, games and simulation, etc.; (2) Special teaching strategies appropriate for certain cultural and ethnic groups in public schools. (In addition, the theoretical and research components of such will be reviewed and studied.); (3) Classroom teachers from nearby districts who have exemplary classroom programs focusing on interethnic problems in the classroom; (4) The classroom dynamics of ethnocity and culture.

1 unit, Win (Deslonde) by arrangement

211C. Classroom Observation — Application of sociological and social-psychological theories and research to teaching, learning, classroom interaction and the organization of the school.

3 units, Win (Cohen) M 4:15–6:05,
W 4:15–5:05
213. Foundations of Aesthetic Education—Analysis of historical and philosophical aspects of art education. Designed to introduce students to the changing functions of art in American education and to the examination of various conceptions of art as they relate to education.

4 units, Aut (Eisner) MW 4:15–6:05

215. Psychological Foundations of Education—(Same as Psychology 145.) Introductory course in application of psychological principles to educational practices. The spring Quarter offering is planned especially for teachers in training. Prerequisite: Psychology 1 or equivalent.

4 units, Aut (Cronbach) TTh 3:15–5:05, Spr (Gage) TTh 4:15–6:05, Sum (Staff) MTWTh 10 and by arrangement

219. Artistic Development of the Child—Designed to introduce students to research in the behavioral sciences having relevance for understanding of the child’s artistic development.

4 units, Win (Eisner) MW 4:15–6:05

239A,B. Observation and Directed Teaching of Study Skills and Developmental Reading in College. (See Psychological Studies in Education.)


1 unit, Sum (Staff), by arrangement

241. Current Issues in Curriculum—Reading and discussion of recent works proposing changes in the aims and programs of elementary and secondary schools. Discussion will focus on methods and grounds for judging the worth of such proposals. Intended for secondary interns and master’s and doctoral students with little or no experience in schools.

3 to 4 units, Aut (Walker) given 1975–76

242. Bicultural Processes in Education—Review and analysis of new research in cognition and motivation with special emphasis on the understanding of the psychological meaning of biculturalism.

3 units, Win (Castañeda) WTh 11–12:30
3 units, Sum (Castañeda) TTh 11–12:30

246A. Instruction Laboratory—Training and practice in specific skills of teaching.

3 to 4 units, Sum (——) by arrangement

246B,C,D. Internship in Teaching—Field experience in local secondary schools. Taken during each quarter of internship. Includes a 1-hour weekly meeting with Stanford tutor supervisors. Prerequisite: 246A.

246B. 2 to 6 units, Aut (Staff) by arrangement
246C. 2 to 6 units, Win (Staff) by arrangement
246D. 2 to 6 units, Spr (Staff) by arrangement

248. Directed Teaching in the Junior College. (Student must provide own transportation.)

3 to 6 units, Aut, Win, Spr (Grommon) by arrangement

249. Curriculum and Instruction in Higher Education—Examines the developmental needs of college students and appropriate curricular and instructional means to meet those needs. Considerable stress placed on social-psychological research relevant to curricular concerns.

3 units, Spr (Mayhew) M 1:15–4:05

261A,B,C. Curriculum and Instruction in Art—Lectures and discussions on foundations of art education and curriculum development.

261A. 3 units, Sum (Staff) MTWTh 3:15
261B. 2 units, Aut (Eisner) T 4:15–6:05
261C. 2 units, Win (Staff) T 4:15–6:05

262A,B,C. Curriculum and Instruction in English—Evaluation of conflicting views of programs of language arts; study of research and recommendations for teaching of composition, critical thinking, semantics, grammar, usage, punctuation, spelling; study of recommendations for teaching of reading and of the various types of literature.

262A. 3 units, Sum (Grommon) MTWTh 3:15
262B. 2 units, Aut (Grommon) T 4:15–6:05
262C. 2 units, Win (Grommon) T 4:15–6:05

263A,B,C. Curriculum and Instruction in Mathematics—Purpose and programs of mathematics in the secondary curriculum; teaching materials, methods.

263A. 3 units, Sum (Staff) MTWTh 2:15–4:05
263B. 2 units, Aut (Staff) T 4:15–6:05
263C. 2 units, Win (Staff) T 4:15–6:05
264A, B, C. Curriculum and Instruction in Modern Languages — Methods, techniques of foreign language teaching, testing. Materials of foreign language teaching.

264A. 3 units, Sum (Politzer) TTh 2:15 and by arrangement
264B. 2 units, Aut (Politzer) T 4:15–6:05
264C. 2 units, Win (Politzer) T 4:15–6:05


265A. 3 units, Sum (Kuhn) MTWTh 10–12
265B. 2 units, Aut (Kuhn) T 4:15–6:05
265C. 2 units, Win (Kuhn) T 4:15–6:05
265D.* 2 units, Spr (Kuhn) T 4:15–6:05

266A, B, C, D. Curriculum and Instruction in Physical Education — Major emphasis on knowledge of the activities basic to school physical education and athletic programs. Also involves teaching techniques, curricular materials, and evaluation. Theoretical and practical training.

266A. 3 units, Sum (Nixon) MTWTh 3:15
266B. 2 units, Aut (Nixon) WF 9
266C. 2 units, Win (Nixon) WF 9
266D.* 2 units, Spr (Nixon) WF 9

267A, B, C. Curriculum and Instruction in Science — Examination of possible objectives of secondary science teaching and related methods: selection and organization of content and instructional materials; laboratory and demonstration techniques; evaluation, tests; curricular changes; ties with other subject areas.

267A. 3 units, Sum (Staff) MTWTh 3:15
267B. 2 units, Aut (Staff) T 4:15–6:05
267C. 2 units, Win (Staff) T 4:15–6:05

268A, B, C. Curriculum and Instruction in Social Studies — Emphasis on the methodology of social studies instruction; review of curriculum trends; survey of teaching materials; opportunities to develop teaching and resource units.

268A. 3 units, Sum (Gross) MTWTh 3:15
268B. 2 units, Aut (Staff) T 4:15–6:05
268C. 2 units, Spr (Gross) M 4:15–6:05

271. Topics in Applied Linguistics — (Same as Linguistics 271.) Topics for 1974–75 include: choice of medium of instruction in multilingual societies, bilingual education, problems of non-standard varieties, and language standardization. May be repeated for credit. Prerequisite: 10 or equivalent.

4 units, Win (Hernandez-Chavez) TTh 11–12:50

277. Human Physical Performance Research — Emphasizes relevant literature and laboratory research experience. Prerequisite: 177 or equivalent. Limited to MA Candidates majoring in Physical Education.

3 units, Aut (Ruff) TTh 8:30–10

282. Linguistics and the Teaching of English — (Same as Linguistics 270.) Linguistic aspects of the problems of teaching English to speakers of other languages, and standard English to speakers of other dialects. Prerequisite: introductory course in linguistics or consent of instructor.

3 units, Spr (Politzer) MWF 10

283. Spanish Linguistics — (Same as Spanish 210.)

3 units

291. Methods of Teaching German — (Same as German Studies 302.)

2 units, Spr (Lohnes) MWF 11

292. Methods of Teaching Spanish — (Same as Spanish 200.)

2 units, Aut (Petersen) TTh 11

295. Language Laboratory Techniques — (Same as Language Laboratory 215.) All aspects of such labs are covered, from administration and equipment selection to operation of recording and playback equipment. Assumes no prior electronics or instrumentation experience.

2 units, Spr (Metcalfe) TTh 1:15

297X. Overview of Reading Instruction for the Public Schools — General survey of elementary school reading instruction, including phonics as an approach to word identification. Introduction to reading in secondary school subjects and to remedial reading. (Limited to Secondary Interns.)

5 units, Win (Staff) MW 7–9

298. Practice Teaching in a Second Lan-
guage or Bilingual Education in the Elementary School.

1 to 2 units, any quarter (Politzer) by arrangement

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

3 units, Spr (Staff) MW 4:15-5:30

314. Seminar in Citizenship Education—A seminar for experienced teachers, administrators, curriculum workers, and other school personnel. Includes a topical consideration of projects and research related to the problems of educating responsible citizens for a free society.

4 units, Spr (Gross) T 3:15-5:05 and by arrangement

317. Introduction to Research on Teaching—Introduction to theory, methodology, and substantive findings of research on teaching and teacher education. Prerequisites: Education 215, Education 250 or equivalent.

2 to 4 units, Aut (Gage) MW 3:15-5:05 alternate years, given 1974-75

335X. Current Practices in Bicultural Education—An examination and research of current teaching methodologies for elementary and secondary bicultural education. Special emphasis on testing, evaluation and curriculum. Research project of current bilingual programs in the Bay Area will be discussed and assigned to participants. Actual bilingual experiences will be shared by professional educators of the Bay Area Bilingual Education League (BABEL).

2 units, Spr (Staff) Th 12-2:05

340. Curriculum Theories and Curriculum Change—An examination of alternative conceptions of curriculum theory with special attention to competing value positions and to the techniques employed in curriculum development. Students will formulate researchable problems in general curriculum.

4 units, Aut (Eisner) MW 9-11

342A,B. Curriculum Construction—A practicum in the design of curriculum materials. Each year an interdisciplinary area is chosen and materials developed for teaching it. The topic and age level change from year to year. All phases of curriculum planning and evaluation are covered. Prerequisite: 340.

3 to 4 units, Win, Spr (Walker, Deslone) MW 1:15-3:05

346X. Teacher Education: An Urban Cross-Cultural Emphasis—A seminar course directed to a review of the literature in three major areas: urban education, teacher education, and multicultural education. Course content and field experiences will be most appropriate for graduate students in teacher education, school administrators interested in the developmental and evaluation aspects of specialized in-service programs.

4 units, Sum (Deslonde) TTh 1:15-3:05

348. Modes of Research in Curriculum and Instruction—An advanced course for doctoral students in Curriculum and Instruction. A critical discussion of the possible aims, methods, and approaches of research in curriculum and instruction and an intensive examination of the types of studies undertaken in a few important sub-areas of the field. Prerequisites: 250B and 340 or equivalents.

3 to 4 units, Spr (Walker) given 1975-76

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

4 units, Sum (Bush) MW 3:15-5:05

354. Planning Educational Evaluations—Intended for doctoral students near the end of course work who expect to play responsible roles in evaluation of instructional programs. Lectures on representative evaluations, criteria of effective evaluation, data collection, etc. Each student develops a detailed plan for an evaluation. Enrollment limited; application for admission required during October. In admitting students, priority will be given to those with training in research method through Education 250B and with an orientation to curriculum problems.

4 units, Win (Cronbach) MWF 10-11:30

356. Seminar in Physical Education Research—Critique of selected recent literature and research.

3 units, Aut (Nixon) M 8-10, W 8-9

357. Seminar in Physical Education Curriculum—Research in physical education curriculum and instruction.

3 units, Win (Nixon) M 8-10, W 8-9

358. Special Assignments, Physical Education—An opportunity for the graduate student to undertake the study of a significant problem in physical education or to engage
in applied or basic research under the direction of the instructor.

1 to 5 units, Aut, Win, Spr (Nixon, Ruff) by arrangement
1 to 5 units, Sum (Nixon) MTWThF 9

359. Seminar in Physical Education (Motor Learning)—Review of research concerning movement behavior, motor skills, motor learning, motor educability, and perceptual-motor acts related to sport, dance, designed exercises, and movement exploration in the physical education curriculum.

3 to 4 units, Sum (Nixon) MTWTh 8

362. Teaching English in Two-Year Colleges—Review of literature about purposes of and programs in community colleges, characteristics of students who attend them, and English programs offered. Major emphasis will be upon methods of teaching English in community colleges and upon visiting English and reading classes.

3 units, Aut (Grommon) T 1:15-3:05 and by arrangement

377. Research Seminar on Human Physical Performance—Recent research in physical education, sports medicine, physiology and related fields concerning man's ability to adapt to various forms of environmental stress while engaging in sports, dance, and designed exercise. Prerequisites: 177 and 277, or equivalent.

3 units, Win (Politzer) Th 4:15-6:05 and by arrangement

380. Curriculum Development in the Visual Arts—This course will be devoted to the application of curriculum theory to the construction of visual and verbal materials designed to increase students' ability to perceive, respond to and create visually expressive form. Students will work individually and in teams to develop curriculum material focused on particular aspects of artistic learning.

3 units, Spr (Eisner) W 7-9 and by arrangement

383. Recent Developments in Foreign Language Education—Basic assumptions, findings of scientific study of language as applied to language teaching methods. Use of audiovisual aids in language class. Programmed instruction in foreign languages.

3 units, Spr (Politzer) T 4:15-6:05 and by arrangement


4 units, Win (Politzer) MW 4:15 and by arrangement

386. Linguistic Theories of Language Acquisition and Language Teaching—Discussion of structuralism, syntactically and semantically based generative grammars and pragmatics as the basis of theories of language acquisition. Theories of language acquisition, developmental psycholinguistics, contrastive analysis and error analysis and their relation to second language teaching. Prerequisite: at least one graduate course in linguistics theory and/or psycholinguistics.

3 units, Win (Politzer) Th 4:15-6:05 and by arrangement

388. Foreign Language Education and Bilingual Education in the Elementary School—Discussion of the rationale, curriculum, methods, and materials of foreign language instruction and of bilingual education in the elementary school. Problems of organization of bilingual curricula and of articulation of foreign language and bilingual curricula with the high school.

4 units, Aut (Politzer) MW 4:15 and by arrangement

390. Recent Developments in Elementary School Mathematics—Purposes and program of mathematics in elementary schools; teaching materials, methods. For experienced teachers, supervisors, administrators only.

2 to 3 units, Spr (Begle) by arrangement alternate years, given 1974-75

391. Recent Developments in Secondary School Mathematics—Purposes and program of mathematics in secondary curriculum; teaching materials, methods. For experienced teachers only.

2 to 3 units, Spr (Begle) by arrangement alternate years, given 1975-76

1 to 3 units, Sum (Staff) T 1:15-3:05 and by arrangement (Limited to NSF Institute participants)
392. Tutorial on Problems in Mathematics Education—Discussion of special problems of current interest in mathematics education. Prerequisite: consent of instructor.
2 to 4 units, Aut (Begle) by arrangement

3 to 4 units, Win (Gross) T 3:15–5:05 and by arrangement

419. Seminar in Research on Teaching—A critical examination of research on teacher behaviors and characteristics considered as either dependent or independent variables. Prerequisite: Education 317.
3 units, Win (Gage), MW 3:15–5:05 alternate years, given 1974–75

444. Seminar in Elementary School Education—Enrollment limited to doctoral candidates in elementary school education and to those in special curriculum fields who plan to work primarily with the elementary school. Major issues and problems of elementary school education analyzed; relevant research literature explored; research problems formulated.
2 to 4 units, Spr (Deslonde) W 3:15–5:05 and by arrangement

459. Seminar on Physical Education Issues—Selected issues and problems in physical education.
3 units, Spr (Nixon) M 8–10; W 8

461A. Seminar in Art Education for Doctoral Students—This seminar provides an opportunity for doctoral students in Art Education to examine and critique specific research studies, reports, and theoretical materials published in the field and to present for group critique ideas and proposals that are being considered for doctoral dissertations.

Students will assume a major responsibility in the selection of the content for the seminar and for the ways in which the content is examined. The seminar is open to doctoral students in the School of Education who have a serious interest in understanding the role of the arts in education. Consent of the instructor is required.
2 to 4 units, Win (Eisner) by arrangement

462A,B,C. Seminar in English Education.
462A. History of English as a School Subject and of the Preparation of Teachers of English.
3 units, Aut (Grommon) W 2:15–5:05
462B. Curricular Developments Related to English in the Schools.
3 units, Win (Grommon) W 2:15–5:05
462C. Research in the Learning and Teaching of English; Programs for the Academic and Professional Education of Prospective and Experienced Teachers of English.
3 units, Spr (Grommon) W 2:15–5:05

463A,B,C. Seminar for Doctoral Students in the Design and Evaluation of Educational Programs—These seminars are intended for doctoral students in the Design and Evaluation of Educational Programs. Each quarter will focus on the problem or theme of special interest to the staff responsible.
2 to 4 units, Aut (Begle and Walker) by arrangement
Win (Bush and Deslonde) by arrangement
Spr (Eisner and ——) by arrangement

482. Seminar in Research Problems in Teaching and Learning of a Second Language.
4 units, Spr (Politzer) MW 4:15 and by arrangement

492. Seminar in Mathematics Education—Discussion of recent research in mathematics curriculum and instruction. For advanced students. Consent of instructor required.
2 to 3 units, Aut, Win, Spr (Begle) by arrangement

496A,B. Seminar in Social Studies Education—A continuing seminar in social studies education for advanced degree candidates. A comprehensive analysis of social studies education for the purpose of identifying searchable problems.
496A. The historical development of social studies education; analysis of the social, curricular, and instructional theories of the
various contemporary schools of thought in the social studies.

1 to 4 units, Win (Gross) W 7-10 p.m.

496B. The identification of researchable problems in the social studies and the development of an appropriate design for conducting the research.
2 to 4 units, Spr (Gross) W 7-10 p.m.
given 1975-76

INTERNATIONAL DEVELOPMENT EDUCATION (SIDEC)

106. Education as Cultural Colonialism—
The course reviews theories of imperialism and colonialism and relates them to the role of formal schooling in Third World countries and in the high income countries themselves. Special emphasis is placed on assessing the traditional view of schooling as contributing to social and personal development. A model of societal transformation based on imperial and colonial relationships is introduced. Case studies of British and French imperialism in Africa, Asia, and Latin America, as well as internal colonialism in the United States and in the classroom are discussed.

3 units, Spr (Carnoy) W 2:15-4:05
and by arrangement

108. Seminar on Education and Politics in Europe—(Same as Political Science 127B.)
The politics of educational innovation in selected countries of Western Europe; education and political socialization and recruitment.

5 units, Aut (Weiler) given 1975-76

161. Introduction to Teaching and Learning in Asia—Designed for students preparing for transcultural living and teaching experiences in Asia. Through a variety of academic and practical experiences the course seeks to develop (1) knowledge of Asian languages, history and culture; (2) understanding of the implications of working or studying in an Asian community; (3) skills which will facilitate effective teaching and/or learning in a transcultural context; and (4) awareness of how one's own attitudes, values and behavior are shaped during the process of growing up in a Western culture.

3 to 7 units, Spr (Herring) Th 7:30-10 p.m.
and by arrangement

206. Problems of Development Education in Southeast Asia—This course is designed as a workshop throughout the year for students in the International Development Education Fellowship Program and, with the consent of the instructor, other interested students.

5 units, Aut (Bock) MTh 9-11 and by arrangement
3 units, Win, Spr, Sum (Bock) M 9-11 and by arrangement

207. Problems of Development Education in Latin America—This course is designed as a workshop throughout the year for students in the International Development Education Fellowship Program and, with the consent of the instructor, other interested students. In the autumn it will deal with the general problem of education in Latin America; in the winter, with educational planning and evaluation models; and in the spring and summer, with a topic of broad common interest to the Fellows in preparation of background material for the annual Fellowship Program Conference.

3 units, Aut, Win, Spr, Sum (Carnoy)
M 12-2 and by arrangement

208A. Personality and Social Structure—
(Same as Sociology 211A.) Lectures and discussion of leading ideas, theories, and research on the relations of personality and social systems, with special emphasis on the ways in which personality modes influence the functioning of institutions. Among the issues reviewed are suicide, juvenile delinquency, recruitment to and performance in school and job, socialization, and political participation. Undergraduates with some background in personality theory or sociological analysis will be accepted. Enrollment limited to sixty-five.

3 to 5 units, Win (Staff) TTh 4:15-6:05
and by arrangement

208B. Personality and Social Structure—
(Same as Sociology 211B.) The course will be a continuation of 208A. Topics reviewed will include political participation, national character, psycho-history, and social change. Students will be encouraged to pursue their own interests, such as success in school being a function of the fit between student personality and the educational institution. Education 208A will be a prerequisite. Students who have taken Education 208 (Sociology 176) in previous years will be admitted.

3 to 5 units, Spr (Staff) by arrangement
209. Problems of Development Education in Africa—The course will focus on three major issues: (1) integrative and disintegrative functions of education; (2) the politics of educational reform; (3) a reappraisal of educational colonialism and neocolonialism.

3 units, Win (Weiler) M 12–2
and by arrangement

212. The Politics of Educational Innovation: Comparative Analysis—This course will focus on innovations designed to enhance “equality of educational opportunity,” and will analyze the political processes involved in the initiation, implementation, or rejection of those innovations. The lectures will present a conceptual framework for the analysis of innovation politics, and a comparative analysis of politics of educational innovation in three countries: (a) Great Britain; (b) West Germany; and (c) the United States. Students are encouraged to pursue individual studies on comparable case material to broaden the empirical basis for the course’s discussion periods.

3 to 5 units, Sum (Weiler) TTh 4:15–6:05

214. Evaluation Methods: Educational Technology in Developing Countries. (Same as Communications 257.)

3 to 5 units, Spr (McAnany, Hornik)
F 1:15–3:05 and by arrangement


3 units, Aut (Weiler) W 12–2 and by arrangement

229B. Research Colloquium in International Development Education—A continuing colloquium for the discussion of research proposals and findings of students and faculty in the area of International Development Education. Emphasis is placed on common research preparation experience, and upon basic and remedial methodological training.

3 units, Win (Textor) W 12–2 and by arrangement

229C. Research Colloquium in International Development Education—Continuation of 229B.

3 units, Spr (Textor) W 12–2 and by arrangement

254. Anthropological Research Methods with Implications for Education—(Same as Anthropology 286.) This course is intended for students whose research plans call for substantial employment of anthropological research methods, especially where the research will concern educational processes, practices, or problems. Some attention will be given to ethnological and formal comparativist approaches, but primary attention will be devoted to ethnographic methods and techniques, such as the collection of genealogies and life histories, the interviewing of key informants in depth, and various forms of participant observation. The coordination of such ethnographic approaches with more structured approaches will also be stressed. Students will be expected to participate in role-playing or other simulated field situations designed to develop empathy and sensitivity to overt and covert feedback. Where appropriate, students will be encouraged to collect their own field data locally, or to carry out analyses of available live data.

3 to 5 units, Win (Textor) by arrangement

Education 272. Introduction to Psychoanalytic Theory—The course will start with a careful critical reading of selected works of Freud. After some of the basic theoretical issues in classical Freudian theory have been examined we will consider some of the ego psychology extensions to the theory, including those of Anna Freud, Hartmann, Erikson, and Robert White. The course will survey some of the problems of measuring psychoanalytic constructs central to personality, paying special attention to models of ego development. Special attention will also be given to educational determinants of ego development, and the implications for a theory of individual change. Considerable use will be made of life history case material. Undergraduates with a prior course in personality theory will be admitted. Prerequisite: consent of instructor.

3 to 5 units, Aut (Suzman) by arrangement

Education 273A,B. Workshop in Field Research and Survey Methodology in an Educational Setting—The class will design, execute, and analyze a survey within the school system. The course will start by examining certain studies, including Becoming Modern by Inkeles and Smith, which exemplify the
research process. The class will then itself design an interview focusing upon the role of school experiences in determining the cluster of attributes known as individual modernity and psychological development. If practicable interests of the class members will be incorporated into the interview protocol. Issues relating to design and hypothesis formulation, sampling, attitude measurement, scale construction, and interviewing techniques will be treated. Members of the class will then go into the field and interview a number of school students. The class will then prepare the data for computer analysis. An introduction to SPSS will be included in the course, and methods of data analysis such as cross-tabular analysis, multiple regression, and factor analysis will be demonstrated using the data. Class members will then do their own analyses of the data. Pre-requisite: Education 250B or equivalent.

3 to 5 units, Aut, Win (Suzman) by arrangement

306A. Education and Economic Development—An introduction into the analysis of the role of education in economic growth and development. Case material will consider development problems both in the U.S. and abroad. Discussion sections will deal with special economic aspects of educational development.

4 to 7 units, Aut (Carnoy) TTh 2:15-4:05 and by arrangement

306B. Education and Political Development—(Same as Political Science 222.) An introduction to the comparative analysis of the relations between educational and political systems. The lectures and discussion sections will deal with (a) problems of political socialization and recruitment, and (b) the politics of educational development and innovation.

4 to 7 units, Win (Weiler) TTh 1:15-3:05 and by arrangement

306C. Education and Sociocultural Change—(Same as Anthropology 228.) This course examines the role of education in modernization from a cultural and social-structural perspective, relying on theories of social and cultural change and on case material from modernizing areas both outside and inside the U.S. The concept of “development” is analyzed in both pan-cultural and culture-specific terms. Role-playing, team research, and other experiential techniques will complement a discussion-group format.

4 to 7 units, Spr (Textor) TTh 2:15-4:05 and by arrangement

307. Non-Formal Education: An Examination of Alternatives to Schooling in Western and Non-Western Societies—This course will investigate the distinction between education and “schooling,” and examine the capability of formal schooling to effectively meet the needs of non-Western societies while preserving the cultural integrity of both indigenous cultures and sub-cultural minorities. An attempt will be made to explore viable, innovative non-formal alternatives to schooling. The course will utilize instructional strategies incorporating and reflecting the basic content of the course.

3 to 5 units, Aut (Bock) MW 9-11 and by arrangement

308. The Social Psychology of Organizational Settings—(Same as Sociology 316.) An exploration of the human response to social climates, this seminar will treat the differential response which individuals and groups make to variation and alteration in the form of social organization in which they are involved. The participants will review available evidence in search of the answer to questions of this type: Do open classrooms increase teacher motivation and foster student development? Does a less restrictive atmosphere in prisons insure fewer riots and lower rates of recidivism? Can cooperative farming give traditional villagers a greater sense of personal efficacy? Settings to be studied will include, among others: schools, colleges, hospitals, factories, co-operative farms, housing developments, and villages. Strong emphasis will be placed on the theory and method for studying organizational climates and for judging the personal response to those climates. Open to graduate students with some preparation in sociology and psychology.

3 to 5 units, Spr (Staff) T 4:15-6:05 and by arrangement

309. The Social Psychology of Modernization—(Same as Sociology 315.) Exploration of the impact of political, economic, and socio-cultural change on the individual in developing countries. Review of standard works in the scientific literature, with special emphasis on data from the Project in Social and Cultural Aspects of Economic Develop-
ment in Six Developing Countries, and presentation of results from research of advanced students. Education, mass communication, community development, technical innovation and political participation are illustrative of the topics on which students work. Enrollment will be limited to fifteen, the selection, if necessary, to be made at the first meeting.

3 to 5 units, Spr (Staff) Th 4:15–6:05
and by arrangement

407. Research Methodology: Practicum—The seminar will review a selected number of dissertations representing various social science approaches to the study of educational problems; these dissertations will be systematically examined from the point of view of methodological adequacy and rigor. Prerequisite: consent of instructor.

4 units, Aut (Weiler) M 2:15–4:05
and by arrangement

408. Research Seminar on the Comparative Study of Political Socialization—(Same as Political Science 323.) The seminar emphasizes the conceptual and methodological problems involved in studying the role of education as a source of political learning in different cultural and sub-cultural settings. It is based on empirical data from field studies in different cultures and includes some comparative secondary analysis of such data. Requires previous course work in the general area of political socialization, and facility in the handling of empirical data.

4 units, Spr (Weiler) M 2:15–4:05
and by arrangement

MATHEMATICAL METHODS IN EDUCATIONAL RESEARCH

250. Introduction to Statistical Methods I—(Enroll in Statistics 160.) Especially designed as a nonmathematical study of statistical methods used in the social sciences, behavioral sciences, biological sciences, and other disciplines. Organization of data and methods of summarization, including averages and measures of variability and association. Statistical inference based on a brief introduction to probability theory, including tests of hypotheses, estimation and confidence intervals.

5 units, Aut (Sager) MTWTHF 2:15
Spr (Calfee) MTWThF 1:15
4 units, Sum (——) by arrangement


4 units, Win, Spr (Sitgreaves) MWF 11–12:30

250C,D. Statistical Analysis in Educational Research II—Continuation of Education 250B: Emphasis on analysis of multiple variables and applications. Topics include multivariate normal distribution, multiple regression, partial and multiple correlations; linear and non-linear models, advanced analysis of variance, analysis of covariance. Prerequisites: 250B or equivalent and consent of instructor.

4 units, Aut (Olkin) MWF 11–12:30
4 units, Win (Calfee) MWF 12:30–2:05

351A,B. Advanced Statistical Analysis in Educational Research—Applied multivariate analysis including multiple regression, canonical analysis, discriminant analysis, factor analysis, cluster analysis. Prerequisites: Statistics 220 or equivalent and consent of instructor.

351A. 4 units, Win (Olkin) MWF 11–12:30
351B. Given 1975–76

493A. Seminar in Mathematical Methods in Educational Research—A continuing seminar in special topics in the applications of statistical methods.

493A. 2 to 3 units, Aut, Win, Spr (Staff) Th 12 and by arrangement

493B. Practicum in consulting on methodological problems in educational research.

2 to 3 units, Win, Spr (Olkin, Sitgreaves) Th 12 and by arrangement

POLITICAL AND ECONOMIC STUDIES IN EDUCATION

106. Education as Cultural Colonialism. (See International Development Education.)

108. Seminar on Education and Politics in Europe. (See International Development Education.)

110. Introduction to Models in Social Sci-
ence. (See Socio-Humanistic Studies in Education.)

120. Organizational Decision Making. (See Socio-Humanistic Studies in Education.)


212. The Politics of Educational Innovation: Comparative Analysis. (See International Development Education.)

218. Computer Models of Social Behavior. (See Socio-Humanistic Studies in Education.)

220A. The Social Sciences and Educational Analysis: Introduction to the Economics of Education—An overview of the relationship between education and economic analysis. Specific attention is devoted to investment and consumption theories of education as well as the financing of education. Particular topics include the effects of education on economic growth and the distribution of income as well as taxation for educational purposes. Students who lack training in elementary economics will be required to enroll in a parallel course in economic analysis for one additional unit of credit.

4 units, Aut (Levin) MW 11-12:30

220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education—An overview of the relationship between political analysis and policy formulation in education. Specific focus is given to alternative models of the political process, the nature of interest groups, political strategies, community power and the external environment of organizations, and the implementation of policy. Particular applications to educational settings and problems are emphasized.

4 units, Win (Kirst) MW 11-12:30

222A,B,C. Decision Analysis in Education. (See Administration and Policy Analysis.)

227. Schools and Community. (See Administration and Policy Analysis.)

300. Education and Law—(Same as Law 300.) Addressed to major issues of educational policy in terms of their legal and social science aspects. Topics will include integration, decentralization and community control, the allocation of educational resources, federal involvement in education, control of expression and conduct in the schools, conflicts between parent and state over the child’s ideological and educational exposure, and the roles of private schools. A recurrent concern will be identifying the meanings of, and evaluating the methods of, achieving educational opportunity. Limited enrollment. Prerequisite: consent of instructor.

3 units, Aut (Levin, Brest) F 9-11:30

306A. Education and Economic Development—An introduction into the analysis of the role of education in economic growth and development. Case material will consider development problems both in the U.S. and abroad. Discussion sections will deal with special economic aspects of educational development.

4 to 7 units, Aut (Carnoy) TTh 2:15-4:05

306B. Education and Political Development—(Same as Political Science 222.) An introduction to the comparative analysis of the relations between educational and political systems. The lectures and discussion sections will deal with (a) problems of political socialization and recruitment, and (b) the politics of educational development and innovation.

4 to 7 units, Win (Weikr) TTh 1:15-3:05

313A,B. Economics of Education—Major attention devoted to the “production,” distribution, and financing of education; contribution of education to economic growth and development; education and the distribution of income; the role of educational characteristics in labor markets; and the organization of the education industry. Prerequisites: economic theory and quantitative methods, and consent of instructor.

313A. 3 units, Win (Carnoy, Levin)
M 7:30-9:30 p.m. and by arrangement

313B. 3 units, Spr (Carnoy, Levin)
M 7:30-9:30 p.m. and by arrangement

323A. Education and Public Policy: Federal Education Policy and Administration. (See Administration and Policy Analysis.)

323B. Education and Public Policy: State Education Policy and Administration. (See Administration and Policy Analysis.)
323C. Education and Public Policy: The Governance of Elementary/Secondary Schools. (See Administration and Policy Analysis.)

326A. Topics in Financing Education. (See Administration and Policy Analysis.)

326B,C. Seminar in Financing Education. (See Administration and Policy Analysis.)

330. Policy Research in the Social Sciences or Policy Analysis in Education. (See Administration and Policy Analysis.)

331. Financing Higher Education. (See Administration and Policy Analysis.)

333. Leadership in Organizations. (See Administration and Policy Analysis.)

363. Evaluation and the Educational Policy Making Process. (See Administration and Policy Analysis.)

408. Research Seminar on the Comparative Study of Political Socialization. (See International Development Education.)

**PSYCHOLOGICAL STUDIES IN EDUCATION**

136. Behavior Modification: Introduction—(Same as Psychology 139.) Rationale, concepts and issues in application in educational settings. Implementations of behavior change program.

3 units, Spr (Krumboltz) M 3:15-5:05 and by arrangement

155. Development of Measuring Instruments—Intended for teachers wishing to improve classroom examinations and for persons planning to develop achievement tests, reasoning tests, or questionnaires for research and evaluation. Planning the test, writing items, item tryout and criticism, qualities desired in tests. Lectures and practical exercises.

3 units, Aut (Cronbach) TTh 1:15-2:45

215. Psychological Foundations of Education—(Same as Psychology 145.) Introductory course in application of psychological principles to educational practices. The spring quarter offering is planned especially for teachers in training. Prerequisite: Psychology 1 or equivalent.

4 units, Aut (Cronbach) TTh 3:15-5:05 Spr (Gage) TTh 4:15-6:05 Sum (Staff) MTWTh 10 and by arrangement

230. Foundations of Counseling — Why counseling? Introduction to counseling theories and counselor as applied behavioral scientist. Contemporary social problems, e.g., counter culture, drugs. Personal behavior of the counselor is emphasized. Prerequisite: consent of instructor.

4 units, Aut (Thoresen) T 3:15-5:05 and by arrangement

4 units, Sum (Staff) MTWTh 8

231. Counseling in Groups—Basic skills in leading small groups in applied settings (e.g., schools) to effect specific changes in client behavior. Emphasis on group setting as learning environment, establishing individual behavioral objectives, tailoring group techniques and assessing individual client change. Participation as member of counseling group. Prerequisite: consent of instructor.

4 units, Win (Thoresen) T 3:15-5:05 and by arrangement

232. Research in Counseling: Research and Introduction to Systems—Evaluation of research studies on attempts to foster student development and to prevent problems. Supervised experience in research activity. Introduction to systems design, research, and evaluation in education. In-basket exercises in systems analysis.

3 units, Aut (Krumboltz) M 3:15-5:05 and by arrangement

234. Decision Making Competencies—Students are expected to learn and present evidence of competency in helping clients learn how to make decisions wisely and in using test information to help generate alternatives and estimate chances of success.

3 units, Win (Krumboltz) M 3:15-5:05 and by arrangement

238A,B,C. Counseling: Supervised Applications—Supervised counseling interventions at Stanford Institute for Behavioral Counseling and in selected field settings. Sequence must begin in Autumn Quarter. For doctoral students in Counseling.

4 units, Aut, Win, Spr (Krumboltz, Thoresen, Zifferblatt) by arrangement

239,A,B. Observation and Directed Teaching of Study Skills and Developmental Reading in College—Two-quarter practicum offering opportunity to participate as observer, tutor-counselor or group instructor in reading and study skills. Weekly seminar
and/or conferences with instructor. Prerequisite: consent of instructor.

2 to 4 units, Aut, Win, Spr (Browning, Staff) by arrangement

244. Issues in Early Childhood Education—(Same as Psychology 243.) This course is designed for graduate students interested in the education and development of the child during the first eight years of life. Philosophies and practices of various current early childhood programs will be reviewed in social, psychological and historical perspective. Such topics as: environments for early learning; teacher-child relationships; the role of curriculum in early childhood development; the effects of federal, state and local legislation on early school programs. The involvement of parents in the education of their children will be explored as well as behavior change, school grouping, early reading, staffing, budgets, in-service teacher education.

3 units, Win (Dowley) TTh 4:15–5:30

251. Laboratory Methods in Educational Research—Introduction to psychological methods of experimentation as applied to problems in education. Research topics will include process areas (perception, memory, verbal and concept learning, cognition) with examples from selected content areas (e.g., reading, mathematics). For graduate students with little or no background in Psychological Studies. Enrollment limited to 20, with preference given to first- and second-year students.

3 units, Aut (Calfee) MWF 12:30–2:05

252. Introduction to Test Theory—(Same as Psychology 248.) Concepts of reliability and validity; mathematical models underlying commonly used procedures for test analysis. Test scales and norms. Prerequisite: Education 250 or Psychology 60 or equivalent.

3 to 4 units, Aut (Snow) MW 2:15–4:05

255. Human Abilities—(Same as Psychology 155.) The nature, development, and measurement of intellectual abilities. Prerequisites: Psychology 1 and Psychology 60 or Education 250, or equivalent.

3 units, Spr (Snow) MWF 10

311A, B. Socialization of The Young in Contemporary Society—(Same as Psychology 245.) Students in this course will examine the role of the family, public school, preschool, and day care in socializing young children. Particular attention will be given to the processes through which institutions and social structures of the society affect individual behavior. Topics will include: discontinuities and continuities in socialization, diffuse socialization through mass media, variations by social class and ethnic groups in the U.S., national differences (Britain, China, Russia, Israel, Cuba, etc.) which illustrate relationships between socialization and political ideology.

311A. 3 units, Win (Ambron, Hess) TTh 9 and by arrangement

311B. 3 units, Spr (Ambron, Hess) TTh 9 and by arrangement

316. Advanced Educational Psychology: Basic Processes—Review of research on perception, learning, and memory processes. Emphasis on research procedures and analysis of problems of school learning. For doctoral students in Psychological Studies. Open to others with consent of instructor.

4 units, Win (Calfee) MWF 9 and by arrangement

317. Introduction to Research on Teaching—Introduction to theory, methodology, and substantive findings of research on teaching and teacher education. Prerequisites: Education 215, Education 250 or equivalent.

2 to 4 units, Aut (Gage) MW 3:15–5:05 alternate years, given 1974–75

334. Counseling Practicum—Supervised experience in the Counseling and Psychological Services unit of the Cowell Student Health Center. Pre- and post-doctoral students with prior counseling or clinical experience work under supervision providing individual and group counseling and testing services. Practice is supplemented by a training seminar and directed reading. Requires a minimum of 8 hours a week. By consent; advanced application required. May be repeated for credit.

2 to 4 units, Aut, Win, Spr (Browning, Staff) by arrangement

338A, B, C. Internship in Counseling—Intensive supervised field experience in local schools or social agencies will be designed to provide the intern with opportunities to design individualized learning environments for the purpose of improving children's deci-
sion-making abilities, overcoming maladaptive behavior patterns, and preventing problems. For doctoral students in Counseling.

1 to 6 units, Aut, Win, Spr (Krumboltz, Thoresen) by arrangement

350. Critical Analysis of Research Literature in Educational Psychology—An examination of contemporary research in educational psychology and its relevance to educational practice. Emphasis is on broadening student perspectives and on the development of critical skills in reviewing substance and method of current research. For doctoral students in any area of education. Admission by consent of instructor.

3 units, Win (Snow) T 7-10 p.m. alternate years, given 1975-76

352. Individual Psychological Testing—Instruction and practice in the administration and interpretation of individual tests of intelligence and their use in connection with other diagnostic instruments.

3 units, Spr (Staff) Th 3:15-5:05

353. Problems in Measurement—(Same as Psychology 249.) Survey of alternative mathematical models used in test construction and analysis covering such topics as generalizability theory, measurement of gains, theory of personnel decisions. Prerequisites: Education 250B and 252, or Psychology 152 and 248, or equivalent.

3 to 4 units, Spr (Cronbach) MW 2:15-4:05

354. Planning Educational Evaluations—Intended for doctoral students near the end of course work who expect to play responsible roles in evaluation of instructional programs. Lectures on representative evaluations, criteria of effective evaluation, data collection, etc. Each student develops a detailed plan for an evaluation. Enrollment limited; application for admission required during October. In admitting students, priority will be given to those with training in research method through Education 250B and an orientation to curriculum problems.

4 units, Win (Cronbach) MWF 10-11:30

389. Experimental Psychology of Reading (Same as Psychology 143.)—Review of research literature on the reading process, and acquisition of reading. Emphasis on critical evaluation of process research, and on interaction of psychological, linguistic, and educational aspects of reading. Prerequisite: consent of instructor.

3 to 4 units, Spr (Calfee, Smith) MWF 9 and by arrangement

402. Clinical Seminar in Early Education—The seminar is organized around field work and group discussion on educational programs for young children. The seminar is oriented toward conceptual bases of early education programs and the implementation of these in field situations. Topic of focus changes each year.

3 units, Aut (Ambron, Hess) W 1:15-3:05 and by arrangement

411. Seminar in Child Development and Early Education—This seminar will provide opportunities for graduate students to discuss professional issues, and to develop and present research ideas and proposals. Current child development and early educational literature will also be reviewed. Prerequisite: consent of instructor.

1 to 3 units, Aut, Win, Spr (Ambron, Hess) T 2:15-4:05 and by arrangement

415. Seminar in Educational Psychology—Topical seminar for advanced students. Admission by consent of instructor.

1 to 3 units, any quarter (Staff) by arrangement

416. Seminar for Psychological Studies Students—Professional roles and problems of the psychologist working in education. May be repeated for credit. Limited to students in the Psychological Studies doctoral program.

1 unit, any quarter (Snow, Staff) by arrangement

419. Seminar in Research on Teaching—A critical examination of research on teacher behaviors and characteristics considered as either dependent or independent variables. Prerequisite: Education 317.

3 units, Win (Gage) MW 3:15-5:05 alternate years, given 1974-75

431. Doctoral Seminar in Counseling—Designed for all doctoral candidates in counseling psychology and related areas. Analysis of professional problems. May be repeated for credit. Prerequisite: consent of instructor.

1 unit, Aut, Win, Spr (Krumboltz, Thoresen, Zifferblatt) T 7:30-9:30 p.m., biweekly
SOCIO-HUMANISTIC STUDIES IN EDUCATION

105. American Education and Public Policy
—This course seeks to introduce undergraduates to social science perspectives in public schools. Who influences education and how? How have American schools responded to human diversity? What consequences does schooling have (e.g., in promoting equality)? What are the prospects for reform in public education? Issues such as these will be analyzed in lectures and in small group discussions. Students may elect to do related fieldwork (for additional credit if desired).

3 units, Aut (Kirst, March, Tyack) WF 10 plus one hour by arrangement

109A. Cultural Pluralism: Classroom-Curricular Strategies. (See Curriculum and Teacher Education.)

109B. Cultural Pluralism: Classroom-Curricular Strategies. (See Curriculum and Teacher Education.)

110. Introduction to Models in Social Science—(Same as Sociology 271 and Political Science 185A.) An introduction to models in social science. Models of choice, exchange, adaptation, diffusion, and structure are used to make predictions in a variety of situations involving human behavior. Emphasis is placed on the invention and application of models more than on the testing of them.

4 units, Aut (March) MW 1:15; sections M 10 or 11

120. Organizational Decision Making—(Same as Sociology 263 and Political Science 103.) An examination of the process of decision making in modern complex organizations, such as universities, schools, hospitals, business firms, armies, and public bureaucracies. The impact of information, power, resources, organizational structure, and the environment. Alternative models of choice and their implications.

4 units, Win (March) MW 1:15–2:45 and by arrangement

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, Spr (Gross) W 7–10 p.m.
4 units, Sum (Gross) MTWTh 1:15 and by arrangement

201. History of Education in the United States—(Same as History 158.) Analysis of selected turning points in education in relation to such topics as religion, political socialization, race relations, immigration, and urbanization.

3 units, Win (Tyack) ThF 11 and one hour by arrangement

202. Contemporary Problems in Social Institutions—(Same as Sociology 180 and Political Science 280A.) An examination of the social structure, process, problems, and ideology of a specific social institution. The institution to be considered varies each year.

4 units, Aut (March) M 7–10 p.m.

203. Models of the Child in Contemporary Educational Thought—This introductory course is intended to focus critical attention on a number of influential views of the child that have been formulated by psychologists, political theorists and philosophers, and to place them in historical and philosophical perspective. The discussions should be of interest not only to those who are specializing in the disciplines mentioned, but also to the teacher and educational administrator. The central themes will be rival environmentalist and hereditary models, deterministic models such as the behavioristic and the Freudian, and developmental models. The educational role of models and paradigms will also be discussed. There will be opportunity for discussion and the presentation of material in class.

4 units, Aut (Phillips) by arrangement

204. Introduction to Philosophy of Education—During Winter Quarter, this introductory course will focus on critical analysis of current generative themes and issues in education. Students will develop skills in conceptual analysis through small group discussion and the writing of several short philosophical papers. Major texts are dialogues from Plato and Paulo Freire’s, Cultural Action for Freedom, as well as readings from Dewey, Whitehead, Bruner, Rogers, and Goodman.

In the Spring Quarter the emphasis will be on critical issues concerning the curriculum: the various forms and structures of knowledge that have been identified; past and present criteria for selection of curriculum content; radical alternatives concerning curriculum content and organizational patterns. The aim is to uncover assumptions,
and to examine the adequacy of justificatory arguments that have been put forward. There will be opportunity for discussion and the presentation of materials in class.

4 units, Win (Pacheco) MW 10–12
Spr (Phillips) by arrangement

205. Comparative Ideologies and Education — This course focuses on the philosophical examination of the concept of ideology and related concepts such as indoctrination, socialization, and cultural transmission with reference to education and schooling. Readings will lead toward both conceptual analysis as well as critical comparative analysis of the specific uses of ideology in some representative countries (USA, Cuba, China, Israel), with special reference to early schooling.

4 units, Spr (Pacheco) MW 10 and by arrangement

208A. Personality and Social Structure — (Same as Sociology 211A.) Lectures and discussion of leading ideas, theories, and research on the relations of personality and social systems, with special emphasis on the ways in which personality modes influence the functioning of institutions. Among the issues reviewed are suicide, juvenile delinquency, recruitment to and performance in school and job, socialization, and political participation. Undergraduates with some background in personality theory or sociological analysis will be accepted. Enrollment limited to sixty-five.

3 to 5 units, Win (Staff) TTh 4:15–6:05
and by arrangement

208B. Personality and Social Structure — (Same as Sociology 211B.) The course will be a continuation of 208A. Topics reviewed will include political participation, national character, psycho-history, and social change. Students will be encouraged to pursue their own interests, such as success in school being a function of the fit between student personality and the educational institution. Education 208A will be a prerequisite. Students who have taken Education 208 (Sociology 176) in previous years will be admitted.

3 to 5 units, Spr (Staff) by arrangement

210. Research Problems in Sociology of Education — (Students planning to take this course during the autumn will take Education 310/210; see description under Education 310/210.) Topics include influence of social status on the social structure of schools, on classrooms and on school systems; the school as a formal organization; equality of educational opportunity; and classroom interaction.

4 units, Aut (Cohen) MW 9–11
Sum (——) MTWThF 9

211C. Foundations of Education: Social. (See Curriculum and Teacher Education.)

216. Cultural Pluralism and Educational Policy — Review of theories affecting educational policy with regard to cultural differences in language, heritage, values, motivation and cognition.

3 units, Aut (Castañeda) WTh 11–12:30
3 units, Sum (Castañeda) MW 11–12:30

218. Computer Models of Social Behavior — (Same as Computer Science 127, Political Science 180M, Psychology 154, Sociology 273.) Models of human behavior in social situations. Particular attention is given to specifying simulation models, determining their properties, and testing them. Enrollment is limited to 20. Prerequisites: knowledge of at least one programming language, advanced courses in social science, consent of instructors.

4 units, Spr (March, Feigenbaum)
Given 1975–76

220C. The Social Sciences and Educational Administration: Introduction to the Sociology of Education. (See Administration and Policy Analysis.)

242. Bicultural Processes in Education. (See Curriculum and Teacher Education.)

254. Anthropological Research Methods with Implications for Education — (Same as Anthropology 286.) This course is intended for students whose research plans call for substantial employment of anthropological research methods, especially where the research will concern educational processes, practices, or problems. Some attention will be given to ethnological and formal comparative approaches, but primary attention will be devoted to ethnographic methods and techniques, such as the collection of genealogies and life histories, the interviewing of key informants in depth, and various forms of participant observation. The coordination of such ethnographic approaches with more structured approaches will also be
stressed. Students will be expected to participate in role-playing or other simulated field situations designed to develop empathy and sensitivity to overt and covert feedback. Where appropriate, students will be encouraged to collect their own field data locally, or to carry out analyses of available live data.

3 to 5 units, Win (Textor) by arrangement

301. Colloquium on the Historiography of American Education—Analysis of the literature of American educational history, designed for students who wish to do further work in the field. In addition to weekly colloquium discussions, students will have an opportunity to pursue specialized topics in small group tutorial sessions.

3 to 5 units, Aut (Tyack) Th 9–11 plus tutorial

302. Colloquium on the History of American Urban Education—Historical analysis of bureaucratization, patterns of political control of schools, teachers’ and students’ perceptions of the system, some functions of mass schooling, and strategies for change today. Discussion of primary sources and contrasting interpretations. Enrollment limited to fifteen. Prerequisite: consent of instructor.

4 to 5 units, Win (Tyack) Th 9–11 and Spr (Tyack) T 7–9 p.m. and by arrangement

303A. Philosophical Analysis: Ethnic Studies and the University—A topical seminar offering philosophical analysis of an educational problem. This seminar explores the role of ethnic studies in the light of the traditional function and uses of the university, including an examination of how ethnic studies have evolved in the university, the political and philosophical assumptions on which such courses and programs are based, and alternative models for such programs. Special attention is given to Chicano and Black studies.

4 units, Aut (Pacheco) T 7–10 p.m. and by arrangement

303B. Philosophical Analysis: Cultural Pluralism—A topical seminar offering philosophical analysis of an educational problem. This seminar focuses on a critical analysis of the concept of cultural pluralism and related key concepts such as biculturalism, marginality, assimilation, and acculturation, with special reference to education and schooling. Students will explore differing philosophical assumptions implicit in alternative formulations and uses of the concept of cultural pluralism.

4 units, Win (Pacheco) T 7–10 p.m. and by arrangement

304. Philosophical Problems of Education as a Social Science—Important philosophical problems arise in the context of methodology and theory in the fields of psychology, sociology, anthropology, political science, and administrative studies. Several of these problems also arise in education, and they form the core of the present course: the possibility of a ‘science of man,’ the problem of rationality, holistic versus individualistic explanations (including systems theory and other anti-reductionist views, and the methodological individualism and the use of psychological explanations in sociology). Introductory knowledge of either philosophy or one of the social sciences would be an advantage.

4 units, Aut (Phillips) by arrangement

305. Philosophy and Empirical Research—This course explores problems of empirical research in education from the point of view of the philosopher of science. It is intended for students who are doing empirical research (or expect to do so soon) and who have had some introduction to philosophical thinking (such as having taken Education 204 or Education 205). The topics of the course will center around: the demarcation of science from non-science and the methodological views of Karl Popper, discovery versus validation, the role of models and paradigms, laws and theories in the sciences, operationism, and value-judgments in research.

4 units, Win (Phillips) by arrangement

306C. Education and Sociocultural Change. (See International Development Education.)
able evidence in search of the answer to questions of this type: Do open classrooms increase teacher motivation and foster student development? Does a less restrictive atmosphere in prisons insure fewer riots and lower rates of recidivism? Can cooperative farming give traditional villagers a greater sense of personal efficacy? Settings to be studied will include, among others: schools, colleges, hospitals, factories, cooperative farms, housing developments, and villages.

Strong emphasis will be placed on the theory and method for studying organizational climates and for judging the personal response to those climates. Open to graduate students with some preparation in sociology and psychology.

_3 to 5 units, Spr (Staff) T 4:15–6:05 and by arrangement_

309. The Social Psychology of Modernization. (See International Development Education.)

310/210. Research Problems in Sociology of Education—(Same as Sociology 341.) A course for both doctoral and master's level students. Lectures are the same, but assignments and discussion sections are separate. 210 is designed for students who would like to be consumers of research in sociology of education and be able to evaluate critically what they read. Education 310 is designed for the student who would like to produce research and wishes to know how to pose critical questions for applied research. Doctoral candidates who have never had background in research in behavioral or social sciences and who intend to carry out a dissertation using social science techniques, are advised to attend both sections. They may arrange for up to 6 units of credit. The course will give the student acquaintance with selected sociological concepts, theories and their application to critical applied problems in the field of sociology of education. The instructor will analyze educational problems from the perspective of status, norms, social structure and social interaction. These concepts will be applied to problems of school organization, classroom interaction, ways in which the societal stratification system is reinforced by the social structure of the school, and the relationship between the technology and structure of teaching. Concepts and analysis will be presented in a form, applicable to settings other than the United States contemporary educational scene, i.e. there will be a strong cross-cultural emphasis. The consistent emphasis of the course is on learning about suitable conceptualization and methodology of applied research.

_4 to 6 units, Aut (Cohen) MW 9–11_

312A. The Low Status Student: Race and Social Class—(Same as Sociology 342A.) This course provides an attack on a problem of great contemporary interest in education from the point of view of sociological theory, research, and analysis. The relationship of research to policy formulation will be stressed. Relevant sociological theory and research will be covered from the areas of stratification, socialization, and race relations. Applications to “education for the disadvantaged” will be made. Because students must be prepared to contribute analyses and research formulations in class presentations, Education 310 or its equivalent is a prerequisite.

_4 units, Spr (Cohen) M 7–9 p.m. and by arrangement_

312B. Interaction Processes in Education—(Same as Sociology 342B.) With increased use of group work as a classroom technique and the new developments in team teaching, the educational researcher can benefit from selected theory and research by sociologists and social psychologists in the small group setting. Topics will include the social processes of evaluation, influence, and role differentiation. The student should acquire skills in selecting theory and research from a heterogeneous behavioral science area that has some promise for problems in the educational setting. Methods for studying interaction in educational settings will be included. The course will involve some field work in observation and scoring of small groups in the educational setting. Because students must be prepared to contribute analyses and research formulations in class presentation, Education 310 or its equivalent is a prerequisite.

_4 units, Spr (Cohen) TTh 3:15–5:05_

315. Cultural Transmission—(Same as Anthropology 256.) 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. Prerequisite: consent of instructor.

5 units, Aut (Spindler) T 7-10 p.m.
4 units, Sum (——) MTWTh 11
given 1975–76

327. Survey Design and Analysis—(Same as Sociology 385.) A basic course in the design of survey for social science research, including educational problems. Topics include: basic research cycle and judgments about when surveys are appropriate; variable language and indicators; construction of questionnaires (including simple indexes); strategies for interviewing and for mail questionnaires. A data analysis clinic will begin at the first of the course using existing data and will continue throughout the course. Prerequisite: basic statistics course.

5 units, Aut (Baldridge) MW 9–11
and by arrangement

328. Change and Innovation Processes in Complex Organizations. (See Administration and Policy Analysis.)

329. Fundamentals of Organization Theory. (See Administration and Policy Analysis.)

330. Policy Research in the Social Sciences and Education—(Same as Sociology 343.) An analysis of the ways social science can be used to aid in policy decisions, especially in complex organizations and educational areas. The focus is on the marshalling of social science evidence and research that can be used to make practical policy decisions. Areas of concern include: problem identification and definition; searching for relevant, manipulable variables; gathering research upon which decisions can be made, offering alternative policy recommendations based on the same data; determining political and/or educational consequences of various recommendations. Students will work in teams, each selecting a different area for policy analysis.

4 units, Spr (Baldridge) given 1975–76

333. Leadership in Organizations. (See Administration and Policy Analysis.)

335X. Current Practices in Bicultural Education—An examination and research of current teaching methodologies for elementary and secondary bicultural education. Special emphasis on testing, evaluation and curriculum. Research project of current bilingual programs in the Bay Area will be discussed and assigned to participants. Actual bilingual experiences will be shared by professional educators of the Bay Area Bilingual Education League (BABEL).

2 units, Spr (Staff) Th 12–2:05

400. Seminar in History of Education—A seminar examining selected issues, topics, and sources in the history of education outside of the United States.

3 units, Win (Gross), given 1975–76

401B. Seminar in the History of American Education: Urban Education — Research seminar, focusing in 1975 upon urban school systems. Students will write and discuss seminar papers. Prerequisite: 302, which should normally be taken during winter quarter.

4 to 5 units, Spr (Tyack) by arrangement

404. Seminar in the Philosophy of Education — A seminar designed for majors in philosophy of education; others admitted on consent of instructor. In the autumn an intensive study of philosophy of education curricula and graduate programs of study, with focus on design and evaluation of alternative training programs for doctoral students in philosophy of education. In the winter, the seminar will focus on contemporary controversies in philosophy of education and on methodological issues. The course will reflect to some extent the interests of students who will be given the opportunity to investigate an issue in depth. Recent books by Scheffler, Peters, Hirst, and others, and important journal articles, will be studied from the point of view of the type of argument used, the assumptions made, the philosophical traditions that are tapped, and the validity of the polemics that are indulged in. Some attempt will be made to place the issues in a broader historical and philosophical perspective.

4 units, Aut (Pacheco) W 10 and by arrangement
Win (Phillips) by arrangement

405. Philosophy, Education, and Society— (Same as Philosophy 215.) An advanced seminar which focuses on philosophy of social science, including an examination of the philosophical bases for social science in the works of Marx, Weber, and Durkheim, as well as an examination of the current relationship of analytic philosophy and phenomenology to modern sociological theory. The
latter half of the seminar will focus on comparative theoretical approaches to educational research in the light of modern philosophy and sociological theory. Enrollment limited to students with substantial background in philosophy and/or sociological theory. Prerequisite: consent of instructor.

4 units, Spr (Pacheco) T 7–10 p.m.

418A,B,C. Advanced Research in Organization Theory I, II, III—(Same as Sociology 365A,B,C and Political Science 304A,B,C.) A research seminar for advanced graduate students. Emphasis is placed on developing original theoretical formulations of major concepts in organization theory. Prerequisites: advanced courses in organizations, research methods, consent of instructor.

4 units, Aut, Win, Spr (March) by arrangement

SPECIAL COURSES, INDEPENDENT STUDY, DIRECTED READING, PRACTICA, RESEARCH, DISSERTATION

180. Directed Reading in Education—For Master’s degree students.

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

190. Directed Research in Education—For Master’s degree students.

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

375X. Organization and Style in Research Writing—Some major considerations in preparing formal reports of scholarship and inquiry, including doctoral dissertations. Emphasis on organization; the achievement of clarity; technical, ethical and legal matters in using quotations and copyright materials; preparation of figures and tables; alternative conventions in citations references, bibliographies and appendices; stylistic practices.

2 units, Win (Coladarci) Th 8–10

407. Research Methodology: Practicum—The seminar will review a selected number of dissertations representing various social science approaches to the study of educational problems; these dissertations will be systematically examined from the point of view of methodological adequacy and rigor. Prerequisite: consent of instructor.

4 units, Aut (Weiler) M 2:15–4:05 and by arrangement


Any quarter (Staff) by arrangement

470. Practicum—For advanced graduate students.

By arrangement

480. Directed Reading—For advanced graduate students.

By arrangement

490. Directed Research—For advanced graduate students.

By arrangement
SCHOOL OF ENGINEERING

Dean: William M. Kays
Associate Deans: Robert H. Eustis (Academic Affairs), John G. Linvill, L. Farrell McGhie, Robert L. Street (Research), Lauress L. Wise (Student Relations)
Assistant Deans: Kenneth S. Down, Alfred D. Kirkland, Edwin F. Laak
Secretary of the Faculty: George M. Homsy
Professor of Space Science and Astrophysics: Peter A. Sturrock
Consulting Professor of Engineering: Hans M. Mark

The School of Engineering offers four-year undergraduate programs leading to the degree of Bachelor of Science, or in the case of Architecture the Bachelor of Arts; five-year programs leading to both Bachelor of Science and Master of Science degrees; others leading to a Bachelor of Science with a Bachelor of Arts in a field of humanities or social science; and graduate curricula leading to the degrees of Master of Science, Engineer, and Doctor of Philosophy.

The School includes ten academic departments: Aeronautics and Astronautics, Applied Mechanics, Chemical Engineering, Civil Engineering, Electrical Engineering, Engineering-Economic Systems, Industrial Engineering, Materials Science and Engineering, Mechanical Engineering, and Operations Research. These departments are responsible for graduate curricula, research activities, and the departmental components of the undergraduate curricula. In research, where faculty interest and competence embraces both engineering and the supporting sciences, there are not only numerous programs within the School, but also there are several inter-School activities, including the Microwave Laboratory, the Center for Materials Research, the Institute for Plasma Research, the Radio Astronomy Institute, the Joint Institute for Aeroacoustics, the Institute for Electronics in Medicine, the Institute for Energy Studies, and the program in Product Design. An undergraduate program in Architecture is offered in the Department of Mechanical Engineering.

Instruction in engineering is offered during the autumn, winter, and spring quarters of the regular academic year. During the summer quarter a few undergraduate and graduate courses are offered.

UNDERGRADUATE 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 intending to major in engineering should take mathematics in high school to as high a level as is offered, including trigonometry. Placement tests are given by the Department of Mathematics during the registration period. Students who do not place high enough in the test will be required to take Mathematics 0, Algebra and Trigonometry, in addition to the normal graduation requirements in engineering. High school courses in physics and chemistry are strongly recommended but not required. Additional elective course work in English is also recommended.

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, selecting insofar as possible courses applicable to the requirements of the School of Engineering, i.e., courses comparable to those discussed under "Undergraduate Programs of Study." Some transfer students may require more than four years to obtain the B.S. degree. However, Stanford affords great flexibility in planning and scheduling individual programs, which makes it possible for transfer students having wide variations in preparation to plan full programs for each quarter and to progress toward graduation without undue delay.

Transfer credit will be given for courses taken elsewhere whenever the courses are equivalent or substantially similar to Stanford courses. The policy of the School of Engineering is to study each transfer student's preparation and make a reasonable
evaluation of the courses taken prior to transfer. Inquiries may be addressed to the Dean of Engineering at Stanford.

THE UNDERGRADUATE COUNCIL
Responsibility for undergraduate curricula and for undergraduate courses designated “Engineering” has been delegated by the faculty of the School of Engineering to its Undergraduate Council. The Council is made up of faculty members with special interests in undergraduate education, most of whom teach undergraduate courses and advise undergraduate students. The Council approves curricula, supervises course offerings, initiates new courses, and recommends students for the degree of Bachelor of Science in General Engineering.

UNDERGRADUATE PROGRAMS OF STUDY
The principal objective of the undergraduate engineering curriculum is to provide opportunity for personal maturity and intellectual growth, for the attainment of professional competence, and for the development of social responsibility. The curriculum is quite flexible and decisions on individual courses, in general, are left to the student and the adviser. For a student with a well-defined educational goal, there is a great deal of latitude.

CURRICULUM COMPONENTS
As an aid in program planning, the curriculum is described in terms of 10 components: Writing, Humanities and Fine Arts, Social Sciences, Technology and Society, Mathematics, Science, Engineering Breadth, Engineering Depth, Free Electives, and the requirement of “Functional Balance” (see p. 90). By planning these components carefully and taking full advantage of the available advising services, a student can arrange a strong program to meet any one of a wide variety of educational objectives. Engineering majors are offered in three categories: Departmental Majors, Interdisciplinary Majors, and Innovative Majors. An Engineering and Society program is offered for those seeking a broad integration of engineering, science, and societal subjects.

Engineering students are subject to the University requirements outlined in the first pages of this bulletin. (The requirements in the areas of mathematics, natural sciences, and technology will be satisfied automatically by the engineering program). Students who qualify for advanced placement will be held to correspondingly fewer units in the math and sciences areas.

Writing
Two courses of instruction in written composition are required by the University for graduation, except that some students may be exempt from all or part of this requirement (see the first section of this bulletin for details).

Humanities and Fine Arts
Three courses (minimum) are required by the University for graduation (see the first section of this bulletin for details).

Social Sciences
Three courses (minimum) are required by the University for graduation (see the first section of this bulletin for details).

Note: The School of Engineering requires that the total number of Humanities and Social Sciences units be at least 23.

Technology and Society
Every engineer needs to have an appreciation of the role of technology in society in order to make the value judgments he must make as a responsible citizen engineer. While this appreciation is gained in many ways, every engineering student is expected to take at least two courses specifically directed to the problems of technology and society (equivalent directed study or work outside the University is acceptable). A list of courses and seminars in this category is available from the Office of the Dean of Engineering.

Mathematics (21 units minimum)
Engineering students need a solid foundation in the calculus of continuous functions, an introduction to discrete mathematics, training in the use of computers, and understanding of statistics or probability theory. The minimum preparation should normally include work to the level of Mathematics 43, some competence in computer programming, and a basic knowledge of statistics. The ability to deal with ordinary differential equations and with matrices is important in many areas of engineering, and stu-
SCHOOL OF ENGINEERING

Students are encouraged to select additional courses in these topics.

Science (24 units minimum)

A strong background in the basic concepts and principles of physical science such as physics, chemistry, and biology is essential for engineering. The basic physics sequence Physics 51 to 56 (14 units) will normally be chosen by engineering students. An alternative to the mechanics covered in Physics 51 and Engineering 12 is the sequence Engineering 3, 4, and 5. These courses are aimed at giving the student contact with engineering during the first year.

The additional science courses should be selected by the student with some consideration of a probable engineering program. Physics 57 to 58 will be of interest to students interested in areas of engineering relying heavily on quantum physics, such as materials science and electrical engineering. Biology 1 and 21, 22, and 23 will be of interest to students anticipating programs in environmental engineering, biotechnology, and related fields. Courses applicable for students interested in the design of civil engineering structures and construction include Geology 1 and Geophysics 51. A list of acceptable science courses is available in the office of the Dean of Engineering.

Engineering Breadth (30 units minimum)

Every engineering student should include in the program course work selected from a variety of disciplines in order

1. to obtain a look at the principles and techniques of the several branches of engineering as an aid in career selection,
2. to gain a general viewpoint by seeing basic principles in a variety of forms as they find application in diverse disciplines,
3. to secure protection against the hazards of too much specialization too early, and
4. to gain an introductory knowledge of several of the engineering sciences as preparation for work on complex problems.

Accordingly, each student is expected to select at least 30 units of courses from not fewer than five of the eight categories listed below. To ensure breadth, the courses selected in at least three of the five chosen categories should lie in areas not directly related to the major program of study as defined by the Engineering Depth sequence. (Note—No more than 10 units in any one category can be counted toward satisfaction of this breadth requirement.) There are many courses which may be used in each of the categories. The following list gives typical courses. (Consult individual course descriptions for prerequisites.) Substitutions may be made with adviser's approval.

Alternatively, a student may, with the help of the adviser, draw up a combination of courses which provides technical breadth and is compatible with his or her unique career goals. Such a program can be approved by the Undergraduate Council if it satisfies the spirit of the breadth requirement. There are many introductory courses offered by various departments which are suitable for this purpose. Students are urged to consider all the various possibilities before making definite course selections.

1. MECHANICS OF SOLIDS AND FLUIDS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. 4.</td>
<td>Applied Mechanics II</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 5.</td>
<td>Applied Mechanics III</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 11.</td>
<td>Applied Mechanics: Stress Analysis</td>
<td>4</td>
</tr>
<tr>
<td>Engr. 21.</td>
<td>Mechanics of Fluids</td>
<td>3</td>
</tr>
<tr>
<td>Physics 110</td>
<td>Intermediate Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 140</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Mech. Engr. 33</td>
<td>Introductory Fluids Engineering</td>
<td>3</td>
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</tbody>
</table>

More advanced courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Appl. Mech. 280</td>
<td>Physiology for Engineers and Physical Scientists</td>
<td>3</td>
</tr>
<tr>
<td>Appl. Mech. 281</td>
<td>Biomechanics</td>
<td>3</td>
</tr>
<tr>
<td>Civil Engr. 107</td>
<td>Mechanics of Fluids</td>
<td>3</td>
</tr>
<tr>
<td>Civil Engr. 114</td>
<td>Mechanics of Materials</td>
<td>4</td>
</tr>
<tr>
<td>Physics 111</td>
<td>Intermediate Mechanics</td>
<td>3</td>
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</table>

2. ELECTROMAGNETISM, ELECTRIC CIRCUITS, AND DEVICES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Engr. 41n.</td>
<td>Circuits</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 42n.</td>
<td>Electronics</td>
<td>4</td>
</tr>
<tr>
<td>Engr. 43.</td>
<td>Electromechanics</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 44.</td>
<td>Basic Electronics</td>
<td>5</td>
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</table>

More advanced courses

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Elec. Engr. 101</td>
<td>Circuits I</td>
<td>3</td>
</tr>
<tr>
<td>Elec. Engr. 141</td>
<td>Electromagnetic Fundamentals</td>
<td>3</td>
</tr>
<tr>
<td>Physics 120</td>
<td>Intermediate Electricity and Magnetism</td>
<td>3</td>
</tr>
</tbody>
</table>

3. THERMODYNAMICS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. 32.</td>
<td>Introduction to the Thermosciences</td>
<td>3</td>
</tr>
<tr>
<td>Physics 170</td>
<td>Thermodynamics, Kinetic Theory and Statistical Mechanics</td>
<td>3</td>
</tr>
</tbody>
</table>
Chem. 171. Physical Chemistry  
Mat. Sci. 181. Thermodynamics and Phase Equilibria

**More advanced courses**
Chem. Engr. 110. Equilibrium in Thermodynamic Systems

4. **MATERIALS SCIENCE AND PROPERTIES**
Engr. 50. Introductory Science of Materials  
Mech. Engr. 111. Failure Prevention

**More advanced courses**
Civil Engr. 118. Materials Engineering  
Mat. Sci. 185. Mechanical Behavior of Solids  
Mat. Sci. 188. Electrical, Optical, and Magnetic Properties of Materials  
Mat. Sci. 190. Polymer Science  
Mat. Sci. 191. Engineering Properties of Polymers  
Mat. Sci. 192. Biomaterials

5. **LOGIC AND COMPUTER SYSTEMS**
Comp. Sci. 106. Introduction to Computing  
Phil. 160A. Symbolic Logic  
Phil. 162. Theory of Automata

**More advanced courses**
Comp. Sci. 111. Introduction to Computer Organization, Machine and Assembly Languages  
Comp. Sci. 140A. Systems Programming  
Comp. Sci. 158. Introduction to Mathematical Theory of Computation  
Comp. Sci. 206. Computing with Symbolic Expressions  
Elec. Engr. 182. Digital Computer Organization  
Indus. Engr. 141. Utilization of Computers  
Phil. 160B. Symbolic Logic

6. **SYSTEMS ANALYSIS AND CONTROL**
Engr. 104. Dynamic Response  
Engr. 105. Control System Analysis and Design  
Indus. Engr. 108. Work Design and Measurement

**More advanced courses**
Engr. 206. Control System Analysis and Design  
Indus. Engr. 160, 164. Analysis of Production Systems; Production Engineering Problems  
Engr.-Econ. Sys. 201A,B,C. Introductory System Analysis

7. **MASS AND ENERGY TRANSFER**
Chem. Engr. 20. Introduction to Chemical Engineering  
Chem. Engr. 120. Separations Processes  
Chem. Engr. 120L. Separations Processes Demonstration Laboratory  
Chem. Engr. 150L. Energy and Mass Transport Laboratory

Math. Sci. 182. Rate Processes in Materials  
Mech. Engr. 230A. Heat Transfer

8. **DECISION PROCESSES, ENGINEERING ECONOMY, AND DESIGN**
Engr. 102. Optimization  
Engr. 161. Engineering Economy  
Chem. Engr. 160. Chemical Engineering Plant Design  
Mech. Engr. 102A,B. Design Communication Workshop  
Mech. Engr. 103. Manufacturing Technology  

**More advanced courses**
Engr. 235A,B. Engr. Systems Design  
Engr.-Econ. Sys. 212A,B. Decision Analysis  
Engr.-Econ. Sys. 231. Decision Analysis  
Engr.-Econ. Sys. 236. Decision Analysis Practice  
Mech. Engr. 115A. Introduction to Product Design  

**Engineering Depth (36 units minimum)**

The rapid advance in scientific knowledge and technological achievement requires even higher technical proficiency in the engineer. The undergraduate should select a coordinated series of courses to gain mastery of the important principles and techniques in a well-defined field and to gain some experience in their application to significant problems.

There are three ways in which a student may satisfy the depth requirement. (1) **Departmental Majors.** One may complete the sequence of courses recommended by one of the engineering departments (Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering, Materials Science and Engineering, and Mechanical Engineering). (2) **Interdisciplinary Majors.** One may complete one of the sequence of courses suggested by the Undergraduate Council. These acknowledge growing needs for engineering education not confined to a traditional discipline. (3) **Innovative Majors.** One may, with the help of an adviser, propose a combination of courses to meet particular career goals.

These three possibilities are described later in more detail under the heading “Engineering Majors.” Not all of these curricula are accredited (see section “Accreditation” below). All programs must of course meet the School and University requirements as outlined in the ten components described herein.
Free Electives

Enough additional courses to bring the total to 180 units or more, typically between 30 and 40 units.

Functional Balance

Every engineering student should obtain experience in analysis, synthesis, experimentation, and communication. Analysis is concerned with the formulation and solving of mathematical models, primarily by use of deductive reasoning. Synthesis places emphasis on problem definition, ideation, inductive reasoning, and optimization. Experimentation involves the innovative applications of experimental equipment and techniques to discover relations and to answer questions. Communication skills include oral, written, and graphical expression, with emphasis on communication for a purpose. All these skills are essential in the successful practice of engineering.

The Engineering Breadth and Depth components of the curriculum will usually ensure adequate experiences in analysis. To round out the program, each student is expected to include the equivalent of at least 9 units each of synthesis and communication and 8 units of experimentation. It is not expected that this will require additional course work; instead, each student should keep in mind the necessity for functional balance while selecting courses in the Science, Engineering Breadth, Engineering Depth, and Elective components of his curriculum. This is particularly important for interdisciplinary and innovative programs that are to be accredited.

Accreditation

The Engineers Council for Professional Development (ECPD), an organization formed by the several professional societies, accredits college engineering programs on a nationwide basis. Accreditation is important in many areas of the engineering profession; students wishing more information about accreditation should consult their Departmental Office or the Office of the School of Engineering.

In addition to standards of quality, ECPD criteria for accreditation include approximately one year of work in the basic sciences and mathematics, approximately one year of study in the engineering sciences, and at least one half year of study with emphasis on design, synthesis, and a systems point of view. Accredited programs meet these criteria through the basic mathematics, science, engineering-breadth and engineering-depth requirements and the functional balance requirement.

The following undergraduate curricula are accredited: Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering and Mechanical Engineering. An Aeronautics and Astronautics curriculum is accredited at the Master's degree level.

Engineering Majors

The 36-unit engineering depth requirement permits the student to select a major course of study and obtain a limited amount of specialization. There are three categories of engineering majors, described below.

I. Department Majors

Satisfaction of the engineering depth requirement by completion of one of the departmental course sequences constitutes a major in that branch of engineering. A student wishing to deviate slightly from one of the departmental depth programs may submit his proposed program to the department for approval. Modified programs recommended by a department will normally be approved by the Undergraduate Council.

Chemical Engineering

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 35</td>
<td>Functional Groups and Stereochromy</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 131</td>
<td>Chemical Synthesis and Properties</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 132</td>
<td>Theory and Practice of Identifications</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 173</td>
<td>Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 174</td>
<td>Physical Chemistry Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 175</td>
<td>Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 110</td>
<td>Equilibrium in Thermodynamic Systems</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 120</td>
<td>Separations Processes Demonstration Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Chem. Engr. 120L</td>
<td>Separations Processes</td>
<td>1</td>
</tr>
<tr>
<td>Chem. Engr. 130</td>
<td>Chemical Kinetics: Theory with Applications to Reactor Design</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 140</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 140L</td>
<td>Fluid Mechanics Demonstration Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Chem. Engr. 150</td>
<td>Energy and Mass Transport</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 150L</td>
<td>Energy and Mass Transport Demonstration Laboratory</td>
<td>1</td>
</tr>
</tbody>
</table>

Civil Engineering

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.E. 107</td>
<td>Mechanics of Fluids</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 114</td>
<td>Mechanics of Materials</td>
<td>4</td>
</tr>
</tbody>
</table>
## C.E. Courses
- C.E. 130. Transportation 3
- C.E. 143. Specifications and Contracts 3
- C.E. 160. Water Resources Engineering 4
- C.E. 170. Man and His Environment 4
- C.E. 180. Elementary Structural Analysis 4
- C.E. 190. Soil Mechanics and Foundations 4
- C.E. 197. Engineering Synthesis, 4 units, or
- C.E. 198. Senior Report, 1 unit plus restricted electives in Civil Engineering 8

### Restricted Electives for Undergraduate Degree

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology 1. Interpreting the Earth</td>
<td>5</td>
</tr>
<tr>
<td>C.E. 40. Elementary Surveying</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 116. Plain Concrete</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 118. Materials Engineering</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 133. Introduction to Urban Planning</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 171. Environmental Planning</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 181. Design of Steel Structures</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 182. Design of Reinforced Concrete Structures</td>
<td>3</td>
</tr>
</tbody>
</table>

### Electrical Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>E.E. 101, 102, 103. Circuits and Networks</td>
<td>9</td>
</tr>
<tr>
<td>E.E. 111, 112, 113. Electronics</td>
<td>9</td>
</tr>
<tr>
<td>E.E. 121, 122. Laboratory</td>
<td>5</td>
</tr>
<tr>
<td>E.E. 141. Electromagnetics and Waves</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 181. Introduction to Computer Organization, Machine and Assembly Languages</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 128, 139, or 274 Laboratory</td>
<td>4</td>
</tr>
</tbody>
</table>

### Industrial Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.E. 100. Industrial Organization and Management</td>
<td>4</td>
</tr>
<tr>
<td>I.E. 108. Work Design and Measurement</td>
<td>3</td>
</tr>
<tr>
<td>I.E. 120. Quality Control</td>
<td>3</td>
</tr>
<tr>
<td>I.E. 133. Industrial Accounting</td>
<td>4</td>
</tr>
<tr>
<td>I.E. 141. Computer Applications and Techniques</td>
<td>3</td>
</tr>
<tr>
<td>I.E. 144. Information Systems and Simulation</td>
<td>3</td>
</tr>
<tr>
<td>I.E. 160. Analysis of Production Systems</td>
<td>3</td>
</tr>
<tr>
<td>I.E. 164. Production Engineering Project</td>
<td>3</td>
</tr>
<tr>
<td>I.E. 199. Senior Seminar</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 181. Engineering Economy</td>
<td>3</td>
</tr>
</tbody>
</table>

### Materials Science and Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S. &amp; E. 180. Atomic Arrangements in Solids</td>
<td>4</td>
</tr>
<tr>
<td>M.S. &amp; E. 181. Thermodynamics and Phase Equilibria</td>
<td>4</td>
</tr>
<tr>
<td>M.S. &amp; E. 182. Rate Processes in Materials</td>
<td>3</td>
</tr>
<tr>
<td>M.S. &amp; E. 185. Mechanical Behavior of Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S. &amp; E. 188. Electrical, Optical and Magnetic Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>M.S. &amp; E. 202A,B,C. Experimental Methods in Materials Science</td>
<td>4</td>
</tr>
<tr>
<td>Phys. 56. (Concurrent with Phys. 55)</td>
<td>1</td>
</tr>
<tr>
<td>Stat. 110.</td>
<td>4</td>
</tr>
</tbody>
</table>

### Restricted Electives:

- science or engineering courses approved by M.S. & E) 8

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## Mechanical Engineering

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. 101. Visual Thinking</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 103. Manufacturing Technology</td>
<td>4</td>
</tr>
<tr>
<td>M.E. 107. Mechanical Systems</td>
<td>4</td>
</tr>
<tr>
<td>M.E. 111. Failure Prevention</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 113. Engineering Design</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 131A,B,C. Thermosciences</td>
<td>14</td>
</tr>
<tr>
<td>Engr. 104. Dynamic Response</td>
<td>3</td>
</tr>
<tr>
<td>or M.E. 161. Engineering Vibrations</td>
<td>3</td>
</tr>
</tbody>
</table>

Any M.E. course in the 100 or 200 series

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## II. Interdisciplinary Majors

The Undergraduate Council is responsible for specialties that cross departmental lines. Students must obtain approval of their programs by the Undergraduate Council; they should be submitted during the junior year, but in any case not later than the end of the fifth week of the third quarter preceding graduation, and should include a statement that describes a well-defined educational objective and the approval of the student's adviser. Additional information regarding these majors may be obtained from the office of the Dean of Engineering.

### Aeronautics and Astronautics

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. 104. Dynamic Response</td>
<td>3</td>
</tr>
<tr>
<td>A.A. 100. Introduction to Aeronautics and Astronautics</td>
<td>3</td>
</tr>
<tr>
<td>A.A. 131. Experimentation in Aeronautics and Astronautics</td>
<td>3</td>
</tr>
<tr>
<td>Civil Engr. 114. Mechanics of Materials</td>
<td>4</td>
</tr>
<tr>
<td>Mech. Engr. 131A. Thermosciences: Thermodynamics</td>
<td>5</td>
</tr>
<tr>
<td>A.A. 200A. Engineering Analysis of Flight Vehicles</td>
<td>3</td>
</tr>
<tr>
<td>A.A. 192. Vector Analysis and Cartesian Tensors</td>
<td>3</td>
</tr>
<tr>
<td>Math. 130. Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>A.A. 210A. Fundamentals of Compressible Flow</td>
<td>3</td>
</tr>
</tbody>
</table>

### Product Design*

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mech. Engr. 103. Manufacturing Technology</td>
<td>4</td>
</tr>
<tr>
<td>Mech. Engr. 115A. Introduction to Product Design</td>
<td>4</td>
</tr>
<tr>
<td>Mech. Engr. 115B. Design Communication</td>
<td>3</td>
</tr>
<tr>
<td>Art 40. Basic Drawing and Painting</td>
<td>2</td>
</tr>
<tr>
<td>Art 50. Basic Sculpture</td>
<td>3</td>
</tr>
<tr>
<td>Art 60. Basic Design</td>
<td>3</td>
</tr>
<tr>
<td>Art 160. Design 1</td>
<td>3</td>
</tr>
</tbody>
</table>

* Refer to Mechanical Engineering section of this bulletin for graduate programs in Product Design.
III. Innovative Majors

Any student, with the help of his or her adviser, may propose a unique combination of courses to meet particular career goals. Such a program should be submitted to the Undergraduate Council during the junior year, but in any case not later than the end of the fifth week of the third quarter preceding graduation. A coordinated sequence of courses that provides mastery of the important principles and techniques in a well-defined field will ordinarily be approved. Programs for other interdisciplinary majors, such as Bio- or Premedical-Engineering, Environmental Engineering (see also Civil Engineering), Urban Planning (see also Civil Engineering), Ocean Engineering, may be developed within the framework of the innovative major. Lists of courses in these areas are available from the Office of the Dean, School of Engineering.

Architecture Program

The Design Division of the Department of Mechanical Engineering offers an undergraduate program in architecture leading to the degree of Bachelor of Arts. More details on this program can be found in the Mechanical Engineering section of this catalogue.

Engineering and Society Program

The increased complexity of social and scientific problems is such that an undergraduate program reflecting the interrelation of engineering, science, and societal subjects forms a desirable basis for many careers. The School of Engineering offers the Engineering and Society Program to meet this need.

The following requirements are prescribed for this Program: Writing (two courses, unless a student is exempt from all or part of this requirement); Humanities and Fine Arts (three courses minimum); Social Sciences (three courses minimum); Mathematics (21 units); Science (24 units); a plan of courses in Engineering and Society forming a coherent program to satisfy a well-defined educational objective (64 units, of which at least 36 units must be in courses in engineering); Functional Balance, including a minimum of nine units of analysis; Free Electives (sufficient for a total of 180 units—typically between 40 and 50 units). A list of suggested courses is available.

Students who elect the Engineering and Society Program must obtain approval of their programs by the Undergraduate Council. Petitions requesting admission to the Program should be submitted not later than the end of the fifth week of the third quarter preceding graduation, and should contain a statement describing a well-defined educational objective, the program of courses relevant to this objective that meets the requirements listed above, and the approval of the student’s adviser. Students in this Program who wish to pursue graduate studies in engineering may require more than three quarters to complete departmental Master’s degree requirements.

Engineering in Biology and Medicine

The bioengineer is one who can apply technology to the solution of biological and medical problems. To do this he must have a mastery of some branch of technology. For this reason, we recommend that engineering undergraduates interested in biomedical problems major in one of the established fields of engineering, while using their electives to build up a basic background in the biological sciences and the interconnection between engineering, man, and his environment. A worthwhile strategy for the bioengineering undergraduate may thus be to supplement his major in some branch of engineering with basic courses in biology and chemistry, such as:

Biol. 1. Introductory Biology
Biol. 21, 22, 23. Principles of Biology
Human Biology 1. Man and Nature
Human Biology 2A. Cells, Organisms, and Societies
Human Biology 2B. Behavior as Adaptation
Chem. 4, 5 or 31, 33, 35. General Chemistry (Note that pre-medical students are usually required to have a full year of chemistry.)

The student with further free electives might then choose from such courses as:
Engr. 104. Dynamic Response—Its prerequisites provide basic engineering background
Biol. 153. The Physiological Basis of Behavior
Civ. Engr. 170. Man and his Environment
Elect. Engr. 208. Biological Information Processing

Program Planning

An engineering curriculum provides a cumulative educational experience, and attention must be paid to course prerequisites. The study of mathematics should begin in the freshman year. Physics is a prerequisite for many engineering courses and should
be started in the Winter Quarter of the freshman year. The engineering breadth courses may be spread over the first three years. The engineering depth sequences ordinarily require at least two years for their completion and should be started no later than the third year. Sample programs are available in the office of the Dean of Engineering.

In selecting courses for his undergraduate curriculum, each student should take into consideration his plans for graduate study. Many graduate programs of study have undergraduate courses as prerequisites; students who enter graduate programs without these prerequisites may have to spend extra time making up deficiencies. Consult your adviser if you have any questions about admission to graduate study.

In addition, some students may eventually seek professional engineering registration; consult your adviser as to desirable courses to take in preparation for the Engineer-in-Training and the Professional Registration examinations.

Co-terminal Degree Programs

A Stanford undergraduate may work simultaneously toward Bachelor and Master degrees, i.e., A.B. and B.S., A.B. and M.S., A.B. and M.A., B.S. and M.S., or B.S. and M.A. The degrees may be granted simultaneously or at the conclusion of different quarters. Usually five years will be needed for a combined program.

1. Co-terminal A.B. and B.S. Degree Program. To qualify for both degrees, a student must: (1) complete the stated University requirements and departmental requirements for each degree, (2) complete 15 full-time quarters or 3 full-time quarters after completing 180 units, and (3) complete a total of 225 units (180 units for the first Bachelor’s degree plus 45 units for the second Bachelor’s degree).

2. Co-terminal Bachelor/Master Program. A Stanford undergraduate may be admitted to the University Division for the purpose of working simultaneously toward a Bachelor’s degree and a Master’s degree. To qualify for both degrees, a student must (1) complete 15 full-time quarters (or the equivalent) or 3 full-time quarters (or the equivalent) after completing 180 units; (2) complete, in addition to the 180 units required for the Bachelor’s degree, the number of units required by his or her graduate department for the Master’s degree (not fewer than the University minimum of 36 units); (3) complete the requirements for the Bachelor’s degree (department, School, and University) and apply for the degree at the appropriate time at the office of the Registrar, and (4) complete the department and University requirements for the Master’s degree and file candidacy forms through his/her graduate department.

3. Procedure for Applying for Admission to the Co-terminal Degree Programs.

(a) A Stanford undergraduate may apply (using the white University petition form) for admission to the Co-terminal A.B./B.S. Program during the student’s tenth or eleventh quarter. The student may apply for admission to the Co-terminal Bachelor/Master Program after the beginning of the eighth quarter of undergraduate work and before the end of the eleventh quarter. Students seeking an undergraduate or graduate degree in engineering will apply through the office of the Dean of Engineering; all other students will apply through the Graduate Study Office (118 Old Union). All necessary forms are available in the office of the Dean of Engineering.

Dual Degree Programs

Stanford University cooperates with certain liberal arts colleges (presently Centenary College, Claremont Men’s College, the College of Idaho, 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.

A minimum of six quarters of residence at Stanford is required for dual-degree transfer students. Thus, such students may not receive the Stanford B.S. degree until at least 6 quarters of study have been completed here. However, 3+2 students also have the option of entering the combined B.S.-M.S. program if they meet the requirements, in which case they may receive the Master’s degree as soon as all appropriate requirements are met, but not sooner than at the end of 6 quarters of study at Stanford.
Inquiries concerning this “three-two” program may be addressed to the Dean of Engineering at Stanford or to the above listed colleges. For a description of the four-two program, see the section titled “Master of Science.”

FOREIGN STUDY

In addition to the regular opportunity available to all Stanford engineering students for study at one of the Stanford overseas campuses, a special opportunity exists whereby engineering students may spend their junior year in residence at the Instituto Tecnologico y de Estudios Superiores de Monterrey in Mexico. The student pursues a regular program of engineering courses, so little if any delay results in graduation. Instruction is in Spanish, so adequate language preparation is needed—either one year of college Spanish or high school equivalent. The student achieves a genuine fluency in a second language, and an opportunity to live in a different cultural setting.

A similar opportunity exists in France, at the Ecole National Superieure de Meccanique of Nantes, to which substantially the same remarks apply.

GRADUATE 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 Chairman of the Department. While most graduate students have undergraduate preparation in an engineering curriculum, it is feasible to enter from other programs including chemistry, physics, or mathematics (see, for example, the Four-Two program described under “Master of Science”).

GRADUATE REGISTRATION

New graduate students should follow procedures for registration as listed in the Time Schedule. Adviser assignments can be obtained from the Department office.

GRADUATE PROGRAMS OF STUDY

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

AERONAUTICS AND ASTRONAUTICS

Acoustics
Aerelasticity
Aerophysics
Aerospace Structures
Aerospace Systems Synthesis and Design
Analytical and Experimental Methods in Solid and Fluid Mechanics
Biomedical Solid and Fluid Mechanics
Flight Mechanics
Gaskinetics
Guidance and Control
Physical Gas Dynamics
Propulsion
Transportation
Waves and Vibrations

APPLIED MECHANICS

Continuum Mechanics
Elasticity, Plasticity, Viscoelasticity, Shells and Plates, Instabilities (elastic, plastic, dynamic)
Stress Waves in Solids
Composites, Fracture of Solids
Experimental Stress Analysis
Dynamics
Rigid Bodies, Space Dynamics, Vibrations (linear and nonlinear)
Fluid Mechanics
Dynamics of Ideal Fluids and Gases
Viscous Flow
Geophysical and Astronomical Fluid Mechanics
Applied Optimal Control
Optimal Trajectories, Feedback, Control, Filtering, and Smoothing
Biomechanics
Bone Fracture and Repair, Joint and Tissue Mechanics, Orthopaedic Procedures

ENGINEERING

Interdisciplinary Programs
Interdepartmental Programs

ENGINEERING IN BIOLOGY AND MEDICINE

Biomaterials
Biomathematics
Biomechanics
Biophysics
Biostatistics
Design for Medical Applications
Water Quality Control
Information Processing for Biomedical Systems
Information Processing in Biological Systems
Integrated Circuits for Medical Electronics
Transport Phenomena in Biological Systems

CHEMICAL ENGINEERING
Newtonian and Non-Newtonian Fluid Mechanics
Hydrodynamic Stability
Chemical Energy Conversion
Applied Chemical Kinetics
Surface Reactivity
Adsorption and Catalysis
Bioengineering

CIVIL ENGINEERING
Construction Engineering and Management
Civil Engineering Planning
Structures, Materials, and Geotechnical Engineering
  Civil Engineering Materials
  Earth Engineering
  Foundation Engineering
  Reliability and Risk Analysis
  Soil Mechanics
  Soil-Structure Interaction
  Structural Analysis and Design
Water Studies
  Environmental Engineering
  Hydrology
  Hydromechanics
  Nuclear Civil Engineering
  Water Resources

ELECTRICAL ENGINEERING
Computer Systems
  Engineering in Medicine
  Integrated Circuits and Systems
  Lasers and Quantum Electronics
  Microwave Acoustics
  Plasmas
  Radioscience
  Space Engineering
  Signal Processing Systems
  Solid State Devices and Systems
  Solid State Phenomena and Materials
  Statistical Theory of Communication and Control

ENGINEERING-ECONOMIC SYSTEMS
Applied Economics
Decision Analysis
System Analysis

Long Range Planning
Public Decision-Making

HYDROLOGY
See “Hydrology, Committee on,” page 561.

INDUSTRIAL ENGINEERING
Computer Utilization
Economic Systems Planning
Management Systems Design
Systems Analysis and Synthesis

MATERIALS SCIENCE AND ENGINEERING
Physical Metallurgy
Electronic Properties of Solids
Mechanics of Solids
Magnetic Behavior of Solids
Mechanical Behavior of Solids
Thermodynamics of Solids
Biomaterials
Reaction Kinetics in Solids
Polymer Science
Crystal Growth
X-ray and Electron Diffraction and Spectroscopy

MECHANICAL ENGINEERING
Energy Systems
Thermodynamics
Heat Transfer
Fluid Mechanics
High Temperature Gasdynamics
Engineering Design
Kinematics, Control Systems
Product Design
Nuclear Engineering
Optimization
Combustion
Air Pollution
Environmental Measurements

OPERATIONS RESEARCH
Applied Probability
Dynamic Programming and Mathematical System Theory
Inventory, Queueing, and Reliability Theory
Linear, Nonlinear, and Integer Programming
Networks, Graphs, and Combinatorial Theory

SPACE SCIENCE
See “Special Opportunities in Graduate Study,” page 592.

For further details about the above pro-
grams, see the department sections in this bulletin.

Related aspects of particular areas of graduate study are commonly covered in the offerings of several departments and divisions. Graduate students are encouraged, with the approval of their departmental advisers, to select courses in departments other than their own to achieve a broader appreciation of their field of study. For example, most departments in the School offer courses concerned with properties of materials, and a student interested in an aspect of materials engineering can often gain appreciable benefit from the related courses given by departments other than his or her own.

**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 and is described in the various department listings. A minimum of 45 units is usually required in M.S. programs in the School of Engineering. However, the presentation of a thesis is not a School requirement in Engineering. Further information may be obtained from the particular department in which the student is interested.

**Four-Two program** — Superior students who hold baccalaureate degrees in physical science with adequate physics and mathematics may complete the requirements for an M.S. in engineering at Stanford (in most of the curricula above) 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 department in which the student is interested.

**ENGINEERING AND ENGINEERING SCIENCE**

The degree of Master of Science in Engineering or Engineering Science is available to those who wish to follow a program of study of an interdisciplinary nature that does not conform to a normal graduate program in a department. The Engineering Science degree is appropriate when the program of study emphasizes the scientific background of some aspect of engineering (e.g. Bioengineering) and contains a high percentage of courses in Mathematics, Physics, Chemistry, etc. The Engineering degree is appropriate to all other cases, including programs in fields lying between two departments within the School of Engineering and programs involving a large amount of non-engineering course work in fields other than the physical sciences.

There are three School requirements for the M.S. degree in Engineering or Engineering Science: (1) the student's program must be a coherent one with a well-defined objective and be approved by a department within the School; (2) the student's program must include at least 21 units of courses within the School of Engineering with numbers 200 or above in which the student receives letter grades; (3) the program must include a total of at least 45 units.

Applications for admission to the Engineering or Engineering Science programs should indicate the department in the School in which the student expects to take most of his or her courses, or, if undecided, indicate the Office of the Dean, School of Engineering. Transfer into this program is also possible from any department program within the School by application to the appropriate department.

**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. The program of study must satisfy the student's department and usually includes 90 units beyond the B.S. degree 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. Special Ph.D. programs which may be interdepartmental in nature (e.g., Bioengineering) can be arranged. See "Graduate Division Special Programs" section in this bulletin. University regulations are given in the section "Degrees" in this bulletin, and further information will be found in the department sections following.
sections following. Inquiries concerning programs in Bioengineering should be addressed to the Dean of the School of Engineering, Stanford University, Stanford, California 94305.

**Fellowships and Assistantships**

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

**The Honors Cooperative Program**

A number of industrial firms, government laboratories, and other organizations participate in the Honors Cooperative Program (HCP), a plan which permits qualified professional employees to register for graduate Stanford courses on a part-time basis. Most of the students in the HCP are in the School of Engineering, though several departments in related fields also offer graduate degree programs under this plan. The HCP is now augmented by the Stanford Instructional Television Network, a four-channel network which enables students to enjoy live lectures with talk-back privileges at their company plants. Further details can be obtained from the School of Engineering.

**Courses of Interest Primarily to Undergraduates**

1. **The Engineer in Modern Society**—Lectures, demonstrations, experiments, case studies, and field trips planned to show what engineering is and what engineers do. Creativity, design, and decision making. Open to any student.
   
   3 units, Aut (DeBra) TTh 1:15-3:05

2. **Peopledynamics Laboratory** — This course studies methods by which the engineer can identify the human nontechnical components of a problem. The methods are demonstrated in a laboratory setting, the data for learning being the behavior, feelings, and reactions of the members of the class. Experiments are performed to sharpen perception, develop the ability to face emotional situations, focus misdirected energy, identify manipulation, develop accurate intuition and judgment, improve communications, and illuminate such interpersonal issues as inclusion, control, and cooperation. The methods used in the course are experimental. Although attendance at all labs is mandatory, participation in individual experiments is optional. Does not fulfill the University Distribution Requirement for Math/Science/Technology. Pass/no credit.
   
   2 units, Aut, Win, Spr (Roth, Wilde) T 1:15-3:05

3. **Applied Mechanics I**—The three courses,
Engineering 3, 4, and 5, constitute a sequence for first-year students interested in engineering. The first course deals primarily with systems at rest on the earth and includes vector algebra, centroids and mass centers, and force systems. Prerequisites: none.

3 units, Aut (Bryson) MWF 11


3 units, Win (Bryson) MWF 11

5. Applied Mechanics III—Continuation of 4. Prerequisites: 4, Math 11 or 41.

3 units, Spr (Bryson) MWF 11

7. Energy, from Nature to Man—(Same as VTS 141.) Nature provides an abundant supply of energy, mostly in forms not directly usable by man. The engineer has the problem of designing systems to convert this energy to usable forms, to transmit energy, and to use the energy in a socially responsible way. This course provides an introduction to the science of energy and to the technical aspects of energy supply. Open to all students who have taken some mathematics and science in high school. Sophomore engineering students should take Engineering 32 instead.

3 units, Win (Reynolds) MWF 11; 1 to 2 additional units (term project) by arrangement

10. Aeronautics and Astronautics—The historical developments leading to controlled, powered flight; atmospheric flight beyond the sound and temperature barriers; and space flight are presented. The fundamental principles of atmospheric and extraterrestrial flight are explained physically, with minimum dependence on mathematics. Participatory discussion is generated on the social, economic, and political ramifications of the rapid growth, achievements, challenges, and potential of aeronautics and astronautics. Open to all students who have taken some mathematics and science in high school.

3 units, Spr (Mayers) TTh 11-12:15

11. Applied Mechanics: Stress Analysis — Analysis of stresses, strains, deformations, and deflections of linearly elastic structural members under load. Tension and compression; shear; torsion; shear force and bending moment in beams; stresses and deflections of beams. Prerequisites: 3 or Physics 51, Math 21 or 42.

4 units, Aut (Mayers) MWF 9; problem sessions by arrangement
Win (Mayers) MWF 9; problem sessions by arrangement
Spr (Richards) MTThF 9

12. Applied Mechanics: Dynamics—Principles of dynamics applied to engineering problems involving motions of particles, rigid bodies, and linearly elastic bodies; vibration and dynamic response of simple mechanical systems. Prerequisites: Mathematics 23 or 43 and Physics 51. (Credit is not given for both Engr. 5 and 12.)

4 units, Win (Bershader) MWF 9, problem sessions by arrangement
Spr (Baganoff) MWF 9, problem sessions by arrangement

21. Mechanics of Fluids—Physical properties of fluids and their effect on flow behavior; the equations of motion for incompressible ideal flow, including the special case of hydrostatics; energy and momentum principles; the control volume analysis; real fluid effects—laminar and turbulent flows; specific engineering applications. Laboratory exercises. Prerequisite: 5 or 12, or Math 23 or 43, or consent of instructor.

4 units, Aut (Hsu) MWF 10; lab. M or T 1:15-4:05
Spr (Bershader) MWF 9; lab. M or T 1:15-4:05

32. Introduction to the Thermosciences — Introduction to the concepts of energy and entropy from elementary considerations of the microscopic nature of matter. Use of the conservation of energy principle in the solution of engineering problems. Methods and problems in the socially responsible economic generation and utilization of energy in central power stations, automotive gas turbine engines, thermoelectric generators, refrigeration devices, life support systems, etc. Prerequisites: freshman calculus and physics.

3 units, Aut (Staff) MWF 8
Win (Staff) MWF 8

41N. Circuits — Introduction to electrical signals, circuits, and analytical techniques. Circuit principles, natural and forced response, network theorems, block diagrams,
and feedback. Prerequisites: Physics 53 and Mathematics 43.

3 units, Aut (Manning) MWF 9
Win (Manning) MWF 10

42N. Electronics — Electronic devices and circuits; linear and nonlinear applications. Digital devices and logic circuits; power, small-signal, and operational amplifiers. Prerequisite: 41N or equivalent.

4 units, Win (Smith) MWF 9; one 3-hour lab. weekly by arrangement
Spr (Manning) MWF 10; one 3-hour lab. weekly by arrangement

43. Electromechanics — Energy conversion, magnetic fields and devices, electromechanical devices, rotating machinery, automatic control. Prerequisite: 41N or equivalent.

3 units, Spr (Smith) TTh 9; one 3-hour lab. weekly by arrangement

44. Basic Electronics — Elementary electronics for the nonspecialist. Electrical quantities and circuit laws; electron ballistics and the CRO; semiconductor diodes and transistors; integrated circuits; digital devices and logic circuits; signal wave-forms and ac circuits; power, small-signal, and feedback amplifiers; operational amplifiers; modulation; instrumentation. Lectures and laboratory work. Not intended for those who take 41. Prerequisite: calculus.

5 units, Aut (Helliwell) MWF 11; one 3-hour lab. weekly by arrangement

50. Introductory Science of Materials — Introduction to the physical basis of the mechanical, electrical, and magnetic behavior of solids. Electron theory, imperfections in solids. Relations between structural features and properties. Prerequisite: Mathematics 23 or 43.

3 units, Aut (Staff) MWF 11
Win (Sherby) MWF 11
Spr (Stevenson) MWF 10


3 units, Aut (Staff) MWF 11
Win (Staff) MWF 11


3 units, Aut (Powell) MWF 10
Win (Franklin) MWF 8
Spr (Staff) MWF 11

121. Conversion of the Sun's Radiation for Man's Use — The purposes of this new interdisciplinary course are: (a) To survey and put in perspective a number of systems for domestic use of solar energy, now being proposed or built, utilizing student reports of current literature; (b) To review quantitatively heat transfer, radiation, etc. as they apply to solar system components such as collectors, converters, controls, insulators, and storage devices. Prerequisite: a basic course in college or engineering physics.

3 units, Aut (Seifert) MWF 1:15

161. Engineering Economy — Economic decision making for alternative engineering designs. Use of compound interest and depreciation calculations to compare the relative economy of both technical investments and plant operating procedures before and after Federal income taxes. Several methods are employed for analysis of multiple alternatives, simple risk, retirement, replacement, resource allocation, and public works projects. May be taken by freshmen. Recommended for sophomores.
176. Nuclear Energy—Theory, design and applications of nuclear energy systems; radioisotope heat sources, fission chain reactors and concepts of fusion reactors. The effects and the shielding of nuclear radiation emitted by these systems. The status of development of fission and fusion power technologies. Prerequisite: Mathematics 43.

3 units, Win (Connolly) MWF 9

199. Special Studies in Engineering—Special studies, laboratory work, or reading under the direction of a faculty member. By consent only.

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

OTHER COURSES OF INTEREST

Political Science 138A, 138B. Arms Control and Disarmament—General international security relations, stressing political, conceptual, and technological problems of arms control. 138A is a prerequisite to 138B; the second quarter will provide for individual research.


138B. 5 units, Spr (Drell, Dunn, Lederberg, Lewis, Weiler) W 1:15 (and tutorials by special arrangement)

COURSES OF INTEREST PRIMARILY TO GRADUATE STUDENTS

204. Introduction to Heuristics of Invention and Discovery—This course aids in the actualization and development of innate potentials for invention and discovery. Students are prepared to make patentable inventions, each in his own chosen field of interest or specialization. Knowledge generating skills of scientific observation, formal reasoning, practical action and heuristic intuition are studied and practiced. Special emphasis is given to retrodiction, as taught by Charles Sanders Peirce and to physical analogy, as taught by James Clerk Maxwell. Library work and writing assignments deal with explorations of creativity and detailed analyses of the latest patents covering the chosen fields. Open to all senior and graduate students.

3 or 4 units, Win (Loebner) TTh 1:15–2:45

206. Control Systems Analysis and Design—Sequel to Engineering 105. Theoretical material learned in 105 is applied to practical design. Two systems design projects will be used to motivate discussion of several new topics of use in handling nonlinear systems. These include describing functions, phase-plane analysis, analog computers in simulation and design, bang-bang control, and state-space design techniques. Different control techniques will be tested in the laboratory. Prerequisite: 105.

4 units, Win (DeBra) MWF 1:15; lab. by arrangement

207. Digital Control I—Study of the computer as an element in feedback control systems. Sampling, z-transforms, discretization of continuous compensation, discrete compensation design, quantization errors, state variable design of discrete controllers and observers. Laboratory experiments on a mini-computer/analog computer system. Limited enrollment. Prerequisite: 105.

4 units, Win (Powell) TTh 11–12:15; lab. by arrangement

208. Digital Control II—Design of digital control systems including multivariable controller/observers, steady state optimal techniques, w-plane frequency response methods. Parameter identification, Kalman filter implementation. Laboratory projects on a mini-computer/analog computer system. Prerequisite: 207.

3 units, Spr (Powell) MW 10; lab. by arrangement

211. The Laboratory Plasma—Methods of forming laboratory plasmas. Collision processes, velocity distributions, the Boltzmann transfer equation, concepts of temperature and pressure, nonequilibrium velocity distributions. Macroscopic averages of the Boltzmann equation. DC and rf breakdown and avalanche phenomena, the effect of a mag-
netic field, the positive column at low pressure and medium pressure, ambipolar diffusion, the plasma sheath, and thermal plasmas. Fusion. Recommended: Electrical Engineering 243 or equivalent.

3 units, Aut (Staff) alternate years, given 1974-75 MWF 3:15

ENGINEERING 101

235A, B. Engineering Systems Design — Fifty to seventy students mostly from engineering and science, but also from business, political science, law, etc., form a team to prepare a preliminary design of a complex system. Topics treated in previous years include: educational television satellites and cables, development of ocean resources, approaches to urban ghetto problems, and evaluation of alternative solutions to the energy crisis. Over twenty speakers from government agencies, universities, and industry give the necessary background and provide contacts for future implementation of the study proposals.

235A. 3 units, Win (Staff) T 1:15-3:05, Th 1:15; two hours by arrangement

235B. 3 to 5 units, Spr (Staff) TTh 1:15-2:05; two hours by arrangement

290. The Historical Context of Engineering — By looking at the past an attempt is made to understand the interplay of technological change and societal development generally. The course is conducted as a colloquium, with discussion based on readings in the history of technology. Consideration of the professional and social position of engineering inevitably arises. Primarily for graduate students; Values, Technology and Society 121 is recommended for undergraduates. Enrollment limited to 15; pass/no credit only.

3 units, Spr (Vincenti) T 7:30-9:30 p.m.; given in 1975-76

291. Management of Research Institutions — Interdisciplinary graduate level seminar dealing with organizations that perform research and development work. The history of these organizations will be discussed with a view toward understanding how their functions have evolved. A description of the impact that selected research laboratories have had on society will be presented. Techniques for evaluating the performance of research laboratories will be discussed and management procedures in finance, personnel and program planning will be described.

1 unit, Aut (Mark) M 3:15-5:05

295. Computational Physics Seminar — A forum for the presentation and exchange of computational methods to solve physical problems encountered in applied science. Emphasis on computer modeling or simulation of media and continuous physical systems such as solids, fluids, the atmosphere, plasmas. Methods to be covered are, mostly, common to applications in several disciplines; interdepartmental and inter-school.

1 unit, Aut, Win, Spr (Buneman) F 3:15

296A, B. Seminar on Engineering Teaching — Weekly presentations and discussions for guidance of those who intend to make a profession of engineering teaching. Open to all. Graduate students from all engineering departments are especially invited. Seminars in the winter quarter will relate particularly to teaching, and in the spring quarter particularly to the other responsibilities of the teacher such as administration, curricula, publication of books and papers, research, and professional duties. 296A need not precede 296B. A student completing this seminar may elect to receive either a letter grade or a pass.

296A. 1 unit, Win (Skilling) T 3:15-5:05

296B. 1 unit, Spr (Skilling) T 3:15-5:05

297. Seminar for Engineers Concerned with Developing Nations — This interdisciplinary, problem-oriented seminar will explore the role of the engineer in a developing nation. Students will learn how to relate their own fields of specialization to problems of population, food, economic growth, resources, technology, education, values and life styles. Autumn quarter will explore the global and national problems related to human survival utilizing several specific case studies. Winter quarter will focus on alternatives to present trends, and spring quarter will undertake group projects on specific planning aspects. The seminar will include students and faculty from other schools to stress the need for interaction of engineering with economics, business, politics, education and other disciplines. The seminar is a required part of the International Program for Engineering Studies and may be taken by other interested students.

1 unit, Aut, Win, Spr (McWhorter, Cooper) M 7:30-9:30 p.m.
298. Seminar in Fluid Mechanics—Interdepartmental seminar on problems in all branches of fluid mechanics, with talks by visitors, faculty, and students. Graduate students may register for one unit, without letter grade; a letter grade is given for students presenting talks.

1 unit, Aut, Win, Spr (Staff) T 4:15

299. Special Studies in Engineering—Special studies, laboratory work, or reading under the direction of a faculty member. By consent only.

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

ENGINEERING IN BIOLOGY AND MEDICINE


Though Stanford does not have a formal department of bioengineering, there are approximately twenty-five faculty in the School of Engineering whose primary research activities are in the general area of bioengineering. These faculty are spread throughout the various departments of the School of Engineering, and a list of their names, together with a summary of their research interests, is available from the Committee Chairman. Students interested in pursuing graduate study in bioengineering apply for both admission and financial aid to the department appropriate on the grounds of their prior training and future interests, and their applications are judged on substantially the same grounds as other applicants to this department.

The research being conducted in the field of bioengineering within the various departments reflects the technological emphasis of those departments. For instance research on membrane transport and enzyme engineering is pursued in the Chemical Engineering Department, bone elasticity in Applied Mechanics, and cardiovascular dynamics and haemodynamics in Mechanical Engineering, Applied Mechanics, and Aeronautics Departments. In the Electrical Engineering department a superb integrated circuits facility is used in research on advanced medical instrumentation, such as ultrasonic imaging systems and Doppler-shift blood flowmeters and on micropower implantable electronics such as neural prostheses and biological microsensors. Also in Electrical Engineering advanced computer techniques are applied to various medical problems such as EKG and EEG recognition and X-ray image enhancement. In essentially all cases research in the School of Engineering is carried out in collaboration with faculty of the Medical School or with members of the local medical community.

The typical graduate student in bioengineering first seriously confronts the medical or biological aspects of his or her education at the thesis research level. In preparation he or she will probably have devoted one quarter or one third of his or her curriculum to relevant courses in biology, physiology, etc. Such courses are spread across the departments and schools of the University. The student's adviser will assist him or her in constructing a program of study incorporating these courses and also satisfying the degree requirements of the department in which he or she is registered. Both the Master's degree and the Ph.D. degree are ordinarily awarded by a particular department, and the candidate must meet the degree requirements of that department. There are also available for special cases the degrees of Master of Science in Engineering and Master of Science in Engineering: Biology and Medicine. In these cases the study program must be approved by an interdepartmental committee. For the rare cases where a student's background makes it unrealistic to satisfy a departmental Ph.D. qualifying requirement, a faculty committee can be formed to supervise an appropriate qualifying and research
program, as a Graduate Division Special Program.

Students accepted into the Biophysics program may choose to develop their specialization in the area of biomedical engineering and to work for the Ph.D. in Biophysics.

A student wishing to earn the M.S. in Engineering while pursuing the M.D. degree, must apply separately for admission to both schools. If the student is admitted to both, each school will encourage his or her pursuit of the other degree. The Medical School curriculum is now so flexible that medical students can devote half of their first two years of study to Engineering. Such students are usually advised to take technical science and engineering courses rather than to concentrate on bioengineering courses, since much of the biology will be treated in greater depth in their medical studies.

In addition to the financial support available through the departments in the form of fellowships, research assistantships and teaching assistantships, there are externally administered fellowship programs for the support of graduate study in health-related fields. In particular, both the National Institute of Health and the National Science Foundation offer such fellowships on the basis of national competition.

**Offerings**

This Department prepares the student for a professional career in aeronautics and astronautics by offering a comprehensive program of graduate teaching and research. Particular emphasis is given to structural, aerodynamic, guidance and control, and propulsion problems of aircraft, missiles and spacecraft. The teaching program provides courses leading to the degrees of Master of Science, Engineer, and Doctor of Philosophy. The Department of Aeronautics and Astronautics offers two curricula for the Master of Science and Doctor of Philosophy—one oriented toward the sciences, the other emphasizing engineering. Specific programs are available in the following areas:

- Acoustics
- Aeroelasticity
- Aerophysics
- Aerospace Structures
- Aerospace Systems Synthesis and Design
- Analytical and Experimental Methods in Solid and Fluid Mechanics
- Biomedical Solid and Fluid Mechanics
- Energy
- Flight Mechanics
- Gaskinetics
- Guidance and Control
- Physical Gas Dynamics
- Propulsion
- Transportation
- Waves and Vibrations

Requirements for all degrees include courses on basic topics in aeronautics and astronautics, as well as in mathematics, physics and applied mechanics.

The current research activities cover a number of advanced fields, with special emphasis on:

- Aerodynamic Noise
- Aeroelastic Optimization
- Astrodynamics
- Bio-Fluid Mechanics and Physiological Acoustics
- Differential Games
- Geophysics
- Inertial Instruments
Lasers
Nonequilibrium Flow
Nonlinear Structural Mechanics
Optimal Control and Estimation
Plasticity and Viscoelasticity
Structural Aeroacoustics
Structures/Materials Systems
Optimization
Transportation Systems Analysis
Wave Propagation

FACILITIES FOR INSTRUCTION AND RESEARCH

The work of the Department is centered in the William F. Durand Building for Space Engineering and Science, completed and occupied in early 1969. This 120,000 square foot building houses advanced research and teaching facilities and concentrates in one complex the Department of Aeronautics and Astronautics as well as the activities of other engineering departments allied in space exploration and aerospace technology.

Included among the facilities in the building are structural laboratories for demonstrating and studying the behavior of high strength and stiffness, lightweight structures under programmed static, dynamic and thermal loads. In conjunction with the computing facilities available both in the new building and the Stanford Computation Center, test data may be obtained and reduced through automatic data acquisition and processing systems. Recent experimental studies of structural behavior have been centered on the effects of creep on stress distribution and structural stability, the buckling and postbuckling phenomena in high quality cylindrical and spherical shells obtained through the electroforming process and the development of techniques for obtaining ultra-small measurements of deformation in conjunction with the buckling process in thin-walled shells.

A new central laboratory for the School of Engineering has recently been constructed for the purpose of conducting structural tests on large-scale prototype structures in static, dynamic, and thermal loading environments. Specific facilities include a static/dynamic testing bed; a programmable, horizontal, sled-mounted crash simulator; a programmable, seismic-shock simulator; and a high-load rate, materials test system.

The guidance and control laboratories include a wide spectrum of specialized facilities for making and testing novel instruments of extremely high precision. The facilities include active table-leveling (0.1 arc sec); low-level accelerometer evaluation chamber ($10^{-4}$ to $10^{-10}$ g); spacecraft thruster test stand with 10 kHz bandwidth; spherical gyro rotor alignment facility (optical-to-principal-axis alignment less than 1 arc sec); air cushion vehicle to simulate the Stanford Drag-Free Satellite in an orbital dynamic environment to 275 km altitude; air-bearing simulator for spinning-spacecraft attitude control to a few arc secs; plus facilities for a number of inertial instrument test stands on an isolated test pad having visual access to Polaris. Clean facilities, ultra-precision machining, and advanced electronics design and fabrication capability support the guidance, control, and instrumentation experiments using these facilities. Elaborate new cryogenic gyro test facilities are available in the nearby Varian Physics Building, and Electrical Engineering's Integrated Circuit Fabrication Facility is adjacent. Three laser-research laboratories and the fluid controls laboratory also participate in the guidance and control programs. Testing of certain systems in Earth orbit is expected to begin this year.

The radiative gas dynamics laboratory houses a research facility to study the coupling between radiant energy and wave production in gases. The gas kinetics laboratory group conducts a program to study velocity distributions and spectral line shapes of selected levels and transitions in gases with the aid of a tuneable laser. The spectro-interferometric laboratory is being outfitted to do tuned-laser experiments on resonant refractivity in gas flows. Additional facilities include a 250,000 joule condenser bank for plasma acceleration work, and a special concrete housing for studies of explosively driven shocks. There is also a specially designed laboratory for studies of aerodynamic noise. Several student instructional laboratories include facilities to study supersonic jets, flame temperature by line reversal, supersonic flow fields with schlieren techniques, refractive index of gases with interferometer equipment, shock-wave development with a shock tube, gyroscopic behavior, vibration mode of a simulated wing, blunt-body flow with ballistic free-flight
range equipment, and hot-wire application with a small low-turbulence air-flow apparatus. An experiment using laser holography is currently being designed. Newly completed for operation in 1971 is a continuous low-speed tunnel with an 18" × 18" working section and speeds to 200 feet per sec.

Adjacent to the Durand Laboratory is the interdepartmental Institute for Plasma Research whose aerophysics laboratory is operated by Aeronautics and Astronautics faculty, staff and students. Its main facility is a high-pressure, high Mach number shock tube for the production of high density, partially ionized plasmas under well-defined conditions. A major measurement technique is high-speed rotating mirror interferometry. Also in use is a diffraction-grating tunable laser for the study of molecular kinetics. Presently, a pulsed-laser scattering experiment is in progress to measure electron temperature behind an ionizing shock wave.

Service facilities in the building include a full machine shop, standards laboratory, chemistry laboratory, an expanded aeronautics library, several conference rooms, extensive digital and analog computer equipment, including several time sharing terminals. Attached to the building is a modern classroom building which is equipped for televising lectures and which contains a lecture auditorium.

The University's Computation Center is complemented by a "satellite" computer facility on the lower level of the new building, which is readily available to Department researchers and students. From this area there are direct tie-lines to the IBM 360-67 Computer (in the University's campus facility) and to an IBM 360-50 computer (at the nearby Stanford Medical Center) for on-line evaluation of experimental data. Terminals provide for individual on-line, time-shared computation with either of the two IBM 360's, and laboratory data may be collected and transmitted directly to the IBM 360-50 through conduits provided throughout the laboratory area of the building for this purpose. A digital and several analog computers are also located in this 2,500 square foot area. This computer facility is contiguous to the major lecture hall, permitting classroom exhibition of computer results.

The Department sponsors a student branch of the American Institute of Aeronautics and Astronautics, which holds periodic meetings, including comprehensive faculty research-area seminars, and conducts visits to nearby research, government, and industrial facilities. A special consortium arrangement between Stanford and the nearby NASA-Ames Research Center makes available many of the unique NASA facilities to Stanford researchers.

A brochure describing and illustrating the facilities and programs of the Department is available on request to the Academic Secretary of the Department.

**ADMISSION AND REGISTRATION**

To be eligible for registration in the Department a student must have received the Bachelor's degree in engineering, physical science, mathematics, or an acceptable equivalent. Students with an aeronautical engineering background should be able to qualify for the Master's degree in three quarters of work at Stanford. Students with a Bachelor's degree in physical science, mathematics, or other areas of engineering may find it necessary to take certain prerequisite courses, which would lengthen the time required to obtain the Master's degree.

**PROGRAMS OF STUDY**

**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 Departmental requirements.

**Engineering Curriculum**—To secure the recommendation of the Department for the Master's degree with a specialization in aero- and astronautical engineering, a candidate must complete a minimum of 24 units of basic course work in aerodynamics, propulsion, aerospace structures, dynamics, guidance and control, and experimentation. In addition, 6 units of mathematics are required, plus 12 units of advanced courses in any aerospace-related area of specialization interest to the candidate, and 3 units of approved electives, making in all 45 units of course work. A detailed list of the requirements can be obtained upon request to the Department. No thesis is required. A minimum grade point average of 2.75 is expected.

**Science Curriculum**—To secure the rec-
commendation of the Department for the Master's degree with a specialization in aeronautical and astronautical sciences, a candidate must complete 24 units of basic course work to be selected from the same areas as listed for the Engineering Curriculum, 9 units of mathematics, 9 units of advanced physical science courses in an aerospace-related area of specialization interest to the candidate, and 3 units of approved electives, making in all 45 units of course work. A detailed list of the requirements can be obtained upon request to the Department. No thesis is required. A minimum grade point average of 2.75 is expected.

For those students who do not wish to meet the Department's specific requirements for the Master's degree, less specialized programs are available leading either to a Master of Science in Engineering or a Master of Science in Engineering Science. These programs are described on page 96 of this bulletin.

**ENGINEER**

The University's basic requirements for the Engineer degree are outlined in the section "Degrees" in this bulletin. The following are Departmental requirements. The candidate's study program must fulfill the Department's requirements for the Master's degree or their substantial equivalent. Beyond the Master's degree, a total of 45 units of work is required, including a minimum of 30 units of courses. The 30 units beyond the Master's degree are chosen as follows: (1) 24 units of approved electives, of which 9 shall be in mathematics and the remainder usually selected from one of the following fields: (a) Acoustics, (b) Aeroelasticity, (c) Aerophysics, (d) Aerospace Structures, (e) Aeronautical Systems Synthesis and Design, (f) Analytical and Experimental Methods in Solid and Fluid Mechanics, (g) Biomedical Solid and Fluid Mechanics, (h) Energy, (i) Flight Mechanics, (j) Gas Kinetics, (k) Guidance and Control, (l) Physical Gas Dynamics, (m) Propulsion, (n) Transportation, (o) Waves and Vibrations; and (2) 6 units of free electives. A list of courses currently accepted as approved electives can be obtained upon request to the Department. Candidates for the degree of Engineer will be expected to have a minimum grade point average of 3.00 for work in 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 following are Departmental requirements.

Qualification for candidacy for the Doctor's degree is contingent on: (a) the student's having fulfilled the Department's requirements for the Master's degree or its substantial equivalent, (b) the student's having completed three units of a directed research problem (Course AA290), and (c) in the second year of graduate study, the student's passing an oral examination given by the Department during the first week of spring quarter. Detailed information about the nature and scope of the Ph.D. Qualifying Examination can be obtained from the Department. Research on the doctoral dissertation may not be formally started prior to passing this examination.

Beyond the Master's degree, a total of 90 additional units of work is required, including a minimum of 45 units of courses.

**Engineering Curriculum**—The 45 course units beyond the Master's degree are chosen by the candidate and the adviser from a list of courses which can be obtained upon request to the Department and must include 12 units of advanced mathematics.

**Science Curriculum**—The 45 course units beyond the Master's degree are chosen by the candidate and the adviser from a list of courses which can be obtained upon request to the Department and must include 15 units of advanced mathematics.

**FELLOWSHIPS AND RESEARCH ASSISTANTSHIPS**

Both fellowships and research assistantships are available to qualified graduate students. For fellowships sponsored by Gift Funds, Stanford University, and Industrial Affiliates of Stanford University in Aeronautics and Astronautics carry grants of $5,500 or more for the nine-month academic year. Students who have demonstrated research capability during a period at Stanford may qualify for half-time research assistantships. The minimum stipend for half-time research assistants, on the basis of 20 hours of work per week, is $300 per month, plus tuition. Research assistants are normally given the opportunity of full-time summer employment at the minimum rate of $600 per month. They may use their work as the basis for a
thesis and for University credit toward an advanced degree.

Further information and application forms may be obtained upon request to the Department.

UNDERGRADUATE PROGRAM IN AERONAUTICS AND ASTRONAUTICS

An interdisciplinary program in Aeronautics and Astronautics leading to the Bachelor of Science degree in Engineering is available in the form of 36 units of electives to constitute the engineering depth requirement for the B.S. degree.

COURSES

10. Aeronautics and Astronautics — (Enroll in Engineering 10.)

100. Introduction to Aeronautics and Astronautics—Explanation of principles of flight and propulsion. Concise discussion of the creation of lifting forces, aerodynamic performance, trajectories outside the atmosphere, and the problems of reentry. Remarks on the history of aeronautics and astronautics. Prerequisite: Mathematics 43 or Engineering 21.

3 units, Aut (Seifert) TTh 11:00-12:15

104. Dynamic Response — (Enroll in Engineering 104.)

105. Control System Analysis and Design—(Enroll in Engineering 105.)

121. Conversion of the Sun's Radiation for Man's Use—(Enroll in Engineering 121.)

129. Colloquium on Life Science Problems in Space Exploration — Basic physiological principles with special emphasis on the cardiovascular, respiratory, metabolic and endocrine systems and their responses to space-related environmental stresses. Aspects of life-support protective systems and habitability of spacecraft. Human behavior under flight conditions. Recent advances in space biology will be included.

3 units, Win (Billingham, Klein, Oyama, Vernikos-Danellis, Young) TTh 3:15-4:30

131. Experimentation in Aeronautics and Astronautics—Principles and importance of experimental methods used in aeronautics and astronautics; experimental design, performance, evaluation and reporting of results; laboratory experiments selected from the major areas, including fluid dynamics, structural mechanics, guidance and control, and propulsion.

3 units, Spr (Bershader, Baganoff) lec. Th 1:15-2:05; lab. Th 2:15-3:05 or T 1:15-4:05

135. Introductory Acoustics—The objective of this course is to introduce the student to the basic concepts of acoustics and their applications to selected problems. The presentation will consist of lectures with experimental demonstrations: acoustic or sound waves; sound propagation through liquids and gases; plane and spherical waves; harmonic waves; energy, intensity, and power of sound; acoustic fields of simple sound radiators; acoustic impedance; reflection and refraction at interfaces; absorption of sound by solid materials; acoustic properties of materials. Applications of these concepts to problems of sound attenuation and noise reduction.

3 units, Aut (Karamcheti) MWF 1:15

138. Noise Pollution—(Enroll in Mechanical Engineering 138.)

188. Experimental Plasma Physics Laboratory—(Enroll in Engineering 215.)

192. Vector Analysis and Cartesian Tensors with Applications—Vector algebra. Differentiation and integration of scalar and vector fields. Gradient, divergence and curl. Theorems of Gauss, Stokes, and Green. Cartesian index notation. Cartesian tensors: algebra and calculus. Dyadics. Selected applications. (All students taking graduate courses in Aeronautics and Astronautics are expected to be familiar with the basic subject matter covered in this course.) Prerequisite: Mathematics 44.

3 units, Aut (Chao) TTh 9:30-10:45

200A. Engineering Analysis of Flight Vehicles—Examination of the dynamic, aerodynamic, propulsive-system, and structural considerations which govern the configurations of flight vehicles, including atmospheric cruisers, rotorcraft, boosters, and entry gliders. Discussion of illustrative examples. Equations of motion for the rigid vehicle and significance of terms therein. Forms of aerodynamic data. Review of vehicle performance, stability and response. Aerodynamic theory of airfoils and wings at subsonic and supersonic speeds. Homework assignments designed to expand on textual ma-
material, encourage the exploration of new ideas and take advantage of Stanford's computation facilities. Prerequisite: 100 (may be taken concurrently) or equivalent.

3 units, Aut (Ashley) MWF 9


3 units, Win (Ashley) MWF 9

200C. Engineering Analysis of Flight Vehicles—Continuation of 200B: dynamic performance. Boost into orbit from nonrotating and rotating planets. Staging and propulsion requirements. Aerodynamic theory of bodies and results needed for the analysis. Atmospheric entry. The uses of optimization, including prediction of optimal flight-vehicle trajectories. Prerequisite: 200B.

3 units, Spr (Ashley) MWF

201. Fundamentals of Acoustics — Acoustic equations for a stationary homogeneous fluid–wave equation; sound energy and sound intensity; plane, spherical, and cylindrical waves; sound sources (simple and multipoles); inhomogeneous wave equation and its solution; harmonic waves; transmission of sound through different media—reflection, refraction, and transmission; radiation of sound from spheres, cylinders, and plane surfaces; moving sound sources and Doppler effect; sound propagation in ducts and enclosed regions, dispersion, attenuation, group velocity; absorption and dispersion of sound owing to viscous and heat conduction effects; sound absorption and dispersion owing to relaxation processes. Prerequisite: first year graduate standing in Engineering Applied Sciences, or consent of instructor.

3 units, Win (Karamcheti) MWF 10

202. Acoustics and Aerodynamic Noise—Acoustics of a uniformly moving homogeneous fluid, and of a nonuniformly moving inhomogeneous fluid; geometrical acoustics; sound propagation in atmosphere and water; introduction to nonlinear acoustics; equations of aerodynamic sound generation: Lighthill’s equation; monopoles, dipoles, and quadrupoles; sound generation by dilatations, fluctuating forces, and stresses; radiated sound field in an unbounded medium; radiated sound field in a medium containing solid surfaces; discrete frequency fluid-mechanical sound: vortex noise, aeolian tones, edgetones generated by jets, vortices, wakes, and other free shear layers interacting with rigid surfaces; noise from turbulence; jet and rocket noise; boundary layer and wake noise; noise from propellers, helicopter rotors, and V/STOL; noise from rotating machinery (compressors, turbines, fans); duct noise; aircraft noise; sonic boom; attempts at suppressing noise from various sources. Prerequisite: 201.

3 units, Spr (Karamcheti) MWF 11

203. Acoustic Measurements Laboratory—Lecture/laboratory course designed to teach the fundamental concepts and laboratory techniques for the measurement of the physical properties of sound fields in fluids and solids, noise criteria and measurement practice, and thus to familiarize the student with basic acoustic instrumentation such as microphones, audio-oscillators, sound level meters, acoustic spectrum analysers, and recorders. Experiments include the following topics: classification, calibration, and frequency response of microphones; speed of sound in fluids and solids; reflection, refraction, and absorption coefficients; sound wave propagation in composite and bounded media; filters and resonators; reverberation time; diffraction, scattering, and dispersion of sound; Doppler effect; analysis of discrete frequency sound fields; analysis of random sound fields; power spectral density and correlation functions; demonstration of advanced measurement techniques using laser interferometry and acoustic holography. Prerequisite: 135 or 201.

3 units, Spr (Koutsoyannis) MWF 9 plus lab. by arrangement

204. Mechanics of Hearing — The unresolved question is—how do we hear? Attention is on the mechanical function of the middle and inner ear in the transformation of an acoustic signal into sound perception. Discussion of fundamental observations of von Békésy and various models for the elastic-fluid interaction in the inner ear, including the simple explanation of the basic basilar membrane motion. Possible mechanisms of neural excitation. Damage due to high intensity sound. Novel systems of hearing in
echo-locating bats and dolphins, dinosaurs, and insects. Prerequisite: 135 or equivalent.

3 units, Win (Steele) by arrangement

206A. Fluid Dynamics—(Enroll in Applied Mechanics 242.)

206B. Fluid Dynamics—(Enroll in Applied Mechanics 243.)

207. Mechanics of Viscous Flow — (Enroll in Applied Mechanics 244.)


3 units, Aut (Chang) MWF 10, alternate years, given 1975-76

210A. Fundamentals of Compressible Flow —Fundamentals of the flow of a compressible gas with selected applications to problems in aeronautics. Kinematics of fluid motion, vorticity, conservation laws, general theorems, development of the basic field equations for flow with friction and heat transfer. Thermodynamic considerations. Similarity parameters. Specialization of equations for flows in one and two-dimensions: compressible Couette flow, unsteady one-dimensional flow, finite waves, oblique shock waves, the shock polar, Prandtl-Meyer flow, flows with shock waves, supersonic two-dimensional flow about thin airfoils. Prerequisites: 192 (may be taken concurrently) and Mechanical Engineering 131A or equivalents.

3 units, Aut (Baganoff) MWF 1:15

210B. Fundamentals of Compressible Flow —Continuation of 210A with emphasis on more general flow geometry. General properties of irrotational flow. Analysis of airfoils, wings, slender bodies, and unsteady lifting systems in \( M = 0 \) flow. Linearized potential equation for subsonic and supersonic flow; applications to similarity laws, thin wings, swept wings, drag of slender bodies, and lifting surface theory. Analysis of Prandtl's boundary layer equations, and the origin of turbulence and the basis for the stability of laminar flow — the Orr-Sommerfeld equation. Prerequisite: 210A.

3 units, Win (Baganoff) MWF 1:15

211A. Physical Gas Dynamics—(Enroll in Mechanical Engineering 211A.)

211B. Physical Gas Dynamics — High-speed, high-temperature flow of gas mixtures in local thermodynamic and chemical equilibrium, including effects of viscosity and heat conductivity; application to boundary-layer heat transfer in hypervelocity flight; introduction to rate process analysis for treating flows with vibrational and chemical non-equilibrium. Prerequisites: 211A and 210B, or equivalent background.

3 units, Spr (Bershader) MWF 2:15

214. Numerical Methods in Fluid Mechanics—Presents methods for the numerical solution of problems involving the Eulerian- and Navier-Stokes equations. The relation between time-accurate and relaxation techniques is discussed, as well as higher order implicit and explicit methods combined with splitting. Accuracy, stability and programming complexity are considered.

2 units, Win (Lomax) TTh 9, alternate years, given 1974-75


218. Similitude in Engineering Mechanics —The reduction of physical problems, dimensional analysis; supplementary information; similarity rules; self-similar solutions by dimensional analysis and other groups of transformations; existence, uniqueness, and numerical integration; application of self-similar solutions; local solutions; self-similar solutions with concealed exponent. Prerequisite: Mathematics 131 or consent of instructor.

3 units, Aut (Van Dyke) MWF 9

219. Perturbation Methods in Engineering Mechanics—Examples of perturbation solutions in fluid mechanics, solid mechanics, dynamics, and other fields; asymptotic expansions; series and iteration schemes; regu-
lar perturbations; slow variations; singular perturbation problems; the methods of matched asymptotic expansions, multiple scales, and other; improvement of series. Prerequisites: Mathematics 106 and 131, or consent of instructor.

3 units, Win (Van Dyke) MWF 9

220. Advanced Physical Measurements in Gas Dynamics — Experiments on special problems in gas dynamics conducted on a project team basis, and making use of departmental facilities such as the shock tubes, supersonic jet, subsonic wind tunnel, or ballistic range. Emphasis is placed on optical methods such as laser interactions, schlieren and shadow techniques, and interferometry and spectroscopy. One lecture hour and three laboratory hours per week. Prerequisite: 131 or equivalent.

3 units, Spr (Bershader, Baganoff) lec. and lab. W 1:15-5:05, by arrangement

222. Holographic and Other Optical Methods in Engineering Science—Fundamentals of coherent image formation and other relevant features of wave interactions, with applications to holography. Selected applications of holography and other optical methods, including laser diagnostics of gases.

3 units, Aut (Vest, Bershader) TTh 1:15-2:30

225. Stochastic Processes in Aeronautics — Applications of probability theory to problems in aeronautics: analysis of a linear system subject to a random forcing function; correlation function; power spectrum; difference and differential equations for probability densities; Fokker-Planck equation with application to diffusion; Ehrenfest model and approach to thermodynamic equilibrium; random walk model for vibrational relaxation and dissociation.

3 units, Spr (Baganoff) TTh 2:15-3:30

227. Space Physics—(Enroll in Applied Mechanics 240.)


3 units, Aut (Chang) MWF 10-11, alternate years, given 1974-75

230. VTOL/STOL Aircraft—Various VTOL and STOL configurations are examined and evaluated as regards their appropriate mission application. Dynamic and aerodynamic characteristics of the classical rotor as the optimum hovering device are considered. Special high-lift devices for STOL operation are emphasized.

3 units, Spr (Carlson) MW 3:15-4:30


240A. Analysis of Aerospace Structures—Elements of one- and two-dimensional linear and nonlinear elasticity theory; reduction to strength of materials theory; strain-functional variational principle; direct and indirect methods of the calculus of variations applied to deflection and stability analysis of beam, ring, plate, and shell elements. Prerequisite: Civil Engineering 114 or equivalent.

3 units, Win (Mayers) MWF 11
finite difference and finite element methods. Prerequisite: 240B.

3 units, Spr (Mayers) MWF 10

241A, B, C. Introduction to Aerospace Systems Syntheses and Analysis—The total development of new aircraft systems is explored with emphasis on commercial aircraft; the underlying economic and technological factors that create markets for new aircraft from both rational and historical viewpoints; methods of determining market demands and system mission performance requirements; techniques of optimizing configurations to comply with requirements with emphasis on the interaction of the various disciplines such as aerodynamics, structures, propulsion, guidance, payload, and ground support; parametric studies; applied aerodynamic and design concepts for use in configuration analysis including airplane layout, wing design, high lift systems, drag, stability and control requirements, and tail sizing. Application to a hypothetical aeronautical system; applied structural fundamentals with emphasis on fatigue and fail-safe considerations; design load determination; weight estimation; propulsion system performance and installation; engine types; environmental problems such as noise and smoke; performance estimation including take-off, climb, cruise, and landing. Direct and indirect operating costs prediction and interpretation; future types of aircraft including V/STOL, supercritical wing, uncompromised cargo and SST; aircraft functional systems such as hydraulic, electrical, environmental control; avionics; importance and achievement of aircraft reliability and maintainability.

241A. 3 units, Aut (Shevell) MWF 2:15
241B. 3 units, Win (Shevell) MWF 3:15
241C. 3 units, Spr (Shevell) MWF 2:15

242. Classical Dynamics—Acceleration and rotation reference frames. Kinematics of rigid body motion; Euler angles. D'Alembert's principle, equations of motion. Inertia properties of rigid bodies. Dynamics of coupled rigid bodies. Lagrange's equations and their use. Dynamic behavior and simple stability, including small departures from equilibrium or steady motion, are considered throughout the course. Prerequisite: Engineering 12 or equivalent.

3 units, Aut (Powell) MWF 12


3 units, Aut (Chao) TTh 2:45-4:00

244A. Structural Dynamics — Eigenvibrations and dynamic response of elastic systems including beams, membranes, plates, and shells. Discussion of approximate methods for analyzing complex built-up structures, such as collocation, lumped parameters, and finite elements. Free vibration and normal coordinates. Forced response to various types of excitations. Applications to fundamental flight-vehicle structures. Prerequisites: 243, 240C, or equivalents.

3 units, Aut (Ashley) MWF 3:15

244B. Aeroelasticity — Presentation of the field of aeroelasticity from a unified viewpoint applicable to all types of flight vehicles. Introduction to aeroelastic operators and unsteady aerodynamics. Forced response, static and dynamic eigenvalues of a simplified system. Aeroelastic analysis of representative one-dimensional and two-dimensional structures. Prerequisite: 244A or equivalent.

3 units, Win (Ashley) MWF 3:15

244C. Aeroelasticity — Continuation of 244B. The unrestrained elastic flight vehicle. Modern unsteady aerodynamic theory. Experimental aeroelasticity. Special topics of current interest such as aeroelastic optimization and new developments in unsteady aerodynamic theory. Prerequisite: 244B.

3 units, Spr (Ashley) MWF 3:15

245A. Theory of Elasticity—(Enroll in Applied Mechanics 202A.)
245B. Theory of Elasticity—(Enroll in Applied Mechanics 202B.)
245C. Theory of Elasticity—(Enroll in Applied Mechanics 202C.)

246. Theory of Plates—(Enroll in Applied Mechanics 207.)

247. Theory of Shells — (Enroll in Applied Mechanics 208.)

248A. Thin Shell Analysis—Application of theory for axisymmetric deformation of shells of revolution to aerospace structural problems. Elementary asymptotic integration methods. Membrane and discontinuity

3 units, Aut (Steele) MWF 1:15, alternate years, given 1974–75

248B. Thin Shell Analysis — Membrane theory for ellipsoids, cones, and hyperboloidal paraboloids. Inclusion of bending for shells of revolution. Inextensible and edge zone solutions. Necessity for appropriate edge constraint. In the last third of the course will be given an introduction to differential geometry and the tensor treatment of the general surface. Prerequisite: 248A.

3 units, Win (Steele) MWF 1:15, alternate years, given 1974–75


3 units, Spr (Steele) MWF 1:15, alternate years, given 1974–75

248D. Thin Shell Analysis — Continuation of 248B: Linear and nonlinear stability of shells. Snap-through of shallow domes. Buckling of cylindrical, conical and spherical shells. Recent developments. Prerequisite: 248B.

3 units, Spr (Steele) MWF 1:15, alternate years, given 1973–74

253. Waves and Vibrations — (Enroll in Applied Mechanics 203.)

256. Mechanics of Composite Systems — (Enroll in Applied Mechanics 269.)

259. Experimentation in Structural Mechanics — (Enroll in Engineering 250.)

260. Aerospace Structures Laboratory — Measurement of strain; measurement of displacement and motion; surface displays (photoelastic, brittle lacquer, and Moiré fringe techniques); heat and pressure sensing; methods of load application; project experiment on aerospace structural component related to properties of materials, buckling, maximum load, vibration, creep, or aerodynamic heating. Prerequisite: 131 or equivalent.

3 units, Spr (Sendelbeck) lec. T 9; one lab. by arrangement

265. Experimental Stress Analysis — (Enroll in Applied Mechanics 205.)

271A. Automatic Control of Aerospace Vehicles — Basic dynamics of vehicles in three dimensions. The environment of space and aerospace vehicles, and its role in their control. Passive and active attitude control moments. Space vehicle control system synthesis and techniques. Aircraft stability and response. Automatic flight-control-system synthesis. Prerequisites: 242 and Engineering 105 or their equivalent.

3 units, Spr (Breakwell) TTh 9:30–10:45

271B. Automatic Control of Space and Aerospace Vehicles — Study in further depth of the systems introduced in 271A; attitude control system design comparing modern optimal synthesis and estimation and classical techniques. Space vehicle gyrocompassing, aircraft stability and response in three axes. Autopilot design and autolanding systems. Prerequisite: 271A. Recommended: 200B and 278A.

3 units, Aut (DeBra) MWF 8, alternate years, given 1975–76


3 units, Win (DeBra) MWF 8, alternate years, given 1975–76


3 units, Spr (Bryson) TTh 11:00–12:15, alternate years, given 1975–76


3 units, Spr (Bryson) TTh 11:00–12:15, alternate years, given 1975–76

273A. (Enroll in Engineering 207.)

273B. (Enroll in Engineering 208.)

275. Fluid Power Control — (Enroll in ME 225.)

276. Control Systems Analysis and Design — (Enroll in Engineering 206.)


3 units, Spr (DeBra) MWF 8, alternate years, given 1974-75


3 units, Win (Bryson) MWF 9


3 units, Spr (Bryson) TTh 11:00-12:15


3 units, Aut (Breakwell) MWF 11, alternate years, given 1975-76

279A. Space Mechanics —Orbits of near-earth satellites and interplanetary probes; transfer and rendezvous; decay of satellite orbits; influence of earth’s oblateness. Stabilization by gravity gradient.

3 units, Win (Breakwell) MWF 12

279B. Advanced Space Mechanics—Effects of several centers of attractions; restricted three-body problem; libration points; Encke’s method for accurate orbit computation; expansion matching for lunar and inter-planetary orbits. Hamilton’s principle and elements of the calculus of variations; canonical perturbation theory; application to non-linear oscillations and orbital analysis; non-linear resonances. Prerequisite: 279A.

3 units, Spr (Breakwell) MWF 10, alternate years, given 1974-75

280A. Rocket Propulsion Fundamentals —Introductory rocket dynamics; fundamentals of nozzle flow; use of performance parameters; thermochemical calculation of performance; heat transfer in rockets; basic design procedures. Prerequisites: thermodynamics or elementary gas dynamics equivalent to 210A, Mechanical Engineering 131A; or consent of instructor.

3 units, Win (Seifert) MWF 11

280B. Advanced Space Propulsion—Topics selected from hybrid rockets, combustion, gas-particle flows, ablative heat transfer, thrust vector control, and basics of electric propulsion. Prerequisite: 280A or equivalent.

3 units, Spr (Seifert) TTh 1:15-2:30, alternate years, given 1974-75

283. Aircraft Propulsion —Aircraft characteristics which influence propulsion performance. Physical parameters of airbreathing propulsors, including ramjets, turbojets, and turbofans. Supersonic inlet and nozzle design. Performance calculations of engines and review of selected items of current propulsion research literature. Prerequisite: Fundamental fluid mechanics equivalent to 210A or Mechanical Engineering 131A.

3 units, Spr (Seifert) TTh 11:00-12:15

284. Introduction to Partially Ionized Gases —Fundamental physical principles and equations underlying properties and dynamics of partially ionized gases. Review of electricity and magnetism. Collisional and radiative processes at the atomic level: interaction potentials, cross sections, nonequilibrium relaxation times, Rutherford scattering, electrical conductivity, recombination rates, classical collision theory. Plasma: collective behavior, the Debye length, plasma frequency, sheaths, weakly and fully ionized limits. Magnetohydrodynamics: motion of single charged particles, Hall effect, ion slip. Equations of motion for conducting fluids and elements of electromagnetic theory; nondimensional parameters and scaling of flows. Simple illustrative examples. Prerequisite:
familiarity with elementary electricity and magnetism and vector analysis.

3 units, Win (Chang) MWF


3 units, Spr (Chao) T 9 and Th 9:35-10:50, given 1974–75

290. Problems in Aeronautics and Astronautics — Investigation, experimental or theoretical, of problems in aeronautics and astronautics. Offers opportunity to students to work in any field of special interest.

1 to 5 units, any quarter (Staff) by arrangement

291A. Linear Transforms and Their Applications to Engineering Problems I — Introduction to linear integral transforms: Fourier, Laplace, Hankel, Mellin transforms. Applications to boundary value problems in solid and fluid mechanics, heat conduction, wave propagation. Inverse transformation, contour integration, approximations. Methods of steepest descent and stationary phase. Prerequisite: Mathematics 106 (may be taken concurrently).

3 units, Win (Chao) T 9 and Th 9:35–10:50, given 1974–75


3 units, Spr (Chao) T 9 and Th 9:35–10:50, given 1974–75

294A. Introduction to Nonlinear Continuum Mechanics — (Enroll in Applied Mechanics 214A.)

294B. Introduction to Nonlinear Continuum Mechanics — (Enroll in Applied Mechanics 214B.)


296. Seminar in Space Science and Technology — Survey of Space Science and Technology intended for undergraduate and graduate students. Includes basic concepts such as rocket propulsion and orbit theory, discussion of results of manned and unmanned space flights that have been carried out, planetary exploration and practical applications of orbiting space vehicles such as communications and weather observations will receive special attention.

2 units, Spr (Mark) M 3:15–5:05

297. Seminar in Flight Control and Guidance — Problems in all branches of vehicle control, guidance and instrumentation. The major purpose of the seminar is to give students who are planning or engaged in thesis research an opportunity to become acquainted with the work of other researchers, both on and off the campus. Students engaged in or anticipating research activity in these areas normally attend. Others are invited. Registration for a unit of credit, without letter grade, is optional; a letter grade is given for students who make presentations.

1 unit, Aut, Win, Spr (DeBra) W 4:15

298. Seminar in Fluid Mechanics — (Enroll in Engineering 298.)


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


2 to 15 units, any quarter (Staff) by arrangement
420A,B. Interdisciplinary Transportation Analysis—(Enroll in Graduate Special 420 A,B.)

APPLIED MECHANICS

Emeriti: Wilhelm Flügge, Miklós Hetényi, Lydik S. Jacobsen, Donovan H. Young (Professors)
Chairman: George Herrmann
Professors: Arthur E. Bryson, George Herrmann, Thomas R. Kane, Erastus H. Lee, John R. Spreiter, Charles R. Steele
Visiting Associate Professor: Lambert B. Freund
Assistant Professors: David M. Barnett, Wilson C. Hayes, Russell L. Mallett
Affiliated Faculty

OFFERINGS AND FACILITIES

Provisions are available for one, two, or three years of advanced training in solid and fluid mechanics, dynamics, automatic control, and biomechanics leading to career opportunities in industrial and governmental research establishments, in technical development in industry, and in universities and institutes of technology. Programs of study are also offered 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 Department of Applied Mechanics provides facilities for laboratory work in experimental mechanics and experimental stress analysis. Additional facilities, including an MTS electrohydraulic materials test system and a vehicle crash simulator are available through the School of Engineering Structures and Solid Mechanics Research Laboratory. Laboratories for biological experimentation are available through the School of Medicine. 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.

A variety of research projects are also conducted in Applied Mechanics. Qualified students participate in these as research assistants, engaged in 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 anelastic elements of machines and structures; fracture mechanics, vibrations and nonlinear dynamics; analysis, synthesis, and control of systems; flow dynamics of liquids and gases, including geophysical and astrophysical applications; and biomechanics.

PROGRAMS OF STUDY

BACHELOR OF SCIENCE

Applied Mechanics operates exclusively on the graduate level and requires the B.S. degree for admission. Suitable preparation for graduate study can be found in the undergraduate curricula of the Departments of Civil and Mechanical Engineering.

MASTER OF SCIENCE

The University’s basic requirements for the Master’s degree are discussed in the section “Degrees” in this bulletin. These requirements, as well as the Applied Mechanics requirements, must be fulfilled.

To secure the recommendation of the Department of Applied Mechanics for the Master’s degree, a candidate admitted to graduate standing with a B.S. degree in Engineering (or the equivalent) must complete a program of course work consisting of 9 or more units of free electives (any graduate course offered by Stanford University), 9 units of approved electives (a list of these may be obtained from the departmental office), and 27 units of the required courses AM 202A, 202B (theory of elasticity), AM 221, 222 (dynamics), AM 242, 243 (fluid mechanics), and AM 250, 251, 252 (mathematics). However, a required course should be replaced with an approved elective carrying three or more units of credit if it can be established that knowledge of the subject matter in question...
has been or is to be acquired without taking the course. Approval of such replacements should be requested in a letter directed to the Chairman of the Department and endorsed by the student's adviser. Special programs which depart from the above requirements can be arranged, for example for students with industrial or research experience in order to permit study in depth of some particular aspect of Applied Mechanics.

At least 45 units of course work must be completed with a minimum grade point average of 2.75. In computing this average, all Stanford courses for which letter grades were given and which were not used to satisfy requirements of another degree are taken into account. The program of study must be approved by the Student's adviser and then be submitted to the Department for approval prior to the third week of the quarter preceding the one in which the degree is to be awarded. No thesis is required.

The program assumes that, at the time of admission, the student is adequately prepared for graduate study in Applied Mechanics, particularly as to Mechanics of Materials, Ordinary Differential Equations, and Dynamics. Otherwise the student will be required to remedy the deficiency by taking appropriate courses during his graduate study. In this case more than the three quarters of residence normally needed 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. These, as well as the Applied Mechanics requirements, must be fulfilled.

To secure the recommendation of the Department of Applied Mechanics for the degree of Engineer, a candidate admitted to graduate standing with a Bachelor's degree in Engineering (or the equivalent) must complete a thesis for which up to 15 units of credit may be granted. In addition, he must complete a program of course work consisting of 15 or more units of free electives (any graduate course offered by Stanford University), 33 units of approved electives (a list of these may be obtained from the departmental office), and 27 units of the required courses 202A, 202B (theory of elasticity), 221, 222 (dynamics), 242, 243 (fluid mechanics), and 250, 251, 252 (mathematics). However, a required course should be replaced with an Approved Elective carrying three or more units of credit if it can be established that knowledge of the subject matter in question has been or is to be acquired without taking the course. Approval of such replacements should be requested in a letter directed to the Chairman of the Department and endorsed by the student's adviser.

At least 90 units of work must be completed with a minimum grade point average of 3.00. In computing this average, all Stanford courses for which letter grades were given and which were not used to satisfy requirements for a Bachelor's degree are taken into account. Up to 45 units of credit may be granted for a Master's degree. The program of study must be approved by the student's adviser and then be submitted to the Department for approval prior to the third week of the quarter preceding the one in which the degree is to be awarded.

**DOCTOR OF PHILOSOPHY**

The University's basic requirements for the Ph.D. degree are discussed in the section "Degrees" in this bulletin. These, as well as the Applied Mechanics requirements, must be fulfilled.

Admission to candidacy for the Ph.D. Degree in Applied Mechanics (in contrast to admission to graduate standing in the University) requires passing a Qualifying Examination given by the Department and obtaining approval of a program of study. To secure the recommendation of the Department of Applied Mechanics for the Ph.D. degree, an admitted candidate must complete the program of study, submit an acceptable dissertation, and pass a Final University Oral Examination.

The Qualifying Examination is given in January and May of each year. To be admitted to this examination, a student must have a minimum grade point average of 3.25 in all Stanford graduate courses for which letter grades were given and which were not used to satisfy requirements for a Bachelor's degree. Students are advised to take the Qualifying Examination as soon as possible after completion of 30 units of graduate course work. The level and range of the Qualifying Examination are indicated by the following Stanford courses: 250, 251 and 252 or 253 (mathematics), 202A, 202B (elasticity theory), 221, 222 (dynamics), 242, 243 (fluid
mechanics), Engineering 105, 106, Electrical Engineering 363A (automatic control), Materials Science 205, 238 (mechanical properties of materials). Each student is examined orally for one-half hour in each of four subjects, one of these being mathematics. Students wishing to be examined in automatic control, or in mechanical properties of materials, select the remaining two subjects from among elasticity theory, dynamics, or fluid mechanics.

The program of study must contain at least 135 units of work. Up to 45 units may be granted for a Master's degree. The program must include 18 units of free electives (any graduate course offered by Stanford University), 45 units of approved electives (a list of these may be obtained from the departmental office), and 27 units of the required courses 202A, 202B (theory of elasticity), 221, 222 (dynamics), 242, 243 (fluid mech.), 250, 251, and 252, or 253 (math). However, a required course should be replaced with an approved elective carrying three or more units of credit if it can be established that knowledge of the subject matter in question has been or is to be acquired without taking the course. Approval of such replacements should be requested in a letter directed to the Chairman of the Department and endorsed by the student's adviser. The program of study must be approved by the adviser and then be submitted to the Department for approval prior to the third week of the quarter preceding the one in which the degree is to be awarded.

Dissertation research is begun when the student has found a faculty member willing to act as dissertation adviser. Up to 45 units of credit may be earned for dissertation research.

The Final University Oral Examination is conducted by a committee consisting of a chairman, appointed by the University, and four faculty members of the Department of Applied Mechanics or departments with related interests. Usually the committee includes the candidate's adviser and the two faculty members chosen to read and sign the candidate's dissertation. The examination consists of two parts. The first part is open to the public and is scheduled as a seminar talk, usually for one of the regular meetings of a seminar series. The second part is conducted in private and covers subjects closely related to the dissertation topic.

All Ph.D. candidates are expected to participate each quarter in one of the following seminars: 295, Solid Mechanics; 298, Fluid Mechanics; 297, Theory of Systems (or Aeronautics 297, Flight Control and Guidance).

**Fellowships and Assistantships**

University Fellowships are open to all (prospective) graduate students. See "Student Aid Funds" in the Information Bulletin obtainable from the Registrar. In addition, several special fellowships and assistantships are offered. Information and application forms (due March 1) may be obtained through the secretary of the Department of Applied Mechanics.

**Courses**

**202A. Theory of Elasticity — Analysis of stress and strain. Stress-strain relations. Compatibility and uniqueness of solutions. Fundamental equations of the linear theory of elastic media. Torsion and bending of bars. Prerequisites: Civil Engineering 114 and Mathematics 130, or equivalents.**

3 units, Aut (Herrmann) MWF 9


3 units, Win (Herrmann) MWF 10

**202C. Theory of Elasticity — Continuation of 202B: Problems of elastic contact. Fundamentals of thermoelasticity: coupled and uncoupled formulations; applications to selected boundary value problems. Fundamentals of theories of elasticity with microstructure with applications. Prerequisites: 202A,B or equivalents.**

3 units, Spr (Herrmann) TTh 11:00-12:15


3 units, Spr (Herrmann) TTh 11:00-12:15
sites: 202A and Mathematics 131 or equivalents.

203A. 3 units, Win (Chao) TTh 2:15–3:30
203B. 3 units, Spr (Chao) TTh 2:15–3:30, alternate years, given 1974–75

205A. Experimental Stress Analysis—Introductory elasticity. Fundamentals of photoelasticity. Analysis of photoelastic data. MTS materials testing system. Strain gauge theory and instrumentation. Laboratory applications to static and dynamic problems. Prerequisite: CE 114 or equivalent.

3 units, Spr (Hayes) T 4:15–6:05; one lab. by arrangement

205B. Advanced Work in Experimental Mechanics — Individual projects on selected subjects. Extension of 205A to advanced topics such as dynamic or three-dimensional photoelasticity, biomechanics. Limited enrollment. By arrangement with instructor.

3 to 5 units, Aut, Win, Spr (Hayes) by arrangement


206A. 3 units, Spr (Herrmann) TTh 2:15–3:30, alternate years, given 1975–76
206B. 3 units, Aut (Herrmann) alternate years, given 1976–77

207. Theory of Plates—Analysis of stress, deformation in plates bent by transverse loads. Applications to circular, rectangular, other shapes. Vibrations, buckling and large deflection plates. Prerequisite: Civil Engineering 114.

3 units, Win (Mallett) MWF 9

208. Theory of Shells — Direct stresses in shells with axial symmetry. Application to shell roofs, tanks, Bending stresses, displacements and vibration. Stress functions, static geometric duality and variational principles. Prerequisite: Civil Engineering 114.

3 units, Spr (Mallett) MWF 9


3 units, Aut (Lee) MWF 1, alternate years, given 1975–76


3 units, Win (Lee) MWF 11, alternate years, given 1975–76

214A. Introduction to Nonlinear Continuum Mechanics — Definitions of general states of stress and deformation of continua. Discussion of constitutive equations, and influence of material symmetries. Applications of the theory with particular reference to finite elasticity. Prerequisite: 202A.

3 units, Win (Lee) TTh 11:00–12:15, alternate years, given 1975–76

214B. Introduction to Nonlinear Continuum Mechanics — Application of theory of continua to nonlinear viscoelastic materials. Thermodynamic effects including thermoelastic coupling for nonlinear elasticity at finite strain. Prerequisite: 214A.

3 units, Spr (Lee) MWF 10, alternate years, given 1975–76

216A. Strength and Microstructure — (Enroll in Materials Science 205.)
216B. Fracture of Solids — (Enroll in Materials Science 238.)


3 units, Aut (Freund) MWF 2:15, alternate years, given 1974–75

217B. Advanced Theory of Viscoelasticity — Equivalent mathematical representations
of stress-strain relations for linear response and connections between them. Stress analysis problems for simple boundary conditions, mixed conditions, and consideration of moving boundaries. Temperature effects. Prerequisites: 202A and 217A.

3 units, Win (Lee) MWF 2:15, alternate years, given 1974–75

221. Dynamics—Partial rates of change of position and orientation. Generalized particle and rigid body kinematics. Generalized active and inertia forces for holonomic and nonholonomic systems.

3 units, Aut (Kane) T 10 and Th 9–11

222. Dynamics — Inertia properties, potential energy, dissipation functions, kinetic energy, virtual work. Lagrange's form of D'Alembert's principle, Lagrange's equations of motion.

3 units, Win (Kane) T 10 and Th 9–11

223. Dynamics — Initial value problems, constraint forces and forces of interaction, impulsive motions. Momentum and energy integrals, Hamilton's canonic equations, canonic variables and transformations, the Hamilton-Jacobi partial differential equation, variation of parameters.

3 units, Spr (Kane) T 10 and Th 9–11


3 units, Spr (Kane) T 2:15–4:05 and Th 2:15, alternate years, given 1974–75

225. Theory of Vibrations — (Enroll in Aeronautics and Astronautics 243.)

226. Kinematic Synthesis of Mechanisms—(Enroll in Mechanical Engineering 222.)

227. Advanced Kinematics—(Enroll in Mechanical Engineering 223.)


3 units, Spr (Kane) W 2:15–4:05 plus one hour by arrangement, alternate years, given 1975–76


3 units, Win (Kane) T 2:15–4:05 plus one hour by arrangement, alternate years, given 1974–75

235A. Optimal Control of Dynamic Systems — (Enroll in Aeronautics and Astronautics 278A.)

235B. Optimal Estimation and Control Logic in the Presence of Noise—(Enroll in Aeronautics and Astronautics 278B.)

235C. Differential Games—(Enroll in Aeronautics and Astronautics 278C.)

236. On-Off Control Logic—(Enroll in Aeronautics and Astronautics 277.)

240. Space Physics—Introduction to selected topics of geophysics and astronomy with emphasis on conditions in the solar and planetary atmospheres, interplanetary space, and on solar-terrestrial relations. Elements of gravitational theory and orbital mechanics with application to determination of density of the upper atmosphere and the shape and internal structure of the Earth. Properties, time variations, and theoretical representation and interpretation of the upper atmosphere, ionosphere, magnetic field, and magnetosphere of the Earth, the photosphere, chromosphere, the corona of the Sun, and the solar wind in interplanetary space. Theory of Motion of a charged particle in electric and magnetic fields with application to Van Allen particles and cosmic rays. Outline of the principal features of the interaction of the solar wind with the Earth and other objects in the Solar System.

3 units, Win (Spreiter) TTh 8:35–9:50, given 1975–76

3 units, Aut (Spreiter) TTh 2:45–4:00

243. Fluid Dynamics—Continuation of 242. Mathematical analysis of selected two- and three-dimensional flows and wave motions involving effects of compressibility, rotation, free-surfaces, and density stratification. Application to surface waves, acoustics, aerodynamics of thin wings and slender bodies at subsonic, transonic, and supersonic speeds, and selected geophysical and astrophysical phenomena.

3 units, Win (Spreiter) TTh 2:45–4:00


3 units, Spr (Van Dyke) TTh 1:15–2:30

248. Geophysical Fluid Dynamics — Introduction to fluid flow and wave phenomena in the atmosphere, oceans, and interior of the Earth, in interplanetary space, and in the solar atmosphere. Effects of rotation, stratification, gravity, and electromagnetic forces. Application to general circulation, mountain lee waves, and Rossby waves in the atmosphere, surface and internal gravity waves and wind-driven circulation of the oceans, hydromagnetic dynamo processes in the liquid core, and solar-wind flow and waves in interplanetary space. Prerequisite: 243.

3 units, Spr (Spreiter) TTh 2:45–4:00

250. Mathematical Methods in Applied Mechanics—A study of linear algebra, matrix calculus, difference equations and systems of differential equations. Applications are emphasized and the concept of a linear operator is used to unify the subjects. Topics include: linear algebraic equations, vector space concepts, eigenvalue problems and eigenvector expansions, functions of matrices, Laplace transforms, transition matrices, linear operators and function spaces concepts. Prerequisite: Knowledge of advanced calculus and elementary ordinary differential equations.

3 units, Aut (Mallett) MWF 11

251. Mathematical Methods in Applied Mechanics—Study of engineering applications leading to partial differential equations and the concept of the mathematical model. Study of properties of these equations and development of methods of solution based on ordinary differential equation theory. Introduction to generalized infinite series solutions, Sturm Liouville theory, special functions and the method of characteristics. Prerequisites: Mathematics 45 and 130 or equivalent.

3 units, Win (Mallett) MWF 8

252. Numerical Methods in Applied Mechanics—Study of numerical analysis and approximation theory with emphasis on engineering applications. Matrix methods, finite difference and polynomial approximation procedures, direct and iterative solution techniques are developed. Application to algebraic, ordinary and partial differential equations arising in initial, boundary and eigenvalue problems for discrete and continuous physical systems. Emphasis on development of viable computational methods and efficient use of digital computers. Students will program and execute problems on Stanford’s IBM 360/67 system. Prerequisites: An elementary knowledge of FORTRAN, matrix algebra, elementary ordinary and partial differential equations.

3 units, Spr (Mallett) T 8–10, Th 8

— the theory of analytic functions and contour integration with applications to physical problems of conformal mapping, integral transforms, and asymptotic methods. A knowledge of the algebra of complex numbers and of the derivative of a complex function is assumed.

3 units, Spr (Lee) MWF 10


3 units, Spr (Staff) TTh 1:00–2:15; alternate years, given 1975–76

270. Special Problems in Applied 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

280. Physiology for Engineers and Physical Scientists—Cellular biophysics. Physiology of human musculoskeletal, circulatory and respiratory systems. Prerequisite: graduate standing or consent of instructor.

3 units, Aut (Hayes) MW 4:15–5:30; alternate years, given 1975–76

281. Biomechanics—Engineering mechanics applied to the human musculoskeletal system. Biological tissue mechanics. Viscoelastic properties. Large deformations. Applications to bone, muscle and synovial joints. Whole body and component dynamic response. Topics of current research interest are emphasized.

3 units, Spr (Hayes) MW 4:15–5:30

295. Seminar in Solid Mechanics—Problems in all branches of solid mechanics. All Ph.D. candidates in solid mechanics are normally expected to attend.

1 unit, Aut, Win, Spr (Steele) Th 3:45

296. Seminar in Flight Control and Guidance—(Enroll in Aeronautics and Astronautics 297.)


298. Seminar in Fluid Mechanics—(Enroll in Engineering 298.)


Aut, Win, Spr (Staff) by arrangement


Aut, Win, Spr (Staff) by arrangement

CHEMICAL ENGINEERING*

Chairman: Andreas Acrivos
Professors: Andreas Acrivos, Michel Bou-dart, David M. Mason
Consulting Professors: Richard F. Balzhiser, Alan S. Michaels
Associate Professors: Channing R. Robert-son, Robert J. Madix
Assistant Professor: George M. Homsy
Lecturer: Robert H. Schwaar
Affiliated Faculty:

PROGRAMS OF STUDY

BACHELOR OF SCIENCE

The B.S. Chemical Engineering program consists of the basic 36-unit engineering depth requirement (described under the “Departmental Majors” section elsewhere in this Bulletin) which provides a broad background in the fundamentals of chemistry as well as basic training in separations processes, engineering thermodynamics, trans-

* The curriculum leading to the B.S. degree in Chemistry is described elsewhere in this bulletin.
port phenomena, applied chemical kinetics and plant design. In addition, this program is supplemented with courses in physics, mathematics, chemistry, and basic engineering, as well as optional advanced chemical engineering courses. With the exception of these certain basic courses and the engineering depth sequence, there is no set program which all undergraduate students follow.

A sample B.S. program is available through the Department of Chemical Engineering advisers or the Dean’s Office, School of Engineering. It is recommended that the student discuss his or her prospective program with an adviser, especially if he or she is transferring to the program from chemistry, physics, or another field in engineering. The student can usually arrange to attend one of the overseas campuses with little difficulty.

MASTER OF SCIENCE IN CHEMICAL ENGINEERING

The M.S. program is intended for students who wish to engage primarily in course work in Chemical Engineering and related sciences and is normally pursued by students wishing to qualify for the Ph.D. degree, as described below. The M.S. degree is awarded without a formal thesis after a minimum of three quarters of study subject to the following restrictions:

Unit and Course Requirements—A minimum of 36 units is required for the M.S. degree, at least 21 of which must be chosen from among the graduate-level lecture course offerings in Chemical Engineering. The remaining courses may include graduate or advanced undergraduate technical courses in the basic sciences or the School of Engineering. Credit toward the M.S. will not be given for courses normally taken to fulfill the requirements for the B.S. degree or for Chemical Engineering 270 through 277. Credit will not be given for courses normally required for the B.S. degree nor for Chemical Engineering 300.

Thesis Requirements—In addition, the degree of Engineer requires the satisfactory completion of graduate research (Chemical Engineering 290) equivalent to approximately one year’s full-time work. A formal acceptable thesis is required.

ENGINEER

The degree of Engineer is awarded upon completion of six quarters of study plus the following requirements:

Unit and Course Requirements—A total of 45 units of course work is required, 21 of which must be chosen from among the graduate-level lecture course offerings in Chemical Engineering. The remaining 24 units may be chosen from graduate or advanced undergraduate courses in the basic sciences and in the School of Engineering and may include up to three units of Chemical Engineering 270-277. Credit will not be given for courses normally required for the B.S. degree nor for Chemical Engineering 300.

Thesis Requirements—In addition, the degree of Engineer requires the satisfactory completion of graduate research (Chemical Engineering 290) equivalent to approximately one year’s full-time work. A formal acceptable thesis is required.

DOCTOR OF PHILOSOPHY

The Ph.D. degree is awarded upon completion of a minimum of nine quarters of study plus the following departmental requirements:

Unit and Course Requirements—A minimum of 60 units of course work is required for the Ph.D. degree, 24 of which normally are chosen from among the graduate-level lecture course offerings in Chemical Engineering. The remaining 36 may be from courses in the basic sciences and the School of Engineering, including up to six units of Chemical Engineering 270 through 277. No credit will be given for Chemical Engineering 300, undergraduate Chemical Engineering courses, or courses usually required for the B.S. degree. The student should take all Chemical Engineering lecture courses for letter grades.

Qualifying Examination—In order to be advanced to candidacy for the Ph.D. degree, the student must pass a qualifying examination which is usually taken at the end of the
second quarter of residence. The candidate presents orally to the Chemical Engineering faculty a comprehensive review and analysis of a technical paper assigned in his or her chosen field of interest. Upon satisfactory performance in this examination, the student is permitted to proceed with a research topic and should be prepared to choose a research adviser at this time.

*Thesis Requirement*—A dissertation based on a successful investigation of a fundamental problem in Chemical Engineering is required, and the student normally enrolls in Chemical Engineering 290 during the course of his research. It is expected that normally in three to four calendar years the student will have fulfilled all the requirements for the Ph.D. including submission of a completed thesis to his research adviser. At this time an oral examination based upon the candidate’s thesis research will be held in the form of a public seminar followed by private questioning by an examining faculty committee. Upon satisfactory performance in the examination, the Ph.D. degree is awarded.

**Research Activities**

Research investigations are currently being carried out in the following fields: Newtonian & Non-Newtonian Fluid Mechanics, Hydrodynamic Stability, Chemical Energy Conversion, Applied Chemical Kinetics, Surface Reactivity, Adsorption and Catalysis, and Bioengineering. A brochure describing research projects currently being pursued in these areas is available from the Department upon request.

**Fellowships and Assistantships**

A number of fellowships and assistantships are awarded each year to incoming students. Application forms may be obtained upon request to the Department. Application should be made no later than February 15 preceding the start of the academic year for which the award is to be made.

**Courses Primarily for Undergraduate Students**

20. Introduction to Chemical Engineering —The concepts of momentum, mass and energy transport in equilibrium and rate processes are developed in detail in this course and their use illustrated by two case studies. In the first, energy and material balances in flowing systems are used to design a solid-waste disposal plant having municipal refuse as an input and a useful energy resource as an output. Elements of economic analysis and air pollution control are included. The second case study deals with the design of artificial kidney devices and the analytical approaches commonly employed to predict operating efficiencies. In this part of the course, material balances in flowing systems are combined with rate processes (in particular, rates of mass transfer) to develop the appropriate design equations. Several commercially available artificial-kidney systems are discussed in detail.

20L. Introduction to Chemical Engineering Laboratory —The laboratory section consists of a small number of local plant trips. These include visits to a municipal waste reclamation facility, a major oil refinery, a large petrochemical facility, and the renal dialysis unit at the Stanford University Medical Center. Pass/no credit. To be taken concurrently with 20.

1 unit, Win (Robertson, Homsy) by arrangement

210. Separations Processes —Application of the equilibrium-stage concept to design of mass-transfer devices; phase relationships; countercurrent multistage extraction and distillation processes, simplified graphical and computer design methods; chromatographic separations, thermal diffusion, reverse osmosis, zone refining. Prerequisite: Chemistry 171 or Engineering 32.

3 units, Spr (Acrivos) MWF 10

120L. Separations Processes Demonstration Laboratory —Experiments in separations processes. To be taken concurrently with 120.

1 unit, Spr (Acrivos) by arrangement
3 units, Spr (Boudart) TTh 2:15–3:30

140. Fluid Mechanics—The flow of isothermal fluids from a momentum transport viewpoint. Continuum hypothesis; scalar fields; fluid statics; deformation of continuous media; non-Newtonian fluids; the equations of motion; creeping flow; potential flow; boundary layer theory; turbulence; macroscopic momentum, mass, and energy balances; free-surface phenomena. Prerequisites: Mathematics 130 or equivalent. Mathematics 131 recommended.
3 units, Aut (Robertson) TTh 9:30–10:45

140L. Fluid Mechanics Demonstration Laboratory—Experiments include: linear shear flows, boundary layer visualization, internal and external flows, non-Newtonian fluids, laser-Doppler velocimetry, fluidics, and the motion of free surfaces. To be taken concurrently with 140.
1 unit, Aut (Robertson) by arrangement

150. Energy and Mass Transport—A basic course in the transport of energy and mass in flowing systems. Fourier's law, heat transfer in solids, laminar flow, forced and free convection, boundary layer heat transfer, the equations of change for non-isothermal systems energy transport by radiation, Fick's Law, binary diffusion, the equation of convective diffusion, mass transfer with chemical reaction, transport in turbulent flows, heat and mass transfer analogies. Prerequisite: 140 or equivalent.
3 units, Win (Homsy) TTh 9:00–10:15

150L. Energy and Mass Transport Laboratory—Experiments in heat and mass transfer. Unsteady state thermal conduction, heat transfer to boiling liquids, heat transfer by natural convection including the Knudsen region, radiation, and convective diffusion in liquids. To be taken concurrently with 150.
1 unit, Win (Homsy) by arrangement

160. Chemical Engineering Plant Design—Lectures given by design engineers from the Stanford Research Institute include: flow sheets and material balances; cost estimation for capital expenditures and production costs; equipment selection for separation processes, chemical reactions, and other energy and mass transfer operations; optimization techniques. Open to seniors in chemical engineering or by consent of instructor.
3 units, Spr (Schwaar) M 3:15–5:05 and one hour by arrangement

190. Undergraduate Research in Chemical Engineering — Laboratory or theoretical work for undergraduate students under the direct supervision of a faculty member. This might involve research in one of the research groups or could be focused on a special project in the demonstration laboratory.
(Staff) by arrangement

COURSES PRIMARILY FOR GRADUATE STUDENTS

(In addition to the courses listed below, graduate students in chemical engineering would be expected normally to enroll in some of the graduate courses offered by the other engineering departments, as well as the Departments of Mathematics, Physics, and Chemistry.)

200. Applied Mathematics in Chemical Engineering—A course treating mathematical problems commonly arising in continuum mechanics with applications in modeling of separations processes, heat and mass transfer, fluid mechanics and chemical reactor design. The emphasis is on the computational aspects of modeling, and the student is expected to write and run a number of computer programs during the course. Topics covered include applications of matrix theory, numerical solution of ordinary differential equations, perturbation techniques, expansion and finite-difference solutions of partial differential equations. Prerequisites: Mathematics 113, 130, 131 or equivalent; knowledge of Fortran.
3 units, Aut (Homsy) MWF 9:00

201. Bioengineering — This course covers the analytical and experimental aspects of selected biological, and physiological problems as viewed from a chemical engineering perspective, with emphasis on transport phenomena. Topics to be treated are: the design of immobilized enzyme reactors; experimental and theoretical approaches to
renal transport mechanisms; hemodialyzer design; irreversible thermodynamic treatment of membrane transport in synthetic and biological systems.

3 units, Win (Robertson) TTh 1:15–2:30


3 units, Spr (Homsey) TTh 9:00–10:15, alternate years, given 1974–75

204. Kinetics of Chemical Processes—Elementary steps; sequences at the steady-state. Reaction networks. Theoretical principles and application to the study of chain and catalytic reactions.

3 units, Win (Boudart) WF 2:15–3:30

205. Transport in Reacting Systems—Physical problems of engineering interest where transport of mass, energy and momentum in multicomponent systems is accompanied by homogeneous or heterogeneous chemical reactions. Selected topics include behavior of non-isothermal porous catalysts, thermal properties of reacting fluids, combustion and electrode processes; oscillatory reactions.

3 units, Aut (Mason) TTh 2:45–4:00

210A,B. Viscous Flow Theory (with Applications to Heat and Mass Transfer) — An intensive course dealing with the fundamental principles of momentum, heat and mass transfer and their application to problems of physical interest. Derivation and analysis of the Navier-Stokes equations, the energy equation, and the equation for mass transport; flows at small Reynolds numbers and Stokes' law; the method of matched asymptotic expansions; laminar boundary layer theory; hydrodynamic stability and the Orr-Sommerfeld equation; interfacial instability.

210A. 3 units, Aut (Acrivos) TTh 8:00–9:15

210B. 3 units, Win (Acrivos) TTh 8:00–9:15

213. Applied Solid State Chemistry — The chemistry of the solid state is discussed as it pertains to environments encountered in chemical engineering. The emphasis of the course will be on generally applicable concepts as opposed to specific reaction systems; however, specific examples will be used throughout. Typical topics representative of the course material are: chemical transport reactions, vapor-solid equilibrium, vaporization and crystal growth, semi-conductivity, defects in solids, non-stoichiometric solids, corrosion and oxidation of metals, solution of gases in solids, decomposition of solids, corrosion and passivity, and solid surfaces and surface reactivity.

3 units, Aut (Madix) WF 1:15–2:30

214. Advanced Topics in Applied Mathematics — A special topics course intended for advanced graduate students desiring a detailed treatment of numerical/analytical techniques in applied mathematics and numerical analysis. The first half of the course deals with the use of ADI, Direct, and Fourier methods for solving initial/boundary value problems on a mesh. Examples will be chosen from fluid mechanics and heat and mass transport. The second half treats variational calculus and the method of weighted residuals, and their application to problems in hydrodynamic stability, turbulence, and creeping flow. Prerequisite: an introductory course in applied mathematics, e.g., 200, Mechanical Engineering 260A,B, Applied Mechanics 250, 251, 252, or equivalent.

3 units, Spr (Homsey) by arrangement, alternate years, given 1975–76

215. Special Topics in Applied Chemistry and Chemical Engineering—In many separation processes involving the transfer of energy and/or mass between phases, phenomena involving surface or interfacial forces, or special molecular organization at phase boundaries, have profound effects upon interphase momentum, heat, and mass-transport kinetics. This seminar will examine in depth a few industrially important “interface-governed” phase-transfer processes, to illustrate the roles of interfacial dynamics and adsorption phenomena in separation operations. Cases to be studied include (1) surface/interfacial tension gradients and their effects on gas absorption by liquids, distillation, and liquid/liquid extraction; (2) nucleation and phase-transformation processes (condensation and crystallization); (3) gas- and vapor-transport through monomolecular films on liquids; (4) foam- and froth-fraction-
SCHOOL OF ENGINEERING

ation; and (5) membrane-transport and separation processes.

3 units, Spr (Michaels) by arrangement

270–277. Research Seminars in Chemical Engineering—Discussion of recent developments and current research in specialized fields. Open to qualified students with consent of instructor; units by arrangement.

Aut, Win, Spr (Staff) by arrangement

270A,B,C. Fluid Mechanics (Acrivos)
271A,B,C. Adsorption and Catalysis (Boudart)
272A,B,C. Applied Chemical Kinetics (Mason)
273A,B,C. Bioengineering (Robertson)
275A,B,C. Surface Reactivity (Madix)
277A,B,C. Stability of Fluid Motions (Homsy)

290. Graduate Research in Chemical Engineering — Laboratory and theoretical work for graduate students on chemical engineering problems leading to partial fulfillment of requirements for an advanced degree. Credits are not given until the student has satisfied the specific report or dissertation requirement.

(Staff) by arrangement

298. Seminar in Fluid Mechanics—(Enroll in Engineering 298.)

300. Colloquium—Students enrolled in this course will be expected to attend the colloquia of the Department of Chemical Engineering as well as selected colloquia of other departments recommended by their advisers. Must be taken every quarter by candidates for advanced degrees in Chemical Engineering.

1 unit, Aut, Win, Spr (Staff) by arrangement

CIVIL ENGINEERING

Emeriti: Jack R. Benjamin, Rolf Eliassen, Wilhelm Flügge, Eugene L. Grant, Miklós Hétényi, Alfred S. Niles, Clarkson H. Oglesby, Victor K. Thompson (Architecture), James B. Wells, Harry A. Williams, Donovan H. Young (Professors); Eugene V. Ward (Lecturer)

Chairman: Robert L. Street
Associate Chairman: Joseph B. Franzini

Professors: James Douglas (on leave winter quarter), John W. Fondahl (on leave winter quarter), Joseph B. Franzini, James M. Cere, George Herrmann, En Y. Hsu, Paul Kruger, Ray K. Linsley, Perry L. McCarty, Henry W. Parker (on leave spring quarter), Cedric W. Richards, Vincent J. Roggeweena, Haresh C. Shah, Robert L. Street, William Weaver, Jr.

Consulting Professor: Irwin Mussen
Associate Professors: G. Wayne Clough, James O. Leckie, Leonard Ortolano
Assistant Professors: Helmut Krawinkler, Boyd C. Paulson, Jr., Lily Y. Young


PROGRAMS OF STUDY

The undergraduate Civil Engineering Major provides a preprofessional program stressing the fundamentals common to many special fields of civil engineering. Free elective units, plus the proper selection of courses for the requirements in Technology and Society, Mathematics, Science, and Engineering Breadth, permit the student to obtain either a broad general civil engineering education or a more specialized education in a specific branch, such as construction, environmental engineering, hydraulics, transportation, public works administration, structures, and many others. Laboratory facilities are available in fluid mechanics, environmental engineering, materials, soil mechanics, structural and earthquake engineering, and experimental stress analysis. At least one year of graduate study is essential for the professional practice of civil engineering and is strongly recommended. Students who contemplate advanced study at Stanford should discuss their plans with their advisors early in the senior year. The opportunity to participate in the co-terminal B.S.-M.S. program should be explored by students desiring an integrated five-year program.

The Civil Engineering Department, in collaboration with other departments of the University, offers graduate programs with particular strength in:

Construction Engineering and Management
Civil Engineering Planning
Structures, Materials and Geotechnical Engineering
Civil Engineering Materials
Earthquake Engineering
Foundation Engineering
Reliability and Risk Analysis
Soil Mechanics
Soil-Structure Interaction
Structural Analysis and Design
Water Studies
Environmental Engineering
Hydrology
Hydromechanics
Nuclear Civil Engineering
Water Resources

Research work under these programs is carried out in the following facilities—the hydraulics laboratory, the George Havas Building which houses water quality and environmental engineering laboratory facilities, the materials laboratory, the concrete laboratory, the soil mechanics laboratory, and the structural engineering laboratory. Office space is provided for most of the graduate students who are acting as research or teaching assistants.

PROGRAMS IN CIVIL ENGINEERING

CONSTRUCTION

The objective of the program in Construction Engineering and Management is to prepare technically qualified students for responsible roles in the construction industry. Coursework concerns the management of people, money, and equipment to accomplish engineering construction competently and profitably. Subjects offered within the program include costs and estimates; equipment and methods; planning, scheduling, and control; administration; human resource management; work improvement; labor relations; equipment replacement policy, and computer applications. Additional related coursework is available from other programs within the Department, from other engineering departments, and from other schools in the university such as Earth Sciences and the Graduate School of Business. Each student, together with his advisor, can design a curriculum to meet individual educational goals. The program is primarily an M.S.-level one although a few students continue post-Master's coursework and research leading to the Engineer or Ph.D. degree. Close contacts are maintained with industry, and all students participate in weekly discussions with industry representatives.

CIVIL ENGINEERING PLANNING

The program focuses on the engineer as a planner of civil engineering systems which ultimately have a significant influence on the development of cities and regions. They include water resources and water quality projects, transportation systems, urban facilities and other developments. Heavy emphasis is placed upon the social, economic, institutional and environmental aspects of planning.

Students design their programs by selecting an appropriate mix of courses from the planning core, analytical series and a specialty area. Core courses cover social, economic, institutional, financial and environmental aspects of public works. The analytic series includes quantitative methods and techniques useful to planners. Courses making up the specialty may emphasize one or more of the following areas: water resources, water quality, transportation, environmental planning and urban and regional planning. Emphasis is on planning as a discipline, and men and women are prepared for all levels of career positions with private industry, consulting firms and government agencies.

STRUCTURES, MATERIALS, AND GEOTECHNICAL ENGINEERING

Instructional programs and research opportunities are provided in the areas of structural engineering, civil engineering materials, and geotechnical engineering. Particular emphasis is given to earthquake engineering, risk and reliability analysis, computer-aided structural analysis and design, structural dynamics, finite-element methods, foundations and earth structures, soil-structure interaction, and materials engineering (cements and concretes). Flexible programs enable students to prepare for careers as consulting engineers or as engineers in industry, government, and universities.

WATER STUDIES

Water studies is a broad and integrated group of graduate degree programs which have a major focus on water but also cover much broader aspects of environmental concern and planning activities. Thus, the chem-
istry, biology, nuclear, and engineering aspects of water quality and water pollution control can be covered in depth in environmental engineering, and additional study is available in air pollution, noise pollution, environmental aspects of power generation, and environmental planning and impact assessment. The hydromechanics, hydrology, and environmental engineering programs represent individual specialties, but can be integrated with appropriate offerings under Civil Engineering Planning to give water resources and environmental programs with technical emphasis, planning emphasis, or a combination of these two important activities. The programs are kept flexible to foster interaction among students and to encourage the development of individual programs suitable for a broad range of engineering and science backgrounds and career goals.

DEGREES

BACHELOR OF SCIENCE

Students who major in Civil Engineering must complete the requirements for the BS degree given previously under the School of Engineering, “Undergraduate Programs of Study.” Suggested courses to be taken in satisfaction of the requirements in Technology and Society, Mathematics, Science, and Engineering Breadth are available from the Civil Engineering Department office or from the office of the Dean of Engineering. Free elective units may be used in any way the student desires, including additional studies in civil engineering. Because the undergraduate engineering curriculum is designed to insure breadth of study, students who intend to enter the professional practice of civil engineering must obtain their professional education at the graduate level.

MASTER OF SCIENCE

Programs are available leading to the degree of M.S. in Civil Engineering with special designation on the diploma as follows: Management, Materials, Construction, Environmental Engineering, Hydrology, Hydromechanics, Planning, Nuclear Civil Engineering, Reliability Engineering, Geotechnical Engineering, Soil Mechanics and Foundations, Structural Engineering, Structural Mechanics, Earthquake Engineering, and Water Resources. A general M.S. in Civil Engineering without special designation is also given. Detailed statements of the 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 in order to make up specified basic undergraduate civil engineering subjects. The specific requirements differ depending upon the M.S. degree sought. For example, in environmental engineering, students with undergraduate degrees in science or other fields of engineering generally can complete course requirements within three quarters. Students desiring to do so may take an additional 45 units of course work to qualify for a second M.S. degree in Civil Engineering in an area other than that of the first degree providing they also fulfill the specific requirements for the second degree.

A minimum 2.7 LGI and a program of at least 45 quarter units are required for candidates to be recommended for the M.S. degree. Not more than five units of “English for Foreign Students” may count toward the total 45 units requirement. The program of study must be approved by the faculty of the Department and shall include at least 40 units of courses in engineering, mathematics, science, architecture and related fields unless it can be shown that other work is pertinent to the student’s objectives.

ENGINEER

A minimum of six quarters (90 units) of graduate work including a thesis (12 to 15 units) is required for the degree of Engineer in Civil Engineering. This degree is recommended for all students desiring more graduate education than is provided by the Master's degree, especially for those planning a career in professional practice. The student normally should start his thesis in the first quarter of graduate work beyond the M.S. degree. Programs leading to the degree of Engineer are offered in the fields of specialization mentioned above. A minimum “B” average (3.0 LGI) is required for candidates to be recommended for the degree. The pro-
gram of study must be approved by the faculty of the Department.

**Doctor of Philosophy**

The degree of Doctor of Philosophy is offered under the general regulations of the University as set forth in the section “Degrees” in this bulletin. This degree is recommended for those who expect to engage in a professional career in research, teaching, or technical work of an advanced nature in planning, design, and analysis. The Ph.D. program is rigorous and should be undertaken only by students with ability for independent work. It requires a *minimum* of three years (nine quarters) of graduate study, at least two years of which must be at Stanford. Experience has shown that few students complete the Ph.D. within the minimum residence period. Prospective doctoral students should anticipate the possibility of at least one extra year. Further information about Ph.D. requirements and regulations will be found in the Department handout entitled “Information and a Typical Timetable for the Ph.D. Degree.”

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 and subsequent years will be applied to further course work and to the completion of an acceptable dissertation. Dissertation research *in absentia* is not permitted.

The program of study will be arranged by the prospective candidate at the beginning of the second year with the advice of a faculty committee whose members are nearest in the field of interest to that of the student. The chairman of the committee will serve as the student’s *pro tem* adviser until such time as a member of the faculty has agreed to direct the dissertation research. Insofar as possible the program of study is adapted to the interests and needs of the student within the framework of the requirements of the Department and the University. In the second year of graduate study the student is expected to pass the Departmental General Qualifying Examination to be admitted to candidacy.

**Financial Assistance**

The Department maintains a large and continuing program of financial aid for graduate students. Fellowship or scholarship awards range from $500 to $6,000. A generous student loan program is available. In addition, a number of Water Quality Office, Environmental Protection Agency Trainee-ships, are available for students with an interest in water pollution aspects of Environmental Engineering or Nuclear Civil Engineering.

Teaching assistantships (normally awarded only to Engineer and Ph.D. candidates) carry stipends for as much as one-third time work as teaching aides during the academic year. Research assistantships are also available. Engineer and Ph.D. candidates may be able to use research results as a basis for a thesis. Assistantships and other basic support may be supplemented by fellowship and scholarship awards or loans. Continued support is generally available for further study toward the Engineer or Doctor of Philosophy degree subject to performance of the student, availability of research funds, and requisite staffing of current projects. Detailed information may be obtained by writing to the Department of Civil Engineering.

**Admissions**

Admission as a graduate student in Civil Engineering is obtained by applying to the Office of Graduate Admissions. Each successful applicant will be advised as to the degree for which he or she is admitted. If, after enrollment at Stanford, the student wishes to continue toward a degree beyond the one for which he or she was originally admitted, a written application must be made to the Department of Civil Engineering.

**Undergraduate Courses**

40. Elementary Surveying — Care and use of instruments; leveling; topographic surveying; triangulation; horizontal and vertical curves; engineering astronomy. Enrollment limited to 27 to each lab.

4 units, Aut (Douglas) TTh 8; lab. TTh 1:00–5:30
Spr (Douglas) TTh 11; lab. MW 1:00–5:30 or TTh 1:00–5:30

107. Mechanics of Fluids — Dimensional analysis and principles of similarity, including application to hydraulic modeling, open
channel flow, elementary hydrodynamics. Prerequisite: Engineering 21.
3 units, Win (Hsu) MWF 10

3 units, Win (Richards) MTThF 9

116. Plain Concrete—Testing of aggregates, design of concrete mixes including statistical mix design, testing of concrete samples, and physical characteristics of Portland cement concrete. Student reports and project. Course consists of lecture followed by laboratory. Enrollment limited to 24 students.
3 units, Aut (Parker) T1 1:15-5:05 plus Th 1:15-4:05

3 units, Aut (Richards) TTh 10; lab. M 1:15-3:05

130. Transportation—Planning, design, and operation of all modes of transportation. Organization and functions; analysis of demand, including relationships to land uses and economic activities; choices between modes; supply of physical facilities, including location and design of plant and equipment in relation to operating philosophies. Interrelationships with institutional, economic, engineering-economy, financial, personal, business, environmental, aesthetic, and social considerations. Open to all students.
3 units, Win (Roggeveen) TThF 2

131. Highway Engineering—Soils, soil conditioners, asphalts, and concrete as highway materials; design and construction procedures for highway embankments, underscourses, and pavements. Prerequisite: junior standing.
3 units, Spr (Oglesby) TTh 8 and M 1:15-4:05

133. Introduction to Urban Planning—The history of cities and urbanization; basic principles for understanding cities; selected contemporary urban issues and problems; planning—its potential as well as its limitations. Emphasis on description. (Graduate students enroll in 233.)
3 units, Aut (Lowenstein) TTh 11-12:15

140. Advanced Surveying — Additional study of surveying. Prerequisite: 40 or equivalent.
1 to 3 units, Aut, Spr (Douglas) by arrangement

143. Specifications and Contracts — Principles of contract law as applied to civil engineering; legal problems in preparing and administering construction contracts; varieties of construction contracts; specification organization and interpretation; engineer-client relationships. Prerequisite: junior standing.
3 units, Win (Oglesby) MWF 11 Spr (Fondahl) MWF 9

144. Construction Engineering and Management—Forms of construction organizations, labor relations, estimating construction costs, planning and scheduling, safety, cost accounting and control, insurance, bonding.
3 units, Aut (Paulson) MWF 10 Spr (Paulson) TThF 10

145. Construction Equipment and Methods—Construction procedures, methods, equipment; selection and efficient use of excavation and hauling equipment, related problems.
3 units, Aut (Douglas) MWF 8, plus three afternoon field trips by arrangement

160. Water-Resources Engineering — Hydrologic measurements, runoff relations, groundwater, water law, reservoir design, frequency analysis, hydraulic structures, planning of water-resources projects. Prerequisites: 107, Engineering 161.
4 units, Spr (Franzini) MWF 11 and T 2:15-4:05

170. Man and His Environment—An introduction to the problems of the engineering control of the pollution of the air, water, and land environment with which man interacts. The course stresses the causes, effects, and controls of air, water, and land pollution and covers such fields as disease, noise, power generation, water resources, transportation, land use planning, and solid waste manage
ment. (Intended for both science and non-science majors.)

3 units, Aut (Masters) MWF 3:15

171. Environmental Planning — Environmental policies, goals and objectives; land use planning and environmental quality control; alternative pollution abatement strategies; environmental impact assessment for public works projects; and environmental quality issues in developing nations. Desirable prerequisite: 170 or equivalent. (Graduate students enroll in 228.)

3 units, Win (Ortolano) MWF 9

172. Air Pollution—(Enroll in Mechanical Engineering 137.)

173. Energy and Society—(Enroll in Mechanical Engineering 180.)

174. Noise Pollution—(Enroll in Mechanical Engineering 138.)

175. Environmental Measurements — (Enroll in Mechanical Engineering 139.)

180. Elementary Structural Analysis—Analysis of beams, trusses, frames; influence lines for beams, girders, trusses; 3-dimensional trusses; deflections by virtual work, moment-area, elastic loads; indeterminate analysis by superposition equations, slope-deflection, moment distribution. Introduction to matrix methods. Prerequisites: Engineering 11 and C.E. 114.

4 units, Aut (Gere) MWF 9 and W 2:15-4:05

181. Design of Steel Structures — Concepts of elastic design of structures; types of loading; structural systems for buildings and bridges; elastic design and analysis of structural elements, i.e., tension members, compression members, beams, beam-columns, and connections; design of trusses and moment resisting frames; introduction to plastic design. Prerequisites: Engineering 11 and CE 180 or equivalent.

3 units, Win (Krawinkler) TTh 11 plus T 2:15-4:05

182. Design of Reinforced Concrete Structures—Properties of concrete and reinforcing steel; behavior of structural elements subjected to bending moments, shear forces, torsion, axial loads, and combined actions; design of beams, slabs, columns, footings, and retaining walls; ultimate strength design and serviceability requirements; design of simple structural systems for buildings. Prerequisites: Engineering 11 and CE 180 or equivalent.

3 units, Spr (Krawinkler) MW 10 plus Th 2:15-4:05

190. Geotechnical Engineering—Principles of soil mechanics employed in the analyses of earth retaining structures, structural foundations, earth dams and embankments, and landslides. Course includes design-type laboratory projects. Prerequisite: Engineering 11.

4 units, Aut (Clough) MWF 11; lab. to be arranged

196. Engineering Practice—Visits to engineering offices including public agencies, consultants and corporations. Limited enrollment with preference given to fourth and fifth year civil engineering bachelors candidates. Normally one unit pass-fail; but may be taken for two units (graded) by preparing a paper that counts as a Senior Report (CE 198).

1 or 2 units, Win (Wise) M 1:15–5:05

197. Engineering Synthesis —Utilization of students’ previous course work and creative abilities with objective of producing problem solutions and workable designs for a comprehensive project. Stress placed on job planning, coordination and efficient use of group talent. Enrollment limited to 8. Prerequisite: senior standing.

4 units, Win (Douglas, Staff) TTh 1:15–2:05 plus two hours by arrangement (offered 1975-76)

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 who do not take 196 for 2 units or 197. Must be taken during either of the last two quarters before graduation.

1 unit, Win, Spr (Staff) by arrangement

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

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

COURSES PRIMARILY FOR GRADUATE STUDENTS

203. Statistical Models in Civil Engineering

Applications of probability and statistical
analysis to civil engineering; model construction from probability theory; descriptive statistics; estimation with small samples; recognition of variation including professional elements; models for reliability studies of civil engineering designs; construction of complex models. Prerequisite: graduate standing.

4 units, Aut (Shah) TTh 9 and W 1:15–2:05

206. Stochastic Processes and Decision Statistics for Civil Engineers—Description of stochastic processes; transportation models; hydrologic models; structural dynamics models; harmonic analysis of stochastic processes; application of Markov chain models to civil engineering problems; statistical decision theory; Bayes' theorem; utility functions; optimization of decisions under uncertainties; economic analysis; system analysis. Prerequisites: a course in statistics and 233.

4 units, Win (Shah) TTh 10 plus W 1:15–2:05

214A. Experimental Stress Analysis — (Enroll in Applied Mechanics 205A.)

214B. Advanced Work in Experimental Mechanics — (Enroll in Applied Mechanics 205B.)

216. Mechanical Properties of Materials—Elastic, inelastic behavior of structural materials; yield criteria; material damping; viscoelastic behavior; creep; rheological models. Effects of internal structure on properties. Prerequisite: 114 or equivalent.

3 units, Spr (Richards) TTh 11:00–12:15

221. Social Aspects of Public Projects—Social implications of public works, and urban and environmental development or conservation efforts. The course will deal with research methods and problems in the application of social/behavioral research to public decision-making. Critical examination will be made of case studies from California, other states, and abroad.

3 units, Win (Mussen) TTh 11:00–12:15

222. Water Resources Planning — Integration of technical, economic, political and social factors in decisions relating to water resources management. Prerequisites: 160 or 268.

3 units, Spr (Linsley) MWF 11

223. Economics of Public Works — A descriptive and conceptual approach to economic theory relevant to environmental planning, engineering, and design. Applications to transportation, public utilities, urban and regional planning, water and air quality, water resources, and other public works. Micro- and macro-economics. Costs, prices, markets, demand, supply, and consumer choice. Input-output, national and regional income analysis, taxation, resource allocation, welfare economics, regional economics, economic development. Benefit-cost, cost-effectiveness, and program budgeting concepts.

3 units, Aut (Roggeveen) MWF 11

224. Institutional Setting of Public Works—The roles and interactions of all institutional factors affecting different kinds of public works. Government, including organization, legislation, and operation at the federal, state, and local levels. Interest groups, technical experts, and the public. Behavior of organizations, officials, and other individuals. Extensive use is made of cases giving detailed descriptions of actual controversies.

3 units, Win (Roggeveen) TTh 11 and F 3


3 units, Spr (Roggeveen) MWF 10

226. Quantitative Planning Techniques — Selected aspects of operations research with an emphasis on determining the relevance of these techniques for civil engineers engaged in planning. Topics include Lagrange multipliers, and linear and dynamic programming. Recent applications will be discussed. Prerequisites: Mathematics 43 or equivalent and elementary matrix algebra.

3 units, Aut (Ortolano) MWF 10

227. Economics and Engineering Planning—Applications of quantitative economics in public sector project planning and evaluation. A survey of basic elements from the theories of demand, production, welfare economics, externalities, and benefit-cost analy-
sis. Multiple objective planning and environmental quality issues are also considered. Prerequisites: 223 or Econ. 1 and Math 43.

3 units, Win (Ortolano) MWF 11

228. Environmental Planning — Same as 171, with additional assignments for students who desire graduate credit.

229. Seminar on Environmental Impact Assessment — An examination of alternative techniques useful for the analysis and evaluation of environmental impacts of public works projects. Enrollment will be limited to 20 students. Prerequisite: 228.

3 units, Spr (Ortolano) T 1:15–3:05

and 1 hr by arrangement

230. Transportation — Same as 130, with additional assignments for students who desire graduate credit. Open to any University graduate student.

3 units, Win (Roggeveen) TTh F 2

231. Highway Planning — A study of the decision process in highway planning as influenced by engineering, economic, political and social problems. Prerequisite: graduate standing.

3 units, Spr (Oglesby) MWF 9

232. Transportation Planning and Engineering — More detailed attention to selected topics. Particular emphasis upon airports, railroads, rapid transit, port development, new technology, multi-modal transport. This course complements the highway emphasis of 231. Prerequisite: 230.

3 units, Spr (Roggeveen) MWF 1:15

233. Introduction to Urban Planning — Same as 133, with additional assignments for students who desire graduate credit.

234. Principles and Practice of Urban Planning — Trends, techniques, and methods of urban planning covering such topics as the general plan and its implementation through zoning and subdivision regulations; project plan making; and growth, non-growth, or controlled growth in a technological society. Emphasis on prescription. Prerequisite: 133 or 233.

3 units, Win (Loewenstein) TTh 9–10:15

235. Urban Planning Research Methods — Sources of economic, social, and physical information, use of census data, demographic forecasting, land use inventories, economic base analysis, gaming and models. Emphasis on techniques. Prerequisite: elementary statistics.

3 units, Spr (Loewenstein) TTh 9–10:15

236. Urban Planning Internship — Work experience in the planning offices of local governmental agencies and private consultants. Requires one full day per week in an office.

2 units, Aut, Win, Spr (Staff) by arrangement

237A. Field Problems in Urban Planning I — Case studies in the urban planning process, with student analysis of selected urban problems, and preparation of plans for future urban development. Prerequisite: 133 or 233.

3 units, Win (Anderson) MW 3:15–5:05

237B. Field Problems in Urban Planning II — A continuation of 237A.

3 units, Spr (Anderson) TTh 3:15–5:05

238. Transportation Problems — Individual investigation. Prerequisite: 130, 230, or equivalent and consent of instructor.

2 or more units, Aut, Win, Spr (Roggeveen) by arrangement

239. Transportation Seminar — Visitors, field trips to operating facilities, reports on current research, presentations by students, and discussions.

1 unit, Spr (Roggeveen) M 4:15–6:05

240. Operations Analysis for Work Improvement in Construction — Application of crew balance, process charts, time-lapse motion pictures, and operations research techniques to construction operations. Accident prevention. Prerequisite: graduate standing.

3 units, Aut (Parker) TTh 1

241. Construction Planning and Scheduling — Planning, scheduling, and progress control of construction operations. Emphasis on the Critical Path Method including network diagramming, calculations based on time data, and scheduling variations to optimize cost. Manpower and equipment leveling. Course includes both non-computer and computer techniques. Prerequisite: graduate standing.

3 units, Aut (Fondahl) MWF 9

Spr (Fondahl) MWF 10

242. Project Control — Analytical techniques for bringing a project to completion within budget, on time and according to specifica-
tions, including study of cost engineering, schedule and resource control, procurement, and quality control. Prerequisite: CE 241.

3 units, Win (Paulson) MWF 9


3 units, Win (Paulson) MWF 11

244. Construction Equipment Policy—Application of sound management principles in establishing equipment policy; treats depreciation and obsolescence, standardization, preventive maintenance, and fiscal aspects of equipment ownership; includes use of computer for economic analysis of equipment problems. Prerequisites: Engineering 161 and computer programming.

3 units, given 1975–76

246. Construction Administration — Business and management aspects of construction: industry profile, company organization, contracting methods, bonding and insurance, subcontracts, cash flow, and markup. Prerequisites: 143, 144, and 145.

3 units, Aut (Fondahl) MWF 11

248. Problems in Land Development — Study of the interrelationships between marketing research, land development, engineering feasibility studies and financial planning as it involves land acquisitions and land development up to the time of construction. Enrollment limited to 15. Prerequisites: Graduate standing and consent of instructor.

2 units, Spr (Medearis) M 7:30-8:50

249. Labor and Industrial Relations in Construction — Study of the laws, institutions and social and economic forces affecting labor and industrial relations in construction. Prerequisite: CE 144.

3 units, Aut (Paulson) MWF 1:15

250. Human Factors in Construction and Engineering Management — Seminar dealing with the problems of working and communicating with individuals and groups. Enrollment limited to 15 students per sec-

252. Heavy Construction Estimates—Estimating and bidding construction work, with emphasis on procedures adapted to large engineering projects. Prerequisites: 144, 145, 254 or equivalent in general knowledge of construction methods and equipment, and graduate standing in construction option.

4 units, Spr (Paulson) TTh 1:15-3:05

253. Estimating for Building Construction — Estimates and costs attached to construction of large buildings, such as apartment houses, warehouses, and other commercial and industrial type structures. Limited enrollment. Prerequisites: 143 and 144; graduate standing in construction option.

3 units, Spr (Staff) by arrangement


3 units, Win (Parker) MWF 10

255. Concrete Construction—Economy and procedures in plant and equipment selection, form design, and field operations. Special techniques in forming and handling concrete. Prerequisite: graduate standing.

2 units, Win (Parker) TTh 10

256. Harbor Structures—Wharves and piers of timber and concrete; sea walls, bulkheads, moles and groins; dredging and channel construction; factors affecting design, construction of waterfront facilities. Prerequisite: 190.

3 units, Spr (Douglas) TTh 10 and F 1:15-4:05

258A, B, C. Seminar in Construction Engineering and Management—Weekly evening discussion of special topics with speakers from industry and government. Normally taken by construction graduate students each quarter for three quarters.

258A. 1 unit, Aut (Fondahl) by arrangement

258B. 1 unit, Win (Parker) by arrangement
258C. 1 unit, Spr (Paulson) by arrangement

259. Construction Problems — Analysis of individually selected problems in construction techniques, equipment, or management, followed by preparation of oral and written reports. Students are expected to consult specialists from construction industry as well as make use of University facilities. Prerequisites: graduate standing in construction and consent of instructor.

1 to 3 units, Spr (Fondahl) by arrangement

261. Environmental Fluid Mechanics I — Technological and ecological problems such as ocean waste disposal, thermal pollution, water quality in fresh water distribution systems and storm sewer systems. Course includes basic theory, applications, construction of numerical models and use of the computer related to: diffusion and disposal in rivers, estuaries, and the ocean environment; thermal transfers in rivers, lakes, and cooling ponds; fluid mechanics and diffusion modeling parameters; design concepts; pipeline network analysis. Prerequisites: fundamental knowledge of fluid mechanics (e.g., Engineering 21) and of computer programming; basic science background (e.g., B.S. degree); or consent of instructor.

4 units, Win (Street) TTh 8 and F 1:15-3:05

262. Environmental Fluid Mechanics II — Designed to provide further technical background for the analysis and solution of environmental problems; an extension of 261, but 261 is not a prerequisite. Coastal and estuary technology including tides, ocean and coastal currents, water waves, estuarine dynamics as related to tides and density stratification, and coastal sediment transport. Modeling and design including hydraulic (physical) modeling, dimensional considerations, and case studies and examples from estuary and coastal problems. Prerequisite: knowledge of fundamentals of fluid mechanics (e.g., Engineering 21) or consent of instructor.

4 units, Spr (Street and Clifton) TTh 8 and WF 12

263. Fluid Mechanics of Closed Conduits—Review of fundamental principles of turbulent flow and application to closed conduits; pipe systems and branching of pipes; unsteady flow in pipes, flow establishment, application of methods of characteristics to water hammer problems. Prerequisite: Engineering 21 or consent of instructor.

3 units, Spr (Hsu) MWF 10

264. Open Channel Hydraulics and Sedimentation Problems — Uniform, gradually-varied, and rapidly-varied flow in channels; hydraulic jump; channel transitions. Erosion, transport and deposition of sediment. Regime of rivers, design of stable channels, reservoir sedimentation. Environmental effects of watershed management and engineering control works. Prerequisite: 107 or equivalent.

4 units, Spr (Franzini) MWF 9 and W 2:15-4:05

265. Seminar in Fluid Mechanics — (Enroll in Engineering 298.)

266. Engineering Hydrology—The hydrologic cycle; runoff relations, unit hydrographs, flood routing, probability in hydrology, hydrologic simulation, stochastic methods in hydrology. Application to typical water-resources planning problems.

4 units, Aut (Linsley) MWF 9; lab. W 2:15-4:05

267. Advanced Hydrology — Application of hydrologic simulation and stochastic methods in hydrology. Review of significant current literature in hydrology with emphasis on new developments. Prerequisite: 266 or a previous hydrology course.

4 units, Win (Linsley) MWFTh 1:15; lab. W 2:15-4:05

268. Water Resources Development—The planning and design of physical facilities and other measures for the control and utilization of water. Special features of irrigation, water supply, hydropower, river navigation, and flood-damage reduction projects. Prerequisite: 266 or a previous hydrology course.

4 units, Win (Franzini) MWF 10; lab. T 2:15-4:05

269. Water Studies Seminar — Discussions by faculty and students on study and Stanford research of water problems. All students in water studies are expected to attend.

0 units, Aut (Staff) W 4:15-6:05

270. Water Quality in Water Resource Development—Effects of organic, nutrient, and thermal pollution on the ecology and chemi-
cal quality of streams, lakes, reservoirs, and estuaries; cause and control of eutrophication; in-place control of natural water quality; quality requirements for various beneficial uses.

3 units, Aut (McCarty) MWF 8

271A. Water Quality Control I — Unit operations and processes for control of water quality, including desalination, for municipal and industrial use. Prerequisite: 270 and 273 or equivalent.

3 units, Win (Leckie) TTh 11:00-12:15

271B. Water Quality Control II — Chemical and biological unit processes for the treatment of sewage and industrial wastes; advanced methods of wastewater treatment including nutrient removal and physiochemical methods. Prerequisite: 274 or equivalent.

3 units, Spr (McCarty) MWF 8

272. Environmental Biology — Discussion on selected topics in aquatic biology including current problems in water pollution, marine biology, limnology, microbial ecology. Prerequisite: 274 or equivalent.

3 units, Spr (Young) TTh 11-12:15

273. Water Chemistry — A systematic presentation of chemical principles and application of those principles to the analysis and solution of problems in water purification technology and water pollution control. Thermodynamics is used for prediction of direction and extent of chemical processes such as precipitation/dissolution, hydrolysis, complex formation and oxidation/reduction. Prerequisite: Chem. 5 or equivalent.

3 units, Aut (Halvadakis) TTh 9 plus

273A. Water Chemistry Laboratory — Laboratory application of techniques for the analysis of natural waters and wastewaters; special emphasis on instrumental techniques. Limited enrollment. Prerequisite: consent of instructor.

1 unit, Aut (Nelson) M 2:15-5:05 or Th 2:15-5:05

274. Water Microbiology — Fundamental aspects of microbiology and biochemistry of stream pollution and water quality control; microorganisms as pollutants and as purifying agents; microbial identification and ecology as related to the aquatic environment. Prerequisite: 273.

3 units, Win (Young) TTh 10; lab. T 1:15-4:05 or W 1:05-4:05

275A. Water Quality Control Processes I — Laboratory and pilot plant studies of physical and chemical processes for the treatment of water and wastewaters. Prerequisites: 273 and 273A.

3 units, Win (Leckie) M 1:15-5:05 and Th 1:15-4:05

275B. Water Quality Control Processes II — Laboratory and pilot plant studies of biological processes for the treatment of water and wastewaters. Prerequisites: 274 and 273A.

3 units, Spr (McCarty) M 1:15-5:05 and Th 1:15-4:05

276A. Nuclear Methods in Environmental Engineering — The use of nuclear technology in the study and control of environmental processes. Basic principles of radiation: effects; chemistry, and measurement methods; radiochemistry; isotope dilution and activation analysis; and tracer methods: radioactive; environmental, and activable isotopes. Nuclear dating and field logging methods. Environmental processes of origin, behavior, dispersion, transport, concentration, and ultimate fate of pollutants. Applications in air pollution, water pollution, hydrology, and waste disposal.

3 units, Aut (F. Kruger) given 1975-76

276B. Environmental Impact of Power Generation — Analysis of the environmental impact of power production from commercial energy resources. Basic considerations of pollution forms: chemical and radionuclide effluents, thermal and noise discharges, seismic activity and land subsidence; environmental aspects of fuel cycle: on site, transportation, and distribution; comparative environmental impact from fossil fuels, nuclear fission and fusion reactors, geothermal, solar, and other potential sources of energy. The concept of benefit/risk ratio and environmental impact statements.

2 units, Win (Eliassen) TTh 9

276C. Environmental Radioactivity — The biological importance of environmental radi-
ation and the radiation protection standards. Sources of radioactivity and radiation in man's environment. The natural radiation background from space and terrestrial radioactivity. Effluents from the nuclear industries: nuclear power reactors, fuel reprocessing and waste disposal; radioisotope utilization, and nuclear explosions. Redistribution processes of environmental radioactivity.

3 units, Spr (P. Kruger) given 1975-76

277. Explosive Construction Engineering— The use of explosives for civil engineering applications. The science of chemical and nuclear explosions, the technology of explosion-produced configurations. Charge emplacement. The mechanical effects from ground shock and air blast and the environmental effects from the explosion products. Survey of current and potential applications in civil construction, water resources, and industry.

3 units, Spr (P. Kruger) given 1975-76


1 unit, Spr (Leckie, Young) W 4:15-6:05

280A. Matrix Analysis of Structures—Analysis of statically and kinematically indeterminate framed structures by matrix methods; flexibility and stiffness methods developed with computer orientation. Prerequisites: mechanics of materials and elementary matrix algebra.

3 units, Aut (Weaver) MWF 11

280B. Computer Programming for Structural Analysis and Design—Continuation of 280A: Emphasis on the stiffness method of analysis, including programming for a digital computer; analysis of large frameworks by band-matrix and substructures techniques; automated design of framed structures. Prerequisite: 280A or equivalent.

4 units, Win (Weaver) MWF 11

281. Finite-Element Method of Structural Analysis—Theory of finite elements applied to problems in continuum mechanics: plates in plane stress, plain strain, or bending; axisymmetric and three-dimensional solids; shells; linear and nonlinear analysis, including programming for a digital computer. Prerequisite: 280B or equivalent.

3 units, Spr (Weaver) MWF 11

282A. Earthquake Engineering I — Earthquake phenomena, faulting, ground motion; study of past major earthquakes; statistical analysis of earthquake data; effects of earthquakes on man-made structures; analysis and design of structures; building codes; current research in earthquake engineering. Open to graduate students and seniors in the Schools of Engineering and Earth Sciences.

3 units, Win (Gere) MWF 10

282B. Earthquake Engineering II—Earthquake motions and their engineering interpretations; strong ground motion studies; design spectrum; importance of dynamic analysis of structures; geologic and soil engineering problems; soil liquefaction; soil-foundation-structure interaction; stability of dams and natural slopes; design of structures to minimize earthquake damage; risk analyses. Prerequisite: 282A or consent of instructors.

3 units, Spr (Shah) MWF 10

285. Design of Structures I—Inelastic behavior of structures; limit analysis and limit design. Theorems of limit analysis; ultimate strength of structural elements; collapse loads for frames; deflection at incipient collapse; minimum weight design; local instabilities, column instability, frame instability; second order effects. Prerequisites: elementary structural analysis, basic course in design of steel structures.

4 units, Aut (Krawinkler) TTh 10 plus W 2:15-4:05

286. Design of Structures II — General aspects of design; serviceability and failure criteria; types of loading; methods of design; structural systems for buildings; elastic and plastic analysis and design of tier buildings for gravity loads and lateral loads; earthquake resistant design; effects of dynamic loading on strength and ductility of structural elements. Prerequisites: basic courses in design of steel and reinforced concrete structures.

3 units, Win (Krawinkler) TTh 9 plus W 2:15-4:05

287. Design of Structures III—Prestressed concrete design; prestressing systems; loss of prestress; analysis and design of sections for flexure; continuous beams; load-balancing methods. Design of flat slabs of rein-
forced concrete. Yield-line analysis of slabs. Design of shell roofs; domes; cylindrical shells; folded plates; hyperbolic paraboloids. Design of box girder bridges; orthotropic bridges. Prerequisites: basic courses in design of steel and reinforced concrete structures.

3 units, Spr (Krawinkler) MW 1:15-2:30

289. Structures, Materials and Geotechnical Engineering Seminar — Guest speakers on topics in these fields.

1 unit, Aut (Weaver) Alternate W 4:15-5:15
Win (Gere) Alternate W 4:15-5:15
Spr (Shah) Alternate W 4:15-5:15

290. Soil Mechanics — Re-examination of basic principles with emphasis on the mechanics of soil behavior. Discussion of stress-strain relations and shear strength; deformation analyses; two-dimensional consolidation; theories of elasticity and plasticity. Prerequisite: 190 or equivalent.

3 units, Win (Clough) TTh 11:00-12:15

291. Foundation Engineering—Types and characteristics of foundations; design criteria; soil exploration; improvement of soil to support structures; dewatering; earth retaining structures; deep excavations; analyses of settlements and bearing capacity; shallow and deep foundations; earthquake effects; field instrumentation; case studies. Prerequisite: 190 or equivalent.

3 units, Win (Clough) MWF 9

292. Earth Structures — Earth dams, embankments, and natural slopes; site investigation; soil properties and compaction; analyses of seepage and slope stability, seepage control and landslide prevention; earthquake effects; performance observations; case studies. Prerequisite: 190 or equivalent.

3 units, Spr (Clough) TTh 9; one hour by arrangement

293. Experimental Soil Mechanics—Laboratory testing with triaxial, direct shear, and simple shear equipment. Model experiments and special projects to suit individual or class interest.

2 units, Spr (Clough) TTh 10


2 units, Spr (Clough) by arrangement

296A. Structural Dynamics I — Vibration and dynamic response of simple structures to periodic and impulsive loadings. Response of multi-degree of freedom systems; normal modes of vibration; modal analysis of structures. Prerequisites: 180 and Engineering 12.

3 units, Aut (Gere) MWF 10

296B. Structural Dynamics II — Vibration and dynamic response of complex structures using matrix methods. Linear and nonlinear analysis, including programming for a digital computer. Prerequisites: 280B and 296A or equivalent.

3 units, Spr (Weaver) MWF 9

297. Random Vibrations—Characterization and transmission of random vibrations; failures due to random vibrations; multi-degree of freedom systems; non-stationary random inputs and response; nonlinear systems; earthquake-type loads. Prerequisite: 296A or equivalent.

3 units, Win (Shah) T 12:00-2:05 plus 1 hour by arrangement

298. Stability Problems — Beam-columns; elastic buckling of columns; non-prismatic columns; inelastic bending and buckling of bars; torsion of bars of open section; lateral buckling of beams; buckling of frames. Prerequisite: 114.

3 units, Spr (Gere) TTh 2:15-4:05

299. Independent Study in Civil Engineering — Directed study for graduate students on subject of mutual interest to student and staff member. Student must obtain faculty sponsor.

1 to 3 units, any quarter (Staff) by arrangement

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

Aut, Win, Spr (Staff) by arrangement

310. Post-Master's Seminar—For post-Master's students to serve as orientation to the selection of a research topic.

1 unit, Aut, Win, Spr (Staff) by arrangement

399. Advanced Engineering Problems—In-
individual projects on selected topics. Provides for independent graduate work under the direction of a faculty member on a subject of mutual interest. Student must find faculty sponsor. A written report is usually required.

1 to 5 units, any quarter (Staff)

by arrangement


Aut, Win, Spr (Staff) by arrangement

ELECTRICAL ENGINEERING


(Professors)

Chairman: John G. Linvill

Associate Chairmen: Ralph J. Smith, James B. Angell


Lecturers: Michael S. Frankel, Otis L. Frost, Frank S. Greene, Victor H. Grinich, Marian E. Hoff


Senior Research Engineers: John P. Katsurakis, William R. Kincheloe

PROGRAMS OF STUDY

UNDERGRADUATE

Students desiring to specialize in Electrical Engineering during their undergraduate period may do so by following the depth sequence given earlier in the general discussion of the School of Engineering. An accelerated program leading to a higher level of achievement in four years is available to highly motivated students with well-formulated objectives. Interdisciplinary Majors providing work in electrical engineering combined with study in another department are available. Attention is also called to the Innovative Major, and Engineering and Society programs in the same general section. Note that it is possible for a Stanford undergraduate to work simultaneously toward the B.S. and M.S. degrees. Information on this program is available in the Office of the Dean of the School of Engineering.

GRADUATE

The Electrical Engineering Department offers graduate courses in the following areas:

Bioelectronics
Communications and Information Theory
Computer Applications
Computer Systems
Electromagnetic Theory and Microwaves
Electronic Circuits and Devices
Integrated Circuits
Modern Optics and Optical Devices
Network Theory
Plasmas
Quantum Theory and Applications
Radioscience
Solid State Materials and Properties
Systems and Control Theory

Descriptions of courses will be found in the following pages.

ADVANCED DEGREES

The practice of the profession of Electrical Engineering demands a strong foundation in
physical science and mathematics, a broad knowledge of engineering techniques, and an understanding of the relation between technology and man. Curricula at Stanford are planned to offer the breadth of education and depth of training necessary for leadership in the profession. 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. For those who plan to work in highly technical development or fundamental research, additional graduate study is desirable.

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

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, should be considered by those with the ability and desire to make a life work of research or teaching.

**Master of Science**

University regulations governing the degree of Master of Science are described in the “Degrees” section in this bulletin; note that this Department has waived the thesis requirement. Applications for admission with graduate standing in Electrical Engineering are made to the Director of Admissions of the University and are reviewed by this Department. Inquiries may be addressed to the Associate Chairman, Admissions, Department of Electrical Engineering.

Modern electrical engineering is a broad and diverse field, and graduate education in this Department may satisfy a great variety of objectives. Students with undergraduate degrees in physics, mathematics, or related sciences, as well as in various branches of engineering, are invited to apply for admission. Such students will ordinarily be able to complete the Master’s degree in one calendar year. Students with undergraduate degrees in other fields may also be admitted for graduate study (see below).

The Master's degree program may provide advanced preparation for professional practice or for teaching on the junior college level, or it may serve as the first step in graduate work leading to the degree of Engineer or Doctor of Philosophy. The faculty does not prescribe specific courses to be taken. Each student with the help of a program advisor prepares an individual program and submits it to the faculty for approval. This should be done as soon as possible and must be done before completion of the first 12 units of graduate study (modifications may be made later). A Supplementary Information Sheet providing detailed instructions, and including a worksheet for preparing a program proposal, is available in the Department Office.

Programs of at least 42 quarter units that meet the following guidelines will normally be approved:

1. A sequence of three or more electrical engineering courses numbered above 200, to provide depth in one area. (See preceding list of graduate course areas.)

2. At least one electrical engineering course numbered above 200 in each of three additional areas, outside of the area selected under item 1, to provide breadth.

3. Enough additional units of electrical engineering courses so that items 1 through 3 total at least 21 units of graded electrical engineering courses numbered above 200, including at least 9 units of such courses numbered 300 or 400. Some 700 level summer courses may also be considered for inclusion in the M.S. Program.

4. At least three courses in departments other than electrical engineering.

5. At least three quarters of 201, 200 Seminar, unless there is a schedule conflict, with the total amount of plus credits, including 201, 200, not to exceed 6 units in the basic 42 units.

6. Additional courses, such as undergraduate electrical engineering courses, to bring the total to 42 or more quarter units, at least 36 units of which must be courses in which letter grades are given.

It is emphasized, however, that any properly prepared student with a specific objective in mind may submit for approval a program which meets his or her particular needs but does not conform to the normal pattern.
Such a program should be accompanied by a clear statement of objective and a description of how the proposed program achieves the stated objective and should carry the endorsement of the student's program adviser.

Able students without formal undergraduate preparation in electrical engineering may also be admitted for graduate study. Such students may have graduated in any field and may hold either the B.S. or A.B. degree. Each student, with the help of an adviser, prepares a program of study to meet his or her particular needs and submits it to the faculty for approval. A student with adequate preparation in mathematics through calculus and college physics including electricity can usually complete the M.S. degree requirements within two academic years. A student with some additional preparation in electrical engineering may be able to complete the M.S. requirements in only one academic year.

Graduate study in Electrical Engineering is demanding and it is essential that students be adequately prepared in physics, mathematics, circuits, fields, electronics, electromechanics, and laboratory work. The ability to take advantage of modern computing facilities is an essential skill for electrical engineers, and an increasing number of our courses routinely require it. Every student should acquire this skill early in the program, either by taking one of the regular Computer Science courses or one of the special "short courses" given by the Computation Center, or by self-study.

It is the student's responsibility, in consultation with an adviser, to determine whether the prerequisites for advanced courses have been met. Prerequisite courses ordinarily taken by undergraduates may be included as part of the graduate program of study. However, if the number of these is large, the proposed program should contain more than the typical 42 to 45 units, and the time required to meet the degree requirements may be increased.

**Engineer**

The degree of Engineer requires a minimum of two academic years of study beyond the B.S. degree (three academic quarters beyond the M.S.). University regulations governing the degree of Engineer are described in the "Degrees" section in this bulletin.

Work toward the degree of Engineer in Electrical Engineering is more individual and independent than work toward the Master's degree. The applicant has almost complete freedom of selection of courses beyond the requirements for the M.S. degree. The equivalent of approximately one quarter is devoted to independent study and thesis work with faculty guidance. The thesis is often of the nature of a professional report on the solution of a design problem. The degree of Engineer differs from the Ph.D. primarily in looking toward professional engineering work rather than toward theoretical research.

Permission to study beyond the Master of Science degree must be obtained from the appropriate Department committee. The decision of the committee is based on its evaluation of the applicant's academic record, performance in independent work, and potential for advanced study, and on the ability of the faculty to support and supervise such study.

A tentative application for candidacy, including a proposed program of study, must be filed in the Department Office before the end of the first quarter of post-M.S. study at Stanford. The program of study is prepared by the student with the help of an adviser and submitted to the faculty for approval. A formal application for candidacy including the signature of a thesis supervisor must be filed in the Department Office before completion of 25 units of work beyond the Master's degree. Approval of formal application will normally be dependent on completion of courses at Stanford with a satisfactorily high record.

**Doctor of Philosophy**

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 the Graduate Division.

Admission to the graduate school does not imply that the student is a candidate for the Doctor of Philosophy degree. Advancement to candidacy requires superior academic achievement, satisfactory performance on a qualifying examination, and sponsorship by two faculty members.

Not later than the first autumn quarter after receiving the Master of Science degree
the applicant should submit an application to take the Department qualifying examination (given each Winter quarter). Upon successful completion of the qualifying examination and after securing agreement by two faculty members to serve as dissertation advisers, the student should file an Application for Doctoral Candidacy. Only after receiving departmental approval of that application does the student become a candidate for the Doctor of Philosophy degree.

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; (3) an approved program of courses in electrical engineering and allied subjects; (4) an oral examination near the completion of the doctoral program; (5) 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 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.

Ph.D. Minor — For a minor in Electrical Engineering, the student candidate will take 15 quarter units of course work in the Electrical Engineering Department following a program to be approved by the Department committee on doctoral candidates.

Special Programs

Computer Engineering — The degree of Master of Science in “Electrical Engineering: Computer Engineering” may be conferred upon students who wish to develop a competence in the design of substantial software-hardware computer systems. This degree will be administered by the Committee on Computer Engineering, composed of faculty from the Electrical Engineering and Computer Science Departments. Present members include Vinton G. Cerf, Chairman, John McCarthy, and Edward J. McCluskey.

A student should indicate preference for this degree at the time of applying for admission. Programs of at least 42 quarter units that meet the following guidelines will normally be approved:

1. A required sequence of courses in Computer Science and Electrical Engineering to provide depth in hardware and software design. This sequence includes C.S.140A,B and one of the following: (a) E.E.381A,B, and C.S.311; (b) E.E.381A,B, and C.S.246; (c) E.E.182, C.S.246, and C.S.311.

2. At least one course in mathematical foundations for computer engineering. Acceptable courses: C.S.150; C.S.155; C.S.156; E.E.284.

3. At least one course in numerical analysis. Acceptable courses: C.S.135 or both C.S.137A and C.S.137B; alternatively at least one course in finance or accounting at the Graduate School of Business. Acceptable courses: 210 Management Accounting I, or 220 Business Finance I.


6. At least 3 units of seminar with a total not to exceed 6 units. Acceptable courses: E.E. 380; C.S.300; C.S.319.

7. Additional courses to bring the total to 42 or more units, at least 36 units of which must be in courses in which letter grades are given. These courses may be in departments other than Computer Science and Electrical Engineering.

Computer engineering programs that deviate from one or more of the above guidelines in order to meet the valid objectives of individual students will be considered by the Computer Engineering Committee on an individual basis. The student should submit a written statement of his or her individual objectives and indicate how the program and previous preparation meet these objectives.

This program is open to students with a scientific bachelor’s degree (a B.S. in Engineering, Mathematics, Statistics, or Physics); or with a degree having a mathematical background (courses in calculus, a knowledge of linear algebra, and probability). Some knowledge of programming will be required.

Students with very little background in programming should enroll in the basic pro-
programming course, Computer Science 106, during the summer quarter preceding entrance into this program.

The Computer Engineering program will begin in autumn quarter each year to enable a full-time student to complete the degree in one academic year. It is advisable, however, for the student to plan on remaining for a complete calendar year with the thought of completing the laboratory courses in the summer term. Honors Cooperative students able to take two courses each quarter should be able to complete the program in two academic years and one summer quarter.

The degree of Master of Science in “Electrical Engineering: Computer Engineering” is intended as a terminal degree. Students who plan to be candidates for the Ph.D. degree are advised to enroll in the regular Master of Science in Electrical Engineering program.

**Electrical Engineering Administration** — The Master's degree carrying the distinction “Electrical Engineering: Administration” on the diploma is conferred upon students who combine not less than 25 units of study in electrical engineering with about 25 units of study in industrial engineering or business. Four 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 also 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.

**Medical Electronics Program** — The Master of Science degree carrying the designation “Electrical Engineering: Medical Electronics” on the diploma may be conferred upon students who wish to combine training in biological or medical sciences with an electronics program in the Department of Electrical Engineering. Such a student should so indicate when submitting his or her application for candidacy for the degree.

The proposed program of study for the degree should show at least 42 units of work.

The minimum amount of time required to obtain this degree is one academic year. Candidates with inadequate preparation in mathematics, physics, and electrical engineering will require more time. A candidate with a Bachelor of Science degree in electrical engineering would normally devote approximately half time to graduate courses in electrical engineering and the balance of time to courses in biology or medicine. A candidate for the Doctor of Medicine degree who plans to apply the academic year of “University Time” toward this Master's degree would devote about half time to undergraduate courses in electrical engineering, mathematics or physics, and the other half to graduate courses in Electrical Engineering.

For further information, the student should read the bulletin entry on “Engineering in Biology and Medicine,” noting especially the data on Information Processing in Biological Systems, Information Processing for Biomedical Systems, and Integrated Circuitry for Medical Electronics.

**FINANCIAL ASSISTANCE**

The Department annually awards a number of fellowships, teaching assistantships, and research assistantships to graduate students. The fellowships are usually awarded only to first-year graduate students. Most of the awards to Engineer and Ph.D. candidates are research assistantships. Research assistantships are awarded by the individual faculty research supervisors and not by the Department as a whole.

Applicants for all three forms of assistance should obtain the necessary application forms from the University Admissions Office. It is helpful for post-Master's degree applicants for research assistantships to contact directly the faculty member under whom they would like to work, in addition to making formal application to the Department.

Research Assistants can, and normally do, carry out their thesis work and write their thesis as an integral part of the commitments of their assistantship.

**AREAS OF RESEARCH**

Candidates for advanced degrees participate in the research activities of the depart-
ment as paid research assistants or as stu-
dents of individual faculty members. At any
one time, certain areas of research will have
more openings than others. A new applicant
should express a second choice of research
interest in the event that there are no vacan-
cies in the primary area of interest. At present
faculty members and students are actively
engaged in research in the following areas.

**Radioscience**
- Radiation and Refraction of Radio Waves
  by Ionized Media
- Solar-Terrestrial Interactions
- Radio Astronomy and Radio Telescopes
- Radar Astronomy
- Space Science and Engineering (also see
  Index)
- Tropospheric Propagation: Microwave,
  Optical, and Acoustic

**Solid State**
- Amorphous Materials
- Semiconductor and Solid State Physics
- Electronic, Magnetic, and Optical
  Properties of Solids
- Crystal Preparation: Epitaxy and Ion
  Implantations
- Solid State Devices
- Applications to Medical Electronics
- Surface Properties of Solids

**Integrated Circuits**
- Linear, Digital, and Optoelectronic
  Integrated Circuits
- Imaging Arrays
- Large Scale Integration
- Micropower Electronics
- Sensor Fabrication
- Applications to Medical Electronics

**Plasmas**
- Plasma Waves and Instabilities
- Plasma Heating and Turbulence
- Computer Simulation
- Geophysical and Astrophysical Plasmas

**Quantum Electronics**
- Laser Devices and Laser Physics
- Nonlinear Optical Devices
- Coherent UV and X-Ray Sources
- Laser Applications
- Holography

**Microwave Physics and Electronics**
- Microwave Acoustics
- Microwave Semiconductor Devices

**Solid State Plasmas**
- Nonlinear and Parametric Devices
- Magnetoacoustic and Acoustooptic
  Phenomena

**Information Systems**
- Statistical Communication Theory
- Information and Coding Theory
- Detection, Estimation, and
  Identification
- Statistical Signal Processing
- Finite Memory Data Processing
- Pattern Recognition and Complexity
- Control Theory and Optimization
- Diagnostic Imaging
- Fourier and Statistical Optics
- Adaptive Systems
- Real-Time Computer Applications
- Biomedical Signal Analysis
- Network Theory

**Digital Systems**
- Fault Tolerant Computing
- Performance Measurement and
  Modeling
- Computer Architecture
- Computer Networks
- Operating Systems

**Course Numbering System**

Electrical engineering courses are num-
bered according to the year in which the
courses are normally taken:
- 0-99 first or second year
- 100-199 third or fourth year
- 200-299 mezzanine courses for advanced
  undergraduates or graduates
- 300-399 first graduate year
- 400-499 second or third graduate year
- 700-799 special summer courses

**Courses for Undergraduate Students**

Attention is called to courses listed under
"Engineering" starting on page 87 that may
be of special interest to Electrical Engineer-
ing undergraduates.

101. Circuits I—Analysis of simple circuit
models, with a view to discovering their fund-
damental characteristics as transmission net-
works. Forced and natural components of
response, natural frequencies, the complex-
frequency plane, resonance; transfer func-
tions and the roles of their poles and zeros. The use of digital computers in circuit analysis. Impulse response: its calculation and its use in obtaining response to other excitations; the superposition (convolution) integral. Definition and use of transfer functions. Prerequisites: Engineering 41 or 41N, Mathematics 44, ability to use digital computation facilities, or consent of instructor.

3 units, Aut (Watkins) MWF 10
Win (Manning) MWF 8

102. Circuits II—Use of transfer functions (continued), the Laplace transformation, development and application of Fourier series. Sampling and bandwidth concepts. The sinusoidal steady state: electric power systems, introduction to frequency dependence, impedance matching, transformers. Circuit theorems and analytical techniques. Prerequisite: 101 (or, by consent, Engineering 104 plus supplementary reading).

3 units, Win (Watkins) MWF 10
Spr (Manning) MWF 8


3 units, Aut (Harris) MWF 9
Spr (Watkins) MWF 10

111, 112, 113. Electronics—Basic electronic devices and circuits and an introduction to their applications in electronic systems. 111: Careful description of the physical principles of charge motion in semiconductors leading to operating principles and circuit models for MOS devices (transistors, gates, CCD's). Basic circuit and system design using both discrete and integrated MOS components. 112: Operating principles and circuit models of pn junction diodes and transistors. Basic circuit design using primarily discrete junction devices. 113: Applications of discrete and integrated circuits in the design of communications equipment including the design of rectification, detection, modulation, amplification, oscillation, switching, and wave-shaping circuits. Prerequisite: previous or concurrent registration in 101 (or consent of instructor, in special cases).

111. 3 units, Win (Gibbons) MWF 8
Win (da Rosa) MWF 11

112. 3 units, Win (Gibbons) MWF 8
Spr (da Rosa) MWF 11

113. 3 units, Aut (da Rosa) MWF 11
Spr (Gibbons) MWF 8

121, 122. Laboratory — Circuit design and measurement techniques for circuits, and electronic devices, supplementing lectures in 101, 102, 103 and 111, 112, 113. Normally taken by Electrical Engineering students in third year. Prerequisite for 121: prior or concurrent registration in 111. Prerequisites for 122: 121 and prior or concurrent registration in 113.

121. 2 units, Win (Frankel) Th 1:15 and 3-hour lab. weekly by arrangement
122. 3 units, Aut, Spr (Frankel) T 1:15 and 3-hour lab. weekly by arrangement

126. Electronic and Microwave Measurements — Laboratory experiments selected from: Measurement of frequency, attenuation, impedance of circuit components at radio and microwave frequencies; power sources, modulation; crystal and bolometer characteristics and their use in standing wave detectors and power meters; resonators and radiation. Normally taken in fourth year. Prerequisites: 113, 122, and 142 (142 may be taken concurrently).

3 units, Win (Bracewell) TTh 9 and 3-hour lab. weekly by arrangement

139. Design Project (Measurements) — A laboratory course in which individuals or small teams design, build, and test special circuits or simple systems. Projects are selected to emphasize the design and measurement aspects. Possible topics include measurements of: time, frequency, bandwidth, distortion, noise, and noise factor. A typical system would be an acoustic radar or a non-moving electronic anemometer. Ideally, two students form a team and propose a project. Prerequisite: some laboratory experience at the level of E.E.122.

3 units, Win, Spr (McWhorter) Th 1:15 and lab. by arrangement

141. Electromagnetic Fundamentals — The field concept, vector analysis, boundary-value problems, electrostatics, computation of fields, magnetostatics, dielectric and magnetic media, time-varying fields, Maxwell's equations, plane waves. Prerequisite: Physics 53 and Math 43.

3 units, Aut (Waterman) MWF 8
Win (Buneman) MWF 9
142. Electromagnetic Waves — Continuation of 141. Emphasis on waves—plane waves and waves in simple guided systems—largely in vacuum but also in non-conducting and conducting media. Phenomena of reflection, refraction, standing waves, transmission of energy, and radiation of energy.

3 units, Win (Waterman) MWF 8
Spr (Quate) MWF 9

181. Introduction to Computer Organization, Machine and Assembly Languages — The organization of a simple digital computer. Binary arithmetic. Instruction execution. Machine language programs. Symbolic assembly language. The assembly process. Subroutines and coroutines. Simple data structures: arrays, stacks, queues. Input-output programming. Interrupts. Introduction to the IBM System/360. Students will program and operate a small computer such as the HP 2116. Enrollment limited to 50. (Same content as Computer Science 111.) Prerequisite: Computer Science 105 or 106 or equivalent.

3 units, Aut (Staff) MWF 1:15
Win (Baskett) MWF 10
Spr (Staff) MWF 10


3 units, Aut (Staff) MWF 9
Win (Staff) MWF 9

190. Special Studies or Projects in Electrical Engineering — Independent work under the direction of a faculty member for which no letter grade is given. Individual or team activities involving laboratory experimentation, design of devices or systems, or directed reading.

By arrangement

191. Special Studies and Reports in Electrical Engineering — Independent work under the direction of a faculty member; a written report or a written examination is required and a letter grade is given. If a letter grade based on written work is not appropriate, student should enroll in 190.

By arrangement

192. Special Seminars — Seminars associated with and supplementing various courses are offered when there is sufficient interest.

COURSES FOR UNDERGRADUATE OR GRADUATE STUDENTS

200A,B,C. Seminar — Special section of 201 A,B,C (see description below) open to students holding assistantships and registering under limited tuition grants.

200A. 0 units, Aut (Angell, Staff) Th 11
200B. 0 units, Win (Siegman, Staff)
200C. 0 units, Spr (Buneman, Staff)

201A,B,C. Seminar — Weekly discussion of special topics of current interest in electrical engineering. Speakers from faculty and from outside the University. Normally taken by graduate students each quarter for 3 quarters.

201A. 1 unit, Aut (Angell, Staff) Th 11
201B. 1 unit, Win (Siegman, Staff)
201C. 1 unit, Spr (Buneman, Staff)

202. Medical Electronics — The physiologic parameters of interest for medical diagnostic and monitoring purposes and the techniques and instruments required to measure them. Electrical, chemical, and mechanical transducer systems and the appropriate accompanying electronics and displays. Constraints peculiar to medical electronics. Prerequisite: familiarity with circuits and electrical instrumentation techniques at an intermediate level—e.g. 113.

3 units, Aut (Staff)

203. Physiology for Engineers and Physical Scientists (Enroll in Applied Mechanics 280.)

206. Models, Men, and Machines — (Enroll in Engineering-Economic Systems 223.)


3 units, Spr (White) TTh 9:30–10:45

211. Principles of Pulse and Timing Circuits — Switching, timing, wave-shaping, and logic circuits to generate the diversity of waveforms and functions used in pulse sys-
tems, instrumentation, and computers. Emphasis on techniques of analysis and obtaining appropriate circuit models for solid state devices in these highly nonlinear circuits. Prerequisite: 113 or equivalent.

3 units, Aut (McWhorter) MWF 10
Spr (Staff) MWF 11

216. Principles and Models of Semiconductor Devices—Physical principles of operation of the p-n junction, MOS capacitor, MOS field effect transistor, and bipolar junction transistor. Junction and surface effects in the p-n junction and MOS capacitor. Fundamentals of carrier transport, charge storage, and generation-recombination; application to the operation of MOSFET and BJT. First-order models that reflect phenomena of device operation and serve as useful tools for circuit analysis and design. Device modeling with emphasis on features and constraints of integrated circuit technologies. Prerequisites: 111, 112 for undergraduates, none for graduates.

3 units, Aut (Angell) TTh 9:30-10:45
Aut (Staff) MWF 1:15
Win (Linvill) MWF 9
Sum (Staff) MTWTh 1:15

221A. Linear Active Networks — The general small-signal properties of active devices and the use of the devices in amplifiers and oscillators. Various forms of two-port network parameters and their properties. The relation between these parameters and various models for active devices. Properties and design of common ac and dc amplifier and oscillator configurations. Prerequisite: an undergraduate electronics sequence.

3 units, Win (McWhorter) MWF 10
Win (Staff) TTh 9:30-10:45

221B. Linear Active Networks — Introduction to the common network functions for approximating constant gain in a desired band (lowpass and bandpass). Implementation of these functions by active filters and LC networks. General concepts relating to effects in multiple-stage amplifiers. The origin of amplifier noise; means for maximizing the signal-to-noise ratio in single and cascaded stages. Prerequisite: 221A.

3 units, Spr (McWhorter) MWF 10

231. Introduction to Lasers — Introductory survey of laser devices and applications (no quantum mechanics background required). Prerequisites: electromagnetic theory at a level similar to 142, and an undergraduate level course in atomic or modern physics.

3 units, Aut (Siegman) TTh 9-10

232. Introduction to Lasers—Continuation of 231. More detailed coverage of selected topics in lasers, optics, quantum electronics. Prerequisite: 231.

3 units, Win (Siegman) TTh 9-10

233A, B, C. Laser and Quantum Electronics Laboratory — Opportunity for individual, self-initiated laboratory projects in lasers, optics, atomic resonance, parametric devices. Recommended: 231 or 232 (may be concurrent).

Any quarter (Siegman) by arrangement

238. Electric and Magnetic Properties of Solids—The electric and magnetic properties of solids from a fundamental point of view, with the necessary elementary concepts of quantum mechanics. Free electron theory, introduction to band theory, surface states, dielectric and ferroelectric materials, magnetic materials, ferromagnetism, and superconductivity. Emphasis on physical understanding. Prerequisites: Physics 57 and preferably 111 or Engineering 50.

3 units, Aut (Spicer) TTh 1:15-2:30

239A, B. Solid-State Physics — (Enroll in Applied Physics 239, 240.)

243. Electromagnetic Theory I—Basic concepts of electromagnetic theory using advanced mathematical techniques and physical ideas. Electrostatics: Gauss’ Law, electrostatic potential and vector properties of fields, images, Green’s functions, conformal transformations, Bessel and Legendre functions, boundary value problems, difference equations and flux plotting. Magnetostatics: laws of magnetic field, Stokes’ theorem, magnetic potentials. Magnetic and dielectric properties of matter. RF effects: Maxwell’s equations, circuit theory from Maxwell’s equations, skin effect, plane waves. Prerequisite: graduate standing or 141.

3 units, Aut (Pantell) MWF 10

244N. Waves — Exploration of a variety of waves and wave phenomena as they appear in widely different physical systems. Examples selected from the fields of acoustics, aquatics, atmospherics, electromagnetics, mechanics, neurobiology, quantum mechanics, and seismology to illustrate the basic concepts common to all forms of wave prop-
agation. Prerequisite: 142 or 243 or equivalent.

3 units, Win (Quate) MWF 10

261. The Fourier Transform and Its Applications—A discussion of the topic from a moderately advanced point of view, with emphasis on applications to physical situations. Fourier’s theorem, convolution, impulse and related functions, other transforms; applications to electric networks, sampling, numerical filtering, antennas, television image formation, statistics, noise waveforms, heat flow. Prerequisite: 102.

3 units, Aut (Goodman) MWF 2:15
Win (Staff) MWF 2:15
Spr (Bracewell) MWF 2:15

262. Environmental Systems Analysis—Procedures used for environmental planning. The systems approach to complex social, economic, and physical problems; economic aspects of environmental decision making; how to measure policy impacts; modeling and optimization. Examples considered include air and water pollution, ecosystems, waste management, and land use. For senior or graduate students. Students outside the School of Engineering are encouraged to enroll.

3 units, Win (Pantell) TTh 2:45-4:00

264. Applied Linear Algebra—Introduction to matrices and linear transformations and their applications in engineering and science. Topics include: linear combinations, systems of linear equations, vector spaces, linear independence, bases and dimension, coordinates and change of basis, linear operators and their matrix representations, inner products and orthonormalization, adjoints, eigenvalues and diagonalization, determinants, numerical methods, matrix analysis. Prerequisite: Calculus or consent of instructor.

3 units, Aut (Padulo) TTh 2:45-4:00

266. Introduction to Network Synthesis—A one-quarter survey of the principal ideas of network theory, for both passive and active networks. Properties of networks, practical limitations on their performance, and procedures for their synthesis, with and without computer assistance, as appropriate. Prerequisite: 103 and ability to use digital computation facilities.

3 units, Aut (Tuttle) MWF 8


3 units, Spr (Tuttle) alternate years, given 1975-76

274. The Computer as a Laboratory Instrument—Mini-computer architecture and design philosophy. Laboratory demonstration of basic principles of real-time measurement, control, and computation. Role of small computer as dedicated system component in data acquisition, control, automated testing, real-time transforms, and signal processing developed by "hands-on" experiments. Limited enrollment. Prerequisite: 181 or equivalent assembler programming experience.

3 units, Aut, Spr (Widrow, Staff) TTh 10 and 3-hour lab. by arrangement
Win (Widrow, Staff) MW 2:15 and 3-hour lab. by arrangement
Sum (Widrow, Staff) MWF 9 or TTh 10 and 3-hour lab. by arrangement


278. Introduction to Statistical Signal Processing—Review and elaboration of elementary probability theory: Expectation, random variables, density and distribution functions, characteristic functions (transforms), limit theorems. Introduction to random processes: definitions and properties, covariance and spectral density, time averages, stationarity, ergodicity, and linear system relations. Prerequisite: some acquaintance with elementary linear systems, transforms, and probability.

3 units, Aut (Hellman) TTh 1:15-2:30
Win (Gray) TTh 2:45-4:00

279. Information Transmission and Modulation—Signals and circuits for information
transmission in electronic systems; analog and digital modulation and demodulation, frequency conversion, multiplexing, noise and quantization; spectrum, envelope, and instantaneous frequency relations; heuristic discussion of comparison of systems from an information theory standpoint. Prerequisites: 261 and 278 or equivalent.

3 units, Spr (Gray) TTh 2:45–4:00

280A,B. Computer Applications Laboratory—“Hands-on” experience in innovative, real-time applications of digital computers as signal processors or portions of control systems. Previous topics include pattern recognition with computer-controlled TV camera, and bloodpressure control using a computer-simulated model of an animal reaction to a pressure-elevating drug. Experimental research projects are developed in cooperation with Electrical Engineering, the Medical School, and other research laboratories. Should be taken for two consecutive quarters. Limited enrollment. Prerequisite: 181 or equivalent programming experience. Corequisite: 274.

3 units, Win, Spr (Widrow, Staff) by arrangement

282. Digital Logic Laboratory — Experiments in digital logic design using integrated circuits commercially available. Circuit families and designs using more than one family; small-scale and large-scale integrated circuit applications; and design of synchronous and asynchronous circuits. Choice of projects.

1–3 units, Aut, Win, Spr (Staff) by arrangement


3 units, Spr (Peterson) TTh 1:15–2:30

284. Introduction to Discrete Mathematics—An introduction to the algebra and combinatorics required for theories of sequential machine and coding, and advanced study of digital systems and computer science. Sets, relations, functions and homomorphisms. Semi-groups and relevance to sequential machines. Groups and relevance to coding. Fields and relevance to linear sequential machines and codes. Prerequisite: 264 or Mathematics 113.

3 units, Win (Staff) MWF 9

286A,B. Systems Programming — A two-quarter sequence intended for those who wish to develop competence in the design of complex program systems. Review of fundamental program design concepts such as systematic program design, modular programs, program verification, data structures, algorithms for sorting and searching, and translators including compilers and interpreters with emphasis on basic ideas illustrated through programming assignments. Specific systems programs and problems: macro facilities, bootstrapping and portability, linkers and loaders, text editors, debugging systems, input/output systems and file systems. Facilities and structure of an operating system. (Same content as Computer Science 140A,B.) Prerequisite: 181 or equivalent. Corequisite: Computer Science 104.

286A. 3 units, Win (Cerf) TTh 9:30–10:45

286B. 3 units, Spr (Cerf) TTh 9:30–10:45

288. Computer Systems Laboratory—Individual and group projects on the design and implementation of computer systems consisting of programs and/or logic circuits. Emphasis on the design process and design evaluation. Areas of particular interest are logic subsystem design, interfacing, systems programming, and operating systems. Students are encouraged to suggest and define their own topics, and normally work on one project for the entire academic quarter. Computer facilities including a PDP-11 computer are available. A written report is required. Limited enrollment. Prerequisite: previous or concurrent registration in any one of the following: 286B, 381B, 386, Computer Science 144A,B, or Computer Science 240B.

3 units, Spr (Baskett) WF 1:15 and by arrangement

292. Special Seminars—Each year special seminars and experimental courses are given on topics of current interest. See the Time Schedule and bulletins in the Department Office for detailed announcements.
COURSES FOR GRADUATE STUDENTS

300. Topics and Methods in Solid State Research — Discussion of technical topics in solid state electronics and related mental processes and thinking tools.
   *Aut (Shockley) by arrangement*

305. Seminar on Electronics in Medicine — Weekly seminars on the application of electronics technology to problems of medical practice or research featuring speakers from educational institutions or industries.
   *1 unit, Aut, Win (White)*

310. Integrated Circuits Technology and Design Seminar — In-depth treatment of technology and circuit design problems. Content will roughly parallel topics of interest from E.E.313 and 314.
   *1 unit, Win, Spr (Dutton)*

311. Integrated Circuit Technology—Fundamental principles of monolithic integrated circuit technology. Technological limitations on integrated circuit design. Lectures and laboratory instruction including photoengraving, oxide masking, diffusion, and thin film deposition. Laboratory portion is limited in enrollment. Prerequisite: 113.
   *2 to 3 units, Aut, Spr (Meindl)*

312. Digital Integrated Circuits — Analysis and Design — Device technology and modeling constraints important to digital integrated circuit design. Comparison of MOS and BJT technologies and device configurations. Design problems relating to power, speed, size, and functional complexity in logic and memory circuits. Standard and special purpose circuit configurations and technologies. Topics may include: Standard and Schottky Clamped TTL, ECL, p-channel vs. n-channel MOS, C-MOS, V-groove vs. Isoplanar, multiphase logic. Prerequisite: 216.
   *3 units, Win, Spr (Dutton)*

313. Linear Integrated Circuits — Analysis and Design — Device technology and modeling constraints important to linear integrated circuit design. The unique capabilities and fundamental constraints of device configurations appropriate for linear IC’s. Circuit configurations that illustrate state-of-the-art linear design. Topics may include: high performance op-amps (fast slew rate, high input impedance), linear multipliers, multiple medium performance amplifiers, phase-locked loops, band-pass and oscillator circuits. Prerequisite: 216.
   *3 units, Spr (Angell, Dutton)*

315. Solid State Circuits Laboratory — Experimental projects on design of high-performance circuits or small systems using transistors, integrated circuits, and other modern solid state devices or on device measurement and evaluation, with emphasis on relationships between observed characteristics and underlying physical mechanisms. Applications to medical electronics are emphasized. Limited enrollment. Prerequisite: previous or concurrent registration in any one of the following: 216, 221A,B.
   *3 units, Aut, Win, Spr, Sum (Meindl)*

320. Solid State Seminar — Discussion by guest specialists, faculty, and students of research topics and current literature in solid state physics.
   *1 unit, Aut, Win, Spr (Spicer)*

322A. Basic Quantum Mechanics — Introduction to the concepts of quantum mechanics; the postulates of quantum mechanics; observables, wave functions, and probability density; the Schrödinger equation; complementary variables and the uncertainty principle; the harmonic oscillator and particles in a box; the hydrogen atom; angular momentum; the matrix formulation of quantum mechanics; the Dirac notation. Prerequisites: introductory atomic physics, classical mechanics, differential equations. Recommended: linear algebra.
   *3 units, Aut (White)*

322B. Basic Quantum Mechanics — Time independent perturbation theory; time dependent perturbation theory; transition probabilities; spin, identical particles, and exchange; energy levels of atoms; elementary band structure; the symmetry properties of wave functions. Prerequisite: 322A.
   *3 units, Win (White)*

324. Applications of Quantum Theory — A unified approach involving the density matrix to lasers, semiconductors, Raman effect, field quantization, and multiple quanta effects. Emphasis on the techniques for obtaining the appropriate equations of motion, rather than on detailed investigation of specific devices. Topics included are photoconductivity, rate equations, sponta-
neous emission, laser action, infrared absorption, and multiple photon absorption. Prerequisite: 322B or Physics 231.

3 units, Spr (Pantell)

325. Acoustic Seminar — Research seminar on acoustic waves. Topics include acoustic surface waves, microwave acoustics, medical applications, materials testing, imaging techniques, biological applications, seismic studies, and other current research in this field.

1 unit, Aut, Win, Spr (Kino, Auld)

326A. Wave Phenomena in Active Media I — (Enroll in Applied Physics 250.)

326B. Wave Phenomena in Active Media II — (Enroll in Applied Physics 251.)


3 units, Win (Kino)

329A,B. Solid State Electronics Laboratory — Experimental projects on semiconductor crystal growth, gaseous diffusion of impurities, Hall effect, minority-carrier diffusion and drift mobility, thermoelectricity, electroluminescence, Gunn effect, optical absorption, plasma reflection, Schottky barriers, etc. Registration by consent of instructor. Prerequisite: 238, or 328 or Physics 172, or Materials Science and Engineering 181.

3 units, Win, Spr, Sum (Pearson)

330. Photoelectronic Materials and Devices Laboratory — Experimental projects on measuring the spatial frequency response (MTF) of low light level image intensifiers, preparation of conventional semi-transparent semiconductor photocathodes and measurement of their spectral response, excitation, emission and optical absorption spectra of luminescent phosphors, secondary emission coefficient of surfaces, etc. Registration by consent of instructor. Prerequisite: Physics 161 or Materials Science and Engineering 181.

3 units, Aut (Bates)


3 units, Win (Spicer)

335. Seminar in Quantum Electronics and Optics — Discussion by staff and students of topics in lasers, optics, quantum electronics, and optical parametric devices.

1 unit, Aut, Win, Spr (Siegman, Harris, Byer)

338A. Quantum Theory of Energy States in Solids — (Enroll in Materials Science and Engineering 233.)

338B. Electronic Transport in Solids — (Enroll in Materials Science and Engineering 234.)

338C. Photoelectronic Properties of Solids — (Enroll in Materials Science and Engineering 235.)

342. Radiation — Spectra; wave packets; mode density; Maxwell stresses; radiation pressure. Green's function; delta-function; retarded potentials; relativity; multipole fields; bremsstrahlung. Huygen's principle; Fresnel diffraction; computational methods for field problems. Prerequisite: 243 or equivalent.

3 units, Spr (Buneman) alternate years, given 1974-75

346. Principles of Nonlinear Optical Devices — Wave propagation in anisotropic, nonlinear, and time-varying media. Tensor description of nonlinear susceptibilities; coupled wave equations; harmonic generation; parametric amplification and oscillation; Manley-Rowe relations; interaction with vibrational waves, Brillouin and Raman scattering; electro-optic and acoustic frequency translation; light modulation; optical scanning, and filtering. Prerequisite: 232, or 243, or 244N or equivalent.

3 units, Spr (Harris)

347. Introduction to Fourier Optics — Application of Fourier theory to the analysis and synthesis of optical imaging and data-processing systems. Diffraction, lenses, coherent and incoherent imaging, optical data pro-
cessing, and holography. Prerequisite: familiarity with Fourier analysis.

3 units, Win (Goodman)

348. Ionospheric Processes—The neutral atmosphere; the solar ionizing radiation; the role of production, loss and diffusion processes in establishing the ionosphere; thermal behavior of the ionospheric plasma; coupling to the protonosphere. Transionospheric propagation and its practical applications. Prerequisite: 243 or equivalent.

3 units, Spr (Staff) alternate years, given 1975–76


3 units, Spr (Goodman)

350. Radioscience Seminar—Student-faculty discussion of research problems in the fields of ionospheric and magnetospheric physics; radio propagation in, and radio emission by, ionized media; solar terrestrial relations; and radio and radar astronomy, and plasma physics.

1 unit, Aut, Win, Spr (Staff)

351. Plasma Wave Theory—Introduction to plasma wave propagation in cold and warm plasmas; equivalent permittivity concept; energy and group velocity; pulse response; dispersion relations for transverse and longitudinal wave propagation; effects of boundaries and inhomogeneities; origins of instabilities and criteria for their classification as absolute or convective; special cases of velocity-space and macroscopic instabilities; wave/wave interaction and parametric amplification. Courses 351 and 352 are complementary, and may be taken in either order. Prerequisite: 243 or consent of instructor; recommended: 261.

3 units, Spr (Crawford) alternate years, given 1975–76

352. Wave Propagation in the Ionosphere and Magnetosphere—Magnetoinic theory from a modern point of view; applications including ray tracing, dispersion (e.g. whistlers), absorption, boundary effects. Interpretation of experimental observations and use of radio waves as diagnostic tools. Introduction to wave-particle interactions. Prerequisite: 243 or equivalent.

3 units, Spr (Helliwell) alternate years, given 1974–75

353. Interferometry and Image Construction—Diffraction theory of antennas and other sensors, interferometry, arrays of sensors. Coherence properties of random radiation fields, image-forming techniques, examples from radio and radar astronomy techniques. Image resolution loss due to scanning with sensor, restoration in the presence of noise, image filtering, image reconstruction from strip integrals. Prerequisites: 243, and 261 or equivalent.

3 units, Aut (Bracewell) alternate years, given 1974–75

354. Theory and Application of Radio Wave Scattering—Theory of radio wave scattering from metallic and dielectric spheres, cylinders, and laminas of small and large size. Scattering from electron ensembles, and from turbulent media. Scattering from rough surfaces, with large and small scale roughness, planetary surfaces and the sea; Rice’s solution. Emphasis on physical descriptions. Applications to radar, radar astronomy, and remote sensing. Prerequisite: 243 or consent of instructor.

3 units, Aut (Eshleman) alternate years, given 1975–76

356. Introduction to Plasma Physics—Plasma as a new medium; its significance in space and fusion research, individual and collective phenomena; ionization, charged particle orbits, collisions, plasma oscillations; Maxwell-Boltzmann distributions, Debye length, Landau damping, magnetoinic propagation and dispersion. Sheath and probe theory, magnetic confinement, pinches, adiabatic motion, mirrors, pressures, stresses, magnetogasdynamics. Prerequisite: 243 or equivalent.

3 units, Aut (Buneman) alternate years, given 1975–76

358A,B. Quantum Electronics Laboratory—(Enroll in Applied Physics 358A,B.)

358C. Solid State Physics Laboratory—(Enroll in Applied Physics 354.)

360. Seminar on the Theory of Systems—Discussion of research problems and current literature in control, communication, and
system theory by faculty, students, and outside specialists.

1 unit, Aut, Win, Spr (Bryson, Kailath)

363. Introduction to Linear System Theory
—Analysis of finite-dimensional single input-single output linear systems. Analog computer realizations, state variables, canonical forms. Controllability, observability, and minimality. Relations to transfer function descriptions. Time- and frequency-domain design of controllers and observers. State-variable realizations from input-output data. Prerequisite: 102 or Engr. 104.

4 units, Aut (Kailath, Franklin)
Spr (Kailath)
Sum (Staff)

364. Multivariable System Theory—Structural properties—controllability, observability, canonical forms. Applications to pole-shifting, decoupling, system realization and identification. A sequel to E.E.363 where similar problems are studied for scalar systems. Student presentations based on current research literature.

3 units, Win (Kailath)

366. Optimal Control of Dynamic Systems
—(Enroll in Aeronautics and Astronautics 278A.)

367. Optimal Estimation and Control Logic in the Presence of Noise—(Enroll in Aeronautics and Astronautics 278B.)


3 units, Spr (Widrow)

375. Information Systems Seminar — Lectures and discussion of topics and research areas in information systems: selected topics such as computational and statistical complexity, rate distortion theory, algebraic systems theory, simultaneous communications, and telecommunications policy.

1 unit, Aut (Macovski)
1 unit, Win (Widrow)
1 unit, Spr (Staff)

376. Information Theory — Information sources. The measure of entropy, information, and mutual information properties of codes; coding information sources; Huffman coding. Information channels; reliable messages through unreliable channels; Shannon’s noiseless and noisy coding theorems; channel capacity; restricted primarily to discrete channels. Prerequisite: Statistics 116 or Engineering-Economic Systems 221 or equivalent.

3 units, Win (Hellman)

377. Classification and Pattern Recognition

3 units, Win (Cover)


3 units, Win (Staff)

378B. Statistical Detection and Nonlinear Estimation—Filtering, smoothing and detection of general signals in Gaussian and/or non-Gaussian noise. Martingales and innovations as basic processes in estimation and detection; properties and applications. Recursive non-linear estimation and detection. The separation theorems of stochastic control and of the detection of random signals. Prerequisite: 378A or consent of instructor.

3 units, Spr (Staff)

379. Communication Channels — Funda-
mental principles of communication engineering; detection of signals in Gaussian noise; channel capacity and channel reliability functions; applications to signal selection, input and output quantization, error-correcting codes. Primary emphasis on continuous channels. Prerequisite: 278 or equivalent.

3 units, Spr (Hellman)

380. Seminar on Digital Systems — Discussion of current research in the area of digital systems including logic design, switching theory, and machine organization.

1 unit, Aut, Win, Spr (Bredt, Staff)
W 4:15

381A,B. Switching Theory and Logic Design—Analysis and synthesis of digital circuits with emphasis on basic design techniques and general concepts. Boolean algebra; simplification of switching functions; sequential circuits; simplification of sequential machines. Characteristics of switching, memory, and input/output devices. Comparison of digital integrated-circuit families. Introduction to large-scale integration. Logic design of a system such as a stored program computer, digital differential analyzer, desk calculator, or radar signal processor. (Same content as Computer Science 211A,B.) Prerequisite: Basic knowledge of Boolean algebra and number systems.

381A. 3 units, Aut (Peterson) MWF 9 and (Staff) MWF 11
Win (Staff) MWF 11
Sum (Staff) MTWTh 11

381B. 3 units, Win (Staff) MWF 11 and (Peterson) MWF 1:15
Spr (Staff) MWF 10

385A. Digital Reliability Seminar — Student-faculty discussions of research problems in areas of reliability, testing, diagnosis, and redundancy in digital systems. Prerequisite: consent of instructor.

1 to 4 units, Aut, Win, Spr (Staff)
Th 3:15–5:05

385B. Parallel Systems Seminar—Student-faculty discussions of research problems in areas of hardware and software system design. Design methodologies for operating systems; system reliability including program verification, program testing, error detection, and error recovery; machine-independent system design; languages for systems implementation; models for parallel systems. Prerequisite: consent of instructor.

1 to 4 units, Aut, Win, Spr (Bredt) M 4:15
and by arrangement

385C. Computer Systems Analysis Seminar — Student-faculty discussions on measuring, modeling, and analyzing the performance of computer systems and computer system components.

1 to 4 units, Aut, Win, Spr (Baskett)

385D. Communications Network Seminar—Student-faculty discussions on computer communication networks, including study of packet switching, loop systems, topology and capacity assignment, reliability, and performance measurement. Major focus on inter-process communication methods and operating system design for distributed resource networks.

1 to 4 units, Aut, Win, Spr (Cerf)

386. Operating Systems — Multi-programming and time-sharing system design. Topics covered include processes and process communication, control of input-output, memory management, scheduling, file systems, protection, resource allocation, design methodologies. Same content as Computer Science 246. Prerequisites: Statistics 116 or equivalent; 286B or systems programming experience.

3 units, Aut (Enroll in Computer Science 246)
Spr (Bredt) TTh 1:15–2:30

387. Algebraic Coding Theory — Information representation; Huffman and alphabetic encodings. Theory and implementation of codes for detection and correction of independent and burst errors. Convolutional encoding and sequential decoding. Optional: synchronization; comma-free codes, codes with special correlation properties. Prerequisite: 284 preferred; 376 or 379 acceptable.

3 units, Spr (Gill)

388. Computer System Evaluation—Performance criteria in computer systems, queueing theory; queueing models of multiprogramming; analysis of bottlenecks, measurements via hardware and software; simulation; models of program behavior, storage devices, memory hierarchies, and file structures; allocation and scheduling of jobs and computer systems resources. (Same content
as Computer Science 247.) Recommended prerequisite: 386.

3 units, Spr (Baskett) alternate years, given 1975–76

390. Special Studies or Projects in Electrical Engineering—Independent work under the direction of a faculty member for which no letter grade is given. Individual or team activities involving laboratory experimentation, design of devices or systems, or directed reading.

By arrangement

391. Special Studies and Reports in Electrical Engineering—Independent work under the direction of a faculty member; a written report or a written examination is required and a letter grade is given. If a letter grade based on written work is not appropriate, student should enroll in 390.

By arrangement

392. Special Seminars—Each year special seminars are given on topics of current interest. These seminars are usually announced one or two quarters prior to their presentation and are given by specialists in the field. See the Time Schedule for detailed announcements.

395. Electrical Engineering Instruction: Practice Teaching—Open to a limited number of Electrical Engineering students who plan to make teaching their career. Qualified students conduct a small section of an established course taught in parallel by an experienced instructor.

(Smith) by arrangement

397. Faculty Seminar—Discussion meetings arranged by a faculty member or initiated by interested students and sponsored by a faculty member.

1 unit, by invitation

400. Thesis and Thesis Research—Limited to students who have established candidacy for the degree of Engineer or Ph.D. A grade of P indicates satisfactory work; no letter grade is assigned.

By arrangement

412. Advanced Integrated Circuit Laboratory—Experimental projects and seminars on integrated circuit fabrication using epitaxial, oxidation, diffusion, evaporation, sputtering, and photolithographic processes with emphasis on techniques for achieving advanced device performance. May be repeated for additional credit. Prerequisite: 312 and consent of instructor.

3 units, Win (Meindl)

413. Ion Implantation Techniques—Theory of ion implantation and related processes, with applications to the study of solid-state materials and the fabrication of solid-state devices. Prerequisite: consent of instructor.

1 unit, Aut, Win, Spr (Gibbons)

415. Solid State Laboratory—Experimental and theoretical problems related to the understanding, control, and use of the electronic, magnetic, and optical properties of solid-state materials and devices. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr, Sum
Section 1 Gibbons
Section 2 Heffner
Section 3 Pearson
Section 4 Shockley
Section 5 Spicer
Section 6 White

417. Integrated Circuit Applications—Computer assisted analysis, and design, fabrication, and application of integrated circuits and transducers in electronic systems such as optical-to-tactile reading aid for the blind, implantable ultrasonic blood flow-meter, microprobe for biopotential sensing, gas chromatograph, and ultrasonic imaging device. Prerequisite: consent of instructor.

1 to 4 units, Aut, Win, Spr, Sum
Section 1 Angell
Section 2 Dutton
Section 3 Linvill
Section 4 McWhorter
Section 5 Meindl


425. Microwave Solid State Devices—Theory and laboratory techniques for microwave acoustics, Gunn effect, and other microwave semiconductor devices, and for biological applications of acoustics. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr, Sum
Section 1 Chodorow
Section 2 Kino
Section 3 Quate

430. Electron Spectroscopy Seminar—Electronic structure, photoemission, and surface physics. Topics of current research interest selected from the literature. The more ad-
Advanced students present the material for discussion.

1 unit, Aut, Win, Spr (Spicer, Staff)

431. Quantum Electronics — Quantum theory of lasers and related quantum electronic devices. Interaction of radiation and atoms; stimulated transitions; the density matrix; inhomogeneous broadening; quantum noise. Provides the quantum theory underlying the semiclassical approach of 231–232. Prerequisites: quantum theory to the level of 322B or Physics 231. 231–232 is not a prerequisite, but background reading from this course material may be necessary.

3 units, Spr (Siegman) alternate years, given 1974–75

435. Advanced Quantum Electronics—Advanced topics in lasers, quantum electronics, and nonlinear optics. May include experimental work on the generation and measurement of tunable optical and ultraviolet radiation. Prerequisite: consent of instructor.

3 to 4 units, Aut, Win, Spr, Sum
  Section 1 Harris
  Section 2 Siegman

438A. Group Theory and Symmetry—(Enroll in Applied Physics 270.)

438B. Solid-State Theory—(Enroll in Applied Physics 339.)

438C. Solid-State Theory—(Enroll in Applied Physics 340.)

445. Plasma Waves and Instabilities—Special topics in plasma wave propagation and instabilities in laboratory and space plasmas. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr
  Section 1 Crawford
  Section 2 Helliwell

450. Radioscience Laboratory—Experimental, observational, and theoretical problems of the ionosphere, magnetosphere, troposphere, and radio and radar astronomy. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr, Sum
  Section 1 Bracewell
  Section 2 da Rosa
  Section 3 Eshleman
  Section 4 Helliwell
  Section 5 Lusignan
  Section 6 Manning
  Section 7 Peterson
  Section 8 Villard
  Section 9 Waterman

451. The Laboratory Plasma — (Enroll in Engineering 211.)


3 units, Aut (Buneman) alternate years, given 1974–75

455. Seminar in Astrophysics — (Enroll in Applied Physics 363.)

456A. Solar Terrestrial Relations—(Enroll in Applied Physics 360.)

457. Computer Simulation of Continuous Media—A survey of the algorithms, tricks, approximations, economies, and data management used in simulating media such as plasmas, gases, the atmosphere, electron and/or hole distributions, etc. on a large computer; introduction to low level languages. For doctoral candidates in Electrical Engineering, Mechanical Engineering, Aeronautics and Astronautics, Applied Physics, or Computer Science.

1 to 3 units, Aut, Win, Spr (Buneman)
  by arrangement

465. Modeling and Optimization of Environmental Systems—Application of the techniques and methodology of engineering and scientific mathematics to problems of the environment. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr, Sum (Pantell)


475. Special Studies in Information Systems—Advanced topics in information and communication theory, control theory, and related areas, including applications. May be repeated for credit. Prerequisite: consent of instructor.

1 to 4 units, Aut, Win, Spr, Sum
  by arrangement
  Section 1 Cover
  Section 2 Franklin
  Section 3 Gill
  Section 4 Goodman
  Section 5 Gray
  Section 6 Hellman
477. Statistical Complexity — (Enroll in Statistics 363.)

478. Topics in Statistical Signal Processing — Problems selected from recent research of the faculty in areas that have reached a level of development suitable for course presentation. Topics to be covered 1974–75: Mathematical theory of data compression, including historical development, and new approaches via information and ergodic theory. Prerequisites: 278 and 376.

3 units, Aut (Gray)

479. Topics in Statistical System Theory — Selected problems in statistical communication, stochastic control, statistical data processing, network and system realization and identification, stability theory. (May be repeated for credit.) For 1975, emphasis is on complexity of computer computations. Prerequisite: some computer programming experience.

3 units, Spr (Gill)

482. Advanced Computer Organization — (Enroll in Computer Science 311.)

483. Advanced Topics in Switching Theory and Logic Design — Functional decomposition theory, iterative networks, threshold logic, NAND networks, reliability, diagnosis, and related topics. Prerequisites: 284 and 381B or equivalent.

3 units, Spr (Staff) alternate years, given 1975–76

484. Advanced Automata Theory — Realization of digital behavior by finite-state machines. Machine recognition experiments, reduction and decomposition, regular expressions, lossless machines, iterative systems, space-time transformations, linear machines, concepts of pipelining and parallelism. Prerequisites: 284 and one of 381B, Philosophy 162, or Computer Science 156.

3 units, Spr (Staff) alternate years, given 1974–75

485. Advanced Computer Systems — Individual student-faculty discussions of advanced topics in logic design, computer architecture, operating systems, reliability, and performance evaluation. Prerequisite: consent of instructor.

1 to 4 units, Aut, Win, Spr, Sum by arrangement

ENGINEERING-ECONOMIC SYSTEMS

Chairman: William K. Linvill
Associate Chairman: Donald A. Dunn
Professors: Donald A. Dunn, Willis W. Harman, Ronald A. Howard, William K. Linvill, David G. Luenberger
Associate Professors: John T. McAlister, Jr., Richard D. Smallwood
Assistant Professors: Edward J. Sondik, James L. Sweeney
Acting: Carson E. Agnew
Consulting: Shmuel S. Oren
Lecturers: Nicolaos V. Arvanitidis, Robert E. Larson, James E. Matheson, Peter A. Morris, Edison Tse

OFFERINGS AND FACILITIES

The Department of Engineering-Economic Systems is dedicated to preparing individuals for careers dealing with the phenomena characteristic of planning, operation, and control of large-scale technological-economic systems through programs of study, internship, and research on the graduate level.

The formal coursework provides the basic framework of professional training and emphasizes the system analysis techniques that are sufficiently powerful to have important application in the planning and operation of the complex systems required by modern society.

A unique feature of the doctoral program is the internship, a period of experience in the real world that allows a student to test theory in the face of reality and thereby gain first hand experience in the limitation of existing methodology. The internship experience will often provide the basis for formulating meaningful research problems.

The research programs of faculty and students are designed to abstract from experience and, thus, extend the frontiers of knowledge in the systems area. The research
program is the source of new methodology that sustains the course program.

**BACKGROUND REQUIRED**

Students admitted for graduate study in Engineering-Economic Systems must have a background of undergraduate work that indicates a level of mathematical maturity customarily found in an intensive undergraduate engineering or physical science program. Undergraduate course work in economics is not required, but will prove helpful in graduate study in this field.

**PROGRAMS OF STUDY**

There are three programs of study, all at the graduate level, leading to the degrees of Master of Science, Engineer, and Doctor of Philosophy in Engineering-Economic Systems.

**MASTER OF SCIENCE**

The degree of Master of Science requires a minimum of one academic year of study beyond the B.S. degree. University regulations governing the degree of Master of Science are described in the "Degrees" section of this bulletin. The Department does not have a thesis requirement for the Master's degree. Department requirements provide great flexibility for meeting individual objectives. The Master's degree may be viewed as a terminal degree program to provide a professional focus, or it may be used as an exploratory vehicle to formulate and select a more advanced graduate school program. Course programs are approved individually by Engineering-Economic Systems faculty. In addition to meeting University requirements, M.S. programs must involve at least 21 units of courses in Engineering-Economic Systems with letter grades and a total of 42 units of course work.

**ENGINEER**

The degree of Engineer requires a minimum of two academic years of study beyond the B.S. degree (three academic quarters beyond the M.S.). University regulations governing the degree of Engineer are described in the "Degrees" section of this bulletin. The applicant has almost complete freedom of selection of courses beyond the requirements for the M.S. degree. The equivalent of approximately one quarter is devoted to independent study and thesis work with faculty guidance.

Permission to study beyond the Master of Science degree must be obtained from the appropriate Department committee. The decision of the committee is based on its evaluation of the applicant's academic record, performance in independent work, and potential for advanced study, and on the ability of the faculty to support and supervise such study.

**DOCTOR OF PHILOSOPHY**

The degree of Doctor of Philosophy requires a minimum of three academic years of study beyond the B.S. degree. A complete statement regarding University regulations governing the degree of Doctor of Philosophy will be found in the "Degrees" section of this bulletin. The requirements are administered by the University Committee on Graduate Studies.

Admission to the graduate school does not imply that the student is a candidate for the Doctor of Philosophy degree. Only after the Application for Doctoral Candidacy has received official Departmental and University approval does the student become a candidate for the degree.

All students who have not already earned a Master's degree must receive the Master of Science degree in Engineering-Economic Systems as a prerequisite to candidacy for the PhD. Not later than the first Autumn quarter after receiving the Master of Science degree the student should submit an application to participate in the Department qualifying procedure.

Requirements may be summarized as follows: The student is to complete successfully (1) a minimum of three years of residence with graduate standing, (2) Department qualifying procedure, (3) an approved program of courses, (4) a 3.5 average letter grade indicator on the core courses (see p. 162), (5) an oral examination near the completion of the doctoral program, (6) a dissertation, based on research, which must be a contribution to knowledge. The Department does not have a foreign language requirement.

Ph.D. Minor—Doctoral students throughout the University may complete a minor in Engineering-Economic Systems by taking 21 units of courses selected from the list below. The selection must be approved by the stu-
dent's Department adviser and by the Engineering-Economic Systems faculty. The primary aim of this minor is to develop system analysis and decision-analysis capabilities for graduate students who anticipate careers associated with system problems.

**SYSTEM INTERNSHIPS**

Since most large-scale system problems cannot be made available within a university, internships are offered to help the student develop the ability to solve system problems by working on real problems in the field environment.

Problems of broad scope requiring a system viewpoint and thus suitable for the internship experience are found in large industrial firms, in companies and research groups concerned with the design and operation of large-scale systems, and in government agencies. Opportunities also exist to participate in economic and industrial planning in developing countries.

The duration of an internship ranges from 6 to 24 months, depending on the time required to complete the project successfully. While interning, the student lives on location and works as an employee responsible to the company or agency concerned. The Engineering-Economic Systems faculty locates and screens suitable internship opportunities in a variety of areas, and reviews each proposed project to verify its educational value.

The student's internship work in the field is mainly directed toward the successful solution of a real-world problem. Consequently, the student will gain an appreciation for the approximations and compromises with rigor that characterize applied work in the field. After returning to the University, the student will complete this phase of the program by reexamining the field work in the light of the fundamental principles of system analysis, pointing out the shortcomings of the existing theory in this application, and abstracting from the experience the general insight that he or she expects to be useful in future studies.

One internship project or equivalent practical experience is standard in both Engineer's degree and Ph.D. programs, but is not a requirement. There is wide flexibility in the Ph.D. program to accommodate the particular interest of the student. Over 80 EES students have been on internships to date.

The variety of internships available will vary in time as new problem areas become of interest. The aim is to undertake projects that are technically challenging, practically significant, and theoretically enlightening.

**RESEARCH AND APPLICATIONS**

Although system concepts are portable and their generality must be emphasized, it is important for a student to receive experience in the application of these concepts in depth to at least one specific problem area. A practitioner, to be responsible and effective, must combine general system knowledge with the important specific factors relevant to the problem at hand. The opportunity for students to receive this important aspect of a systems education exists primarily in the internship program, in various applied research projects that may be in progress within the Department, and in special courses that concentrate on the application of system concepts to specific areas.

The major research programs of the department are listed below. Regular and acting faculty and lecturers who are active in these programs are indicated.

**Mathematical System Analysis** (Luenberger, Sweeney, Oren, Tse)

Mathematical system analysis is the development and application of those mathematical principles and techniques that form the basis for problem formulation and solution in the system area. The field is one of great multiformity, both with respect to the types of mathematics employed and in the areas of application. The Stanford program emphasizes the development of new techniques through an involvement in a variety of practical problems ranging from system design to institutional function analysis. Faculty and students in the program have developed effective analytical approaches to problems such as: the design of a national housing allowance experiment; planning of electric power expansion; improvement of defense systems; the theory of instruction; the control of various physical, economic, and social systems; land-use planning; housing policy planning; word processing system evaluation; and water resource planning. Students have often been employed by various local consulting firms while working on these problems. In parallel with this practical in-
involvement, members of the program have made several fundamental contributions to theory in dynamic systems, optimization, and economics. Current projects in the program include the application of dynamic system concepts to organizational structure, land-use analysis, housing dynamics, and the development of control theory.

Decision Analysis (Howard, Matheson, Smallwood)

Decision analysis is a logical procedure for balancing the many factors that influence a decision, including economic, technical, and social factors. It is the only procedure known that can simultaneously consider the uncertain, dynamic, and complex consequences of a decision as well as the assignment of value to those consequences. Business applications in such areas as new product introduction, plant expansion, and merger decisions have been successfully treated under the Stanford program (which includes activities at the university, Stanford Research Institute, Xerox Palo Alto Research Center, and KMB Health Systems, Inc.). Government applications which have been treated include optimal expansion through nuclear plants of the electrical power system of Mexico, planning unmanned space exploration, and determining whether hurricanes threatening the United States should be seeded with silver iodide crystals. Theoretical research is being done in the areas of establishment of preference structures, development of decision systems for decentralized use, expert resolution, approximate methods, Markovian decision models, determining the sensitivity to modeling assumptions, and the application of decision analysis to multi-party social decisions.

Public Policy Analysis (Dunn, Harman, Linvill, McAlister)

The policy analyst is concerned with exploring and mapping alternative approaches to large-scale problems of the society and with evaluating relative costs, benefits, and long-term intentions implied by various approaches. Agreement is widespread that policies in the public and private sectors need to be made in the context of (1) understanding of second- and higher-order consequences, (2) a long-term strategic perspective, and (3) coordinated actions among diverse agencies and institutions. The analysis of public policy alternatives requires a synthesis of several disciplines, including decision analysis, economics, quantitative systems analysis, and law.

A policy analysis program emphasizing future research is centered at SRI, involving EES faculty and students working with social scientists and systems analysts under the direction of Professor Harman.

An interdisciplinary research program in telecommunications has been conducted by Professor Dunn in cooperation with faculty and students from several departments and schools. This work has dealt with policy issues in relation to cable television, broadcast television, and computer communications.

A third policy research program is one in national growth policy being conducted by Professors Harman, Linvill, and McAlister. The focus of this project is on the definition of national objectives for a wide range of growth-connected quantities such as environmental quality and on the ways that a national consensus in this area can be developed.

Health Systems (Smallwood, Sondik)

EES health systems research is directed toward the development of an integrated methodology for the analysis of health care systems. Our previous research has developed methodologies and analysis tools to aid in the planning and evaluation of alternative programs or policies in several health care problem areas. We are now collaborating in health care planning research with the local regional health planning authority, the Bay Area Comprehensive Health Planning Council. Another current research project is a joint project with the Stanford University School of Medicine, the formulation, evaluating, and testing of alternative heart disease prevention programs.

Telecommunications Systems (Dunn, Linvill)

Developments in computers and communication technology over the last decade and the synthesis of these two technologies have created a wide range of opportunities for society. A long-term interdisciplinary study of the technology, costs, markets, and social effects of computer communication systems is being carried out under Professor Dunn. The study is centered in EES, but it
will bring together faculty and students from the economics, communication, and electrical engineering departments as well as EES. The research utilizes decision analysis and economics in the analysis of public policy issues, as well as legal and social science research methodologies. Specific topics being studied include: (1) cost-performance tradeoffs in computer communication networks; (2) the effects of pricing policy on congestion in such networks; and (3) international standards and agreements and their effects on domestic systems.

Professor Linvill is working at the interface between telecommunications and the society. He is developing a system to integrate the delivery of public services which would utilize a public information system, a credit card system for accounting for public service deliveries, and a process for planning public service delivery systems.

**Urban Models, Analysis, and Planning**
(Luenberger, Sweeney)

EES research in urban modeling has been focused in two areas: the development of housing market models and the development of land use planning methodologies. The first component involves modeling of supply and demand forces and the resultant adjustment dynamics of the system that determines how housing is supplied and used in urban areas. Based on these models, the short-run and long-run effects of public policy measures such as subsidy programs, code enforcement, tax law changes, and public housing programs are being examined in order to guide such programs better. The second component of our research, conducted both at the University and at Intasa, Inc. is aimed at the development of quantitative tools that can assist in the land use planning process. Attention is being directed to questions of zoning, infrastructure development, and tax incentives as they relate to the major issues of urban growth. Several specific planning projects have been addressed using the newly developed methodology.

**Financial Assistance and Admission**

Most students in the EES Ph.D. program have found that, after completing the qualifying procedure, they are able to obtain financial support through a combination of research assistantships, teaching assistantships, and their internships, all of which contribute directly to their educational programs as well as providing financial support. In the recent past students have typically received $1000 per month during the period of their internships. The critical period financially for most students has been the first year to year-and-a-half of graduate work. A financial commitment of about $5000 per year is required to cover tuition and expenses.

A limited number of fellowships for first-year students are available through the department. These pay tuition plus an allowance of approximately $200-$250 per month during the academic year. Two other potential sources of first-year support are research assistantships and loans. However, research assistantships are, in most cases, awarded to students who have completed the qualifying procedure.

For all students who are U.S. citizens and who wish to obtain loans, the department can provide the means of obtaining loans up to $5000. Loans may be repaid from the salary that the student earns during the internship, but repayment need not begin until graduation.

Applicants for all forms of assistance may obtain the necessary application forms from the University Admissions Office. Applications for fellowships must be made by the 15th of January preceding the Autumn quarter that admission is desired and must be accompanied by application for admission. Research assistantships, however, are awarded by the individual faculty research supervisors, not by the Department, and have no such deadline. Applicants, because of the individual nature of these awards, are advised to contact directly the faculty member under whom they wish to work. Formal applications to the Department for research assistantships will be referred to the individual faculty research supervisors.

Except in unusual circumstances, admission to the Department of newly entering graduate students is confined to the Autumn quarter because the course offerings are arranged sequentially with basic courses and prerequisites falling early in the academic year.

**Courses of Study**

Study programs should be selected to give a broad coverage as well as work in depth
in one or more specific areas. System analysis is a young discipline that draws many of its models and methods from mathematics, physical science, and social science. Future developments in system analysis will often be an outgrowth of concepts born in these foundation fields. The student's course program should include a selection of foundation material from the offerings of other departments so that the student will have the breadth to contribute to the growth of his or her profession both now and for the years to come.

Up to half of the student's courses for the M.S. degree may be taken outside the department. However, a typical M.S. program would include 30 units of EES courses including 3 units of EES 293, Math 113 and 115, and two additional out-of-department courses.

Examples of student programs for the Ph.D. which emphasize different foundation disciplines are as follows:

1. A quantitative system analysis program which emphasized mathematics might include the following mathematics courses: 113, 114, 115, 116, 117, 205A, B, C, 261A, B, C.

2. A program which emphasized economics might include the following economics courses: 202, 203, 204, 249, 250, 254, 256.

Similar programs with an emphasis in other specific areas such as political science or sociology can be developed with the aid of an adviser. In most such cases it is possible to obtain a minor in the student's additional area of special interest.

In some cases a student may wish to emphasize an interdisciplinary area such as communications which might involve taking courses in a number of other departments. Individual programs can be developed with the aid of an adviser to meet particular student interests, but an attempt should be made to develop substantial depth in at least one area outside the EES department during the course of the Ph.D. program.

The courses in this Department are divided into the following categories:

1. System Analysis
   a) Modeling
      1) Introductory System Analysis: 201A*, B*, C
      2) Probabilistic Models for Problems of Uncertainty: 221*, 251*
   b) Optimization

2. Economics: 210, 211, 212A*, B*
3. Decision Analysis: 231*, 232, 236
4. Applications and Research
   a) Health Systems: 264
   b) Telecommunication Systems: 280
   c) Urban Systems: 249
   d) Research Seminars: 291, 292, 293, 300

**Courses**

**System Analysis: Modeling**

201A,B,C. Introductory System Analysis —
Introduction to analytical concepts and examples of dynamic systems useful in system engineering and policy analysis. Mathematical description of dynamic systems: state space description, external description, and transform methods; discrete-time systems, continuous-time systems; flow graphs and block diagrams. Eigenvalue analysis of linear time invariant systems. The theory of positive matrices. Applications of dynamic system analysis to general population growth, study of organizational hierarchies and promotion systems, the convergence of supply and demand, study of national economy, the analysis of housing markets, the propagation of rumors, etc. Controllability and observability. Canonical forms for linear systems. Z-transforms and Laplace transforms. Stability analysis and feedback. Observers and estimators. Fundamental concepts of optimal control: Euler-Lagrange equations, Pontryagin maximum principle, Bellman-Hamilton-Jacobi theory. Turnpike theorems. Applications to control of epidemics, the theory of instruction, economics, conservation of resources, social interaction. Prerequisite: Concurrent or previous registration in Mathematics 113 and 114.

3 units, Aut, Win, Spr (Luenberger)
TTh 9:30-10:45

221. Probabilistic Analysis — A self-contained development of probability theory that is both theoretically sound and suited to application. Appropriate either as a terminal course or as a foundation for further graduate work in applied areas. Theory presented axiomatically with emphasis on

* The courses identified by asterisks above are core courses. A 3.5 average letter grade indicator is required on these core courses for doctoral candidates.
sample space representation for both discrete and continuous random variables. Discussion of basic concepts, description of random variables, changes of variable, transform techniques, named distributions, and computer simulation. Goal is to provide student with same understanding and competence in analysis of probabilistic problems that he already possesses in dealing with deterministic problems. Prerequisite: working knowledge of calculus.

3 units, Aut (Howard) TTh 11:00–12:15

251. Dynamic Probabilistic Models—Emphasizes the extension and further application of basic systems concepts to modeling of processes exhibiting both dynamic and uncertain behavior. Linear systems under uncertainty. Application of linear system theory to the study of Markov and semi-Markov processes over finite and countable state spaces and discrete and continuous time. Examples in the areas of system reliability, marketing, health systems. Prerequisites: 201A and 221 or equivalents.

3 units, Spr (Sondik) TTh 1:15–2:30

SYSTEM ANALYSIS: OPTIMIZATION

242. Introduction to Optimization — Overview of optimization field. Basic notions related to convexity. An introduction to linear programming including: basic properties, simplex method, duality, dual simplex method, reduction of linear programs to minimal form. Special computing techniques and their economic interpretations. Applications.

3 units, Win (Oren) M 3:15–4:15, W 3:15–4:45


3 units, Spr (Oren) MW 7:35–8:50

248. Dynamic Programming—The discrete-time dynamic optimization problem. Bellman's principle of optimality. The basic computational procedure. Advanced computational procedures, including successive approximations, approximations in policy space, dynamic programming with shift vectors, and state increment dynamic programming. Dynamic programming for continuous time systems and the calculus of variations. Linear systems. Dynamic programming for stochastic and adaptive systems. Applications in system expansion planning, operations research, process control, power systems, environmental systems, and trajectory optimization.

3 units, Aut (Larson) TTh 2:45–4:00

263A. System Optimization — Introduction to functional analysis; linear vector spaces, normed spaces, Hilbert space. The projection theorem in Hilbert space with applications to approximation, control and estimation theory. Dual spaces and linear functionals, the Hahn-Banach theorem. Prerequisite: 201B or Mathematics 113. Recommended: Mathematics 115.

3 units, Aut (Staff) TTh 9:30–10:45

263B. System Optimization — Linear operators; inverses; adjoints, pseudo-inverses. Minimization of functionals; calculus of variations, Fenchel duality. Constrained optimization: Lagrange multipliers, Kuhn-Tucker theorem, duality, optimal control theory. Iterative techniques of optimization. Prerequisite: 263A.

3 units, Win (Staff) TTh 9:30–10:45

ECONOMICS

210. Introduction to Microeconomics — A self-contained presentation of the basic tools of microeconomics for graduate students having an analytical background typical of graduate students in engineering, but having no previous economics background. Topics presented include: theories of the consumer and of the firm, theories of competitive and monopolistic markets, conditions for economic efficiency, theories of efficient and non-efficient markets, and planning rules for the improvement of resource allocation. Particular emphasis is placed on phenomena characteristic of decentralized economies.

3 units, Aut (Staff) MW 11:00–12:15

211. Economics of Public Policy — Mechanisms of market failure and the analysis of alternatives for public action. Antitrust law, patents and copyrights, legal and economic
aspects of pollution and congestion, private production of public goods. Welfare economics and the redistribution of wealth and income through public action. Analysis of public policy in relation to government production of services and regulated industries, criteria for public investment, price and non-price rationing of services, financing of services, political and bureaucratic behavior. Prerequisite: 210 or 212A.

3 units, Win (Dunn) MW 11:00–12:15

212A,B. Economic Analysis—Analytic modeling of economic phenomena: methodologies for modeling choices of individual agents, for modeling the interactions among choice-making agents, and for analyzing normative economic models. Models of individual agents include theories of consumers and of firms. Models of interactions include theories of competitive and noncompetitive markets, general equilibrium theories, aggregate models of employment, national income, and inflation, and models of economic growth. Normative economic models include those which focus on the conditions for economic efficiency, the mechanisms by which markets may fail to be efficient, the planning rules for improving resource allocation, and the conditions for optimal economic growth.

3 units, Win, Spr (Sweeney) MW 11:00–12:15

DECISION ANALYSIS

231. Decision Analysis — Development of a normative rationale for individual and group action in the face of uncertainty, complexity, and dynamism. Presentation of the procedures necessary to reduce the rationale to practice. Encoding of information and preferences. Discussion of utility measures of risk preference and discounting measures of time preference. Analysis of problems using decision trees that include risk and time preference. Determination of the economic value of perfect and imperfect information on one or several variables in a decision problem. Design of economic information-gathering experiments. Presentation of examples that range over the fields of business, engineering, law, and medicine. Applications drawn from private and public sectors of the economy. Prerequisite: 221 or equivalent.

3 units, Win (Howard) TTh 11:00–12:15

232. Advanced Decision Analysis—Extension of decision analysis beyond the basic paradigm. Emphasis on determining and extending the boundaries of logical analysis of decisions. Discussion of such representative topics as creation of alternatives; the encoding of subjective information without bias; foundations of inference; invariance and exchangeability principles; relationship of decision analysis to classical inference and data analysis procedures; analysis of complex preference structures; normative preference principles; repetitive, iterative, and decentralized decision systems; value of information in special contexts; use of experts; competitive and social decision analysis; sensitivity and approximation; and decision analysis in dynamic processes. Content will vary with current research interests. Prerequisite: 231.

3 units, Spr (Howard) Th 3:15–5:45

236. Decision Analysis Practice — Provides an opportunity for students trained in the theory of decision analysis to apply that knowledge in practice, and also to extend the domain of rational analysis. Teams of students each analyze a current decision problem faced by an actual decision maker. They must carry out the technical procedures of modeling, information assessment, and value encoding by communicating with individuals who are usually not trained in logical analysis. Problems chosen by students have covered every level of decision-making from the university to the community of nations, and many fields of human endeavor. Project evaluations are based solely on the professional quality of analysis and presentation. Prerequisite: 231.

4 units, Spr (Howard) TTh 11:00–12:15

APPLICATIONS AND RESEARCH

223. Models, Men, and Machines — Those systems that require a quantitative analysis of the human component in the system. Emphasis on quantitative modeling of this human component, especially human decision-making. Specific system areas considered include: manual control, monitoring, decision-making, automated instruction, and medical diagnosis. Discussion of the importance of this area to future systems. Presentation augmented by classroom experiments. Prerequisite: 221 or consent of instructor.

3 units, Aut (Smallwood) alternate years, given 1975–76
Industrial Engineering

Emeritus: Eugene L. Grant (Professor)
Chairman: W. Grant Ireson


Programs of Study

Industrial Engineering is concerned with the organization of people, information, and equipment in order to produce and distribute a service or product in an economic way, consistent with prevailing social values and the preservation of natural resources and environment. Depending on the degree level, students are prepared to design, manage, and perform research on or teach about these productive systems which may be in federal, state or local government, public or quasi-public hospitals or schools, or in private industry. The curriculum is especially concerned with planning, designing and implementing organizations and programs for the application of technology to societal problems.

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 the planning, designing, and implementing of complex economic and technological management systems where a scientific and engineering background is necessary or desirable. The fundamentals of engineering are stressed. The Industrial Engineering program is designed to introduce the student to measurement and control theory, organization theory and behavior, management, economic analysis and modeling, facilities planning and design, and utilization of computers and information systems. The objective is to provide the student with systems concepts, the role and function of management, methods of analysis, and the human
and economic factors that bridge the gap between pure engineering design and pure management. To achieve this objective, the student will take several courses in which group projects comprise an important part of the course. In these projects, the student has the opportunity to formulate and solve problems and implement solutions for firms and organizations in the surrounding community.

Many students completing the Bachelor's program will wish to pursue graduate study in Industrial Engineering, in other professional schools—law, medicine, or business—or in fields related to Industrial Engineering such as economics, statistics, or operations research.

**ADVANCED DEGREES**

The Industrial Engineering Department, in collaboration with other departments of the University, offers programs leading to the degrees of Master of Science, Engineer, and Doctor of Philosophy in Industrial Engineering. Options at the Master's degree level are available in

1. Management Systems Design
2. Economic Systems Planning
3. Systems Analysis and Synthesis
4. Computer Utilization
5. Transportation Systems

Opportunities for special study are available under the first three of these options. The Management Systems Design option incorporates production systems and man-machine systems. The Economic Systems Planning option presents special work in planning, programming, and budgeting for economic development, and engineering economy. Systems Analysis and Synthesis concentrates on analytical methods, systems synthesis, and control methods. Computer utilization incorporates computation, data processing, and information systems design and operation. The Transportation Systems option emphasizes methods of analysis and planning; students interested in this field should consult the bulletin of the Stanford Transportation Research Program (STRP) for other courses dealing with transportation.

Applicants for admission as graduate students in Industrial Engineering must submit the results of the verbal and quantitative aptitude parts of the Graduate Record Examination.

**MASTER OF SCIENCE**

The Master of Science program is designed to provide sufficient additional skills over the B.S. course in Industrial Engineering to prepare students for the careers described above. It is also designed to prepare students with Bachelor's degrees in other engineering disciplines to learn more about application of their technology to societal problems or for using the technology as a basis for a productive system. An additional use of the Master's degree is as a step toward a second advanced degree.

The Master of Science degree programs require a minimum of 45 units beyond the equivalent of a Bachelor of Science degree at Stanford. All programs represent substantial progress in the major field beyond the equivalent of a Bachelor's degree. Suggested or sample programs leading to the degree of Master of Science in Industrial Engineering without specialization or with specialization in one of the four option areas previously listed are available. These sample programs and the requirements for the Master of Science degree may be obtained from the Department of Industrial Engineering.

All Master of Science degree programs must contain certain core courses unless the student has already had equivalent courses before entering the Industrial Engineering graduate program. Only 15 units of these core courses may be applied toward the 45 units required for the M.S. degree.

Any student admitted to graduate standing on the basis of a Bachelor's degree in a field other than engineering must complete 45 units of work as outlined above, but must also have successfully completed or must complete the equivalent of 45 units of mathematics and science. In addition, the student must be sure that he or she has complied with the prerequisites for the courses listed on the program for the M.S. degree.

**ENGINEER**

The Engineer degree is designed for students desiring the maximum academic preparation for a career of professional practice in the activities and areas described previously.

The Engineer degree requires two years of academic work beyond the Bachelor's degree. Normally a program of study for the Engineer degree will include the courses required for the M.S. plus approximately 30
units of additional courses of a more advanced level and a thesis. Up to 15 units may be allowed for the thesis. The purpose of the thesis is to prove the professional competence of the candidate and not necessarily to make an original contribution to knowledge.

**Doctor of Philosophy**

The Doctor of Philosophy degree is for students desiring careers in teaching or research as opposed to professional practice.

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 usually 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 fellowships and assistantships with stipends of $750 to $4,650 a year are awarded each year. Application forms and detailed information may be obtained by writing the Department of Industrial Engineering. Applications should be made by March 1 preceding the start of the academic year for which the award is to be made.

The University's Information Bulletin should be consulted for a description of the procedure for making application.

**Undergraduate Courses**

10. **The Practice of Industrial Engineering** – A project course in which the students will work in groups of 3 or 4. Each group will select a problem from a list of problems defined in advance by the I.E. faculty. Each group will have a senior I.E. undergraduate, an I.E. graduate student, or an I.E. professor acting as a guide, a coordinator, a consultant, and a reviewer. This resource person will not be a project leader; that role must be assumed by one or more of the students. Each group will be supervised by a professor, but the resource person will be the primary contact for the group. The purpose of the course is to provide (1) project experience in practical systems analysis and design work and (2) some insight into the methodology of group problem solving.

3 units, Spring (Staff) F 1:15 and 2 hrs.

by arrangement

50. **Human Values in a Technological Society** — The ways in which technology is changing our physical lives is obvious: we have better health and longer more comfortable lives, greater mobility, more opportunities and more information about these opportunities, etc. But less obvious and at least as important is the effect of technology on our beliefs and our value system, particularly as it affects ourselves and others. The class will explore some of these effects in an attempt to understand them a bit better and in the conviction that the thrust of technology can be shaped and redirected by society.

3 units, Aut (Thompson) M 2:15–4:05

100. **Organizations: Theory and Management**—A survey of classical and modern organization theory; concepts and functions of management; and the behavior of the individual, the work group, and the organization.

4 units, Aut (Jucker) TTh 8–9:50

Win (Jucker) TTh 8–9:50

108. **Work Systems Design and Measurement**—Concepts and techniques of designing and improving work performance and productivity of men and man-machine systems. Work flow sequences, human physiological information processing capabilities and resultant principles of job design. Measurement and evaluation of work with respect to time and wages. Prerequisite: 120 (or concurrent registration), or a course in statistical methods.

3 units, Spr (Thompson) MWF 11

120. **Quality Assurance** — This course will examine the various aspects of modern quality assurance, for products, services, and public goods (e.g., air and water). The setting of standards, the determination of performance, and the methods for achieving standards will be discussed. Major emphasis
will be on quality assurance for industrial processes and products. Quality Control charts and Acceptance Sampling Plans will be covered. Opportunities for visits to local industries will be provided. Prerequisite: Statistics 40 or 116.

3 units, Win (Daetz) MWF 11

133. Industrial Accounting — Principles of financial and cost accounting, design of accounting systems, techniques of analysis and cost control, impact of taxes. Interpretation and use of accounting information for decision making is stressed through case discussions. (Students who have taken or are taking another University course in elementary accounting should not enroll.)

4 units, Aut (Riggs) MWF 1:15 and one hour by arrangement
Win (Riggs) MWF 11 and one hour by arrangement
Sum (——) MTWThF 8

140. Introduction to Computers and Programming—An introduction to computers and their application in engineering and business. FORTRAN taught through programming problem approach. Extensive use of the Stanford Center for Information Processing (SCIP) will be made. The student will learn the concepts of text-editing (WYLBUR) and time-sharing (ORVYL) through the use of terminal interaction with the computer. Daily quizzes and exercises. Intended for non-I.E. undergraduates and I.E. graduates with no prior computer programming experience. I.E. 242 or 243 may follow this course.

4 units, Aut (Ludwig) MWF 2:15

141. Computer Applications and Techniques—Exposure to various industrial engineering problems through the use of computerized exercises and examples. FORTRAN is utilized in conjunction with the text-editing and time-sharing capabilities of the Stanford Center for Information Processing (SCIP). References made to other computer languages to determine programming efficiency and effectiveness. Prerequisite: CS 106 or equivalent. (Must have programmed in a Macro Language such as FORTRAN or ALGOL.) Not for students who have taken I.E. 140 for credit.

3 units, Win (Ludwig) MWF 2:15

144. Information Systems & Simulation—Exposure to the fundamental concepts and applications of management information systems and simulation. Topics include: indexing, data structures, lists, arrays, pointers, clocks, random number generation, report generation. A project oriented course. Prerequisite: I.E. 141.

3 units, Spr (Ludwig) TTh 9:30–10:45

149. Computation Laboratory—Application of digital computers to problems relating to industrial engineering. Student will choose a problem, program and test the solution, prepare the input data and analyze the output. Prerequisite: consent of instructor.

1 or more units, Spr (Daetz) by arrangement

152. Introduction to Operations Research I—(Enroll in Operations Research 152.)


160. Analysis of Production Systems—Introduction to the design, scheduling, and control of production systems using mathematical, computational, and other modern analytical techniques. Areas investigated will include capabilities and costs of production systems, determination of plant location, production-inventory systems, scheduling of job shop, line balancing for continuous production processes, and aggregate planning of work force, production, and inventory under fluctuating demand. Graduate students enroll in 260. Prerequisites: 141, 153, Engineering 161, and Statistics 110 or 116.

3 units, Aut (Carlson) MWF 8
Win (Carlson) MWF 9

164. Production Engineering Problems—Each student will participate in a major term project. Special attention will be given to problem identification and definition. Students may work individually or in groups of from two to four. Students will be expected to apply analytic methodology obtained from previous course work, but the emphasis will be on the creativity exhibited in the synthesis of feasible solutions to real problems. Not open to graduate students. Prerequisite: 160.

3 units, Win (Carlson, Staff) MWF 1:15

191. Directed Study — Directed study on subject of mutual interest to student and
staff member. Student must find a sponsor and submit a one-page description of plan.

1 or more units (Staff) by arrangement

199. Senior Seminar—Class discussions of current problems and methodologies. Emphasis given to reading current literature. Students will be encouraged to critically evaluate recent work. Concentration on broad problems requiring initiative, ingenuity, and the judicious selection and integration of analytical techniques from all previous course work. Prerequisite: 164.

3 units, Spr (Jucker) MWF 10

Courses Primarily for Graduate Students

208. Man-Machine Systems — Design and analysis of human and man-machine information processing systems with emphasis on man-machine interface. Physiological considerations, such as effort and skill, and intellectual considerations, such as subjective decision-making. Special topics include interactive information systems, including computer graphics; keyboard design; and public information display (for passengers, patients, etc.).

3 units, Aut (Thompson) MWF 10

210. Systems Analysis and Synthesis I—A first year course in mathematical methods of systems analysis. The emphasis in the lectures is on deterministic optimization tools, including linear programming, integer programming, network flow models, discrete and continuous dynamic programming, branch and bound methods. The theory is developed in an effort to provide the student with the ability to make rational choices from the set of candidate models available for a particular application. The exploitation of special structure in formulating and solving problems is emphasized. Assigned readings will include papers discussing specific applications of the models discussed in class. Prerequisites: calculus; linear algebra suggested.

3 units, Aut (Brastow) MWF 9

211. Systems Analysis and Synthesis II—Continuation of 210. Topics include deterministic and stochastic models. Lectures cover non-linear programming, Kuhn-Tucker conditions and special structure, geometric programming, optimal control, non-linear transportation models, decomposition of large mathematical programs, probabilistic programming, probabilistic dynamic programming, markovian decision theory, the application of z-transforms. Emphasis is on the understanding necessary to make rational choices among candidate models for specific applications. Readings include papers discussing specific applications. Prerequisites: 210, Statistics 116, or equivalents.

3 units, Win (Brastow) MWF 10

212. Systems Analysis and Synthesis III—Continuation of 211. Lecture topics include surveys of semi-markov decision processes, queuing theory, simulation models and experimental design, Bayes estimation, and data analysis. Since the techniques discussed in 210, 211, and 212 can only be applied once a problem has been clearly defined, students in 212 are required to work in small groups on a project, of their choosing, involving the synthesis of a tractable problem definition from an otherwise nebulous real-world problem. Prerequisites: 211, Statistics 219, or equivalents.

3 units, Spr (Brastow) MWF 10

215. Urban Public Transportation Systems—Current and emerging urban public transportation systems will be surveyed from technical, social and economic viewpoints. The needs of travelers and community groups will be examined. Emphasis will be given to innovations in services, equipment, facilities, institutions and financing. Planning and evaluation techniques will be outlined.

3 units, Aut (Henderson) F 3:15-5:05

216. Airline Management—This course will be limited to 25 students who have a strong interest in airline management. It is designed to be an action-oriented curriculum studying functional airline management in three basic fields: Finance, Operations, and Marketing. Airline management problems and techniques will be studied both academically and in the field.

4 units, Spr (Banfe) MF 3:15-5:05

217. Transportation Modeling — Methods and techniques useful in modeling components of transportation systems will be studied and discussed. Current literature will be emphasized, and experienced modeling practitioners will make presentations relating real-world problems to the literature. Topics discussed will include demand mod-
eling, traffic assignment, constrained optimal routing, and network investment.

3 units, Spr (Carlson) W 4:15–6:05

220. Advanced Quality Assurance—Current practices in program planning and control of quality and reliability in both industry and government. Design, production, testing and economic considerations. Plant visits to local industry. Prerequisite: 120.

3 units, Spr (Ireson) TTh 11; lab. Th 1:15–4:05, alternate years, given 1974–75

229. Engineering Economy—The logic of engineering economy and capital budgeting decisions is developed. Measures of worth commonly used in the literature are defined rigorously and compared. Income taxes are introduced. Satisfies prerequisite for 230, 231, and 232. Prerequisite: graduate standing.

3 units, Aut (Oakford) TTh 2:45–4:00

230. Capital Budgeting — Development of the logic of the capital budgeting decision is continued from 229. Topics treated include borrowing, retirement and replacement, sensitivity analysis, the probabilistic treatment of uncertainty, and the role of capital budgeting in financial management. Prerequisite: 229 or Engineering 161.

3 units, Win, Spr (Oakford) TTh 2:45–4:00

231. Problems in Engineering Economy—Independent study of selected problem in engineering economy. Prerequisites: 229 or Engineering 161 and consent of instructor.

1 or more units (Staff) by arrangement

232. Engineering Economy Cases—A series of case studies dealing with special problems in engineering economy. Emphasis will be on application of fundamental principles of engineering economy to regulated publicly and privately owned utilities, transportation, benefit/cost studies, income tax, leases vs. ownerships, and replacement. Prerequisite: 229 or Engineering 161.

3 units, Win (——) TTh 10

233. Industrial Financial Controls—Following on the basic courses in accounting, cost accounting, and engineering economy, this course develops further sophistication in financial decision making within an industrial environment. The importance of management judgment and effective written and oral expression is stressed. Seminar format is used, with emphasis on case analysis and discussion. Prerequisites: 133 and Engineering 161 or consent of the instructor.

3 units, Spr (Riggs) TTh 8:00–9:15

234. Research and Development Management—The function of research and development in the business enterprise. The practical problems of project selection, integration of R&D with marketing, production, and financial management; selection and retention of scientists and engineers; establishment of research priorities, financial controls of R&D operations, R&D evaluation. An examination of the current state of the art in technological forecasting. Prerequisite: graduate standing or consent of instructor.

3 units, Win (Blake) MW 4:15–5:30

235A,B. Engineering Systems Design — Same as Engineering 235A,B with emphasis on the role of technical project organization and management.

235A. 3 units, Win (Staff) T 1:15–3:05, Th 1:15; two hours by arrangement

235B. 3 to 5 units, Spr (Staff) TTh 1:15–2:05; two hours by arrangement

240. Introduction to Computers and Programming—For graduate students. Lectures same as 140. Prerequisites: same as 140.

4 units, Aut (Ludwig) MWF 2:15

242. Utilization of Computers—An in-depth study of various computer topics. Programming language considerations, discussion of job control language, data structures, text-editing, and time-sharing. Overview of differences between programming language structure. Guest lecturers presenting developed and implemented systems operating at Stanford and in industry. Prerequisite: I.E. 140/240 or equivalent.

3 units, Aut (Brastow) MWF 11

243. Computing Techniques for Information Systems—The basic building blocks of information systems are presented along with the concepts of logical records, physical records, data structures, indexes, hierarchial decision trees, etc. Examples of Management and Medical Information Systems are presented. Extensive research into recognizers, gener-
ators, filing systems. A substantial term project is required. Prerequisite: I.E. 240 or consent of instructor.

3 units, Win (Ludwig) TTh 9:30–10:45

244. Computer Modeling and Simulation—Topics covered include simulation and business gaming, with an in-depth presentation of modeling techniques. Random number generators, report generators, simulation clocks, as well as list philosophies are covered. Simulation languages such as GPSS, SIMSCRIPT, and DYNAMO are presented usually by guest speakers. A substantial term project and presentation is expected of every student. Prerequisite: I.E. 243 or consent of instructor.

3 units, Spr (Braaschow) TTh 4:00–5:30


249. Computation Laboratory—For Graduate Students. See I.E. 149.

1 or more units, Spr (Daetz) by arrangement


260. Analysis of Production Systems—For graduate students. Lectures same as 160. Prerequisites: same as 160.

3 units, Aut (Carlson) MWF 8

Win (Carlson) MWF 9

263. The Engineering and Organization of Small Businesses—A laboratory for the development of a technical idea, embodied in a specific product, into an economic enterprise. Includes product selection, market analysis, pricing, engineering design, production design, economic analysis, establishment of marketing plan, financing and financial planning, design of management organization. Students, including qualified undergraduates, from all appropriate disciplines are encouraged to enroll. Special emphasis on planning small industries in developing nations. Prerequisite: consent of instructor.

3 units, Spr (——) TTh 11; lab.

T 2:15–5:05

264. Advanced Analysis of Production Systems—Advanced topics in production planning and control, inventory accumulation, assembly line balancing, facility location, and industrial growth. Not open to undergraduates. Prerequisite: 260 or equivalent.

3 units, Spr (Jucker) MWF 9

280. Health Systems Analysis—A projects course emphasizing the systematic development and application of Systems Analysis techniques to the design and improvement of various areas of health care delivery. Specific problems will be studied in hospitals and health maintenance organizations by student teams acting as consultants to the appropriate hospital supervisors and professional staff. Studies will include hospital information systems, patient room assignments, admission procedures, central supply distribution, and service delivery.

3 units, Win (Thompson) TTh 11–12:15

281. Individual Study in Biotechnology—Directed reading and research in man-machine systems. Prerequisite: consent of instructor.

1 or more units, any quarter (Thompson) 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

293A. Development Planning I—Introduction to model construction for development situations. Presentation will be mainly from a systems analysis point of view, although review of some popular models in the economics literature will be included. Discussion of means and ends of development. Prerequisites: graduate standing, at least one prior course in economics or engineering economy, good working repertoire of mathematical skills, and elementary understanding of mathematical modeling.

3 units, Win (Daetz) TTh 1:15–2:30

293B. Development Planning II—Continuation of 293A for the purpose of preparing...
and utilizing mathematical models of development problems of interest to the students. Emphasis will be on inclusion of feedback effects. Students will have an opportunity to present their models for class discussion. Prerequisite: 293A or consent of instructor.

3 units, Spr (Daetz) TTh 1:15-2:30


Aut, Win, Spr (Staff) by arrangement


Aut, Win, Spr (Staff) by arrangement

341. Interactive Computer Graphics—An introduction to current hardware and software techniques applicable to interactive computing using CRT graphics for input/output. The course is designed to stimulate the use of this tool for problem solving in various disciplines. Examples of the use of computer graphics in a number of fields will be shown and discussed. Lecture material will cover software appropriate to the design of interactive programs, and the mathematics of linear transformations, as well as the more common algorithms peculiar to graphic displays. Each student will design and implement an interactive graphics program for the solution of a problem of his own choosing using the AGT-30 three-dimensional graphics system. Prerequisite: FORTRAN (or comparable) programming experience.

3 units, Win (Brastow) TTh 9, and one hour by arrangement

351. Dynamic Programming and Stochastic Control — (Enroll in Operations Research 351.)

355. Reliability Theory — (Enroll in Operations Research 355.)

358. Queuing Theory — (Enroll in Operations Research 358.)

360. Models for Production Planning—Intended for students interested in doing research in the area of modeling and constructing algorithms for solving models of components of production systems. Topics will include scheduling, capacity expansion, inventory systems, and areas of interest from current literature. Prerequisite: 264 or consent of instructor.

3 units, Aut (Carlson) MWF 11, alternate years, given 1975-76

MATERIALS SCIENCE AND ENGINEERING

Emeriti: Welton J. Crook, O. Cutler Shepard (Professors)

Chairman: John C. Shyne


Lecturers: Claus G. Goetzl, Egon Loebner, Rosemarie Koch, Glen B. Haydon

Members of the faculties of other divisions of the University giving courses or cooperating in the offerings of the Department of Materials Science and Engineering are Robert W. Bartlett, Norman A. Parlee, George A. Parks, and Paul Kruger.

OFFERINGS AND FACILITIES

Materials Science and Engineering is concerned with the relation between the structure and properties of materials, factors which control the internal structure of solids, and processes for altering the structure and properties of solids. It brings together in a unified discipline the developments in physical metallurgy, ceramics, and the physics and chemistry of solids. The undergraduate program of the Department, described under School of Engineering, provides training for the physical metallurgist or materials engineer and also preparatory training for graduate work in materials science. 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.

FACILITIES FOR INSTRUCTION AND RESEARCH

The Materials Science and Engineering Department occupies an area of 30,000
square feet in the Thomas F. Peterson Engineering Laboratory building. The laboratory includes modern facilities for teaching and research in physical metallurgy and materials science. Ordinary melting and heat treating furnaces are included as well as furnaces for vacuum melting, zone refining, and crystal growing. Mechanical testing equipment includes hardness measuring devices, variable strain rate machines for mechanical deformation studies, creep machines and equipment for dynamic elastic modulus and internal friction measurements. For studying the structure of solids, there are optical and electron microscopes as well as X-ray and electron diffraction machines, X-ray fluorescent equipment, gamma ray spectrometer, electron probe microanalyzer, nuclear magnetic resonance spectrometer, and equipment for standard electrical, magnetic, and optical measurements.

The Department, together with Physics, Chemistry, and Solid State Electronics, participates in an interdisciplinary Center for Materials Research. The Center provides equipment, service facilities, and funds for faculty and student research. In addition the Center provides 35,000 square feet of space for materials research in the McCullough Building.

Programs of Study

Bachelor of Science

The undergraduate Materials Science and Engineering program provides training in solid state fundamentals and in physical metallurgy. Students desiring to specialize in this field 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. Electives are available so that students with broad interests can combine Materials Science and Engineering with work in another science or engineering department.

Advanced Degrees

Graduate students can specialize in any of the areas of Materials Science and Engineering. In collaboration with other departments of the University, additional special programs are available. For example:

Materials Science and Engineering—
Electronic Materials
Materials Science and Engineering—
Applied Mechanics and Structures
Extractive and Process Metallurgy (in cooperation with the Applied Earth Sciences Department).

Master of Science

The University’s basic requirements for the Master of Science degree are discussed in the section “Degrees” in this bulletin. The following are general Departmental requirements:

1. Completion of the equivalent of the requirements for the B.S. degree in Materials Science and Engineering. Deficiencies in previous training should be made up.

2. Completion of 45 units of an approved program. A minimum grade point average of 2.75 for course work is expected.

The Department offers two different programs of study which lead to the Master of Science degree, a general program in Materials Science and a specialized program in Mechanics of Materials. The requirements for the programs are listed below:

1. Materials Science

This program should be taken by those who wish to pursue a Ph.D. degree in Materials Science and Engineering.

a) All courses in the 180 series (17 units) except for students who have had equivalent courses at other universities.

b) Completion of 6 units of Materials Science and Engineering 202A, B, and C, Materials Science Laboratory, except for students who have had equivalent previous experience at other universities.

c) A minimum of 12 units of advanced course work (beyond the 180 and 202 series) in the Department (excluding attendance-only seminars and research and special problems).

d) The entire 45-unit Master’s program should represent an integrated technical program. Approval of the program by the student’s adviser is reviewed by the Advanced Degree Committee prior to admission to candidacy.
e) A minimum of 6 units and not more than 12 units of Materials Science and Engineering 200 (Special Problems) with a Master's Research Report approved by two faculty members. This requirement is optional at the discretion of candidate's adviser. Zero units of Materials Science and Engineering 200 are allowed if no Master's Report required.

2. Materials Engineering

These programs are designed for those students who wish to obtain a working knowledge of Materials Science and Engineering applied to materials technology. These programs are normally viewed as terminal M.S. programs although transfer into the Ph.D. program may be possible in some cases. Course requirements are listed below.

Mechanics of Materials

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS&amp;E 151</td>
<td>Materials Technology for Structural Applications</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 179</td>
<td>Intermediate Materials Science</td>
<td>4</td>
</tr>
<tr>
<td>MS&amp;E 185</td>
<td>Mechanical Behavior of Solids</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 202A,B,C</td>
<td>Experimental Methods in Materials Science</td>
<td>6</td>
</tr>
<tr>
<td>MS&amp;E 238</td>
<td>Fracture of Solids</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 244</td>
<td>Failure Analysis</td>
<td>3</td>
</tr>
<tr>
<td>A.M. 202A,B</td>
<td>Theory of Elasticity</td>
<td>6</td>
</tr>
<tr>
<td>A.M. 250</td>
<td>Math. Methods (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>A.M. 251</td>
<td>Math. Methods (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>45</strong></td>
<td></td>
</tr>
</tbody>
</table>

Electrical, Optical, and Magnetic Properties of Materials

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS&amp;E 179</td>
<td>Intermediate Materials Science</td>
<td>4</td>
</tr>
<tr>
<td>MS&amp;E 188</td>
<td>Electrical, Optical, and Magnetic Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 202A,B,C</td>
<td>Experimental Methods in Materials Science</td>
<td>6</td>
</tr>
<tr>
<td>MS&amp;E 209</td>
<td>Mathematical Methods in Materials Science</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 222</td>
<td>Statistical Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 322A,B</td>
<td>Quantum Mechanics</td>
<td>6</td>
</tr>
<tr>
<td>MS&amp;E 233</td>
<td>Quantum Theory of Energy States in Solids</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 234</td>
<td>Electronic Transport in Solids</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 332</td>
<td>Optical Properties of Solids</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>45</strong></td>
<td></td>
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</tbody>
</table>

Materials Processing—Extractive Metallurgy

This program is designed for students who wish to obtain a basic knowledge of Materials Science and Applied Earth Sciences, with particular focus on the Materials Processing—Extractive Metallurgy industry. The program has a concise central core of required courses combined with a liberal number of electives, so that the student may choose any of a number of possible facets of this broad field including research units. Students may elect to obtain their degree in either the Department of Materials Science and Engineering or the Department of Applied Earth Sciences.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS&amp;E 181</td>
<td>Thermodynamics and Phase Equilibria</td>
<td>4</td>
</tr>
<tr>
<td>MS&amp;E 182</td>
<td>Rate Processes in Materials</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 185</td>
<td>Mechanical Behavior of Solids</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 105 (AES 105)</td>
<td>Extractive Process Metallurgy</td>
<td>2</td>
</tr>
<tr>
<td>MS&amp;E 214 (AES 214)</td>
<td>Metallurgical Reaction Engineering</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 203A (AES 203A)</td>
<td>Mineral Processing</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 207 (AES 207)</td>
<td>Metal Refining and the Nature of Liquid Metals</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>45</strong></td>
<td></td>
</tr>
</tbody>
</table>

ENGINEER

The University's basic requirements for the degree of Engineer are outlined 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 Materials Science and Engineering.

2. Completion of an acceptable thesis and 15 units of approved advanced course work beyond the requirements of the Master of Science degree.

3. A program of study should be submitted to the Department for approval prior to the end of the third quarter at Stanford.

DOCTOR OF PHILOSOPHY

The University's basic requirements for the Ph.D. degree are outlined in the section "Degrees" in this bulletin.

The following are Departmental requirements:

1. Complete the substantial equivalent of the requirements for the Master of Science degree in Materials Science and Engineering.
2. Pass a Departmental oral qualifying examination.

3. Knowledge of at least one foreign language must be demonstrated before a student is admitted to candidacy for the Ph.D. degree.

4. Graduate students working toward the Ph.D. degree must submit a program of study to the Department prior to the end of the student's third quarter at Stanford. The program should contain at least 72 course units beyond the B.S. degree and should include the following:
   a) All courses in the 180 series or their equivalent. These must be taken on a letter grade basis.
   b) A minimum of 36 units of advanced course work which, when taken as a group, comprise a coherent and well-designed program leading to proficiency in a certain area of Materials Science and Engineering. These courses are to be taken for a letter grade and must include a minimum of 21 units of graduate courses within the Materials Science and Engineering Department. A minimum of 15 of the 36 units should be advanced specialty courses. Courses which are graduate courses within the department but not considered specialty courses include 204, 206, 209, 222, 233, 240, 246.
   c) A minimum of 18 units of course work taken outside the department (excluding courses in the Department of Physical Education and including no more than 4 units of English in the case of foreign students).

5. Maintain a grade point average of 3.0 for all course work taken as a graduate student at Stanford.

6. A candidate must present the results of his or her dissertation at a Departmental Seminar prior to his University Oral Examination.

**Courses**

50. Introductory Science of Materials — (Enroll in Engineering 50.)

105. Extractive Process Metallurgy — (Enroll in Applied Earth Sciences 105.)

120. Industrial Report — Report covering at least two consecutive months of industrial experience related to Materials Science.

1 unit, any quarter (Staff) by arrangement

140. Independent Study — Independent study in Materials Science under supervision of a faculty member. Prerequisites: junior or senior standing in science or engineering with high scholarship and approval of Materials Science Faculty.

2 to 3 units, any quarter (Shyne) and by arrangement

151. Materials Technology for Structural Applications — Metals, alloys, ceramics, glass, materials used primarily for their mechanical properties. Description of materials processing techniques, e.g., heat treatment, used to develop optimum properties. This course provides information necessary for materials selection and processing for engineering applications. Prerequisite: Engineering 50.

3 units, Spr (Shyne) dhur

179. Intermediate Materials Science — An intermediate level course on the structure, thermodynamics and kinetics of solids. Topics include atom arrangements, defects in crystalline and amorphous solids, application of thermodynamics and kinetics to the control of microstructure. Prerequisite: Engineering 50.

4 units, Aut (Staff) dhur

180. Atomic Arrangements in Solids — Description and determination of atomic arrangements in perfect and imperfect crystals and in amorphous materials. Among topics to be treated are formal crystallography, crystalline defects, and diffraction phenomena.

4 units, Aut (Tiller, Shyne) MTWTh 

181. Thermodynamics and Phase Equilibria — Application of thermodynamics to the control of the properties of materials. Heterogeneous equilibria with emphasis on solids. Prerequisite: elementary thermodynamics. Recommended: elementary computer programming.

4 units, Aut (Stevenson) TTh 2:15-4:05

182. Rate Processes in Materials — Diffusion in solids, structural transitions including recrystallization and liquid-solid and solid-solid phase transformations, property control by microstructural control. Prerequisites: 180 and 181.

3 units, Win (Pound) MWF 10

3 units, Win (Nix) MWF 9

188. Electrical, Optical, and Magnetic Properties of Materials—A course with phenomenological orientation covering electrical, optical, thermal, dielectric, ferroelectric, diamagnetic, and ferromagnetic, and superconducting properties in pure and imperfect crystal and polycrystalline solids. Prerequisite: Engineering 50.

3 units, Win (Bube) TTh 9

190. Polymer Science — Relationships of structure and composition of polymers to their physical properties. Polymerization, copolymerization, degradation, diffusional transport properties, glass transition behavior, and polymer crystallinity are discussed. Illustrative polymer problems and their solutions are presented. Prerequisite: Engineering 50 or equivalent.

3 units, Aut (Staff) TTh 11

191. Engineering Properties of Polymers—The course studies the mechanical, electrical, and thermal behavior of polymer materials as related to their structural variables. Amorphous and crystalline polymers in stress-strain, creep, stress-relaxation, and dynamic tests is discussed. The electrical behavior plus the thermal properties and the degradation behavior of polymeric materials will be treated. The emphasis is on describing and solving relevant problems in polymeric materials. Prerequisite: Engineering 50 or equivalent.

3 units, Win (Staff) TTh 11

192. Biomaterials—A study of the properties and functions of materials in the body environment. Structure and function of membrane processes, and ion transport will be treated. Blood surface interactions, medical prosthesis of plastics, and applications of polymers to the artificial kidney and heart will be treated. Prerequisites: 190 and 191.

3 units, Spr (Tiller) TTh 11

200. Special Problems.

Any quarter (Staff) by arrangement

201. Principles and Methods of Crystal Growth—Broad look at the important phenomena involved in the growth and perfection of crystalline solids from melt, solution, vapor, electrodeposition, etc. Discussion of the merits of the various preparation methods.

3 units, Win (Tiller) TTh 2:15–3:30; optional 2 units lab. to be arranged

202A, B, C. Experimental Methods in Materials Science — Laboratory course involving experimental techniques in different areas of materials science. Typical experiments are listed below. 202A: crystal growth, structural determinations via optical microscopy, x-ray diffraction and electron diffraction. 202B: experiments on the thermodynamics and kinetics of materials including phase diagram determination, diffusion, oxidation, phase transformations. 202C: Experiments on the mechanical, electrical, optical and magnetic properties of solids. Prerequisites: previous or concurrent registration in the Materials Science and Engineering 180 series or their equivalent.

2 units, Aut (Tiller), Win (Shyne), Spr (Bube, Nix)

203A. Mineral Processing—(Enroll in Applied Earth Sciences 203A.)

205. Strength and Microstructure — Mechanical properties of solids as viewed by the materials scientist or physical metallurgist. Basic aspects of dislocation theory and the role of dislocations and other defects on mechanical behavior of solids. The elastic, anelastic, and plastic properties of solids, stressing the relation between the internal structure of solids and the corresponding mechanical properties. Methods of hardening materials and mechanisms of hardening. Specific mechanical properties such as fracture, fatigue, and creep. Application of the concepts developed will be made to materials useful in technology. The course is directed toward non-materials science majors. Prerequisite: graduate standing in Engineering or Science.

3 units, Aut (Sherby) TTh 11:00–12:15

206. Imperfections in Crystalline Solids — Relation of lattice defects to the physical properties of crystals. Introduction to point imperfections and their relation to transport properties in metallic, covalent, and ionic crystals. Introduction to the geometric and energetic aspects of dislocation theory. Re-
lation between dislocation mechanics and the mechanical properties of crystals. Structure and properties of interfaces. Prerequisite: Engineering 50.

3 units, Spr (Nix) MWF 8

207. Metal Refining and the Nature of Liquid Metals — (Enroll in Applied Earth Sciences 207.)

208. Radioactivation Analysis — (Enroll in Engineering 177.)

209. Mathematical Methods in Materials Science—A study of the formulation and solution of boundary value problems in transport phenomena diffraction, and elasticity, utilizing transform, matrix, variation, complex variables, and Green's function techniques. Emphasis on the physical and mathematical similarities in the continuum field theories which form the basis of a description of the behavior of materials. Prerequisite: Mathematics 131.

3 units, Spr (Barnett) MWF 9, given 1974-75

212. Seminar on High Temperature Materials — Applications, product specifications, properties, and fabrication methods for refractory metals, dispersion alloys, reactive metals, graphite, ceramics, cermets, and intermetallic compounds.

3 units, Sum (Goetzel) TTh 10:30-12:00

214. Metallurgical Reaction Engineering—(Enroll in Applied Earth Sciences 214.)

220. Phase Transformations in Solids — Thermodynamic, kinetic, and crystallographic aspects of phase transformations in metals and alloys, with particular attention to martensitic transformations. Prerequisite: 182.

3 units, Spr (Shyne) TTh 11, alternate years, given 1975-76

222. Statistical Thermodynamics — Systematic development of the methods of statistical mechanics with application to problems in Materials Science. Prerequisite: 181.

3 units, Spr (Pound) MWF 10

223. Advanced Seminar on Statistical Thermodynamics—A discussion of the Grand Canonical Ensemble approach to the statistical mechanics of statistical fluctuations and to the statistical mechanics of irreversible processes. Applications to the description of material systems and processes. Prerequisite: 222.

3 units, Aut (Pound) MWF 9, given 1974-75

224. Physical Properties of Disordered Materials—Examination, at a microscopic level, of our understanding of the structural, thermal, electrical, and mechanical properties of alloys and amorphous materials. Emphasis of the course will change from year to year. Prerequisites: 180, 181, and 188 or equivalents.

3 units, Win (Bates) TTh 10:00-11:30

225. Surfaces and Interfaces — (Enroll in Applied Earth Sciences 225.)

226. Electrochemistry and Corrosion—Development of electrochemical principles with application to corrosion, electrolytic processes, and galvanic cells. Prerequisites: elementary thermodynamics.

3 units, Win (Stevenson) TTh 8:30-9:50 alternate years, given 1974-75

229. Principles of Steelmaking—(Enroll in Applied Earth Sciences 229.)

230. Materials Science Colloquium.

1 unit, Aut (Staff) M 4:15

Win (Staff) M 4:15

Spr (Staff) M 4:15

Sum (Staff) M 4:15

232. Point Defects in Crystals—Structure of point defects. Defect equilibria; influence of temperature, chemical and electrical potentials, interface association. Solid-state electrochemical transducer effects; structural control, sensors, batteries, other applications.

3 units, Aut (Huggins) MWF 9

233. Quantum Theory of Energy States in Solids—Applications of wave mechanics and approximate methods of atomic systems, free electron model of metals, and energy bands in one and three dimensional crystals. Prerequisite: 204 or Electrical Engineering 322A.

3 units, Spr (Bates) MWF 1:15

SCHOOL OF ENGINEERING

Prerequisite: 233 or Electrical Engineering 322B.

3 units, Aut (Bube) MWF 1:15, alternate years, given 1975–76

235. Photoelectronic Properties of Solids—Seminar on selected topics in photoelectronic properties of solids, including photoconductivity, luminescence, photovoltaic effects, and methods of photoelectronic analysis of ordered and disordered materials. Prerequisite: 233 or Electrical Engineering 322B.

3 units, Spr (Bube) TTh 1:15, alternate years, given 1974–75

236. Advanced X-ray Diffraction — X-ray diffraction from perfect crystals, use of Fourier analysis in diffraction, particle size line broadening, strain measurements, effect of stacking faults, diffuse scattering, low angle scattering, diffraction from noncrystalline materials. Prerequisite: 180.

3 units, Win (Barrett) TTh 9

237. Dislocations in Crystals — Continuum elastic theory of dislocations including the interaction between dislocations and other sources of internal and external stress (dislocations, surfaces, interfaces, point defects, applied stresses), forces on dislocations, anisotropic effects. Continuous distribution of dislocations representing elastic cracks and slip lines. Eshelby's transformation strain problem. Prerequisite: 180.

3 units, Aut (Barnett) MWF 10


3 units, Aut (Nix) MWF 11


3 units, Aut (Pound) MWF 1:15


3 units, Spr (Barrett) lec. TTh 10; lab. by arrangement, given 1975–76

244. Failure Analysis — A study of techniques and methods used in the analysis of failures in the field of materials sciences. Topics covered include optical and electron fractography, electron microprobe, X-ray techniques, non-destructive testing methods and selected case studies from the areas of mechanical properties and solid state electronics.

3 units, Spr (Barrett) lec. TTh 10; lab. by arrangement, alternate years, given 1974–75

245. Advanced Mechanical Properties of Solids—A study of dislocation dynamics and the mechanics of yielding in crystalline solids; delayed yielding and dislocation multiplication yield point phenomena; theoretical treatments of dislocation mobilities in imperfect crystals; strain hardening in single and polycrystals; effects of recovery on plastic flow; special subjects such as the mechanical properties of composite materials and shock phenomena in crystalline solids. Prerequisite: 237.

3 units, Win (Nix) MWF 8, alternate years, given 1974–75

246. Crystalline Anisotropy — Seminar on the application of tensor notation to the description and analysis of the properties of crystalline materials.

2 units, Win (Barnett) TTh 9, alternate years, given 1974–75

248. Photoelectronic Materials and Devices Laboratory—(Enroll in Electrical Engineering 392B.)

249. Time-Dependent Plasticity — Theories and mechanisms of creep. Temperature and strain rate effects on plastic flow of solids. Relation of high temperature strength and ductility of materials to structure. Prerequisite: 185 or 205 or Engineering 50.

3 units, Spr (Sherby) TTh 1:15–2:45

258. Optical Properties of Solids — (Enroll in Electrical Engineering 332.)

259. Basic Quantum Mechanics—(Enroll in Electrical Engineering 322A.)
260A. Basic Quantum Mechanics—(Enroll in Electrical Engineering 322B.)

264. The Equilibrium Structure of Surfaces—Quantitative treatment of diffuse interfaces, gamma plots, thermal faceting, electrical double layers, adsorption, equilibrium forms, interface attachment kinetics. Pre-requisite: 181 or equivalent.

3 units, Aut (Tiller) TTh 2:15, alternate years, given 1975–76


3 units, Win (Pound) TTh 1:15–2:45, given 1974–75

266. The Science of Crystallization I—Analysis of the factors involved in predicting distribution coefficients for solutes between two phases. Analysis of solute redistribution during and after a phase transformation under both equilibrium and non-equilibrium conditions. Consideration of diffusion in only one or both phases, applied electric field, shape of new phase, time dependence of transformation velocity, dendritic interface, multi-phase interface, fluid motion, and layer edge effects. Prerequisites: 201 or 240, and Mathematics 131.

3 units, Aut (Tiller) TTh 3:15–4:30, alternate years, given 1975–76

267. The Science of Crystallization II—Quantitative determination of growth rate, shape, and perfection of crystals. Stability of planar, cylindrical, and spherical crystals; dendritic growth; spherulite formation; eutectic and eutectoid growth; volume change effects; interface attachment kinetic dominated growth forms. Prerequisite: 266.

3 units, Win (Geballe) MWF 11, given 1975–76


3 units Win (Stevenson) TTh 2:45–3:30, alternate years, given 1975–76

283. Irreversible Thermodynamics—This course deals with the statistical mechanical foundations of fluctuation theory and irreversible thermodynamics. Prerequisites: 181 and 222.

3 units, Spr (Pound) TTh 3:45–5:00

288. Superconducting and Magnetic Materials—The electrical and magnetic properties of important classes of intermetallic compounds and alloys will be studied. Emphasis will be on currently active research areas such as the A-15 high temperature superconductors, the layered transition metal dichalcogenides and the rare earth permanent magnets.

Relationships between the physical properties and crystal structure, interatomic distance and coordination, the electron configuration and crystal field splitting, and electronic band structures will be utilized.

3 units, Win (Geballe) MWF 11, given 1975–76

297. Electron Microscopy Techniques—(Enroll in Pathology 207.)

1 unit, Spr (Haydon) dhur

300. Research.

Any quarter (Staff) by arrangement

339. Seminar in Advanced Mechanical Metallurgy.

1 unit, Aut, Win, Spr (Staff) by arrangement

340. Advanced Seminar in Kinetics—Discussion of important current topics in the area of phase transformations (solid, liquid, vapor) and diffusion. Particular emphasis will be placed on the statistical mechanics and irreversible thermodynamics of the various thermally activated rate processes.

2 units, Aut, Win, Spr (Staff) by arrangement

342. Solid-State Electrochemistry Seminar—Selected topics related to point defect structure, use of solid state electrochemical cell techniques, solid electrolytes, fuel cells,
batteries, electrochemically controlled growth processes. Prerequisite: 232.
1 unit, Win, Spr (Huggins) by arrangement

352. Photoelectronic Materials Seminar.
1 unit, Aut, Win, Spr (Bube) by arrangement

1 unit, Aut, Win, Spr (Bates) by arrangement

356. Seminar on Stress Corrosion—A new approach to this important technological subject which utilizes basic understanding of surfaces on an atomistic level and treats the corrosion event (uniform or catastrophic) as a phase transformation. Electron redistribution inside metals plus surface polarization in layer changes as a function of stress and dislocation passage events, ion redistribution in the environment phase and surface film formation will all be treated. The discussions will be on a basic level, designed to provide a foundation for a quantitative predictive theory concerning corrosion events for gaseous, aqueous as well as liquid metal environments.
3 units, Win (Tiller) TTh 2:15-3:30

MECHANICAL ENGINEERING

Emeriti: Arthur Domonoske, Henry O. Fuchs, Boynton M. Green, Lydik S. Jacobsen

Chairman: William C. Reynolds
Associate Chairman: Thomas J. Connolly
Division Directors: James L. Adams (Design), Robert J. Moffat (Thermosciences)
Laboratory Directors: James L. Adams (Design), Daniel B. DeBra (Guidance and Control), Robert H. Eustis (High Temperature Gasdynamics), Robert J. Moffat (Thermosciences)


Associate Professor: Robert J. Mittelstadt (Architecture)
Consulting Professors: George P. Hill, III, Anthony Leonard
Assistant Professors: Robert L. Piziali, J. David Powell
Acting Assistant Professors: William L. Verplank, Harry T. Whitehouse

Lecturers: Dan R. Derby, David A. Horine, John R. Manning, Carl G. A. Rosen


Affiliated Faculty: Daniel Bershader (Acoustics), Matthew S. Kahn (Art), Bruce B. Lusignan (Systems Design), David A. Thompson (Biotechnology and Computer Graphics)

ORGANIZATION AND OBJECTIVES

The programs in Mechanical Engineering are designed to provide background for a wide variety of careers. The discipline of Mechanical Engineering is very broad, but is generally understood to emphasize an appropriate mix of energy science and technology, applied mechanics, and design. Graduates at all degree levels typically go into various energy industries, into the product manufacturing industries, into government laboratories and agencies dealing with these problems, and into a variety of academic situations.

Since Mechanical Engineering is a very broad discipline, many students use the Mechanical Engineering undergraduate program as a springboard for graduate study in medicine, law, political science, and other professions where a good understanding of technology is often very important. The Mechanical Engineering undergraduate and graduate programs provide excellent technical background for persons who want to work in environmental pollution control, transportation, ocean engineering, and other multidisciplinary problems that concern our society. Throughout the various programs considerable emphasis is placed on the development of systematic procedures for analysis, effective communication of one's work and ideas, practical and aesthetic aspects in design, and on the responsible use of technology. This can provide a student
with an approach and a philosophy of great utility, irrespective of an ultimate career.

The Department is organized into two divisions, Thermosciences and Design, each of which maintains its own laboratories, shops, and offices. The Thermosciences Division offers courses and specialized work in the areas of applied thermodynamics, energy systems, nuclear energy, pollution control, fluid mechanics, and heat transfer. The Design Division emphasizes the design process, and is specifically concerned with manufacturing technology, automatic controls, analytical and numerical design methods, optimization, design aesthetics, human factors, and systems design. The Design Division also offers an undergraduate program in Architecture and offers undergraduate and graduate programs in Product Design (jointly with the Art Department).

It should be noted that this Department does not offer a comprehensive program in engineering mechanics. However, students in the Department have ample opportunity to do course work in the Department of Applied Mechanics and other departments with concentrations in other areas related to the broad discipline that is mechanical engineering.

**Facilities**

Both Divisions of the Department maintain modern laboratories which are used for both undergraduate and graduate instruction and graduate research work.

The Thermosciences Division has two primary laboratories. The Thermosciences Laboratory is equipped with representative power, fluid handling, refrigeration and heat and mass transfer equipment, and extensive special facilities for advanced graduate research in convective heat transfer and fluid mechanics relevant to energy systems. The High Temperature Gasdynamics Laboratory is deeply engaged in a variety of research activities relating to the practical generation of electrical energy from flowing plasmas to gas kinetics of pollutants, and to gasdynamic lasers. Facilities in the HTGL include a large MHD power channel with normal and superconducting magnets, a shock tube, a variety of plasma diagnostic devices, and high-power laser systems. In addition, the Thermosciences Division has a small Nuclear Measurements Laboratory which includes a neutron source, a neutron accelerator, a variety of radiation detection instruments, and other instrumentation for environmental measurements pertinent to energy systems, and a Thermosciences Measurements Center, which houses information on all aspects of measurements. A wide variety of instrumentation, extensive shop facilities, utilities, and research space are all available within and shared by these laboratories.

The Design Division maintains shops and laboratory space for use in instruction, for construction of project apparatus, and for graduate research work in various disciplines of interest to the Design Division faculty. The Design Division also has a unique "Product Design Loft," in which students in the Product Design program engage in creative activity, and other stimulating facilities for undergraduate students in architecture.

The Guidance and Control Laboratory, a joint activity with the Departments of Aeronautics and Astronautics and Mechanical Engineering, specializes in the construction of electromechanical systems and instrumentation, particularly where high precision is a factor. Work in this laboratory ranges from space vehicle systems to feedback control of carburetors for automotive emission control. The faculty and staff of this laboratory work in close cooperation with both the Design and Thermosciences Divisions on device development projects of mutual interest.

Computation facilities at Stanford are excellent. Typewriter terminals in each laboratory provide for remote access to the Center for Information Processing's IBM 360/67. A Sigma V hybrid computer and an Addage computer with graphical input/output capability are operated by the School of Engineering. There are several minicomputers available within the Department's laboratories. In addition, Stanford is a member of the ARPA computational network, and as such has access to NASA's ILLIAC, a unique high-storage parallel-processor computer. Various groups within the Department now use all of these machines.

The library facilities at Stanford are also outstanding. In addition to the general library, there are special libraries for Engineering, Mathematics, and Physics, and other departmental libraries, of which engineering students make frequent use. In addition, each Division maintains a reading room and small library collection, and specific research collections in the areas of energy, high
temperature gasdynamics, internal flow, nuclear energy, and noise pollution.

Graduate students participating in research are provided with office space in the laboratory buildings, and have access to substantial staff support from their research group and from the Office of Research Coordination, which is housed in the Thermosciences Laboratory building.

The Thermosciences Division faculty are deeply involved with activities of Stanford's Institute for Energy Studies. The Institute sponsors seminars, research, and other activities throughout the University, and acts as a focal point for energy at Stanford.

PROGRAMS OF STUDY

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.

A program for Product Design is offered by the Design Division and leads to the degree of Bachelor of Science in General Engineering. It is recommended, however, that this should not be considered a terminal degree and that all students who elect this program continue on through the Master's degree in this field.

BACHELOR OF ARTS IN ARCHITECTURE

This is a preprofessional curriculum, open to all undergraduates who intend to pursue careers in architecture, landscape architecture, planning, or any related field. Required courses for the architecture major provide the basis for a broad liberal arts background for continued study in a graduate, professional degree program. These courses are scheduled so that students may enter the architecture major program as late as the beginning of the junior year. However, freshmen may begin architecture course work in the first quarter.

Central to the curriculum is the architectural design studio, which is given in the senior year. This is a 3-quarter course in which the student is equipped to synthesize solutions to case-study problems by relating design determinants ranging from the visual principles of space, light, color, and scale to the philosophical values of architecture. This work is supported by courses in history and theory of architecture, building construction, professional practice, and the development of graphic skills in design communication.

The architecture program also shares courses and work space with other design disciplines within the School of Engineering. This arrangement provides opportunities for joint activities among students and faculties, and exposure to related design work which stimulates thinking beyond the normal scope of architectural education. The Design Division provides courses in basic design, visual thinking, product design, and manufacturing processes.

Other University resources add to the breadth of the architecture curriculum: the Art Department provides courses in drawing and sculpture and additional courses in design, and the history of art and architecture; the Department of Civil Engineering provides courses in advanced engineering and urban planning; the Urban Studies Program provides courses in social, political, economic and cultural analyses of urban problems. Other resources, such as the Stanford Workshops on Political and Social Issues (SWOPSI), provide courses in topical environmental concerns.

Students are encouraged to consider a double major, combining architecture with Product Design, Civil Engineering, Art, or Urban Studies. Three additional quarters in residence are usually required to complete both majors.

Architecture students are subject to University Bachelor's degree requirements in addition to the Architecture Program requirements listed below.

1. Humanities and Fine Arts: 21 units minimum
   Art Studio: 3 courses, to include Art 40
   History of Art and Architecture: Art 1, 175A, 175B
2. Science: 10 units minimum, to include Engineering 3 or Physics 51
3. Mathematics and Computer Application: 9 units minimum
4. Engineering: Engineering 7 and 11; Mechanical Engineering 101, 102A, 115A
5. Architecture: 45 units minimum, to include Architecture 42, 110, 120, 131, 132, 135, 141, 142, 143, 144, 145, 148, 160
MASTER OF SCIENCE

Admission and Registration — The basic University 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 a student must have received a B.S. degree in engineering, physics, or some comparable science program. One's undergraduate record and personal recommendations must demonstrate capability of handling graduate level work and ability to complete the requirements for the M.S. degree. Students whose undergraduate backgrounds are entirely devoid of some of the major subject disciplines of engineering (for example, fluid mechanics, applied thermodynamics, applied mechanics, circuit theory) may find it desirable to take some undergraduate courses to fill in obvious gaps and prepare themselves to take graduate courses in these areas. Such students may require more than three quarters to fulfill the Master's degree requirements, as the make-up courses may not be used for other than the free electives (see item 5 below) in the M.S. degree program. However, it is not the policy to require fulfillment of mechanical engineering B.S. degree requirements in order to obtain an M.S. degree, and furthermore students who have already fulfilled certain categories of the M.S. degree requirements as a result of their undergraduate work may find they have sufficient time under item 3 below to obtain the M.S. degree in the normal three quarters.

Graduate Program — Mechanical Engineering is a varied profession, ranging from primarily aesthetic aspects of design to highly technical scientific research. The discipline areas of interest to mechanical engineers include rigid and elastic body mechanics, materials, fluid mechanics, thermodynamics, heat transfer, nuclear reactor engineering, magnetohydrodynamics, human factors, systems engineering, to name a few of the more important. No mechanical engineer is expected to have a mastery of this entire spectrum. Breadth is particularly important for some, while for others depth in a single specialty may be more relevant.

The Master's degree program is normally expected to ensure breadth and provide an opportunity for modest depth in one or two areas. The student has a wide range of course choices which allow for individual interests. However, it is expected that each student's program include course work in several of the above listed areas. Students desiring a high degree of specialization should continue toward the degree of Engineer and/or Doctor of Philosophy, or include more than 45 units in their M.S. program.

The Master's degree program requires 45 units of course work taken as a graduate student. Ne thesis is required, although many students include some research work in their course program. At least 36 of these units must be taken at Stanford; any units transferred from other universities (up to 9 are allowed) must be graduate level courses taken while registered as a graduate student, and may not be applied toward fulfillment of item 2 below.

The Departmental requirements which must be met for the degree of Master of Science are:

1. 6 units of mathematics from Applied Mechanics 250, 251, 252 (or Computer Science 137A or B), Mathematics 106, 113, 131, 132, Mechanical Engineering 260A, 260B. (Ordinary differential equations, e.g., Mathematics 130, may not be used to fulfill this requirement; it may be taken as a free elective, item 5 below.) Students who have already fulfilled the mathematics requirement in full or in part may place the released units in the approved elective category.

2. 18 units of graduate level courses (200 series) in the Department of Mechanical Engineering. This program should include a focus on some subject area. In order to obtain exposure to a variety of thinking modes and a range of subject matter expected of mechanical engineers, students are encouraged to include courses from both the Thermosciences and Design Divisions. M.E. 260A, 260B, 291, and 292 may not be counted in this requirement.

3. 15 units of approved electives (approved by adviser); these ordinarily should be in mathematics, physics, chemistry, or engineering. Courses in this category should be graduate level courses or, if in another department, they should be at least junior level courses with a minimum of introductory courses; specific exceptions to the graduate level rule are Engineering 104, 174, 176; Mechanical Engineering 116B,
116C, and any courses listed under “Mezzanine Level Courses” listed below. Advisers will normally also approve a limited number of units in the Graduate School of Business or other areas in the University.

A maximum of 9 units in Mechanical Engineering 291, 292, and 3 units in credit seminars, workshops, and colloquia may be included in this category.

4. Included in the above courses must be a minimum of work in Engineering Experimentation and in Engineering Synthesis. This requirement can be fulfilled as outlined below:

a) In Experimental Engineering, a minimum of 3 units of Mechanical Engineering 292 (Experimental Project Work) by arrangement with a member of the faculty, or by completion of any one of the following courses: Mechanical Engineering 201A,B,C, 206, 242A, 242B, 247, Applied Mechanics 205, Aeronautics and Astronautics 131.

b) In Engineering Synthesis, a minimum of 3 units of Mechanical Engineering 291, 292 (Engineering Synthesis Work) by arrangement with a member of the faculty, or by completion of any one of the following courses: Mechanical Engineering 201A,B,C, 206, 214, 220, 222, 224, 235A,B, 237A, 282. Mechanical Engineering 113 can also be used if it was not taken as an undergraduate.

5. Free electives, to make a total of 45 units.

Candidates for the degree of Master of Science will be expected to have approval of the faculty, and to have a minimum scholastic average of 2.75 in the 45 units presented to fulfill degree requirements, regardless of grades in other courses that might be taken as a graduate student. (Courses with + grades can be included in the 45 units, but will not be counted in grade point computation.) Any courses used to fulfill items 1, 2, and 3 of the Department M.S. requirements should be graded courses (excluding seminars and courses for which a pass/no credit grade is given to all students).

Students falling below an overall average of 2.50 at the end of 20 units may be disqualified from further registration. Students failing to meet the complete degree requirements at the end of 60 units of graduate registration will be disqualified from further registration. An exception to the 60-unit rule will be units used to fill deficiencies arising from inadequate undergraduate preparation for mechanical engineering graduate work.

Product Design—A graduate program in the field of Product Design is intended primarily for those students who have completed the undergraduate program in this field and who are admissible to the graduate school. For these students, the 45 units of work specified below are all that is required for a Master of Science in Engineering (Product Design). Students with undergraduate engineering degrees from other schools will usually spend one additional year taking prerequisite undergraduate courses required for the B.S. in Product Design (see page 91 of this bulletin). A special program is also available in cooperation with the Art Department for students who have non-engineering undergraduate degrees in design. These students will register with the Art Department and, while they will take many of the courses listed below, will receive the degree of Master of Arts in Art.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>*M.E. 299A,B,C</td>
<td>Master’s Project</td>
<td>12</td>
</tr>
<tr>
<td>*Art 360</td>
<td>Master’s Project</td>
<td>6</td>
</tr>
<tr>
<td>Art 261</td>
<td>Advanced Design I</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 203</td>
<td>Advanced Manufacturing Technology</td>
<td>3</td>
</tr>
<tr>
<td>M.E. 204</td>
<td>Human Factors in Design</td>
<td>3</td>
</tr>
<tr>
<td>Indus. Engr. 263</td>
<td>The Engineering and Organization of Small Businesses</td>
<td>3</td>
</tr>
<tr>
<td>Approved electives</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>Free electives</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

* Taken jointly.

Admission requirements and grade point average graduation requirements are the same as for the Mechanical Engineering Master’s Degree described above. If possible, applicants should also submit evidence of design ability (e.g., photos or slides of several design projects).


Degree of Engineer

The basic University requirements for the degree of Engineer are discussed in the section “Degrees” in this bulletin.
This degree represents nominally an additional year of study beyond the Master of Science degree, and includes a research thesis. This program is designed for students who desire to do professional engineering work upon graduation, and who desire an opportunity to engage in more specialized study than is afforded by the Master's degree alone.

The admission standards for this program are substantially the same as indicated under the Master's degree. However, since thesis supervision is required, and the availability of thesis supervisors is strictly limited, the Department cannot admit a student to candidacy until the student has personally arranged with some member of the faculty to supervise a research project. This will frequently involve a paid research assistantship, and research assistantships are awarded by individual faculty members (usually from the funds of sponsored research projects under the direction of individual faculty members) and not by the Department, so again a personal arrangement is necessary. Students studying for their Master's degree at Stanford and desiring to continue to the Engineer degree ordinarily make such arrangements during their M.S. degree year. Students holding Master's degrees at other universities will be admitted and allowed to register if they are sufficiently well qualified. However, the Department cannot guarantee thesis supervision or financial assistance, and the student must make such arrangements during his or her first quarter or two of residence.

The Departmental requirements for the degree include an acceptable thesis; up to 15 units credit will be allowed for thesis work. In addition to the thesis, 30 units of approved advanced course work in mathematics, science, and engineering are expected beyond the requirements for the Master of Science degree; the choice of courses is subject to the approval of the adviser. Students who have not fulfilled the Stanford M.S. degree requirements will be required to do so (with due allowance for approximate equivalence of courses taken elsewhere).

All candidates for the degree of Engineer will be expected to have approval of the faculty and to have a minimum scholastic grade point average of 3.0 for all courses (exclusive of thesis credit) taken beyond those required for the Master's degree.

It is the policy of the Department that students engaged in faculty supervised research and special study are obligated to provide the faculty supervisor with a minimum of 20 hours per quarter of reading and grading assistance in the faculty member's other courses, if the faculty member asks for this assistance. The student will be paid for this assistance unless precluded by a fellowship arrangement.

Product Design—A special two-year program in the field of Product Design leads to the degree of Engineer in Mechanical Engineering. It is intended for students who wish to augment in-depth graduate engineering study with education in the aesthetic and human qualities essential in new product development.

A typical program represents course and thesis content equivalent to the Master of Science in Mechanical Engineering plus the Master of Science in Engineering (Product Design). Alternatively, a program of interdisciplinary graduate study may be devised according to guidelines described on page 96 (e.g., in Biomedical Design, Computer-aided Design, or Man-Machine Systems). The thesis requirement for the degree of Engineer is satisfied mainly by documenting the M.E. 299A,B,C Master's Project.

The total of 90 units (including 20 or more in the Department of Art) can normally be completed in two academic years. Students deficient in prerequisite areas may take more time. Students who fulfill requirements for this program are awarded the M.S. in Engineering (Product Design) and Degree of Engineer in Mechanical Engineering (Product Design) simultaneously at its completion.

Admission to the program follows the same requirements as for the Master's degree in Product Design.

DOCTOR OF PHILOSOPHY

The basic University requirements are discussed in the section "Degrees" in this bulletin. The Doctor's degree is intended primarily for students who desire to pursue a career in research, advanced development, or teaching; for this type of work a broad background in mathematics and the engineering sciences, together with intensive study and research experience in a specialized area, are the necessary requisites.

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 by taking a group of courses in one or more related fields or departments.

A student studying for the Ph.D. degree ordinarily will not take an Engineer degree, although this is not precluded. However, the student must have a Master's degree, and must fulfill in essence the requirements for the Stanford M.S. degree in Mechanical Engineering.

Admission to the program involves much the same consideration as described under the Engineer degree. A sufficiently well-qualified student from Stanford or elsewhere will be admitted and assigned to an adviser. If the student has not arranged with a faculty member for supervision of research prior to admission, the student's adviser will assist him or her in making the arrangement. However, the Department cannot guarantee research supervision, as this involves a personal arrangement between the student and the individual faculty member, and such an arrangement is entirely the responsibility of the student. Once a student has obtained a research supervisor, this supervisor becomes thereafter the student's academic adviser. Research supervisors may require that the student pass the Departmental Oral examination before starting on research work and before receiving a paid research assistantship. Note that research assistantships are awarded by the individual faculty research supervisors and not by the Department.

It is very strongly urged that students anticipating working for a Ph.D. degree arrange to do some research work under M.E. 291 or 292 prior to attempting to make a Ph.D. supervision arrangement. Faculty members supervising Ph.D. research will generally require some such proof that a student has research potential before committing themselves to Ph.D. supervision and a research assistantship. It is most efficient to carry out this preliminary research effort during the M.S. degree year.

Prior to being formally admitted to candidacy for the Ph.D. degree the student must demonstrate his knowledge of engineering fundamentals by passing the Departmental qualifying oral examination. The academic level and subject matter of this examination correspond approximately to the Master of Science degree program described above. The examination consists of four oral interviews, one of which must be in mathematics, and the other three are chosen from the areas of controls, mechanical engineering design, fluid mechanics, heat transfer, elastic body mechanics, dynamics, physics, nuclear reactor theory, or applied thermodynamics. A student must have the adviser's approval, and at least a tentative arrangement for research supervision, in order to take the examination. The examination is offered during the autumn and spring quarters and may in addition be offered at other times as the need arises. Normally the examination will be taken during the first post-Master's year.

The Ph.D. thesis normally represents one full year of research work and must be a substantial contribution to knowledge. Students may register for up to 45 units of course credit for thesis work (Mechanical Engineering 301) to help fulfill University residence requirements (payment of the equivalent of 9 quarters of full tuition), but they are not required to do so if they would prefer to fulfill residence by formal course work, and there is no minimum limit on registered thesis units.

The Department has a Breadth Requirement for the Ph.D. degree. Breadth may be provided either by completion of three courses outside of the four areas taken in the qualifying examination, or by a formal minor in another department. Courses chosen must be approved by the dissertation reading committee.

The Department also has a Non-Technical Breadth requirement for the Ph.D. degree. This can be satisfied by completion of six units of course work in the humanities and fine arts, approved by the thesis adviser. Alternatively, the student may demonstrate proficiency in a foreign language, normally French, German, or Russian.

It is the policy of the Department that students engaged in faculty-supervised research and special study are obligated to provide the faculty member with a minimum of 20 hours per quarter of reading and grading assistance in the faculty member's other courses, if the faculty member asks for this assistance. The student will be paid for this assistance unless precluded by a fellowship arrangement.
FINANCIAL ASSISTANCE

The Department annually awards a number of fellowships, teaching assistantships, and research assistantships to graduate students. The fellowships are usually awarded to first-year graduate students, with the assistantship used primarily for post-Master's degree students. Preference for the assistantships is generally given to students who obtain their Master's degree at Stanford. Research assistantships are awarded by the individual faculty research supervisors and not by the Department as a whole. Special fellowships are available for applicants from ethnic minorities.

Applicants for all three forms of assistance may obtain the necessary application forms from the University Admissions Office. However, post-Master's degree applicants for research assistantships are advised to contact directly the faculty member under whom they would like to work, because of the individual nature of these awards, and if they are successful they need not apply to the Department for assistance. Formal applications to the Department for research assistantships will be referred to the individual faculty research supervisors.

Research assistants can, and normally do, carry out their thesis research work and write their thesis as an integral part of the commitments of their assistantship.

FRESHMAN LEVEL COURSES

The following courses offered by the faculty of the Department are suitable for Freshmen.

Course No.    Subject
Engnr. 7.    Energy, from Nature to Man
M.E. 30.    Social Aspects of Nuclear Power
M.E. 101.    Visual Thinking
M.E. 103.    Manufacturing Technology
Architecture 42.    Introduction to Architecture

COURSES PRIMARILY FOR UNDERGRADUATES

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.

30. Social Aspects of Nuclear Power.—This course will present an overview of the nuclear power industry, with the aim of examining the bases of public controversy surrounding nuclear power generation. Technical presentation is descriptive rather than analytical. The course includes: projected nuclear power demands (are they reasonable?); principles of nuclear reactor design (how a reactor supplies energy); different reactor types; breeding; the nuclear fuel cycle; radiological and environmental concerns; nuclear insurance; reactor safety; nuclear safeguards; and other topics as time permits. Open to any student who has had high school physics or chemistry. Engineering students desiring a more analytical treatment of nuclear reactor technology should take Engineering 176 instead.

3 units, Aut (Sher) TTh 1:15–2:30

32. Introduction to the Thermosciences — (Enroll in Engineering 32.)

33. Introductory Fluids Engineering — Elements of fluid mechanics, introduction to the use of thermodynamics and the momentum principle in the solution of fluids engineering problems; flow metering, energy losses in pipe flow, drag on a body, jet engine thrust, operation and performance of turbines, compressors and pumps. Prerequisite: Engineering 32.

3 units, Spr (Whitehouse) TTh 10; lab. one afternoon by arrangement


3 units, Aut (McKim, Verplank) lec. and lab.
Sec 1 MW 1:15–3:05
Sec 2 MW 3:15–5:05

102A. Design Communication Workshop I
102B. Design Communication Workshop II
—Basic methods and materials for visualizing and communicating design concepts in three dimensions. Emphasis upon economical means that designers can use quickly, with high effect in relation to effort. Pass/no credit.

1 unit, Win (Staff) T 7–10

103. Manufacturing Technology — The capabilities and limitations of common manufacturing processes. Selection and specification of metallic and non-metallic engineering materials. Properties of materials as they affect and are affected by manufacturing processes. Engineering shop drawings—the interrelation of part description, dimensioning, tolerances, and process of manufacture. Laboratory experience in machining, casting, and welding. Various aspects of the course will be developed in a project to be designed, described in engineering drawings, and fabricated in shops.

4 units, Win (Adams), Spr (Chilton) T 9, Th 9–11; lab. T, W, Th, or F 1:15–4:05 for first four weeks of quarter; additional hours by arrangement during last six weeks

104. Dynamic Response — (Enroll in Engineering 104.)

105. Control System Analysis and Design—(Enroll in Engineering 105.)

107. Mechanical Systems—An investigation of the techniques used in design and development of complex mechanical systems. The relative role of test, cut-and-try development, intuition and analysis will be investigated. Critical parameters of mechanical system elements and transmission of force and motion through systems will be discussed. Typical mechanical systems and their design and development will be studied. Each student will design and build a simple mechanical system (model flying machine, tree shaker, stair climber, etc.). Pre-requisites: Engineering 11 and 12 or equivalent and 111.

3 units, Win (Piziali) lec. TTh 10; lab. W 2:15–5:05

111. Stress, Strain and Strength—Analysis of basic engineering structures under load, the resulting stresses and strains, and failure criteria. Bending and torsion of bars, combined stresses, fatigue, fracture mechanics, buckling, corrosion and creep. Emphasis will be on actual industrial problems and will include engineering modeling and an introduction to experimental stress analysis. Prerequisite: Engineering 11.

3 units, Aut (Piziali) T 10, Th 10–12

113. Engineering Design—The design process involves the application of information from various sources in the creation of tangible objects and intangible system concepts to improve the quality of human life. In this course, design is both studied as a process and experienced by students as they work on a design project. Final project results are presented to a professional jury. Prerequisites: 101, 103, 107, and 111.

3 units, Spr (Piziali) TTh 2:15–5:05

115A. Introduction to Product Design—Active encounter with human values in design. Lectures survey central philosophy of product design program, with emphasis upon the relation between technical and human values, the creative process, and design methodology. Laboratory exercises include the development of simple product concepts visualized in rapidly executed three-dimensional mockups. Prerequisite: 101.

3 units, Win (Adams) MW 1:15–4:05

115B. Design Communication—A planning approach to communicating design concepts. Analyzing communication needs and language orientation of intended audiences. Choosing the most appropriate languages: charts, graphs, schematics, mechanical drawings, perspective renderings, free-hand sketches, three-dimensional models, photographs, spoken or written words. Organizing and delivering verbal-visual presentations. Closed circuit TV used as learning tool. Prerequisites: 101 and 102A,B, or consent of instructor.

3 units, Spr (Staff) MW 1:15–4:05

116A. Advanced Product Design — Small-scale projects carried to a high degree of
refinement. Emphasis upon craftsmanship and aesthetics. Prerequisite: 115B.

3 units, Aut (Derby) TTh 12:00-2:05

116B. Advanced Product Design — New product innovation via need-finding. Prerequisite: 116A.
3 units, Win (Verplank) TTh 12:00-2:05

116C. Advanced Product Design — Summary project utilizing knowledge, methodology, and skills obtained in 101, 113, 115A,B and 116A,B. Final presentation to professional jury. Prerequisite: 116B.
3 units, Spr (Horine) TTh 12:00-2:05

131A. Thermosciences — First of a three-quarter sequence that should be taken in consecutive quarters. Lecture and laboratory covering thermodynamics, fluid mechanics and heat transfer. The lecture sessions emphasize basic principles used in the energy sciences and their application in man-made systems. Laboratory sessions devoted to demonstration and experiments in the specific area of the lectures and cover basic experimental procedures, including measurement techniques, experiment design, data collection, processing, and evaluation. Prerequisites: Familiarity with basic principles of thermodynamics, and some elementary knowledge of fluid mechanics, equivalent to Engineering 32 and Mechanical Engineering 33. Mathematical background should include intermediate calculus and ordinary differential equations.
5 units, Aut (Johnston) MWF 10; lab. one afternoon by arrangement

131B. Thermosciences — Continuation of 131A.
5 units, Win (Whitehouse) MWF 10; lab. one afternoon by arrangement

131C. Thermosciences — Continuation of 131B.
4 units, Spr (Eustis) MWF 10; lab. one afternoon by arrangement

137. Air Pollution—Sources and effects of urban air pollution. Photochemical smog. Chemistry and fluid mechanics of pollutants in the atmosphere. Pollution control: devices and legislation. (Open to non-science students.)
3 units, Aut (C. Kruger) MWF 1:15

3 units, Aut (Bershader) MWF 3:15

139. Environmental Measurements — This course will consist of lecture, laboratory, and field experiments involving measurement techniques for determining environmental quality and pollutant concentrations. Air quality measurements will be particularly emphasized, but techniques applicable to other forms of pollution will also be covered. M.E. 137 recommended.
3 units, Win (Staff) TTh 10 plus lab. one afternoon by arrangement

3 units, Win (Staff) MWF 11

174. Nuclear Science—(Enroll in Engineering 174.)

176. Nuclear Energy—(Enroll in Engineering 176.)

180. Energy and Society—(Same as Human Biology 140.) A unified analysis of the effects on man's environment of the production, distribution and consumption of energy. Treatment will include: the kinds and magnitude of energy resources; the various technologies for conversion to electric energy and other consumer forms; priorities and strategies for future development; the social conflicts between growing demands and environmental degradation, technological assessment; the legal and economic framework of the energy industry. Presentation of technical information will be in terms understandable to the non-engineering student. Prerequisites: high school physics and junior standing or consent of instructor.
3 units, Spr (Connolly, Liebes) MWF 9

191. Engineering Problems and Experimental Investigation — Directed study and research for the undergraduate student on a subject of mutual interest to student and
staff member. Student must find faculty sponsor and have approval of his adviser.

1 to 5 units, any quarter (Staff) by arrangement

**Architectural Courses for Undergraduates**

42. Introduction to Architecture—A survey of architecture as artifact, as commodity, as urban form, and as a profession, with discussions of the history and theory of architectural design and the relationships of architecture to allied fields. Lectures, readings, and projects. Visiting professionals.

3 units, Win (Staff)

110. Manufactured Architecture—Explores common concerns of product design and architecture through design problems in the space and systems planning of mobile living modules, transportation units, and/or industrialized building, with emphasis on manufacturing processes and life support systems. Individual research, discussions, field trips and projects. Primarily for seniors and graduate students in Product Design and Architecture.

3 units, Win (Staff)

120. Architectural Theory—Survey of architectural design in the Western World from 500 B.C. to the present, with emphasis on pre-19th century architecture. A study of how formal design problems were dealt with in the past, with analogies to problems encountered in current work, which will lead to conclusions about the components of design. This is based on the premise that an understanding of past design solutions will provide information against which modern solutions may be measured. Prerequisites: 42 and Art 1.

3 units, Spr (Staff)

131. Structural Design I — Emphasis on structure as a form-generating resource, making a distinction between the abstractions of structural mechanics and the realities of materials and construction. Design of the structural systems of a series of buildings, study of appropriate uses of wood, steel, concrete, and masonry from a practical as well as an aesthetic viewpoint. Work performed in and outside class. Prerequisites: 142 and Engineering 11.

3 units, Aut (Gray) F 1:15–4:05

132. Structural Design II—Continuation of

131. From the fairly simple structures studied in 131, the scope is widened to include more refined systems, tall buildings, very long spans, thin shells, manufactured buildings, and some of the more subtle aspects of seismics design. The intent is to develop skill in the use of current technology through complete drawings and calculations. Prerequisite: 131.

3 units, Win (Gray) F 1:15–4:05

135. Environmental Control for Buildings—A survey of mechanical, thermal, and electrical systems used to control the indoor environment. Topics will include heating, cooling, and ventilation system design with emphasis on energy conservation. Conventional and alternative utility systems—i.e., solar, geothermal, wind, and others—will be discussed. The intent of the course is to provide architecture majors with a basic knowledge of the outlined material for direct application in the work of Architectural Design I, II, and III. Primarily for architecture majors. Prerequisites: 42 and Engineering 7 or Physics 51.

3 units, Aut (Whitehouse) TTh 9–10:30

141. Design Communication—Exercises in architectural graphics. Drawings and rendering techniques in various original and reproductive media incorporating line, texture, shade and shadow. Includes axonometric and perspective projection. Studio format with lectures and individual criticism. Prerequisites: Art 40, Mechanical Engineering 101 and 102A, or equivalent.

3 units, Win (Thomason) Th 1:15–5:05

142. Building Technology—A study of the physical systems, materials, construction procedures, and documentation constituting a building project. Separate elements (plumbing, electrical systems, etc.) will be studied in the sequence in which they are encountered in the course of construction, with emphasis on the coordination of these elements. Lectures, readings, short papers, field trips, and discussions. Primarily for architecture majors. Prerequisite: 42.

3 units, Spr (Staff) F 1:15–4:05

143. Architectural Design I — Problems in the synthesis of architectural design incorporating principles of space, light, scale, function, and building systems with emphasis on three-dimensional planning of small buildings. In the design studio, instructors
will act as organizers, catalysts and critics, providing lectures and reviews, generating discussions and arranging field trips, and providing individual consultation and criticism. Visitors are called on for information and critiques. Students are expected to participate in project research and group discussion, in addition to doing individual work on design projects. Development of skills in graphic and verbal presentation techniques is an important part of the design studio. Architecture majors only. Prerequisites: 141 and 142.

6 units, Aut (Mittelstadt and Staff) TTh 1:15-5:05

144. Architectural Design II — Continuation of 143 with emphasis on land use and site planning. Prerequisite: 143.

6 units, Win (Mittelstadt and Staff) TTh 1:15-5:05

145. Architectural Design III — Continuation of 144 with emphasis on building in the urban context: analysis of the effects of economic, legal, social and physical systems on architectural form through case-study design problems. Prerequisite: 144.

6 units, Spr (Mittelstadt and Staff) TTh 1:15-5:05

148. Architectural Practice — Provides the graduating architecture major with professional knowledge regarding the functions, responsibilities, and challenges of the practicing architect. Examines related fields contributing to the design of the man-made environment and how they interact with the architectural profession to achieve common goals. Seminar with lectures, visitors, field trips, discussions and readings. For architecture seniors. Prerequisites: 142 and concurrent enrollment in 145.

3 units, Spr (Mittelstadt) TTh to be arranged

160. Principles of Urban Design — A study of the elements of architecture, city planning, the social sciences, and environmental engineering, emphasizing urban form and appearance. Exploration through lectures, readings, and studio projects of space, form, human activities and life styles, and urban mechanical systems—all factors in a dynamic process by which urban design becomes an expression of changing public policy in contrast to the relative permanence of architecture. Prerequisite: 42.

3 units, Aut (Okamoto)

MEZZANINE LEVEL COURSES

The following courses are especially suitable both for advanced undergraduates and for graduates, and may be used to satisfy the M.S. requirement, item 3, 15 units of approved electives.

Course No. Subject
M.E. 105. Control System Analysis and Design (Enroll in Engineering 105)
M.E. 113. Engineering Design
M.E. 137. Air Pollution
M.E. 138. Noise Pollution
M.E. 139. Environmental Measurements
M.E. 161. Engineering Vibration
M.E. 174. Nuclear Science (Enroll in Engineering 174)
M.E. 176. Nuclear Energy (Enroll in Engineering 176)
M.E. 180. Energy and Society
M.E. 203. Advanced Manufacturing Technology
M.E. 204. Human Factors in Design
M.E. 206. Control System Analysis and Design (Enroll in Engineering 206)
M.E. 230A. Heat Transfer
M.E. 235A,B. Engineering Systems Design
M.E. 236. Gasdynamics

COURSES PRIMARILY FOR GRADUATES

ENGINEERING MATHEMATICS


3 units, Aut (Ferziger) MWF 11

260B. Mathematical Methods in Mechanical Engineering — Solution of partial differential equations arising in mechanical, thermal, and hydrodynamic problems. Analytical considerations include self-similar transformations, separation of variables, eigenvalue
problems, eigenfunction expansions, special functions, transforms. Numerical methods as an adjunct to theory in solution of practical PDE problems. Prerequisites: background in linear algebra, advanced calculus, and ordinary differentiation equations, and experience in simple uses of the computer.

3 units, Win (Reynolds) MWF 9

260C. Mathematical Methods in Mechanical Engineering — A number of topics in mathematics applicable to engineering will be covered but the coverage will change from year to year. Topics may include advanced numerical analysis, tensor calculus, asymptotic methods and expansions, calculus of variations, integral equations. Prerequisites: 260A, B, or equivalents.

3 units, Spr (Ferziger) MWF 9

DESIGN DIVISION

201 A,B,C. Engineering Design—Experience in the formulation, design and analysis of real engineering projects presented by local industry. Designs will be developed by small groups of students, each group under supervision of an instructor from the Design Division faculty and in close cooperation with the industrial sponsor. Projects will be carried through construction and testing of prototype, and first design revision. Instruction in design methodology, safety, liability, and patents for engineers. Students should enroll for all three courses. Grading will be deferred until the completion of 201C. Limited enrollment. Prerequisite: 113 or equivalent.

201 A. 4 units, Aut (Chilton) TTh 1:15–4:05
201 B. 2 units, Win (Chilton) Th 1:15–4:05
201 C. 3 units, Spr (Chilton) W 1:15–4:05


3 units, Win (Wilde) MWF 1:15

203. Advanced Manufacturing Technology — Capabilities and limitations of high production and specialized manufacturing processes, including numerically controlled machining, small-scale joining, deposition, etching, electrical discharge machining and high-rate forming. Automation in fabrication and assembly. Selection and specification of polymers, adhesives, composites, coatings, and materials with extreme properties. Field trips will be integrated into course content where possible. Prerequisite: 103 or equivalent first-level materials and processes course.

3 units, Spr (Adams) Lectures MW 9, Field trips F 1:15–5:05


3 units, Spr (Verplank) TTh 10–12

206. Control Systems Analysis and Design — (Enroll in Engineering 206.)

207. Digital Control I — (Enroll in Engineering 207.)

208. Digital Control II — (Enroll in Engineering 208.)


3 to 4 units, Spr (Wilde) Th 1:15–4:05

214. Philosophy of Design — The course stresses creativity, examines values, and emphasizes the interpersonal processes involved in design. Students will experience and de-
velop their capacities for design in various ways—such as synectics and brainstorming. Emphasis on experiential learning by design and construction of unusual devices. Directed reading in the literature of creativity. Limited enrollment; open to graduate students of all disciplines.

3 units, Spr (Chilton) M 2:15–5:05

220. Computer-Aided Design — The use of machine computation as a design tool. A discussion of techniques and algorithms which increase the rationality of the design process and lead to more nearly-optimum solutions. The emphasis is on extending the designer's potential, and not on automating his activities. Topics are taken from all phases of the design process. Students will be expected to program algorithms and complete a design project. Prerequisite: FORTRAN (or ALGOL or LISP) programming ability.

3 units, Aut (Roth) MWF 12

221. The Individual and Technology—This course is intended to be an intensive personal experience in which the participants' career objectives and psychological orientation are compared with existing social values and conditions. The emphasis is on helping the individual to assess his role as a person and engineer in modern society. Stereotyped views of engineers and engineering are critically evaluated. The relevance of current political, social, and humanistic thought to technology is considered. Students are asked to do readings, participate in field trips, and complete a term project. Limited registration. Prerequisite: graduate standing or consent of instructor.

3 units, Win (Roth) F 1:15–4:05

222. Kinematic Synthesis of Mechanisms — The rational design of linkages is the central theme of this course. The problem of determining linkage proportions to fulfill various design requirements is treated analytically. Topics include: three- and two-dimensional displacements and motions, the theory of higher plane curves, higher-order path-curvature analysis, circle and center-point theory.

3 units, Spr (Roth) MWF 12

223. Advanced Kinematics — Discussion of kinematics from both the mathematical and engineering viewpoints. Introduction to algebraic geometry. Application of matrix, tensor, and dual-quaternion methods to kinematic analysis and synthesis. A survey of current research and unsolved problems in kinematics. Prerequisite: 222.

3 units, Win (Roth) by arrangement


3 units, Spr (Manning) MWF 9,
alternate years, given 1974–75

226. Automatic Control of Space and Aerospace Vehicles—(Enroll in Aeronautics and Astronautics 217B.)

227. Inertial Instruments—(Enroll in Aeronautics and Astronautics 272A.)

228. On-Off Control Logic—(Enroll in Aeronautics and Astronautics 277.)

229. Logic in Configuration Design—Rigorous logic and combinatorial optimization applied to engineering design involving combinations of indivisible components. Students are required to do an approved design project of their choice.

3 units, Spr (Wilde) MWF 10


2 units, Win (Fuchs) by arrangement

261. Vibrations—Development of equations of motion for continuous systems, lumped systems and approximations of continuous systems, Rayleigh Ritz, Galerkin, Collocation, and finite element methods. Solution techniques for the eigenvalue problem and forced responses. Prerequisites: 161 or equivalent, and computer programming ability.

2 units, Win (Piziali) TTh 11:00–12:15

293. Methods and Experiences in Engineering Education—Analysis of effective teaching in an engineering college. Theories of how people learn, use of media, when and
how to lecture, self-paced learning, student and teacher evaluation, writing of instructional objectives. Emphasis will be on gaining experience and self-evaluation by such methods as practise teaching with video-tape recording. Available to advanced graduate students from all disciplines with an interest in a college teaching career.

3 units, Win (Chilton) by arrangement

294. Design Research Colloquium — Students, faculty, and visitors survey research results from design related science and technology.

1 unit, Aut (Staff and Students) F 2:15
Win, Spr (Staff and Students) M 2:15

295. Experiential Workshop in Design Education — Experiential and intellectual study of psychological influences on the design process: awareness, inhibition, repression, communication, and group dynamics. Pre-requisite: advanced graduate standing in Design. (Concurrent with Engineering 2, Peopledynamics Lab.)

1 unit, Aut, Win, Spr (Wilde) T 1:15-5:05

296. Design Forum — Presentations, discussions, and happenings; matters of concern to the entire Design Community which do not fit into regular courses.

1 unit, Aut, Win, Spr (Staff and Students) Th 4:15 plus one day-long Saturday retreat

299A,B,C. Master’s Project — Three-quarter graduate design project guided by a diverse faculty team. In the first quarter, the student uses rational and intuitive problem-finding procedures to identify a design project within an unexplored area of need, presents a project proposal, and performs research. In the second quarter, the student prepares a design program, develops concepts, performs necessary experiments, and carries project to the stage of a working prototype. In the third quarter, the student refines design from the standpoint of cost and production, builds demonstration model, and presents project to professional jury. (For Product Design majors only.)

299A. 4 units, Aut (Staff) by arrangement
299B. 4 units, Win (Staff) by arrangement
299C. 4 units, Spr (Staff) by arrangement

THERMOSCIENCES DIVISION

211A. Physical Gas Dynamics — The fundamentals of high-speed, high-temperature flow of a gas from the molecular point of view; molecular concepts and simple kinetic theory; equilibrium properties of gases and gas mixtures as obtained from kinetic theory, chemical thermodynamics, and statistical mechanics.

3 units, Win (Mitchner) MWF 2:15

211B. Physical Gas Dynamics — (Enroll in Aeronautics and Astronautics 211B.)

230A. Heat Transfer — An applications-oriented first course open to all graduate students and to undergraduates outside of Mechanical Engineering. The course covers the basic techniques of solving heat transfer problems involving conduction, convection, and radiation. It may stand alone or serve as the introductory course for M.E.230B or for the M.E.231 series. The fundamental techniques of control volume analysis, lumped parameter modeling and thermal circuit description are used in formulating solvable heat transfer problems based on physical systems. Existing heat transfer data from standard sources are used: emphasis is on the simplifications and assumptions required to model a real problem, and on the response of the system. Ordinary differential equations will be used and some familiarity with the computer would be desirable, but may be concurrently acquired.

3 units, Aut (London) MWF 9

230B. Heat Transfer — Advanced applications in heat transfer. The course covers the analysis of complex systems of conduction, design of heat exchangers and cooling towers, and treatment of radiation exchange with several interacting bodies. M.E.230A or an equivalent undergraduate level course in heat transfer is required.

3 units, Win (London) TTh 11:00-12:15

231A. Convective Heat Transfer — An advanced convection course aimed at predicting the rate of heat or mass transfer between a solid and a fluid starting from descriptions of the geometry and the flow field. Differential and integral equations are developed which describe the transfer of momentum, energy, and specie within a moving fluid. Exact solutions are discussed for some laminar problems (fully developed tube flow; similarity flows). Approximate solutions to
turbulent heat transfer are developed using mixing-length theory, experimental results, and superposition. Integral methods are developed for approximate solutions to external heat transfer problems. Operational familiarity with the computer is strongly recommended, to the level of the "quick courses" offered on campus. This course should not be taken as a first course in heat transfer.

3 units, Win (Staff) MWF 10

231B. Convective Heat Transfer — An advanced convection course continuing the study begun in 231A. This course will make much use of the computer, using an existing general program as an exploratory trial to study heat transfer behavior. Laminar and turbulent external boundary layer solutions using finite difference solutions to the differential equations. Operational theories of turbulent transport and solutions for arbitrary boundary conditions. Eddy diffusivity models and mixing-length models. Formulation of the mass transfer problem and simultaneous solutions of heat and mass transfer. Operational familiarity with the computer is required, as is M.E.231A, or consent of the instructor.

3 units, Spr (Kays) MWF 8

233A. Engineering Thermodynamics — Thermodynamic analysis of engineering systems including thermodynamics of gas mixtures, physical chemistry of combustion and thermodynamic bookkeeping methodology for mass, energy and entropy. Applications to internal combustion engines, power cycles, refrigerator cycles, compressors, turbines, heat exchangers, combustion chambers, cooling towers, etc. for performance predictions and the evaluation of losses (irreversibilities).

3 units, Win (London) MWF 1:15

233B. Engineering Thermodynamics — A continuation of 233A including a critical review of the fundamental thermodynamic concepts and principles and a study of the current literature of thermodynamics.

3 units, Spr (London) TTh 11:00–12:15


3 units, Aut (C. Kruger) MWF 10

236. Gasdynamics — Introduction to compressible flow. Sound waves and normal shock waves. Quasi-one-dimensional steady flows in variable area ducts with friction, heating and cooling, etc. Oblique shock waves, Prandtl-Meyer expansions, shock wave structure. Relation of continuum conservation equations to simple kinetic theory. Prerequisite: graduate standing or consent of instructor.

3 units, Aut (Mitchner) MWF 2:15

237A. Thermodynamics of Propulsion Systems—Analysis of the performance of propulsion prime movers from thermodynamic and dynamic points of view including rocket, ramjet, turbojet, and fanjet systems as well as piston, gas turbine and compound piston-turbine type engines.

4 units, Aut (London) MWF 1:15, one hour by arrangement

237B. Thermodynamics of Propulsion Systems—A continuation of 237A including the thermodynamics and kinetics of combustion reactions as applied to internal combustion engines of both the piston-cylinder and turbine types.

4 units, Spr (London) MWF 9; one hour by arrangement

238A. Advanced Fluids Engineering — A two-quarter course in continuum fluid mechanics, and engineering design and optimization of internal flow systems, e.g. nozzles, diffusers, turbomachines. Development of the basic mathematical models for the kinematics and dynamics of the fluid continuum. Integral theorems for mass, momentum and energy. Differential equations of motion, Euler’s inviscid flow equations and the Bernoulli theorem. Potential flow of an incompressible fluid and introduction to the boundary layer. Dimensional analysis, modeling and analogues, flow visualization. Emphasis on applications to engineering problems by exact and approximate methods. Prerequisite: graduate standing.

3 units, Aut (Eustis) MWF 8

238B. Advanced Fluids Engineering—Continuation of 238A. Exact solutions to Navier-
232. Fluid Mechanics of Solids—Introduction to the mechanics of solids, including deformation, stress, and strain. Applications to materials and structures. Prerequisite: 231B or 238B.

3 units, Spr (Kline) MWF 11

240. Research Frontiers in Fluid Mechanics—Group study of selected topics from turbulent shear flow. Topics selected may include three-dimensional boundary layers, separation, boundary layer structure, unsteady turbulent flows. This course will expose the student to the frontiers of research in an area of fluid mechanics, and will help develop a critical attitude towards research in fluid mechanics.

3 units, Spr (Staff) one afternoon by arrangement, alternate years, given 1975-76

241. Turbulence—Introduction to the basic concepts of turbulence structure, kinematics, dynamics, with emphasis on shear flows and mixing processes. The student will be expected to fill in between major mathematical steps individually outside of class.

3 units, Spr (Reynolds) TTh 9, alternate years, given 1974-75

242A. Experimental Methods in the Thermosciences—Planning experimental programs, uncertainty analysis and the selection of instrument systems. Steady-state measurements of heat flux, temperature, pressure, and flow rate. Mean-velocity and mean-temperature measurements in the boundary layers. Advanced laboratory problems in heat transfer and fluid dynamics. Prerequisite: graduate standing or consent of instructor.

4 units, Spr (Moffat) MWF 10; one
3-hour lab. by arrangement

242B. Experimental Methods in the Thermosciences—Special topics in measurement techniques of the thermosciences. Transient temperature, pressure, and flow. Hot-wire anemometry in boundary layer studies. These topics will be studied analytically and experimentally. Planning research programs. Proposal writing, sources of funding, evaluation criteria. Budget estimation. Student teams will select an existing major technical paper and develop a plausible proposal, time schedule, budget and program which could have led to that research. Prerequisite: Graduate standing or consent of the instructor.

3 units, Sum (Moffat) MWF 10 plus lab.
or discussion period by arrangement

243. Computer Laboratory in Thermosciences—A “laboratory” supplement to the M.E.238 fluid mechanics and M.E.231 heat transfer sequences. Solution of ordinary differential equations and applications to self-similar flows. Solution of parabolic partial differential equations and application to boundary layer and related flows. Solution of elliptic equations and application to recirculating flows. Established computer programs will be available for each aspect of the course; the students will have the opportunity to use them, modify parameters and modify the programs themselves. Prerequisites: 231B or 238B and familiarity with computer.

3 units, Sum (Ferziger) MWF 9

249. The Physics of High-Temperature Gases—This is a one-quarter course especially designed for students with a conventional mechanical engineering background. It provides an introduction to some of the fundamental ideas in electromagnetic theory and in quantum mechanics. Emphasis is placed on the relationship of these ideas to atomic processes in high-temperature gases. Topics to be covered will include radiation from an accelerated charge, blackbody radiation, deficiencies of classical theory, de Broglie waves, the uncertainty principle, Schrödinger's equation and its solutions. Prerequisite: familiarity with partial differential equations.

3 units, Spr (Mitchner) MWF 3:15,
alternate years, given 1975-76
245. Coal Conversion Processes — Analysis of the reactions, processes and conditions for conversion of coal to synthetic natural gas, low Btu gas, liquid fuels and chemicals, solvent refined coal, and other products; coal pyrolysis and hydrogenation; chemical character of coal products; fundamental engineering challenges.

3 units, Aut (Hill) dhr

247. Experimental Plasma Physics Laboratory — (Enroll in Engineering 215.)

251. Introduction to Partially Ionized Gases — (Enroll in Aeronautics and Astronautics 284.)

252. Magnetofluidmechanics — Interaction of conducting fluids with electric and magnetic fields. MHD one-dimensional channel flow, boundary layers, power generation and fluid acceleration. Calculations of electrical conductivity of equilibrium and nonequilibrium partially ionized gases.

3 units, Spr (Mitchner) MWF 1:15

253. Kinetic Theory of Partially Ionized Gases — Collisions between charged particles. Debye shielding. The Boltzmann and Fokker-Planck equations. Accurate calculation of electrical and thermal conductivities and thermal-diffusion coefficients of partially ionized gases in a magnetic field. Evaluation of approximate transport-property formulas for practical calculations. The effect of strong electric fields on the electron temperature and on the values of the transport coefficients; the electron energy equation. Rate equations for the population of excited atomic states and the degree of ionization. Applications to nonequilibrium as a result of relaxation and radiation escape. Prerequisites: 251 and 211 A, or consent of instructor.

3 units, Spr (Mitchner) MWF 3:15, alternate years, given 1974-75


3 units, Spr (Ferziger) MWF 11

270. Nuclear Energy — A one-quarter course in the theory and design of nuclear energy systems: radioisotope heat sources, fission chain reactors and concepts of fusion reactors. The effects and the shielding of nuclear radiation emitted by these systems. Prerequisite: graduate standing (undergraduates enroll in Engineering 176).

3 units, Win (Connolly) MWF 9

271A. Nuclear Reactor Theory — Fundamentals of reactor analysis, including: the fission process; neutron-nuclear interactions and cross sections; infinite-medium criticality calculations for homogeneous systems; neutron slowing-down theory; one-group neutron diffusion theory; multi-group techniques for thermal and fast reactors; criticality calculations for bare homogeneous reactors.

3 units, Aut (Sher) MWF 10

271B. Nuclear Reactor Theory — Continuation of 271A. Reflected reactors; heterogeneous reactors; resonance capture in homogeneous and heterogeneous reactors; point reactor kinetics, the inhour equation; poisoning and burn-up; control rods; perturbation theory. Prerequisites: 271A and concurrent registration in Mathematics 131 or Applied Mechanics 251.

3 units, Win (Staff) dhr

271C. Advanced Nuclear Reactor Theory — Neutron transport theory, the Boltzmann equation; approximation and numerical techniques for solving the Boltzmann equation; reactor shielding: analytic and semiempirical methods; reactor stability and safety analysis. Prerequisite: 271B.

3 units, Spr (Staff) dhr

272. Controlled Thermonuclear Fusion — The fusion reaction. Fundamentals of plasma physics as applied to plasma creation and containment in a fusion device. Experimental devices: pinch, mirror, stellerator, Tokamak. Concepts of fusion reactors and fusion-elec-
tric generators. Prerequisite: consent of instructor.

3 units, Spr (Staff) by arrangement; given 1974-75

282. Nuclear Reactor Design — The development of a reactor design from a set of specifications. The synthesis of reactor theory, heat transfer, properties of materials, and economics, in reactor design. The use of digital computer codes in reactor design. Prerequisite: 271A or consent of instructor.

3 units, Spr (Connolly) TTh 11:00-12:15

297. Energy Policy Seminar—Weekly presentations and discussions on energy policy with emphasis on technological aspects. The status of various national programs for the advancement of energy technology will be reviewed. Views on the political, social and economic aspects of projects to which engineers devote their efforts will be presented. Prerequisite: graduate standing in engineering.

1 unit, Aut, Win, Spr (Connolly) by arrangement

298. Seminar in Fluid Mechanics—(Enroll in Engineering 298.)

DIRECTED STUDY

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 15 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 15 units, any quarter (Staff) by arrangement


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


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

OPERATIONS RESEARCH

Chairman: Gerald J. Lieberman


Associate Professor: B. Curtis Eaves

Assistant Professors: Václav Chvátal, Patricia A. Jacobs

Research Associate: John A. Tomlin

Affiliated Faculty:

Professors: Gene H. Golub, Ronald W. Howard, Samuel Karlin, David G. Luenberger, Ingram Olkin, Douglass J. Wilde, Robert B. Wilson

Associate Professors: Charles P. Bonini, J. Michael Harrison, Evan Porteus

OFFERINGS AND FACILITIES

Operations Research is a mathematical science concerned with optimal decision making and modeling of deterministic and probabilistic systems. The Department's principal objectives are to provide a comprehensive program of instruction in the basic mathematical foundations of operations research, to acquaint students with the application of these methods to real problems, and to train research workers in operations research.

Introductory courses are offered for both undergraduate and graduate students from other departments. Operations Research 50 is a first course designed for students who wish to become familiar with the basic terminology and ideas of operations research without using any mathematics beyond high school algebra. Illustrations are drawn from important socio-economic applications. Operations Research 152 and 153, open only to undergraduates, is a two-quarter introductory sequence which covers the basic concepts of operations research, and includes material on both deterministic and probabilistic models. Operations Research 252 is a similar type introductory course for graduate students. Its purpose is to acquaint students from other disciplines with the techniques of operations research which may be useful to their field. Operations Research 240 is a first course in linear programming, and the sequence 240, 250, 251 forms a basic
one-year course in operations research, aimed at students who desire a mathematical science professional career in business, government, or industry.

The Department offers programs leading to the Master of Science and Doctor of Philosophy. Under the Graduate Division Special Ph.D. Programs, it is also possible to arrange a well-considered program that is a combination of Operations Research with some other departmental area. Some possibilities are either Computer Science, Statistics or Economics.

Among the many areas of operations research the Department has special competence in the following: applied probability; dynamic programming; inventory, queueing, and reliability theory; linear, nonlinear, and integer programming; and networks, graphs, and combinatorial theory.

Adequate office facilities are available for visiting scholars and doctoral students. In addition, the Department has its own library and remote-access computer terminal.

**Programs of Study**

**Bachelor of Science in Mathematical Sciences**

Although the Department of Operations Research does not have an undergraduate degree program in Operations Research, it participates with the Departments of Computer Science, Mathematics, and Statistics in a program leading to the degree of Bachelor of Science in Mathematical Sciences. See Program in Mathematical Sciences on page 536 of this Bulletin.

**Master of Science**

The program leading to the degree of Master of Science in Operations Research is designed to prepare individuals for high-level professional work in applying operations research. Thus, the emphasis is on providing a solid foundation for a life-long professional career involving the formulation, solution, and implementation of operations research models for analyzing complex systems problems in business or government.

In addition to the University's basic requirement for the Master's degree discussed in the section "Degrees" in this bulletin, a candidate is expected to complete an approved course program of 45 units. This program normally can be completed in one academic year (three academic quarters) of full-time work. A number of operations research workers in local industry also attend part-time, taking one or two daytime classes per quarter, under the Honors Cooperative Program. Each student will normally fulfill the following requirements for the Master of Science degree:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op. Res. 240</td>
<td>Linear Programming</td>
<td>3</td>
</tr>
<tr>
<td>Math. 113</td>
<td>Linear Algebra and Matrix Theory</td>
<td>3</td>
</tr>
<tr>
<td>Math. 115*</td>
<td>Fundamental Concepts of Analysis</td>
<td>4</td>
</tr>
<tr>
<td>Stat. 116</td>
<td>Theory of Probability</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 217</td>
<td>Introduction to Stochastic Processes</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 218</td>
<td>Introduction to Stochastic Processes</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 219</td>
<td>Statistical Inference</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 220</td>
<td>Statistical Inference</td>
<td>3</td>
</tr>
<tr>
<td>*One additional course in Computer Science: 106 or beyond</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Electives from the offerings of the Department of Operations Research or from authorized courses in other departments</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

Total. .................................................. 45

No thesis is required. A minimum grade point average of 2.75 is expected.

* Comp. Sci. 135 (or 137A) may be substituted with the permission of the student's adviser.

**Doctor of Philosophy**

The program leading to the degree of Doctor of Philosophy in Operations Research is directed to those primarily interested in a career of research and perhaps teaching in a university, business, or government position. Therefore, emphasis is given to the scientific foundations of operations research. In particular, the program is focused on:

1. the study of the abstract mathematical structure of models derived from real life situations such as allocation models of an enterprise or an economy, network flow models of transportation and communication systems, reliability models of complex engineering systems, queuing models of congestion, modeling and control of dynamical systems arising in physical, economic, or management contexts, discrete selection models for routing and pattern cutting, policy decisions for production and inventory control, and models for conflict resolution, and

2. the development of the mathematical the-
ory, including the theory of optimization. Necessary for the solution of these models.

Examples of the applied mathematical disciplines studied include mathematical programming, dynamic programming, structure and identification of dynamical systems, stochastic processes, network and combinatorial theory, reliability, queuing theory, inventory theory, and game theory.

Candidates for the Ph.D. in Operations Research will normally satisfy the course requirements shown below. An individual student in consultation with the adviser may make adjustments in the program to reflect his or her special interests.

1. Prerequisites: Mathematics 113, 115, 116; Statistics 116, 119, 120; Computer Science 106, Engineering-Economic Systems 212A.


In addition to the course requirements, the doctoral candidate must fulfill several University requirements, as described in the section “Degrees” in this bulletin. These include passing a University oral examination and completion of a dissertation which represents an original contribution to knowledge expressed in a satisfactory form. The Department of Operations Research also requires that the candidate have a reading knowledge of at least one foreign language and successfully complete a set of written comprehensive examinations.

A student performing satisfactorily in the Ph.D. program normally would be eligible to receive a Master of Science degree in Operations Research, if he or she so desires, after completing 45 units of course work.

Fellowships and Assistantships

Financial aid is available on a competitive basis for qualified doctoral candidates. This includes a number of fellowships as well as some research assistantships supported by departmental research grants and contracts. Although these research assistants work closely with the faculty on their research projects, they usually are able to take close to a full course load. Supplementary financial aid can sometimes be obtained by grading, assisting in special projects, or University loans.

All applicants for financial assistance are required to take the Aptitude Test and the Advanced Test (in the field of the applicant’s choosing) of the Graduate Record Examination.

Applications for fellowships and assistantships should be made to the Financial Aids Office by March 1.

Courses

A. UNDERGRADUATE COURSES

The undergraduate offerings are Operations Research 50, 152, and 153. Operations Research 50 is an introductory course designed for students who wish to become familiar with the basic terminology and ideas of operations research without using any mathematics beyond high school algebra. Important socio-economic problems are analyzed using operations research methods. Operations Research 152 and 153 is a two-quarter introductory sequence which covers the basic concepts of operations research at a post-calculus level. Each technique presented is illustrated by examples drawn from a variety of fields where operations research has been applied.

50. Models and Applications of Operations Research in Society—Analysis of important socio-economic problems by methods of operations research. Problem areas include the environment, health, urban planning, and criminal justice systems. Intended for students in the social sciences or pre-engineering desiring a broad introduction to the potential role of operations research in modern society. (Graduate students enroll in 150.) Prerequisite: high school algebra.

3 units, Win (Hillier) MWF 10:00

150. Models and Applications of Operations Research in Society—Lectures same as 50, but a term paper is required.

3 units, Win (Hillier) MWF 10:00

152. Introduction to Operations Research I — Introduction to deterministic models in operations research. Linear, nonlinear, and dynamic programming. Network analysis, inventory theory, simplex method, transportation problem, dual theorem, convex pro-
gramming, integer programming, structure of deterministic dynamic programming problems, minimax theorem. Matrix notation will be introduced. (Graduate students enroll in 252.) Prerequisite: Mathematics 43.

3 units, Win (Veinott) TTh 4:15-5:30

153. Introduction to Operations Research II—Introduction to stochastic models in operations research. Stochastic processes and their use in analysis of industrial problems. Game theory, minimax theorem. Emphasis on discrete and continuous time parameter Markov chains. Queueing theory, linear and dynamic programming under uncertainty, including the use of certainty equivalents with quadratic costs. (Graduate students enroll in 252.) Prerequisites: 152 and Statistics 40 or 110 or 116 or Mathematics 123.

3 units, Spr (Jacobs) TTh 4:15-5:30

B. COURSES PRIMARILY FOR MASTER'S CANDIDATES AND GRADUATE STUDENTS IN OTHER DEPARTMENTS

These courses are all applications oriented. Operations Research 252 covers the basic concepts of operations research, and its purpose is to acquaint students from other disciplines with the techniques that may be useful in their field. Operations Research 240 is a first course in linear programming, and the sequence 240, 250, 251 forms a basic one-year course in operations research, aimed at students who desire a mathematical science professional career in business, government, or industry. Operations Research 241, 245, 257, 280, and 290A,B form a group of elective courses covering a variety of specialized topics.


240. Linear Programming—This course will survey linear programming, emphasizing standard model formulation, fundamental theorems, variations of the simplex method and parametric programming. Corequisite: Mathematics 113.

3 units, Aut (Hillier) TTh 1:15-2:30

Sum (——) TTh 1:15-3:00


3 units, Spr (Chvátal) TTh 2:45-4:00

250. Deterministic Models in Operations Research—Formulation, solution, and analysis of mathematical programming models in operations research, including those of integer programming, nonlinear programming, network flow theory, dynamic programming, and game theory. Prerequisite: 240.

3 units, Win (Cottle) TTh 4:15-5:30

251. Stochastic Models in Operations Research—Formulation, solution, and analysis of stochastic models in operations research, including those of queueing theory, inventory theory, Markov processes, simulation, reliability theory. Prerequisites: 250 and Statistics 116 and 218 (concurrently) or Mathematics 124 (concurrently).

3 units, Spr (Iglehart) TTh 4:15-5:30

Sum (——) MW 1:15-3:00

252. Operations Research—For graduate students who have not had the equivalent of 152 and 153. Prerequisites: calculus and Statistics 40, or 110, or 116. May be taken concurrently.

4 units, Aut (——) MW 3:15-5:05

Win (Jacobs) TTh 4:15-6:05

Sum (——) TTh 3:15-5:30

257. Simulation—Random number generators, discrete-event simulations, simulation languages, statistical analysis of the output of simulations, and applications to stochastic models in operations research. Prerequisites: Statistics 40, 110, or 116.

3 units, Win (——) TTh 2:45-4:00

280. Applications of Operations Research—Applications of operations research to important problems arising in business, industry, government, and society will be discussed. Formulation and analysis of complex systems problems. Case studies. Prerequisites: OR 240, 250, 251 (concurrently) or the equivalent.

3 units, Spr (——) MW 4:15-5:30

290A,B. Projects in Operations Research—Case studies and field work. Seminar paper required. Students must enroll in both 290A and 290B to receive credit. Prerequisite: consent of instructor.

290A. 0 units, Win (Manne) T 9:00-11:00
290B. 3 units, Spr (Manne) T 9:00–11:00
290. 3 units, Sum (——) MW 3:15–5:00
299. Independent Study — Intensive study of literature of special topics.
   Any quarter (Staff) by arrangement

C. COURSES PRIMARILY FOR DOCTORAL STUDENTS

These advanced courses are concerned with the development of the mathematical theory of operations research.

314. Matrix Analysis and Inequalities — A study of various topics in matrix theory and inequalities having applications in computer science, operations research and statistics. The subjects covered will be chosen from the following list: matrix factorizations, patterned matrices, determinants, pivot theory, special classes of matrices, linear inequalities, matrix inequalities, moment inequalities, stochastic inequalities, condition number inequalities, unification of certain types of inequalities, extremal problems; integrals and functional equations with matrix argument. Prerequisites: Mathematics 102 or 113, and consent of instructor.

3 units, given 1975–76

340A. Mathematical Programming — Formulation of standard linear programming models. Simplex method and lexicographic resolution of degeneracy. Theory of polyhedral convex sets, linear inequality, alternative theorems, and duality. Matrix games. Variants of the simplex method including the dual simplex method, the revised simplex method with product form of the inverse, and parametric linear programming. Prerequisite: Mathematics 102 or 113, and consent of instructor.

3 units, given 1975–76

340B. Mathematical Programming — Introduction to large-scale linear programming, network programming, integer programming, quadratic programming, and linear complementarity. The decomposition principle and upper bounding methods. Techniques for solving transportation, transshipment, and distribution problems. Cutting plane and enumerative methods of integer programming. Unified treatment linear programming, quadratic programming, and bimatrix game problems via linear complementarity theory and its pivotal methods. Prerequisites: 340A and Mathematics 115 or consent of instructor.

3 units, Win (Dantzig) TTh 1:15–2:30


3 units, Spr (Cottle) TTh 1:15–2:30

341. Large-Scale Systems in Mathematical Programming — Specializes the methods of 340. Development of efficient solution methods for optimizing special large-scale linear inequality systems such as those encountered in control theory, programming in a Markov chain, investment and economic planning, multi-commodity network flows, multi-item production and distribution models; and those that arise as a solution procedure for non-linear, integer, and stochastic programming problems. The decomposition principle, partitioning proposals, compact inverse schemes will be developed and applied to various special structures. The role of flexible computer languages to assist in the experimental development will be discussed. Prerequisite: 340B.

3 units, given 1975–76

344. Methods of Nonlinear Programming — This course is concerned with numerical procedures for solving nonlinear programming problems in finite-dimensional spaces. The algorithms studied will include the steepest descent method, Newton's method, the conjugate gradient method, David-Fletcher-Powell method, feasible direction methods, the gradient projection methods, the generalized reduced gradient method, penalty and barrier function methods, cutting plane methods and fixed point methods. Students will be encouraged to use the computer to gain acquaintance with the nonlinear programming problems and their solution. Prerequisite: 340C.

3 units, Spr (Veinott) TTh 8–10

346. Combinatorial Optimization — Optimization over discrete grids and lattices. Fib

3 units, Spr (Wilde) MWF 11


3 units, Spr (Jacobs) TTh 9-11


3 units, Aut (Lieberman) TTh 1:15-2:30

356. Inventory Theory — Characterization and computation of optimal inventory policies for single and multi-item dynamic inventory models with convex or concave cost functions and known or uncertain requirements. Myopic policies. Bayes and minimax policies. Multi-echelon models. Prerequisites: 340C and 351, or consent of instructor.

3 units, Aut (Veinott) TTh 8-10

358. Queuing Theory—Structure of queuing processes, limit theorems for single and multiple server queues in light and heavy traffic. Emphasis will be on non-parametric assumptions and classical limit theorems. Prerequisite: 359.

3 units, Win (Harrison) TTh 2:45-4:00


3 units, Spr (Iglehart) TTh 8-10

360. Advanced Applied Probability—This course will cover basic topics in applied probability at the advanced probability (measure theoretic) level. Topics selected from renewal theory, random walks, functional limit theorems, diffusion processes. Extremal processes, and point processes. Prerequisites: 359; Mathematics 230A,B, or Statistics 230A,B,C.

3 units, given 1975-76

363. Analysis of Competitive Strategies—(Enroll in Business 363.) This course extends the basic concepts and methods of decision analysis and noncooperative games to the analysis of competitive strategies under uncertainty.

4 units, Spr (Wilson) by arrangement

370. Seminar in Mathematical Programming—Advanced topics. Prerequisite: 340B.

3 units, Spr (Cottle) by arrangement

371. Seminar in Combinatorial Analysis and Integer Programming—Advanced topics.

3 units, Win (Chodtal) by arrangement

372. Seminar in Nonlinear Programming—Advanced topics. Prerequisite: 340C.

3 units, given 1975-76

375. Seminar in Network Theory — Advanced topics. Prerequisite: 345.

3 units, given 1975-76


3 units, given 1975-76

377. Seminar in Game Theory—Advanced topics.

3 units, given 1975-76

381. Seminar in Dynamic Programming — Advanced topics. Prerequisites: 351 and Mathematics 205A.

3 units, given 1975-76

384. Seminar in Applications of Point Processes.

3 units, Spr (——) by arrangement

385. Seminar in Reliability Theory — Advanced topics. Prerequisite: 355.

3 units, given 1975-76
386. Seminar in Inventory Theory — Advanced topics.
   3 units, given 1975–76

387. Seminar in Probabilistic Models — Advanced topics. Prerequisites: 359 and Mathematics 230A.
   3 units, Aut (Jacobs) by arrangement

388. Seminar in Queueing Theory — Optimal design and control of queueing systems. Prerequisite: 358.
   3 units, given 1975–76

389. Seminar in Applied Probability — Advanced topics. Prerequisite: 359 or consent of instructor.
   3 units, Win (Iglehart) TTh 8–10

390A,B. Advanced Topics in Operations Research. Two seminars will be offered, topics to be announced. Prerequisite: second-year graduate standing or consent of instructor.
   3 units, Sum (——) by arrangement
   3 units, Sum (——) by arrangement

   Any quarter (Staff) by arrangement

468. Multi-Person Decision Theory — (Enroll in Business 468.) Subjects covered include methodology and applications of welfare economics; axiomatic theory of social choice, including revealed preference theory, Arrow's Possibility Theorem and related results; game-theoretic analysis of exchange, public goods, and voting processes.
   4 units, Win (Wilson) by arrangement

469. Management Science Workshop — (Enroll in Business 469.) Seminar in Mathematical Programming approaches to Capital Budgeting of interrelated projects.
   4 units, Aut (Hillier) TTh 4:10–5:45
   Spr (Staff) MF 10:00–12:00
ORGANIZATION

The School of Humanities and Sciences includes all members with the rank of instructor or above of the Departments of Anthropology, Applied Physics, Art, Asian Languages, Biological Sciences, Chemistry, Classics, Communication, Computer Science, Drama, Economics, English, French and Italian, German Studies, History, Humanities Special Programs, Mathematics, Music, Philosophy, Physics, Political Science, Psychology, Religious Studies, Slavic Languages and Literatures, Sociology, Spanish and Portuguese, and Statistics, and of the Committee on Linguistics.

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, Interdepartmental Major, Physical Sciences General Program, and Social Sciences Special Program in following sections of this bulletin) should consult the Director of Special Programs in the Humanities, the Dean of Undergraduate Studies, the Chairman of the General Program in the Physical Sciences, or the chairman of the interdepartmental program 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.

The School of Humanities and Sciences offers several survey courses in Geography which are listed separately in this publication. It is not possible, however, for a student to elect Geography as a major or minor field.

GRADUATE PROGRAMS

Candidates for the degree of Master of Arts, Master of Science, or Doctor of Philosophy should consult appropriate sections of the announcements following and should also consult the department in which they intend to specialize.

For regional, area studies, or other special graduate programs leading to the degree of Doctor of Philosophy, see listing under Graduate Division Special Programs.

UNDERGRADUATE PROGRAM IN AFRICAN AND AFRO-AMERICAN STUDIES

Committee-in-Charge: Thom Rhue, Acting Chairman, St. Claire Drake, Sr. Research Associate, David Abernathy, Frederick Bowser, Cedric Clark (X), John Cochran, Barbara Hatton, Paul Erwin, Tetteh Kofi, Philip McGee, Bridget O’Laughlin; Student Representatives: Glenn Jordan, Glenn Nance.

STATEMENT OF PURPOSE

This interdepartmental program is designed as a major sequence for students who
wish to increase their knowledge and understanding of what is sometimes referred to as “The Black Experience,” combined with training in a traditional academic discipline. The focus is upon sub-Saharan Africa and those societies in the Western Hemisphere where peoples of African descent are a significant element in the population.

ADMISSION TO THE PROGRAM

Students interested in majoring should consult with the Chairman of the Committee in Charge. Ordinarily, students should declare a major by the last quarter of the sophomore year.

REQUIREMENTS

A major involves 50 units of credit for a bachelor’s degree in African and Afro-American Studies. Twenty-five of these will be in “core” courses, i.e. the Core Seminar and 20 units from departmental offerings. An additional twenty-five units are to be presented as “collateral” courses; and, normally, these will be earned in one department with which the student has chosen an affiliation. Majors in the Program may offer an African language, Hausa, Swahili, or Yoruba, for core course units.

The precise content of each student’s program will be worked out in consultation with an adviser from the department with which he or she is affiliated. In the senior year each student will write a substantial research paper or carry out a comparable project in consultation with his or her adviser. (Program requirements may change in Autumn quarter 1974.)

CORE COURSES

African and Afro-American Studies 101, Core Seminar, is offered during the Winter Quarter. Emphasis is upon recurrent themes in relations between peoples of Africa and populations of African descent in the New World since 1500 A.D. Concepts and methods used in studying the impact of the various segments of “The Black World” upon each other are examined by case analysis (e.g., Pan-African movements and cultural retentions and reinterpretations in religion, music, art, language, and social institutions).

COURSES OFFERED BY DEPARTMENTS

ANTHROPOLOGY

104. Race and Culture Contact in the Caribbean
   MWF, 5 units (Drake) Spr

109. Peoples of Africa
   MWF, 5 units (O’Laughlin) 10:00, Win

110. Urbanization in African Societies
   MWF, 5 units (Drake) 10:00, Aut

111. Myth and Ritual in Sub-Saharan Africa
   MWF, 5 units (O’Laughlin) 2:15 Spr

135. Racism and Power: Anthropological Perspectives
   MWF, 5 units (Drake) 11:00, Win

147. Socio-Political Integration in Contemporary Africa
   MWF, 5 units (Drake) Spr

150. African Systems of Production
   5 units (O’Laughlin) given 75-76

269. Languages of Africa
   5 units (Greenberg) given 75-76

ECONOMICS

106. The World’s Food Economy
   3 units (Johnson) Aut

109A,B. Undergraduate Workshop in World Food Problems
   5 units (Jones, Taylor) Win, Spr

109. An Introduction to Welfare Theory
   5 units (Scitovsky) Spr

118. Economics of Underdevelopment
   (Same as Economics 118),
   MTWThF, 5 units (Yotopoulos) Aut

127A,B. Economic Development Problems of Third World Economies with Colonial Heritage I and II
   5 units (Kofi) Win

160. Trade and Development Problems of Tropical Africa
   3–5 units (Pearson)

ENGLISH

161. Afro-American Fiction
   5 units (Rampersad) Win

HISTORY

147. Kingdoms of Africa: Society and History
   4–5 units (Jackson) Spr
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Instructor</th>
<th>Credits</th>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>148</td>
<td>African Resistance to Colonialism</td>
<td>5</td>
<td>Jackson</td>
<td></td>
<td>Win,</td>
</tr>
<tr>
<td>148A</td>
<td>The History of West Africa</td>
<td>5</td>
<td>Irwin</td>
<td></td>
<td>Aut</td>
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<tr>
<td>157A</td>
<td>Afro-American History to 1865</td>
<td></td>
<td>Carson</td>
<td>MTWThF</td>
<td>9:00 Aut</td>
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<tr>
<td>157B</td>
<td>Afro-American History Since 1865</td>
<td></td>
<td>Carson</td>
<td>MTWThF</td>
<td>9:00 Aut</td>
</tr>
<tr>
<td>182</td>
<td>Latin America and the African</td>
<td>4-5</td>
<td>Bouser</td>
<td></td>
<td>Win</td>
</tr>
<tr>
<td>247</td>
<td>Undergraduate Colloquium: Realism, Romanticism and the African Intellectual</td>
<td>5</td>
<td>Jackson</td>
<td></td>
<td>Win</td>
</tr>
<tr>
<td>248</td>
<td>Undergraduate Colloquium: Religion and Social Protest in Colonial Africa</td>
<td></td>
<td>Irwin</td>
<td>T</td>
<td>2:15-4:05 Aut</td>
</tr>
<tr>
<td>249H</td>
<td>Senior Honors: Research in African History</td>
<td>1-5</td>
<td>Irwin, Jackson</td>
<td></td>
<td>Aut</td>
</tr>
<tr>
<td>254S</td>
<td>Undergraduate Seminar: Afro-American and Other Social Movements in 20th Century America</td>
<td>5</td>
<td>Carson</td>
<td></td>
<td>Aut</td>
</tr>
<tr>
<td>277</td>
<td>Ethnic and Institutional Stereotypes as Factors in U.S.–Latin American Relations</td>
<td></td>
<td>Johnson</td>
<td>W</td>
<td>2:15-4:05 Spr</td>
</tr>
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</table>

**Food Research Institute**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<th>Credits</th>
<th>Terms</th>
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<tr>
<td>118</td>
<td>Economics of Underdevelopment</td>
<td></td>
<td>Yotopoulos</td>
<td>MTWThF</td>
<td>10:00 Aut</td>
</tr>
<tr>
<td>150, 151</td>
<td>World Food Problems (Same as Econ 108A,B)</td>
<td>5</td>
<td>Jones, Taylor</td>
<td>Win, Spr</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>Trade and Development Problems of Tropical Africa (Same as Econ 160)</td>
<td></td>
<td>Pearson</td>
<td>MW, 3-5</td>
<td>units</td>
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**Linguistics**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<th>Instructor</th>
<th>Credits</th>
<th>Terms</th>
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<tbody>
<tr>
<td>185A,B,C</td>
<td>Beginning Hausa</td>
<td></td>
<td>Leben</td>
<td>MTWThF</td>
<td>12:00 Win, Spr</td>
</tr>
<tr>
<td>186A,B,C</td>
<td>Intermediate Hausa</td>
<td></td>
<td>Staff, by arrangement</td>
<td>Aut, Win, Spr</td>
<td></td>
</tr>
<tr>
<td>190A,B,C</td>
<td>Beginning Swahili</td>
<td>5</td>
<td>Staff</td>
<td>Aut, Win, Spr</td>
<td></td>
</tr>
<tr>
<td>191A,B,C</td>
<td>Intermediate Swahili</td>
<td>5</td>
<td>Staff</td>
<td>Aut, Win, Spr</td>
<td></td>
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</table>

**Political Science**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>118A</td>
<td>Government and Politics in Tropical Africa</td>
<td></td>
<td>Abernethy</td>
<td>MWF, 5</td>
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<tr>
<td>118B</td>
<td>Government and Politics in Southern Africa</td>
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<td>Abernethy</td>
<td>MWF, 5</td>
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<tr>
<td>131C</td>
<td>International Dependency</td>
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<td>Abernethy</td>
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**Psychology**

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<tr>
<td>124</td>
<td>Communication and Community Psychology I, II</td>
<td></td>
<td>Clark</td>
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<tr>
<td>235B</td>
<td>Seminar in African Psychology I, II, III</td>
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<td>Clark</td>
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**Sociology**

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<tr>
<td>160</td>
<td>Ethnic Relations in Modern Society</td>
<td></td>
<td>Hannon</td>
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**Drama**

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<tr>
<td>126A,B,C</td>
<td>Black Performing Arts</td>
<td></td>
<td>Cochran</td>
<td>TTh, 3-5</td>
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**Service Courses**

The Program also administers three courses for the Black Students Volunteer Service Center:

**African and Afro-American Studies: 130A, B,C. Toward Relevant Counseling**—A laboratory course designed to train Stanford students in skills and attitudes needed to counsel Black students in elementary, junior, and high schools. Combines seminar with tutoring and counseling in public schools.

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<tr>
<th>Course Code</th>
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<tr>
<td>130A</td>
<td>3 to 5 units, Aut (Staff) T 7:00–10:00. Field-work by arrangement</td>
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<tr>
<td>130B</td>
<td>3 to 5 units, Win (Staff) T 7:00–10:00. Field-work by arrangement</td>
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<tr>
<td>130C</td>
<td>3 to 5 units, Spr (Staff) T 7:00–10:00. Field-work by arrangement</td>
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**133A,B,C. Cultural Awareness and Sociological Perspectives**—Combination of semi-
narr and field-work designed to provide participation in community situations and to develop analytical skills needed for working with teachers and students concerned with education of Black children and youth. Instruction in preparation of field-reports, and material for use in curriculum, K-12.

133A. 3 to 5 units, Aut (Staff) T 7:00–10:00. Field-work by arrangement
133B. 3 to 5 units, Win (Staff) T 7:00–10:00. Field-work by arrangement
133C. 3 to 5 units, Spr (Staff) T 7:00–10:00. Field-work by arrangement

136A,B,C. Urban Educational Experiences—Reading, discussion, and participant-observation related to the problems of providing meaningful and adequate education for residents of Black communities. Emphasis upon gaining an understanding of the role of public schools and of institutions providing alternative education in the process of Black community development.

136A. 3 to 5 units, Aut (Staff) T 7:00–10:00. Field-work by arrangement
136B. 3 to 5 units, Win (Staff) T 7:00–10:00. Field-work by arrangement
136C. 3 to 5 units, Spr (Staff) T 7:00–10:00. Field-work by arrangement

ANTHROPOLOGY

Chairman: Frank A. Cucian


Associate Professors: Farumi Befu, Arthur P. Wolf (on leave Winter, Spring)

Assistant Professors: George A. Collier, Jane F. Collier, M. Bridgett O’Laughlin, Michelle Z. Rosaldo (or leave Autumn), Renato I. Rosaldo, Jr. (on leave Autumn), Ezra B. W. Zubrow. Acting: James A. Fox, Harriet Whitehead

Lecturers: Suzanne Chevalier-Skolnikoff (Autumn quarter), Louise S. Spindler (on leave 1974–75)

OFFERINGS AND FACILITIES

The courses offered by the Department of Anthropology are designed (1) to provide undergraduate students 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.

PROGRAMS OF STUDY

BACHELOR OF ARTS

There are three different undergraduate programs leading to the Bachelor of Arts degree with a concentration in Anthropology. General requirements for all majors are as follows:

Students wishing to declare a major in Anthropology must apply to the Department’s Committee on Undergraduate Studies. The Committee will appoint an adviser with whom the student will plan a program of courses which satisfies the requirements for the major and meets the needs and interests of the student. The Department maintains a file for each student who declares for the major, which documents progress toward fulfilling the degree requirements. It is the individual student’s responsibility to make certain that these records are kept up to date.

All majors are required to have or attain a reading competence in a modern foreign language. The language requirement may be met by certification in writing from the department involved that the student has demonstrated a reading proficiency in a foreign language, by presentation of superior S.A.T., G.R.E., or comparable foreign language placement scores.

To transfer from another major into Anthropology after the beginning of his or her junior year, the student must have a grade of B or better in all letter-graded courses previously completed which are to count toward the Anthropology degree requirements.

In the course work that is to count for the Anthropology degree requirements, only 5 units may be taken for pass/no credit grad-
ing; the remaining required units must be taken for letter-grading.

**Major in Anthropology.** For the regular Bachelor’s degree in Anthropology, 45 units of course work are required. Five units of course work in either Psychology or Sociology may be counted toward the major. The remaining 40 units must be in Anthropology and must include: Anthropology 1. To obtain a balanced view of the field, students are required to take at least one course in each of the following topics: (a) Archaeology and Physical Anthropology — 5, 170–179, 270–279; (b) Ethnographic area—100–119, 200–219; (c) Socio-cultural Theory — 120–159, 220–259; (d) Linguistics—3, 160–169, 260–269. Undergraduate majors are encouraged to seek admission to 100- and 200-level seminars but students who wish to take a particular course are advised to plan ahead to be sure of having fulfilled required prerequisites. Undergraduates may also take part in field work on local archaeological sites (Anthropology 180), obtain training in museum methods by doing directed research relating to the Stanford anthropological collections (Anthropology 182), or apply for summer funds to support field research in social anthropology.

**Honors Program in Anthropology.** The Honors Program in Anthropology is open to all majors who have a 3.5 grade point average in Anthropology courses, who have successfully completed Anthropology 199, and who wish to pursue a program of independent research culminating in an honors thesis in their senior year. Candidates of sophomore or junior standing should apply for admission to the Honors Program with the Department’s Committee on Undergraduate Studies no later than the end of the fourth week of the spring quarter. The application should include a transcript, a short paper, and a letter of recommendation from the professor who will supervise the honors project. Students who do not meet all the requirements but who wish to be considered for admission to the honors program should petition the Committee on Undergraduate Studies for special consideration. Successful applicants will meet on a regular basis with their advisers and will be required to attend a non-credit seminar on research methods during the fall quarter of their senior year. The completed honors thesis must be presented to the student’s honors adviser no later than four weeks prior to the end of the quarter in which graduation is anticipated.

For the Bachelor’s degree in the Honors Program, 50 units of course work are required. Ten units of course work in either psychology or sociology may be counted toward the major. The remaining 40 units must be in Anthropology, fulfilling the distribution requirements for the regular major, and including at least 5 units of Anthropology 195. Students wishing to write an honors thesis without following the above program may petition for special consideration to the Undergraduate Committee. This petition must be supported by a faculty member who agrees to supervise the writing of the honors thesis and who will accept the responsibility for finding a second reader for the thesis.

**Major in Social Sciences (Anthropology).** The Major in Anthropology who is interested in pursuing an approved program of interdisciplinary study in the social sciences may wish to declare for the Bachelor’s degree in “Social Sciences (Anthropology).” To do so, students must declare for this program no later than the beginning of the winter quarter of their junior year.

For the Bachelor’s degree in Social Sciences (Anthropology), 50 units of course work are required. Thirty units must be Anthropology and must include Anthropology 1. The remaining 20 units must be selected in consultation with the adviser from the course offerings of one or more other departments in the social sciences (Communication, Economics, Political Science, Psychology, Sociology) and, with special arrangements, Linguistics.

Students wishing to combine concentration in anthropology with an interdisciplinary interest not represented by a field in the social sciences (e.g., Classics) are advised to arrange for a special major in the University’s Interdepartmental Major Program.

**Advanced Degrees**

Prospective graduate students should apply formally through the Graduate Admissions Office, which will submit their names to the Department for approval when application requirements are completed.

An applicant for admission to graduate work must file a report of his or her scores on the Aptitude Test of the Graduate Record Examination. This examination may be taken at most American universities (see
your Registrar for further information). Applicants who do not have access to testing centers should write to the Educational Testing Service, Box 955, Princeton, New Jersey 08540, for possible arrangements, or notify the Department.

The Department of Anthropology offers the Master of Arts and the Doctor of Philosophy degrees. The Master of Arts degree is normally granted as a step toward eventual fulfillment of requirements for the Doctor of Philosophy degree. Ordinarily the Department will not admit students who wish to work only toward the Master of Arts degree unless they are enrolled in a Ph.D. or M.D. program in another division of the University.

**MASTER OF ARTS**

The requirements for the Master of Arts degree consist of residence at Stanford University as a graduate student for one year, with a minimum of 45 quarter units in Anthropology with a grade of B or better in each course, and additional graduate or undergraduate course work in anthropology or a discipline in which the student is a doctoral candidate. Specific requirements will be determined by the department depending on the student's program.

**ANTHROPOLOGY MINOR**

The requirements for a Minor in Anthropology are the same as those for the Master of Arts as described in the preceding section.

**DOCTOR OF PHILOSOPHY**

The Doctor of Philosophy degree is earned by fulfilling the following requirements:

1. Pass during the first year, at an acceptable graduate level, four of the courses designated as “core courses” by the faculty.
2. Submit an acceptable, substantial research paper in the Spring Quarter of the first year.
3. Gain teaching experience by serving as a teaching apprentice during one quarter of graduate work, normally during the second year.
4. By the end of the second year pass, at a satisfactory graduate level, four courses distributed in at least two of the following areas: Archaeology, Biological Anthropology, Linguistics, Statistics.
5. Pass, by the end of the second year of graduate study, an examination in a foreign language in which there exists a substantial body of literature relevant to the student's program of study.
6. Pass a Special Examination (written and oral), normally given during the Spring Quarter of the second year or the Autumn Quarter of the third year, covering the candidate's major topic of specialization and one major ethnological area of the world. The oral part of this examination is normally taken as the University Oral.
7. Prepare a dissertation proposal to be approved by the student’s dissertation committee before undertaking field-work.
8. Present an approved dissertation based upon independent research.

**FINANCIAL SUPPORT**

The Department endeavors to provide financial support (tuition plus scholarship) when needed, to anyone admitted as a graduate student and maintaining a satisfactory level of graduate work.

**INTRODUCTORY COURSES**

**LECTURES**

1. Cultural Anthropology — An introduction to social and cultural anthropology, including the assumptions underlying various approaches, the interaction between man's institutions and his biological characteristics, and the relation of language to culture.
   5 units, Aut (Wolf) MTWThF 1:15
   5 units, Spr (Gibbs) MTWThF 1:15

   5 units, Aut (Ferguson, Greenberg, Huntington, Staff) MWF10

3. 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, Win (Gerow) MWThF 10
UNDERGRADUATE AND GRADUATE COURSES

100. Seminar on Mayan Ethnohistory: Astronomy and Astrological Symbology of the Maya—The course will focus on the Codex Dresden, but material will also be drawn from classical and modern ethnographies. In addition to its inherent interest, the course provides a foundation for future courses on Mayan paleography and epigraphy. No prerequisites, but knowledge of Spanish or German would be very helpful.

5 units, Spr (Fox) MW 4:15-6:05

102. Natives of North America—Lecture and seminar format on the history, cultural background, and contemporary situation of major tribes and groups in North America. (Graduate students enroll in 202.)

5 units, Aut (Zubrow) TTh 3:15-5:05

103. Peoples of Mesoamerica—Lecture course surveying the cultural development culminating in the high preconquest civilizations of Mexico and Guatemala, and tracing postconquest changes in Indian peasant traditions. Emphasis falls on the broader contexts of Mesoamerican society since the time of the Spanish conquest. Not open to those who have completed 105A,B.

5 units, (Staff) given 1975-76

104. Race and Culture Contact in the Caribbean—Lecture course on types of social systems and cultural patterns in the West Indies arising from relations between Europeans, West Africans, and Asians, with implications for development and social change.

5 units, Aut (Drake) MWF 10

105. Peoples of Latin America—Survey of cultural development culminating in high preconquest civilizations of Mesoamerica and South America. Tracing postconquest continuities and changes in indigenous cultures. Consideration of broader contexts of Latin American society since Spanish conquest and significant of regional variations. Lecture course. Credit offered only for two-quarter continuous enrollment.

5 units, Win (G. Collier and R. Rosaldo) MWF 11

5 units, Spr, (G. Collier and R. Rosaldo) MWF 11

109. Peoples of Africa—An introduction to the ethnography, languages and prehistory of sub-Saharan Africa; special attention will be given to the analysis of problems in the African literature which have led to theoretical advances within social anthropology. Lecture course.

5 units, Aut (O’Laughlin) MWF 9

110. Urbanization in African Societies—Seminar on ancient centers for urbanism; types of cities arising from contact with Europeans; social problems incident to rapid urbanization; city planning and theoretical issues.

5 units, Spr (Drake) MWF 10

111. Myth and Ritual in Sub-Saharan Africa—Analysis of particular systems of African folklore: myth, cosmology, tales, legends, epics, and science; the dialectic of transformations between belief and action systems; the mediation of ritual in such transformations. Seminar course. Limited enrollment. Prerequisite: consent of instructor.

5 units, Win (O’Laughlin) MWF 2:15

112. Religion and the Family in China—Lecture course analyzing family life and religion in traditional and Communist China. The analysis is presented as an example of anthropological interpretation, and attention is given to the theoretical implications of the Chinese case.

5 units (Wolf) given 1975-76

115. Peoples of Island Southeast Asia—A survey of history and the contemporary situation of ethnic peoples in Indonesia, the Philippines, Madagascar, and portions of Malaysia. Among topics discussed are: prehistory, the process and impact of colonization, the contrast between hill and valley peoples, subsistence modes, social organization, and religion.

5 units (M. and R. Rosaldo) given 1975-76

116. Japanese Society and Culture—Racial, cultural, social characteristics, and background. Relationships between the Japanese and other peoples of East Asia. Opportunities for reading in special subject areas. Prerequisite: 1 or consent of instructor. Lecture course.

5 units, Aut (Befu) MWF 11

117. Traditional Chinese Society—Course of lectures which analyses the society, culture, polity, and economy of late traditional China as a total system. Secondary attention
is given to the nature of premodern social change. Prerequisite: 1 or Sociology 1 or 3 or consent of instructor.

5 units, Aut (Skinner) MWF 10


5 units, Win (Siegel) MWF 1 1:15

120. Primitive Curers—Seminar primarily for advanced anthropology majors and anthropology graduates, centering on the recruitment and performance of such ritual specialists as shamans, medicine men, midwives, bone setters, spirit mediums, and diviners, and on the nature of their supernatural powers. Initially instructor will present Mayan Indian case material; thereafter participants will discuss readings and plans for individual term papers. Limited enrollment. Prerequisite: consent of instructor.

5 units, Spr (Befu) MWF 4 1:15

121. Cultural Evolution—Examination of theories of origins and development of culture. Biological, linguistic, archaeological and ethnological approaches are combined for analysis. Lecture course.

5 units, Spr (Befu) MWF 4:15-6:05

122. Social Movements—Seminar on Cultural Process—Typology of social movements. Consideration of such social problems as origins, recruitment to membership, organization, and group-environment interaction. Attention paid to competing theories (e.g., collective behavior, revitalization, relative deprivation, cognitive dissonance, stress-strain relations). Relation to peasant and national movements. Examples drawn principally from North America, Latin America, Africa and Europe. Prerequisite: consent of instructor. (Graduate students enroll in 222.)

5 units, Win (Siegel) Th 3:15-4:05

125. Cultural Dynamics—Interrelations between cultural, social, psychological processes; innovation, group responses to stress, social and cultural transformations, social implications of economic and political development. Lecture course. Prerequisite: 1 or consent of instructor.

5 units, Win (Siegel) MWF 1 1:15

126. Culture Change—Long and short range processes and theories of sociocultural growth and change, including cultural evolution, diffusion, syncretism, acculturation (culture contact), and directed culture change, with illustrative examples drawn from Mesoamerica and other culture areas. Prerequisite: 1 or consent of instructor. Lecture course.

5 units (Paul) given 1975-76

127. Applied Anthropology—A course focusing on the interplay between anthropological theory, methods, and findings; and the instigation, study, ethics, and findings of planned culture change and action programs. Consideration of domestic and overseas programs of technological change, community and national development, and urban migration and relocation. Students will be encouraged to study or participate in action programs. Lecture course. Prerequisite: 1 or consent of instructor.

5 units, Spr (Barnett) MW 3:15-5:05

129. Seminar on Ethnic Boundaries—Seminar investigating the nature of ethnicity, the mechanisms of ethnic boundary maintenance, and the role of ethnic groups in social, cultural, and ecological systems.

5 units, Aut (Frake) MW 3:15-5:05

130. Social Stratification—Seminar on systems of social and economic inequality in small communities in comparative perspective. Attention will be given to egalitarian societies. Prerequisite: four or five courses in anthropology and/or sociology. (Graduate students enroll in 230.)

5 units, Aut (Cancian) TTh 2:15-4:05

131. Comparative Social Systems—Lectures and discussion to provide a common framework for comparative analysis of societies involving the interrelationship of resources, technology, and social systems in adaptation to environmental constraints and opportunities. An examination of case materials from film, lectures and reading on societies of increasing degree of scale (popu-
lation size, density and differentiation) in the anthropological literature.

5 units (Siegel) given 1975-76

132. Social Exchange—Examination of the concept and theory of exchange as a fundamental process in human behavior. Analysis of such phenomena as gift exchange, potlatch, kula ring, cross-cousin marriage, compadrazgo, jajimani system, dyadic contract, from point of view of exchange theory. Lecture course.

5 units, Win (Befu) TTh 3:15-5:05

133. Kinship and Social Organization—Analysis of interpersonal and group relations in terms of kinship; cultural notions of marriage, parenthood, the family, and intergroup principles of alliance and enmity.

5 units, given 1975-76

134. Peasant Society and Culture—Analysis of peasantry as a concept, its community structure and personality, its interrelation with the outside world. Prerequisite: 1 or consent of instructor.

5 units, given 1975-76

135. Racism and Power: Anthropological Perspectives—Distinction between the use of the concept of race in physical anthropology and its use as a social category; the functions of racism as distinguished from ethnocentrism within various types of social systems; the historical role of anthropology in research and social action related to racism and its consequences. Lecture course.

5 units (Drake)

138. Women in Cross-Cultural Perspective—(Same as Mod. Thought and Literature 248) A lecture course on various traditional anthropological concerns as these are illuminated by a study of the position and behavior of women. Topics will include: the place of women in kinship, political, economic, and ritual systems.

5 units, Aut (J. Collier, M. Rosaldo) TTh 1:15-3:05

141. Marginal Religions in America—(Same as Modern Thought and Literature 241.) Seminar, examining the alternate and "underground" religious traditions in America, the sorts of groups that embody them, and their relationship to the mainstream culture. Prerequisite: consent of instructor.

5 units, Win (Whitehead) MW 3:15-5:05

142. Symbolic Anthropology—Seminar on the past and current trends in the analysis of symbolism and symbolic action in primitive ritual, myth, and social organization. General theories of the symbolic process will be covered as well as particular methods of analysis and interpretation.

5 units, Aut (Staff) given 1975-76

143. Anthropological Approaches to the Study of Religion—(Same as Modern Thought and Literature 249.) An examination of religious symbolism, belief and practice in light of major social science theories of religion.

5 units, Aut (Whitehead) TTh 10-11:50

144. Mythology and Folklore—Anthropological contributions to understanding these fields of human activity; comparisons with Western literature. Lecture course.

5 units, Aut (Gerow) MWF 11

145. Political Anthropology — A lecture course reviewing findings of anthropologists about politics in primitive, historical and developing societies. Critical examination of alternative approaches to political anthropology, comparative analysis of political systems in these societies, and consideration of the relevance of anthropology to contemporary politics. Prerequisite: 1 or consent of instructor.

5 units, Aut (J. Collier) MWF 9

146. Anthropology of Law — Theories of law, social control and conflict resolution set in ethnographic perspective. Prerequisite: consent of instructor.

5 units, Win (J. Collier) to be arranged

147. Socio-Political Integration in Contemporary Africa—Seminar on “Westernization” and “Modernization” as specific forms of the acculturation process; neocolonialism and decolonization since World War II; civilian and military elites in the resolution of conflicts arising from shifts in power, authority, and legitimacy, and from the continuing viability of ethnic and kin loyalties as well as traditional political structures. (Graduates enroll in 247.)

5 units, Spr (Drake) TTh 4:15-6:05

150. African Systems of Production — The interrelationship of environment, technology, historical processes and the social organization of production in selected societies
of rural sub-Saharan Africa. (Graduate students enroll in 250.)

5 units (O'Laughlin) given 1975-76

151. Economic Anthropology — The economic organization of tribal and peasant peoples; special attention to systems of social and economic stratification and problems of economic change in peasant societies. Lecture course.

5 units (Cancian) given 1975-76

152. Anthropology and Demography — A seminar devoted to the relationship between family organization and population trends, including the problems involved in determining the frequency of various forms of marriage, adoption, and the quantitative characteristics of the family cycle. Special attention will be given to the Chinese, Japanese, and pre-modern Western European cases. Limited enrollment. Prerequisite: consent of instructor.

5 units, Win (Frake) Th 3:15-6:05

153. Culture and Agriculture—This seminar will examine systems of subsistence agriculture as culturally maintained ecological systems and will explore the interrelations among agricultural and other cultural systems.

5 units, Win (Frake) MWF 10

154. Cultural Ecology—This lecture course discusses systems of cultural adaptations of human societies to their environments. It considers ecological approaches to archaeological and ethnographic studies, as well as evaluating different theoretical interpretations of the relationship between cultural and ecological systems. Prerequisite: 1 or consent of instructor.

5 units, Spr (Staff) given 1975-76

155. Psychological Anthropology — An examination of the way in which the social and cultural order mold and affect behavior and consciousness; attention to the uses of altered states of consciousness, definitions of normality and abnormality and the way in which psychological theory itself embodies ideological positions.

5 units, Spr (Whitehead) MWF 2:15

158. Personality in Culture—Anthropological contributions to psychological and psychiatric theories of personality formation. Cross-cultural comparative studies leading to hypotheses about cultural determinants of personality structure. Cross-cultural perspective on the notion of "normal" vs. "abnormal" adjustment. Prerequisite: 1 or Psychology 1, or consent of instructor. (Lecture)

5 units (Staff) given 1975-76

159. Cognitive Anthropology — Investigation of the relation between cognitive process and cultural behavior. Selected topics from the fields of perception, language, and belief will be considered. Prerequisite: 1 or consent of instructor.

5 units, Win (Fox) TTh 9-10:50

161. Linguistic Field Methods — (Same as Linguistics 175.) Seminar on rapid introduction to descriptive phonetics, and to principles of phonetic transcription and phonological analysis. Applications to the descriptive analysis of one or more languages, eliciting data in class from native speakers. Limited enrollment. Prerequisite: introductory course in linguistics or consent of instructor. (Graduate students enroll in 261A.)

5 units, Win (Fox) TTh 9-10:50

163. Language and Social Interaction — (Same as Linguistics 247.) Seminar on examining ways in which people use language to signal and create social identities, relationships and meanings. We will explore a number of topics in sociolinguistics, linguistic theory, and the philosophy of language (especially the study of speech acts and performatives) in asking how language shapes and is shaped by the contexts of language use. (Graduate students enroll in 263.)

5 units, Spr (Greenberg) TTh 2:15-4:05

164. Typology and Universals of Language — (Same as Comparative Literature 167. Same as Linguistics 208.) The methodology of structural comparisons of languages; the connection between typological analyses and generalizations about language; universals of language in phonology, grammar, and semantics; problems concerning deductive explanation of universals. Limited enrollment. Prerequisite: elementary linguistic course or consent of instructor. Seminar.

5 units, Spr (Greenberg) TTh 2:15-4:05

166. Language, Society and Culture — (Same as Linguistics 45.) The linguistic basis of culture, the relation of language to culture and society and the role of linguistic data in the reconstruction of history. The course will emphasize three general topics: (1) language and cultural theories (evolutionary, functional, and diffusional), (2) language and cultural change (linguistic and
non-linguistic factors in change), and (3) language and cultural history (especially linguistic evidence for cultural history). Lecture course. Prerequisite: 3 or consent of instructor.

5 units, Win (Greenberg) MWF 3:15

167. Language and Culture—Lecture on the relevance of linguistic theory, semantic analysis, and the study of speech as social behavior to problems of anthropology, sociology, and psychology. Prerequisite: consent of instructor.

5 units (Frake) given 1975–76


5 units, Aut (Fox) MWF 1:15

170. Prehistoric Archaeology of the Old World—Lecture on the methods, findings in this field; correlations of prehistory of Europe and Near East with that of other zones over the world. Prerequisite: 5 or consent of instructor.

5 units, Spr (Zubrow) MWF 9

172. Prehistoric Archaeology of the New World—This course is a survey of the known prehistoric cultural record in terms of both time-space systematics and models for cultural change and growth. It will attempt to assess the adequacy of the models in terms of comparative data from various cultural areas in both North and South America.

5 units (Staff) given 1975–76

173. Development of Civilization—Seminar course considering the archaeological evidence for the development of civilization. Limited enrollment. Prerequisite: consent of instructor.

5 units, Win (Zubrow) given 1975–76

174. Prehistoric Peoples of California—A review of the major available literature in terms of methods, techniques and models of interpreting the life styles of the aboriginal inhabitants of the California culture area and their adaptations to diverse local environments. Such problems as dietary analysis, skeletal analysis and grave-lot analysis will be viewed with the space-time continuum of 7000 years. Relationships with adjoining culture areas (Great Basin, Northwest Coast, Southwest) and with the present-day Indians of California will be explored. Enrollment limited to about 15 students with previous archaeological coursework or experience, or consent of the instructor. Lecture course.

5 units, Spr (Gerow) MW 10–11:50

175. Evolution of Primate Behavior — Introduction to evolutionary theory, including such concepts as population, variation, genetics, the forces of evolution and adaptation, and the process of speciation. Brief survey of the fossil record. Classification, distribution, and general behavioral adaptations of the major groups of contemporary primates. Primate dispersal patterns and their relevance to the evolution of human behavior. Lecture course.

5 units, Aut (Skolnikoff) TTh 1:15–3:05

177. Medical Anthropology—Seminar, analyzing theories of disease and therapy in selected societies, the relation of medical beliefs to other areas of culture, and similar problems of medical anthropological interest. (Graduate students enroll in 277.)

5 units, Spr (Barnett) TTh 4:15–6:05

178. Geological Archaeology (Same as Geology 178. Same as Earth Sciences 178.) This course explores the relationship between a wide variety of archaeological and geological topics through informal classes, geological and archaeological field trips, and the examination of specific problems. Some broad areas of discussion will be: the comparative history, content, and methodology of geology and archaeology; problems in cultural and environmental interpretation; an examination of archaeological data and geochronology; methods of geophysical and archaeological exploration; application of statistical analysis to archaeological and geological problems. The course has no prerequisites and includes guest lectures from the geological and archaeological sciences.

5 units, Win (Zubrow, Harbaugh) W 3:15–6:05

179. Advanced Medical Anthropology — Seminar devoted to examination in depth of selected research problems requiring medical and behavioral science collaboration.
Prerequisite: 177 or consent of instructor. (Graduate students enroll in 279.)

5 units (Barnett) given 1975-76

180. Archaeological Field Methods—Studies, excavations of local archaeological sites, and related work in the Department archaeological laboratory. Prerequisite: 5 or consent of instructor.

4 units (Staff) by arrangement

181. Time Perspective in Anthropological Studies—Seminar for graduate and undergraduate students on anthropological approaches to the study of historical processes in pre-industrial societies; readings on theory and on the integration of linguistic, archaeological and ethnohistorical materials; case-studies of diachronic re-analysis of selected ethnographies. Prerequisite: consent of instructor. (Graduate students enroll in 281.)

5 units (O'Laughlin) given 1975-76

182. Museum Methods—Directed work on anthropological collections. Can be taken for one or two quarters with consent of instructor.

1 to 4 units, Spr (Staff) by arrangement

183. History of Anthropological Theory—(Same as Comparative Literature 183 and Modern Thought and Literature 247.) Undergraduate lecture course in the history of anthropological theory; introduction to seminal controversies and opposed traditions in the analysis of society and culture.

5 units, Spr (O'Laughlin) MWF 2:15

184. Design of Field Research—A seminar on basic issues in research design, with special attention to problems of preparing dissertation proposals and applications for research grants. Limited enrollment. Prerequisite: consent of instructor. (Graduate students enroll in 284.)

5 units, Spr (Cancian) T 2:15-5:05

185. Statistical Methods—Introduction to theory and use of parametric and nonparametric statistics with special emphasis on applications in anthropology. Open to Departmental majors in their senior year and to anthropology graduate students. Continuous enrollment through autumn and winter quarters required for credit. Lecture course.

A. 5 units, Win (G. Collier MWF 2:15
B. 5 units, Spr (G. Collier MWF 2:15

186. Anthropological Research Methods with Implications for Education—(Same as Education 254.) This course will devote primary attention to ethnographic methods and techniques, such as the collection of genealogies and life histories, the interviewing of key informants in depth, various forms of participant observation and the coordinations of such ethnographic approaches with more structured approaches. Students will participate in role-playing or other simulated field situations designed to develop empathy and sensitivity. Where appropriate, students will collect their own field data, or carry out analyses of available live data. Open to all graduate students, and to juniors and seniors with consent of instructor. (Graduate students enroll in 286.)

3 to 5 units, Win (Textor) by arrangement

187. Data Analysis—Training in computer applications and other formal methods of data analysis in anthropology. Limited enrollment. Prerequisite: consent of instructor.

5 units (G. Collier) given 1975-76

188. Methods of Research on the Local Community—The course focuses on theoretical comprehension of, and practical experience with, problems and techniques of anthropological field research. Students will be expected to carry out a project in a suitable Chicano community in the greater Bay Area. Enrollment limited. Prerequisite: consent of instructor.

5 units (R. Rosaldo) given 1975-76

190. Directed Individual Study—For undergraduate students with special needs, and showing capacity to do independent work. Prerequisite: 1 or consent of instructor.

Any quarter (Staff) by arrangement

191. Undergraduate Tutorials—Group tutorials for undergraduate majors in Anthropology.

3 units (Staff) by arrangement 1974-75

192. Seminar on Selected Topics in Anthropology—Normally open to anthropology majors.

5 units, given 1974-75

193. Seminar on Japan—Analysis of, and research on, selected topics on Japan, such as kinship, modernization, industrial organization, demography, urbanization, socio-linguistics, non-verbal communication. Em-
phasis on comparison with other cultures. Prerequisite: 116.

5 units, Spr (Befu) Th 3:15–6:05

195. Honors Program — Directed independent study and honors thesis work for students admitted to this program.

Any quarter (Staff) by arrangement

**Courses for Graduates and Advanced Undergraduates**


203. Mesoamerican Social Organization — Problems in the social organization of Mesoamerica with an emphasis on inter-ethnic relations. Prerequisite: 103 or 105.

5 units (G. Collier) given 1975-76

207. Latin American Peasantry—Seminar treating selected topics in the study of agrarian-based societies of Latin America. Emphasis is on plantation systems, socioeconomic adaptations, and relations between local communities and larger political units. Prerequisite: consent of instructor.

5 units (Siegel) given 1975-76

212. Religion and the Family in China—Seminar analyzing family life and religion in traditional and Communist China. The analysis is presented as an example of anthropological interpretation, and attention is given to the theoretical implications of the Chinese case. Prerequisite: consent of instructor.

5 units, Aut (Wolf) T 3:15–6:05

217. Social Change in Chinese Society—Seminar treating social structure in late Imperial, Republican, and Communist China. Special attention is given social change and problems of cultural and structural continuity. Prerequisite: 112, 117 or 118 or coursework on China in other social sciences, including history.

5 units, Spr (Skinner) MW 1:15–3:05

220. Primitive Curers—See 120.

222. Social Movements—See 122.

226. Mesoamerican Culture Change—Seminar for anthropology majors and graduates on selected topics and problems, with primary or comparative focus on historical and contemporary changes in the culture of communities in southern Mexico and high-land Guatemala. Prerequisite: graduate standing in the Department or consent of instructor.

5 units, Spr (Paul) Th 9–11:50

228. Education and Sociocultural Change — (Same as Education 306C.) This course examines the role of education in modernization from a cultural and social-structural perspective, relying on theories of social and cultural change and on case material from modernizing areas both outside and inside the U.S. The concept of “development” is analyzed in both pan-cultural and culture-specific terms. Role-playing, team research, and other experiential techniques will complement a discussion group format.

5 units, Spr (Textor) TTh 2:15–4:05

230. Social Stratification—See 130.

233. Social Organization — Examination of theories and findings in the area of culturally defined interpersonal relations, focusing on kinship and local group organization. Prerequisite: graduate status in anthropology or consent of instructor.

5 units, Aut (Frake) TTh 9–10:50

234. Comparative Peasant Societies—Seminar treating selected topics in the comparative analysis of traditional agrarian societies. The focus is on urbanization and regional systems, in particular the manner in which the mode and extent of peasant integration and cultural variation reflect the structure of city-centered regions. Prerequisite: consent of instructor.

5 units (Skinner) given 1975-76

235. Kinship and Social Behavior—Analysis of kinship terminologies; relations among terminological systems, social behavior, and social structure; kinship as a principle of social grouping, marriage regulation, and role behavior; examination of the technical vocabulary of kinship studies; training in data elicitation, analysis, and interpretation. Prerequisite: graduate standing or consent of instructor.

5 units (Skinner) given 1975-76

243. Primitive Religion—Readings in classical social theory (Weber, Durkheim, Freud, Levy-Bruhl) on the nature of primitive religion, followed by more contemporary works which continue and further interpretations of such phenomena as religious sects, worship, rites of passage, magic, shamanism,
and dreaming. Prerequisite: consent of instructor.

5 units, Spr (R. Rosaldo) T 9–11:30

244. Structural Studies of Myth—The purpose of this seminar will be to develop a critical language for discussing, evaluating, and applying Levi-Strauss' theories to the study of mythology. The first sessions will involve a discussion of theory; in the last weeks, structural methods will be applied to a body of related myths. Limited enrollment. Prerequisite: consent of instructor.

5 units, (M. Rosaldo) given 1975–76

245. Political Anthropology — Proseminar treating the political process in traditional societies ranging from bands to agrarian civilizations. Attention is also given political development in such societies. Prerequisite: Graduate standing.

5 units, Spr (Skinner) TTh 1:15–3:05


251. Economic Anthropology—Seminar on the economic organization of peasant and tribal peoples; special attention given to the displacement of pre-capitalist modes of production and questions of transition. Prerequisite: Graduate standing or consent of instructor.

5 units, Win (O'Laughlin) TTh 1:15–3:05

255. Advanced Psychological Anthropology — Analysis of selected psychocultural processes, including attention to group and individual adaptations to rapid cultural change and urbanization. Prerequisite: consent of instructor.

5 units, Win (O'Laughlin) TTh 1:15–3:05

263. Language and Social Interaction — See 163.

265. Seminar in Historical Linguistics: Linguistic Change—Survey of types of linguistic change and problems of generalization and explanation in the light of diachronic universals and of contemporary linguistic theory. Prerequisites: 214 and 230, or consent of instructor.

5 units (Greenberg) given 1975–76

268. Ethnographic Semantics—Problems of data elicitation and analysis to uncover systems of lexical meaning in languages not native to the investigator. Seminar participants will work jointly on a selected lexical domain in an unfamiliar language. Limited enrollment; preference will be given to students familiar with descriptive linguistics (including knowledge of phonetic transcription). Prerequisite: graduate standing or consent of instructor.

5 units (Frake) given 1975–76

269. Languages of Africa—(Same as Linguistics 281) A survey of the history of African linguistic investigation, characteristics of African languages, and sociolinguistics in Africa, including the formation of standard languages, language and educational policy, and language in connection with colonialism and national policy.

5 units (Greenberg) given 1975–76

271. Archaeological Anthropology — The relationship of archaeology to the discipline of anthropology as a whole is discussed, emphasizing both theoretical concepts and critical data for modern anthropologists. This course is designed to examine the assumption base, the theories, methods, and data of "paleo-anthropology." This course is designed for the anthropology student who is interested in what archaeology has to offer and for the student who is interested in contemporary archaeological thinking whether or not he has decided to specialize in archaeology.

5 units, Win (Zubrow) Th 3:15–6:05


276. Family Ecology — This seminar acquaints students with a range of family structures in our society and helps the student understand the impact of illness on the family and the effect of the family's behavior on health and disease. Arrangements are
made for each student to follow a family during the quarter, interviewing, observing, and studying them at their home and in a clinical setting. The seminar provides the student with interview and observation skills and sensitizes him to his reaction to others and their reactions to him. It helps the student understand the meaning of illness from the patient's point of view and defines the role, responsibility, and impact of professional intervention. The field experience is supplemented by readings and seminar discussion on topics arising from the field contacts.

5 units (Barnett) given 1975-76

279. Advanced Medical Anthropology—See 179.


283. Seminar: Research Paper—Forum for guiding first-year graduate students in Anthropology in preparation of their required research papers. Prerequisite: graduate standing in Department.

5 units, Spr (M. Rosaldo) by arrangement

284. Design of Field Research—See 184.

286. Anthropological Research Methods with Implications for Education—See 186.

288. Field Training in Cultural Anthropology—Instruction and practice in data gathering methods and analyses in native or ethnic settings. Prerequisites: graduate standing in Department and consent of instructor.

3 to 12 units, Sum (Staff)

290A. History of Anthropological Theory—A historical treatment of the chief theoretical trends in anthropology up to approximately 1930.

5 units, Aut (Greenberg) MWThF 11

290B. The Historical Background of Contemporary Anthropological Theory—A critical treatment of contemporary anthropological theory and its historical background.

5 units, Win (Greenberg) MWThF 11

296. Anthropological Ethics—An exploration of the political, social and personal implications of anthropological research in terms of the ethical problems they pose for practicing anthropologists. Seminar; limited enrollment. Consent of instructor.

5 units, Win (Cancian, G. Collier) MW 4:15-6:05

302. Directed Individual Study — Provides opportunities for advanced students to explore special areas of interest.

Any quarter (Staff) by arrangement

308. Teaching Apprenticeship—Supervised experience as assistant in one undergraduate course.

5 units, any quarter (Staff) by arrangement


Any quarter (Staff) by arrangement

Graduate courses offered in other departments, institutes, and schools within the University may also be elected for graduate credit provided the course concerned is approved by the adviser as fitting into the student's program.

APPLIED PHYSICS

Emeritus: Rudolf Kompfner (Professor)
Chairman: Hubert Heffner
Associate Professors: Malcolm R. Beasley, Robert L. Byer, Vahe Petrosian, Arthur B. C. Walker, Jr., Mitchel Weissbluth
Lecturer: Robert M. White
Senior Research Associates: Bertram A. Auld (Hansen Laboratories, on leave 1974-75), H. John Shaw (Hansen Laboratories), John M. Wilcox (Institute for Plasma Research)

OFFERINGS AND FACILITIES

The program in Applied Physics offers to qualified students with backgrounds in physics or engineering the opportunity for graduate course work and research in those areas of physics which may be relevant to technical applications, and to natural phenomena. These areas include solid state, superconductivity, plasmas, quantum electronics, space science, astrophysics, and physics of biological macromolecules. Student research is supervised by the faculty members listed above and also by various
members of other departments such as Materials Science and Electrical Engineering, who are engaged in related research fields. Research activities are carried out in the W. W. Hansen Laboratories of Physics, the Stanford Electronics Laboratories, the Institute for Plasma Research, and the McCullough Laboratory.

The number of graduate students admitted to Applied Physics is limited. Applications should be received by January 15, 1975. Graduate students may normally enter the Department only at the beginning of autumn quarter.

**Programs of Study**

Requirements for admission to candidacy for the M.S. and Ph.D. degrees in Applied Physics include a Bachelor's Degree in Physics or an equivalent Engineering degree. Students entering the programs from an engineering curriculum should expect to spend at least an additional quarter of study acquiring the background to meet the requirements for advanced degrees in Applied Physics.

The University's basic requirements for the Master's degree are discussed in the section "Degrees" in this bulletin. Thirty-six units of applied physics, physics, engineering, and mathematics are the minimum requirements for the degree. Up to 6 units of transfer credit for post-B.S. work taken elsewhere may be granted by validation in individual cases. Minimum subject matter requirements for the Master's degree include: Applied Physics 213, 215 (or Physics 210, 211); Physics 220 (or Electrical Engineering 342); Physics 221; Physics 230, 231, 232 (or Electrical Engineering 322A, 322B, Applied Physics 237); and two quarters of advanced laboratory (chosen from Physics 200, 201, Applied Physics 354, 356S, 358A, 358B, or Electrical Engineering 329A,B,C). Additional course requirements are 12 units in a major field (such as solid state physics or quantum electronics), 9 units in minor fields (specialized courses outside the major field), and 9 additional units of advanced or specialized courses. The total requirement, including units in research as well as courses, is 80 units beyond the B.S. degree. A minimum grade average of B during the last five quarters is required in the courses taken toward the Ph.D. degree.

**Astronomy, Astrophysics, and Space Science**

Applied Physics students may specialize in one of the above fields. Courses relevant to these studies are offered in Applied Physics and other departments. For further information, please see Courses and Degrees entries on "Astronomy Course Program" and "Space Science and Related Programs."

** Fellowships and Assistantships**

Besides the University fellowships open to all students, there are available in the Department several special fellowships and a number of assistantships involving research. Information on application procedures and deadlines should be obtained from the Graduate Awards Office.

**Courses**

15. The Nature of the Universe — This course is intended to familiarize undergradu-
APPLIED PHYSICS

213. Methods of Theoretical Physics — A course designed to give basic background mathematics needed for physics and engineering. Topics covered will include: operators in function space, eigenfunction expansions, Fourier series, contour integrals, boundary value problems, generalized functions, Green’s function for operators with discrete and continuous spectra, special functions. Prerequisites: Mathematics 130 and 131 or equivalent.

3 units, Aut (Staff) TTh 11:00-12:15

215. Computer Methods for Physicists and Engineers—This course is designed to emphasize the principles behind methods of using the computer. Elementary FORTRAN or ALGOL is assumed and computer exercises will be part of the course. The subject matter is as follows: (1) basic numerical methods — polynomial fitting to functions and data — Lagrange formula, Gauss integration, Tchebyshev polynomials, Padé approximants, fast Fourier transforms, Monte Carlo methods of integration, Newton-Raphson method, differential equations — Euler and Runge-Kutta methods, matrix inversion and solution of simultaneous equations, boundary value problems and eigenvalue methods, partial differential equations; (2) advanced numerical methods and introduction to non-numerical methods—optimization methods, linear programming, ill-conditioned systems and inversion of the Laplace transform; List processing, lambda conversion, recursive functions, Turing machines, introduction to LISP. Prerequisites: Mathematics 113 and 130 or equivalent.

3 units, Spr (Doniach) TTh 11:00-12:15

232, 233, 234. Atomic and Molecular Physics—A systematic development of the structure and interactions of atoms and molecules based on quantum mechanical methods and concepts. Topics will include Dirac, Pauli and Schrödinger formulations, multiplet structure by Racah methods, Hartree-Fock calculations, hyperfine couplings, group theory, vibrational-rotational structure, molecular orbitals, ligand-field theory as well as the physical content of various experimental methods. Prerequisite: Physics 131 or Electrical Engineering 322B.

232. 3 units, Aut (Weissbluth) MWF 11
233. 3 units, Win (Weissbluth) MWF 11
234. 3 units, Spr (Weissbluth) MWF 11

237. Quantum Mechanics of Atomic Sys-
tems—Directed toward application to solid state, magnetics, quantum electronics, etc. Includes the density matrix; quantization of the EM field; second quantization; interaction of EM radiation and matter; multiple-quantum effects. Prerequisite: Electrical Engineering 322B or Physics 231.

3 units, Spr (Heffner) MWF 11

238. Electric and Magnetic Properties of Solids — (Enroll in Electrical Engineering 238.)

239. Solid-State Physics I—The emphasis is on general concepts of solid-state physics and the application to specific problems. Topics include diffraction, energy bands, statistics and equilibrium properties, electron and hole dynamics, transport and optical properties, lattice vibrations, defects and dislocations, phenomenological theory of magnetism and superconductivity. Prerequisite: Physics 57 or equivalent.

3 units, Win (Harrison) MWF 10

240. Solid-State Physics II — Electronic structure as the basis for understanding the properties of matter. Covalent, ionic, and metallic bonding and their relation to energy bands. Crystal structures and the different solid types. Dielectric properties, effective charges and piezoelectricity. Defects, solid surfaces and their properties. Free electrons and bonding in metals. Electronic structure and properties of amorphous materials and glasses. Prerequisite: Physics 57 or equivalent; Applied Physics 239 is not required.

3 units, Spr (Harrison) MWF 10

250. Wave Phenomena in Active Media I— Theory of wave interactions in various active media. Space charge waves in electron beams, plasmas and semiconductors. Instability criteria for growing waves. Applications to various types of devices such as the klystron, the Gunn amplifier and the small signal theory of the avalanche diode. Domain theory of the Gunn oscillator, and the LSA mode. The Read diode, and other types of IMPATT oscillators. Prerequisites: Physics 111 and 122, or Electrical Engineering 244N or the equivalent.

3 units, Aut (Chodorow) TTh 9:00-10:15

251. Wave Phenomena in Active Media II — Interactions of coupled systems. The traveling wave tube, the backward wave tube, and the acoustoelectric amplifier. Normal mode theory and coupled mode theory. Parametric interactions. The Manley-Rowe relations. The principles of various types of oscillators, amplifiers and frequency conversion devices. Illustrative applications from various types of nonlinear media such as varactor diode, harmonic generators and amplifiers, the scattering of light by sound waves in dielectric materials, interactions between sound waves, between light waves, and nonlinear interactions in plasmas. Prerequisite: 250.

3 units, Win (Chodorow) TTh 9:00-10:15


3 units, Aut (Harrison) MWF 10

290. Directed Studies in Applied Physics— Special studies under the direction of a faculty member for which academic credit may properly be allowed. Such studies may include laboratory work or directed reading.

Any quarter (Staff) by arrangement

300. Thesis Research.

Any quarter (Staff) by arrangement


339. 3 units, Win (Staff) MWF 10

340. 3 units, Spr (Staff) MWF 10

354. Solid State Physics Laboratory—Combined lecture and laboratory course which considers fundamental properties of solids including X-ray and crystal structure, phase transition theory, heat capacity, ferroelectricity, magnetism semiconducting and acoustic properties and solid state spectroscopy. Experiments include X-ray and crystal symmetry, phase transition measurements, heat capacity at low temperatures,
acoustic properties, bulk semiconductor measurements and spectroscopy.

3 units, Sum (Staff) MW 9, lab. by arrangement

356S. Superconductivity and Low Temperature Physics Laboratory—Combined lecture and laboratory course which discusses important concepts in superconductivity including phenomenological theories, phase transitions, magnetic properties, type I and II superconductors tunneling and Josephson effect. Experiments include low temperature thermometry and phase transition measurements, magnetic properties, solenoid design, superconducting cavity properties, levitation, power transmission line properties and ac Josephson effect.

3 units, Sum (Staff) MW 9, lab. by arrangement

358A. Quantum Electronics Laboratory I—Combined lecture and laboratory course emphasizing laser theory and device operation. The lasers studied include HeNe, Argon ion, Nd:YAG, CO$_2$, and dye. The topics discussed are properties of lasers, laser theory, Gaussian beam and laser cavities, modulation and Q-switching and interferometry. Experiments are performed with emphasis on laser device properties. Prerequisites: Electrical Engineering 231 and 232 or consent of instructor.

3 units, Win (Byer) MW 9, lab. by arrangement

358B. Quantum Electronics Laboratory II—Combined lecture and laboratory course emphasizing laser interaction with matter. The lasers are considered as a source for optical experiments which include laser modulators, propagation in anisotropic crystals, harmonic generation, Raman, Brillouin and parametric scattering and acousto-optic interactions. Optical pumping atomic and molecular spectroscopy experiments using tunable dye and parametric sources are also possible. Prerequisites: Electrical Engineering 231 and 232, or Applied Physics 358A, or consent of instructor.

3 units, Spr (Byer) MW 9, lab. by arrangement

360. Solar Terrestrial Relations — Origin and characteristics of the solar wind. Magnetosphere and bow wave; radiation belts; aurorae. Phenomena caused by solar flares: interplanetary shock waves; geomagnetic storms; Forbush effect. Prerequisite: Physics 220 or Electrical Engineering 244N, or equivalent.

3 units, Aut (Sturrock) MW 9, alternate years, given 1974–75

361. The Sun and Solar Activity — Photosphere, chromosphere, and corona. Fraunhofer spectrum. The solar cycle. Active phenomena: sunspots, prominences, flares, radio bursts. Prerequisites: Physics 221, Electrical Engineering 244N or equivalent. (Physics 131 desirable.)

3 units, Win (Sturrock) MW 9, alternate years, given 1974–75

362. Physical Processes in Stars — Astronomical data on stars and star clusters; classification; Hertzsprung-Russell diagram. Equations of hydrostatic equilibrium and energy transport; equation of state for normal and degenerate matter; opacity; nuclear and neutrino processes. Stellar evolution from main sequence to white dwarfs, neutron stars and black holes. Prerequisites: Physics 220 or Electrical Engineering 243, or consent of instructor. (Physics 132 desirable.)

3 units, Win (Petrosian) MW 11, alternate years, given 1974–75

363. Seminar in Astrophysics—Limited enrollment. Study of the principles and techniques of scientific research with application to current problems of astrophysics. Students are required to take an active role, preparing and presenting reviews and working out specific research problems. Topics to be selected but may include: astrophysical plasmas; solar activity; pulsars and neutron stars; quasars and activity in galactic nuclei; experimental tests of general relativity and gravitational waves. Course may be repeated for credit.

3 units, Spr (Sturrock) by arrangement


3 units, Aut (Sturrock), alternate years, given 1975–76
365. Introduction to General Relativity and Cosmology — Review of special relativity, followed by basic material of general relativity with selected applications, including gravitational collapse, gravitational radiation and cosmology. Prerequisite: Physics 221 or equivalent. (Concurrent enrollment acceptable.)

3 units, Aut (Petrosian), alternate years, given 1975-76

366. Cosmology and High-Energy Astrophyiscs—Observational properties and theoretical models of selected astrophysical phenomena involving nonthermal electromagnetic processes, such as pulsars, X-ray sources, quasars, radio galaxies, Seyfert-type galaxies, and cosmic rays. Discussion of basic observational data and theories of the structure and evolution of the universe, with emphasis on the physical processes in the early phases of the big bang universe. Prerequisite: Physics 221 or equivalent. Recommended: Applied Physics 364.

3 units, Win (Petrosian), alternate years, given 1975-76


3 units, Spr (Sturrock), alternate years, given 1975-76

385. Magnetism and Superconductivity — Magnetism and superconductivity will be discussed within the context of real materials. The microscopic mechanisms underlying these phase transitions as well as their consequences on physical properties will be developed. The similarities and differences of these phenomena will be stressed. Experimental results of a wide range of materials will be analyzed. The format will consist of two-part lectures, which in succeeding years will emphasize either superconductivity or magnetism. Prerequisites: Applied Physics 270, 339, 340, or consent of instructor.

2 units, Spr (White, Staff) W 12:00-1:45

388. Many Body Problems in Solid-State Physics — Topics will include—the normal state: Green's function theory of linear response, impurity scattering and electrical resistivity; instabilities of the interacting Fermi gas: ferro and antiferromagnetism, superconductivity and the insulator-metal transition; localized states in a fermion system: the X-ray problem and the Kondo effect. Prerequisites: Applied Physics 239 and 240, or equivalents.

3 units, Win (Doniach) TTh 11:00-12:15

390A. Solid-State Physics Seminar—Discussion of current research and literature in solid-state physics is offered by faculty, students and outside specialists.

1 unit, Aut, Win, Spr (Staff) Th 4:15

390B. Physics of Biological Systems — A seminar devoted to the discussion of biological systems from the standpoint of physics. Research problems and current literature on topics including molecular properties, energy transfer, transport phenomena and instrumental developments.

1 unit, Aut, Win, Spr (Weissbluth) T 4:15

ART

Emeriti: Ray N. Faulkner (Professor); Daniel M. Mendelowitz (Professor); Victor M. Arnautoff (Assistant Professor)

Chairman: Lorenz Eitner


Associate Professors: Keith Boyle, Suzanne Lewis, Richard Randell, Isabelle Raubitschek

Assistant Professors: James N. Johnson, John-David P. LaPlante, Jon W. Molenkamp, Paul Turner

Lecturers: Art History—Studio—Leo Holub, Robert Parker. Visiting: Alfred Frankenstein, Al Ring

Principal Adviser to Undergraduate Studio Majors: Keith Boyle

Principal Adviser to Undergraduate Art History Majors: Isabelle Raubitschek

Director of Graduate Studies in Art History: Dwight C. Miller

OFFERINGS AND FACILITIES

The Department offers courses of study in three areas: (1) in the history of art, (2) in
the practice of drawing, painting, sculpture, design, printmaking, and photography, and (3) in art education. The undergraduate program of the Department is designed to introduce students to the humanistic study of the visual arts. The courses are intended to increase the students' understanding of the meaning and purpose of the arts, of their historical development, their role in society, and their relationship to such other humanistic disciplines as literature, music, and philosophy. The work in classroom and studio is designed to intensify the students' visual perception of the formal and expressive means of art and to encourage insight into a variety of technical processes. The collections of the Stanford Museum and the exhibitions program of the Stanford Gallery supplement the regular academic program of the Department.

PROGRAMS OF STUDY

Undergraduates may major in Art History or the Practice of Art (Studio). A freshman or sophomore intending to major in one of these areas should consult with an adviser appointed by the Department in order to plan his or her course of study.

Graduate programs are offered in Art History, Studio (including Product Design), and Art Education.

All graduate students are required to take an active part in the practical work of the Department as part of their requirement for the degree. This work is to be determined in consultation with their advisers.

During the first two years of their resident graduate work at Stanford, students are required to live in the immediate proximity of the University. Exceptions may be granted only on the basis of a petition formally submitted to the Chairman of the Department.

HISTORY OF ART

BACHELOR OF ARTS

The major program in the history of art must include the following:

4 units—Art 1
32 units in courses in art history
Total units—36. These units must be taken for a grade, may not be taken pass/no credit. University units earned by placement tests or advanced placement work in secondary school will not be counted within the 36 units required.

Art 40 and Art 50—Recommended, but not required

Each undergraduate major in the history of art shall take at least one year of beginning German, French, or Italian, or present proof of reading ability in one of these languages. (Students are encouraged to become proficient in two languages.)

MASTER OF ARTS

The University's basic requirements for the Master's degree are set forth in the section "Degrees" in this bulletin. The following are Departmental requirements:

Admission to Candidacy—Completion of the University's requirements for a Bachelor of Arts degree in the history of art, or an approximately equivalent training, is required of students entering a program of study for the Master of Arts. After acceptance and before beginning the program, students shall take a preliminary counseling test to determine the degree of the students' previous preparation. The students will be required to remedy deficiencies indicated by this test.

Recommendation for the Degree—To be recommended to the University Committee on Graduate Studies for the degree of Master of Arts in the history of art, the student must have satisfied the following requirements:

1. Completion of a minimum of three full quarters of graduate work in residence or its equivalent at this University.
2. Completion of a total of at least 36 units of graduate work in the history of art in courses at the 200 level. Students will also be required to take a seminar in art historiography and methods of research.
3. Reading knowledge of two foreign languages, preferably German and French or Italian. For oriental art history, reading knowledge of two oriental languages or one oriental language and either French or German.
4. Submission of two from among the term papers written during the year, for consideration by the faculty.
5. Demonstration to the faculty, by course work and/or examination, that the student has adequate knowledge of the major areas of the history of art.
Doctor of Philosophy

The University's basic requirements for the degree of Doctor of Philosophy are set forth in the section "Degrees" in this bulletin.

Admission to Candidacy — The graduate student does not become a formal candidate for the Ph.D. degree until he or she has fully satisfied all the requirements which govern the A.M. program in the history of art (see above), and has been accepted as a candidate by the University Committee on Graduate Studies. Immediately upon acceptance of a student into the Doctoral program, a committee of at least three art historians shall be formed which shall take responsibility for advising and evaluating that student through the obtaining of the degree. It shall be left to the discretion of the committee whether or not the student will take examinations to test competence in the major field. (The committee shall also decide on the type of examination if one is required.) The committee shall also pass on the candidate's satisfying of the language requirements.

The principal thesis adviser shall be the committee chairman. It is the responsibility of the incoming student to contact his or her advisers before registration in order to be interviewed and counseled on a program of course work.

Having satisfied all preliminary requirements, the candidate will submit a concise written statement of his or her dissertation topic to the Department. Departmental approval of the projected dissertation is necessary for admission to candidacy for the Ph.D. degree.

Residence—In order to be eligible for the doctoral degree, the student must have completed three years of full-time graduate work in the history of art, and must have spent at least one of them in residence at Stanford.

Collateral Studies—The student should be prepared to take approximately 15 units in one or, at most, two supporting fields of study (such as history, literature, classics, anthropology, or philosophy), determined in consultation with the Departmental Advisors.

Dissertation—A senior member of the Department will act as the student's dissertation adviser and as chairman of his or her dissertation committee. The final draft of the dissertation must be in the adviser's hands at least four weeks before the University deadline in the quarter during which the candidate expects to receive his or her degree. Dissertations may not be submitted during the summer quarter. The dissertation must be completed within five years from the date of the student's acceptance to candidacy for the Ph.D. degree. A candidate taking more than five years will be required to reinstate his or her candidacy.

Oral Examination—The oral examination is taken after completion of the dissertation, and its acceptance by a majority of the committee, including the principal adviser. It serves primarily as a defense of the dissertation, but may range, at the committee's discretion, over a wider field.

Practice of Art (Studio)

Bachelor of Arts

The major program in the studio area must total 65 units. Students may major in one of five areas: Painting/Drawing, Sculpture, Lithography, Design, or Photography.

Requirements for Painting/Drawing:
Art 40, 50, 60
Art 140, 141, 142 (These drawing classes need not be taken in sequence. Any of the drawing classes may be taken concurrently with Art 145-Painting I)
18 units of painting courses
12 or more units of the Modern Art series (Art 120A through Art 121B)
TOTAL UNITS REQUIRED: 48

Requirements for Sculpture:
Art 40, 50, 60, 70
Art 140, 141, or 142 (Two quarters required)
18 units of sculpture courses
12 units of Modern Art series
TOTAL UNITS REQUIRED: 49

Requirements for Lithography:
Art 40, 50, 60, 70
Art 140, 141, 142 (These drawing classes need not be taken in sequence. Any of the drawing classes may be taken concurrently with Art 145–Painting I)
Art 145 and 146
18 units of lithography courses
Art 120A, 121A, and 122
TOTAL UNITS REQUIRED: 57

Requirements for Design:
Art 40, 50, 60, 70
Art 1
ME 101 or ME 115A (Mechanical Engineering)
Art 160, 161, 162, 166, 167 (Intermediate Design)
Art 261, 268 (Advanced Design)
Art 140, 145, or 150 (Intermediate Fine Arts)
Two courses in art history
TOTAL UNITS REQUIRED: 57

Requirements for Photography:
Art 40, 50, 60, 70
Art 140, 141, or 142 (One quarter required)
Art 148
15 units of photography courses
12 or more units of the Modern Art series (Art 120A through 121B)
TOTAL UNITS REQUIRED: 45

The above requirements for a major in one of the five areas are part of the total of 65 units. A major in studio may take units pass / no credit in courses outside the requirements in the major area of interest.

Students are required to formulate their program in careful consultation with their advisers. A program expressing the concerns of the student should evolve.

MASTER OF FINE ARTS

Programs for the Master of Fine Arts degree are offered in the areas of painting, lithography, sculpture, photography and product or graphic design.

The Graduate Program in Painting, Sculpture, Lithography, and Photography provides an environment sympathetic to the needs of advanced students who are ready to involve themselves fully in these areas. Participants are chosen for the program on the basis of work which shows artistic individuality, motivated by the students’ own goals and principles, and which indicates an ability to work without further need of close faculty supervision.

The Graduate Program in Design is focused upon mature study in an area of design largely defined by the student’s own interest. Master’s projects have involved urban design, transportation, recreation, film animation, housing, seating, signing, medical and therapeutic facilities, musical instruments, informational systems, and a great many other areas. The Graduate Program is structured to balance independent concentration with rich utilization of the University and the community, and personal interaction with the students and faculty of the Graduate Design Program.

The Design Program is formally undertaken in collaboration with students and faculty of both the Art Department and the Design division of the Department of Mechanical Engineering. Physical facilities, such as shops and individual studio space, are shared by all the students. Similarly, faculty members from both departments serve as planners, advisers, and critics to the entire group. Students interact with faculty and one another through seminars, critiques, and informal working contact. The program centers on a master’s project, and includes a distribution of work between the following areas:

- Master’s Project and Graduate Design Seminar
- Advanced Design Course
- Advanced Art Course
- Advanced Technical Courses

A Master of Arts Degree in Design is offered to qualified students who prefer to participate in the graduate program for only one year.

Admission to candidacy for the degree of Master of Fine Arts 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 65 units of undergraduate work in art.
3. Formal admission to candidacy granted by the University Committee on the Graduate Division.
4. Candidates for admission must submit six or more slides of paintings, lithographs or sculpture and six or more slides of drawings. Photography candidates must submit at least twelve photographs of recent work. Design candidates must submit a portfolio of twelve or more slides or photos of creative work, including original work when possible.
5. Applications and portfolios for the studio program must be submitted by February 1. They will be reviewed the first week of February. Students accepted are admitted for the beginning of the following Autumn Quarter only; no applicants for mid-year entrance will be considered.

The requirements for the degree of Master of Fine Arts are:
1. Painting, sculpture, lithography, and photography students must participate in a weekly seminar in which their work is criticized and discussed in detail.

2. Completion of a minimum of three full quarters of graduate work in residence or its equivalent at this University.

3. Completion of the equivalent of 54 units of selected third- and fourth-year undergraduate and graduate courses. At least 39 units of this work must be in art with a grade of B or above and distributed as follows:
   a) 15 units in one of the five areas of concentration: (a) Drawing and Painting, (b) Sculpture, (c) Design, (d) Printmaking, or (e) Photography.
   b) A total of 6 units in the remaining areas of concentration.
   c) 18 units of work on thesis or creative project.

The studio faculty reserves the right to make use of graduate painting, sculpture, lithographs, and photographs in exhibitions serving the interests of the Graduate Program.

ART EDUCATION

MASTER OF ARTS IN TEACHING

The degree of Master of Arts in Teaching is offered by this Department and the School of Education for teachers who wish further to strengthen their academic preparation. The candidate must have a teaching credential. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. Detailed requirements are outlined in the section “School of Education” in this bulletin.

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. Consult the section on “Graduate Degrees” listed in the “School of Education” section in this bulletin. Complete information concerning these degrees may be secured from the Office of the Dean of the School of Education.

TEACHING CREDENTIAL (SECONDARY)

A program leading to a Master of Arts degree with a specialization in art education and/or including a California Teaching Credential in art is offered in art education by the School of Education. This program is available to students who have majored in art at the undergraduate level, who have had no teaching experience, and who wish to become teachers of art at the elementary or secondary levels. For details with respect to this program consult the “Teaching Credential Program” listed in the “School of Education” section in this bulletin.

COURSES IN HISTORY OF ART

BASIC COURSES

1. Introduction to Art—A topical introduction to the history and appreciation of architecture, sculpture, and painting.
   4 units, Aut (Elsen)

5. Survey I—Main currents in the history of Western art from prehistoric time, Egypt, Greece, and Rome, to the end of the Middle Ages.
   4 units, Win (Staff)

10. Survey II—Main currents in the history of Western art from the Renaissance to the present.
   4 units, Spr (Miller)

INTERMEDIATE COURSES

100A. Ancient Art I—The Pre-Hellenic Cultures: Egypt, Mesopotamia, Crete, Mycene.
   4 units, Aut (Raubitschek)

100B. Ancient Art II—Greece from the Geometric period to the Hellenistic, with emphasis on sculpture and painting.
   4 units, Win (Raubitschek)

100C. Ancient Art III—Rome from the Prehistoric and Etruscan periods to the early Christian.
   4 units, Spr (Raubitschek)

103. Greek Architecture—From its origins to the Hellenistic Age, with emphasis on the Classical period.
   4 units, Spr (Raubitschek) given 1975-76

104A. Late Roman and Early Christian Art—Art and architecture of the Late Roman Empire from ca. 200 to 525 A.D.
   4 units, Aut (Lewis), given 1975-76

104B. Byzantine Art—Art and architecture of the Eastern Empire from the Reign of Jus-
tinian to the Ottoman Conquest of Constantinople in 1453.

4 units, Aut (Lewis)

105A. Early Medieval Art—Art and architecture of Western Europe from the 7th to mid-11th century: the Dark Ages, Carolingian Renaissance, Mozarabic Spain, Ottonian Germany and Saxony England.

4 units, Win (Lewis), given 1975–76

105B. Romanesque Art—Stylistic and iconographic traditions in sculpture, painting and manuscript illustration of the later 11th and 12th centuries in Western Europe.

4 units, Win (Lewis)

105C. Gothic Art—Stylistic and iconographic traditions in sculpture, painting and manuscript illustration in Western Europe from the mid-12th century to the end of the International Style ca. 1425.

4 units, Spr (Lewis), given 1975–76


4 units, Spr (Lewis)

108A. Late Medieval Art in Northern Europe—15th century traditions of style and iconography in painting and sculpture of the Netherlands, France, Germany and England.

4 units, Spr (Lewis)

109A,B. Renaissance Society and Culture—
(Same as Humanities and History 109A,B.)

5 units, Win, Spr (Forster, Spitz, Ryan)

110A. Renaissance Art I—Italian architecture, sculpture, and painting of the fourteenth century. Emphasis on Tuscan art, major fresco cycles, Giotto, the Lorenzetti, and developments in Milan.

4 units, Aut (Forster), given 1975–76

110B. Renaissance Art II — Italian architecture, sculpture, and painting of the fifteenth century. Concentration on civic programs of the early Renaissance in Florence: Donatello, Ghiberti, Brunelleschi; on princely patronage in Urbino (Piero della Francesca), Mantua (Mantegna), Milan (Leonardo); on papal projects, and the new basis of artistic practice (Alberti, Leonardo).

4 units, Win (Forster), given 1975–76

110C. Renaissance Art III—Italian art and architecture from Leonardo and Michelangelo to Titian and Palladio. Focus on coherent programs of patronage in papal Rome, Medici Florence, Venice, Mantua, and on the changing function of art.

4 units, Spr (Forster), given 1975–76

111A. Northern Renaissance Art I—Art in German-speaking countries during the Reformation: painting, sculpture, and printmaking from Schongauer and Pacher to Dürrer, Grünewald, and Holbein.

4 units, Aut (Forster)

112. Renaissance Architecture from Brunelleschi to Palladio — Major enterprises and their builders in the context of urban expansion and renewal in Italy, 1400–1600.

4 units, Win (Forster)

115A. Baroque Painting in Italy — Important developments in painting with emphasis on Bologna and Rome; major trends of style and problems of iconography.

4 units, Aut (Miller)

115B. Painting in the Low Countries and France During the Seventeenth Century—
Major artistic developments in the Low Countries and France during the seventeenth century focused on the great personalities and important episodes during this period. The question of the artist's position in his society will serve as the basic point of departure.

4 units, Win (Miller)


4 units, Spr (Miller)

120A. Modern Art I—Rococo to Revolution.
Main currents in European art in the periods of the Enlightenment and Neoclassicism. Watteau, Boucher, Tiepolo, Chardin, Hogarth, Greuze, Fragonard, Robert, Piranesi, and early works of David, Goya, and Blake.

4 units, Aut (Eitner)

120B. Modern Art II — Romanticism and Naturalism. Main currents in European art in the time of the Napoleonic Wars, the Restoration, and the era of middle class dominance. The later works of David, Goya, and Blake; the German Romantics; Ingres, Gericault, Delacroix, Daumier, Courbet, Millet, Manet, and Degas; the landscape art of Turner, Constable, and the Barbizon Painters.

4 units, Win (Eitner)

4 units, Spr (Elsen) alternate years

121A. Modern Art IV—Twentieth Century Painting I, 1900–1920—Fauvism, Matisse, German and Austrian Expressionism, Picasso and Cubism, Orphism, Futurism.

4 units, Win (Elsen) alternate years


4 units, Spr (Elsen) alternate years


4 units, Spr (Elsen) given 1975–76


4 units, Win (Elsen) alternate years

123B. Modern Sculpture II—Sculpture since World War I. Tatlin, Malevich, Gabo, Pevsner, Duchamp, Arp, Giacometti, Ernst, Moore, Lipchitz, Picasso, Gonzales, and American Sculpture since World War II.

4 units, Spr (Elsen) alternate years

125A. Oriental Art I—The arts of India, China, and Japan from the Neolithic through the sixth century A.D.

4 units, Aut (LaPlante)

125B. Oriental Art II—The arts of India, China, and Japan from the seventh century A.D. to the Mongol Invasion (thirteenth century).

4 units, Win (LaPlante)

125C. Oriental Art III—The arts of India, China, and Japan after the thirteenth century.

4 units, Spr (LaPlante)

126A. Introduction to Chinese Art.

4 units, Aut (Sullivan)

126B. Introduction to Chinese Painting.

4 units, Win (Sullivan)

126C. The Art of Japan.

4 units, Spr (Sullivan)

126E. The Meeting of Eastern and Western Art—The interaction between the art of the Far East, Europe, and America from the sixteenth century to the present day.

4 units, Aut (Sullivan) given 1975–76

130A. Art in Nineteenth Century America—Major developments and personalities in painting in 19th century America.

4 units, Aut (Frankenstein)

130B. Art in Twentieth Century America—Major developments and personalities in painting in twentieth century America.

4 units, Win (Frankenstein)

175A,B. Modern Architecture I, II—A two-quarter course tracing the development, largely in Europe, which led to the present state of architecture and urbanism. Emphasis on the designer’s responses to totally new materials, technology and environmental conditions.

4 units, Aut, Win (Turner)

176. American Architecture and Urbanism—The development of architecture and city planning in the United States since colonial times, concentrating on those characteristics and problems which are distinctively American.

4 units, Spr (Turner)

ADVANCED UNDERGRADUATE AND GRADUATE COURSES


4 units, Spr (Raubitschek) given 1975–76

203. Studies in Greek Architecture.

4 units, Spr (Raubitschek), given 1975–76

204A. Studies in Late Roman and Early Christian Art.

4 units (Lewis) given 1975–76

204B. Studies in Byzantine Art.

4 units (Lewis)

205A. Studies in Medieval Art.

4 units (Lewis) given 1975–76

205B. Studies in Romanesque Art.

4 units, Win (Lewis)
205C. Studies in Gothic Art.
4 units, Spr (Lewis) given 1975-76

206. Seminar in Medieval Art.
4 units, Spr (Lewis)

206A. Colloquium in Medieval Art.
4 units, Aut (Lewis)

207. Studies in Medieval Architecture.
4 units, Aut (Lewis)

208. Seminar in Medieval Architecture.
4 units, Win (Lewis)

4 units, Aut, Win, Spr (Forster) given 1975-76

211A. Studies in Northern Renaissance Art.
4 units, Aut (Forster)

212. Studies in Renaissance Architecture from Brunelleschi to Palladio.
4 units, Win (Forster)

214A. Seminar in Renaissance Art.
4 units, Aut (Forster)

214B,C. Seminar in Renaissance Art.
4 units, Win, Spr (Forster)

4 units, Aut, Win (Miller)

216A. Colloquium on Painting in Eighteenth Century Venice — Sebastiano Ricci, Piazzetta, Pittoni, Pellegrini, the Tiepolo, Canaletto and Guardi.
4 units, Win (Miller)

217. Colloquium on Art in 18th Century European Culture—A study of some of the principal artifacts of 18th century artistic culture: the Garden, the Palace, 18th century collecting, practical aesthetics and fashions of taste.
4 units, Aut (Miller)

4 units, Aut, Win, Spr (Eitner, Elsen)

221. Seminar in Nineteenth Century Art.
4 units, Aut, Spr (Elsen, Eitner)

221A. Studies in Modern Painting from 1900–1920.
4 units, Spr (Elsen) alternate years

4 units, Spr (Elsen)

4 units, Spr (Elsen) given 1975-76

223. Seminar in Modern Painting and Sculpture.
4 units (Elsen) given 1975-76

223A,B. Studies in Modern Sculpture.
4 units, Win, Spr (Elsen) alternate years

4 units, Aut, Win, Spr (LaPlante)

226A. Studies in Chinese Art.
4 units, Aut (Sullivan)

226B. Studies in Chinese Painting.
4 units, Win (Sullivan)

226C. Studies in the Art of Japan.
4 units, Spr (Sullivan)

226E. Studies of Meeting of Eastern and Western Art.
4 units, Aut (Sullivan) given 1975-76

227A,B. Seminar in Chinese Art and Culture Between 200 and 600 A.D.
4 units, Aut, Win (Sullivan)

227C. Seminar in Far Eastern Art.
4 units, Spr (Sullivan)

228A. Seminar in Japanese Ceramics.
4 units, Aut (LaPlante)

228B. Seminar in Architecture of India and Farther India.
4 units, Win (LaPlante)

228C. Seminar in Indian Painting.
4 units, Spr (LaPlante)

230A,B. Studies in Nineteenth and Twentieth Century Painting in America.
4 units, Aut, Win (Frankenstein)

235. Proseminar in Art Historiography and Research Methods—Introduction to the major methods and approaches developed by modern schools of art historical research through discussion and comparative analysis of selected readings. Sessions on research methods and bibliography in the major areas of art history will be given by specialists in each field, as well as an introduction to basic art reference materials by the art librarian.
4 units, Win (Staff) given 1975-76

4 units, Aut (Finch)
239. Colloquium: The Artist from Antiquity to the Present—Extensive readings and discussion of important developments in the history of the artist's profession. Enrollment restricted to twelve with approval of Instructor. Primarily for art history majors. Recommended prerequisites: Art 1 or Art 5 and 10.

 4 units, Win (Elsen)


  Any quarter (Staff) by arrangement

275A,B. Studies in Modern Architecture I, II.

  4 units, Aut, Win (Turner)


  4 units, Spr (Turner)


  4 units, Aut (Turner)

278. Seminar on Twentieth Century Architecture.

  4 units, Win (Turner)

279. Seminar on American Architecture.

  4 units, Spr (Turner)


  Any quarter (Staff) by arrangement


  Any quarter (Staff) by arrangement


  Any quarter (Staff) by arrangement

RELATED COURSES

Classical Greek Sculpture and Painting—See Classics 102.

Hellenistic Greek Sculpture and Painting—See Classics 103.

Athenian Everyday Life—See Classics 105.

Art and Monuments of the Romans—See Classics 106.

Reading in German Art History—See German 112.

  3 units, Spr (Snow)

INTERDEPARTMENTAL COURSE

Renaissance Society and Culture—See Art 109A,B, Humanities 109A,B or History 109 A,B (Art History credit given)

INTERDEPARTMENTAL SEMINAR

Art and the Law—See Law 235 (Art History credit given)

COURSES IN PRACTICE OF ART (STUDIO)

Students enrolled at the overseas campuses who wish to sign up for studio courses during advanced registration for the following quarter, must send notification to the Art Department detailing course number and section for the classes in which they wish to register.

BASIC COURSES

40. Basic Drawing—Basic drawing concepts introduced through charcoal, pencil, pen and ink, colored chalk, and opaque watercolor.

  3 units, Aut, Win, Spr (Johnson)

50. Basic Sculpture—Introduction to sculpture through the use of clay, wire, wood construction, and plastic materials.

  3 units, Aut, Win, Spr (Randell)

60. Basic Design—Introduction to visual language and media, and their applications to communication and environment. Two- and three-dimensional projects.

  3 units, Aut, Win, Spr (Kahn, Molenkamp)

70. Basic Photography—Basic laboratory problems in developing and printing.

  3 units, Aut, Win, Spr (Holub, Parker)

INTERMEDIATE COURSES

140. Drawing I—Intermediate drawing. Object drawing, memory drawing, figure drawing. Stress is placed on varied media and composition. Prerequisite: 40 or equivalent. May be repeated for credit.

  4 units, Aut, Win, Spr (Boyle)

141. Drawing II—Advanced drawing. Life drawing and composition. Prerequisite: 140 or equivalent, or consent of instructor. May be repeated for credit.

  3 units, Aut, Win, Spr (Ring)

142. Drawing III—Advanced drawing. Emphasizes work from the model, still life, and imagination as necessary to the student's development. Prerequisite: 140 or equivalent. May be repeated for credit.

  3 or more units, Aut, Win, Spr (Lobdell)

145. Painting I—Introduction to painting
procedure. Still life, landscape, and figure studies in oil and varied media. Prerequisite: 40 or equivalent. May be repeated for credit.

3 units, Aut, Win, Spr (Johnson)

146. Painting II—Extended problems in pictorial organization and content, with stress on oil painting. Prerequisite: 145 or equivalent. May be repeated for credit.

4 units, Aut, Win, Spr (Boyle)

147. Painting III—Advanced painting with emphasis on the individual point of view. Prerequisite: Three quarters of 145, 146, or equivalent.

3 or more units, Aut, Win, Spr (Lobdell)

148. Lithography—Introduction to lithography. Prerequisite: 140 or equivalent. May be repeated for credit.

3 units, Aut, Win, Spr (Oliveira)

150. Sculpture I—Introduction to woodcarving and wood construction. Prerequisite: 50.

3 units, Aut, Win, Spr (Randell)

151. Sculpture II—Introduction to sculpture in metal. Gas and arc welding are principal techniques used. Prerequisite: 150.

3 units, Aut, Win, Spr (Randell)

160A,B. Design I—Comprehensive design experiences in a broad range of practical problem areas, with emphasis on fundamental design principles and methodology. Prerequisite: 60.

3 or more units, Aut, Win, Spr (Kahn, Molenkamp)

161. Design II—Graphic design media and processes, including illustration with ink and paint, pasteup techniques, typography, and experience in offset lithographic printing. Project work will emphasize graphic communication. Prerequisite: 60.

3 units, Molenkamp)

162. Design III—Three-dimensional design media and processes, with emphasis on wood construction. Creative projects in areas of functional structure. Prerequisite: 160.

3 units, Spr (Molenkamp)

166. Silkscreen Process—Design problems in textiles, papers, and other surface materials with emphasis on the silkscreen printing process. Prerequisite: 160 or 161.

4 or more units, Aut (Kahn)

167. Metalsmithing—Design problems in jewelry and small utilitarian objects. Emphasis on craftsmanship in metal construction and lost wax casting. Prerequisite: 162.

4 or more units, Win (Kahn) given 1975–76

170. Intermediate Photography—Perfecting skills and techniques acquired in basic photography. Prerequisite: 70 or equivalent.

3 units, Aut, Win, Spr (Holub, Parker)

171. Photo Essay and Photo Silk-Screening—For serious students of photography. Prerequisites: 170 and consent of instructor.

3 units, Aut, Win, Spr (Holub, Parker)

ADVANCED UNDERGRADUATE AND GRADUATE COURSES

241. Advanced Drawing and Painting Criticism I—Prerequisite: at least two quarters of painting or drawing.

Aut, Win, Spr (Oliveira) by arrangement

242. Advanced Drawing and Painting Criticism II—Prerequisite: at least two quarters of painting or drawing.

Aut, Win, Spr (Boyle) by arrangement

243. Advanced Drawing and Painting Criticism III.

Aut, Win, Spr (Boyle) by arrangement

244. Individual Work: Drawing and Painting.

Any quarter (Staff) by arrangement

248. Advanced Lithography—Continuation of lithography, dealing with advanced technical and aesthetic problems in the medium. Prerequisite: 148.

Aut, Win, Spr (Oliveira) by arrangement


Any quarter (Staff) by arrangement

251. Metal Sculpture—Plastic construction, plastic forming. Prerequisite: 151.

3 units, Aut, Win, Spr (Randell)

252. Advanced Metal Sculpture—Welding aluminum and stainless steel. Prerequisite: 251.

3 units, Aut, Win, Spr (Randell)


3 units, Aut, Spr (Randell)


Any quarter (Kahn, Molenkamp)

by arrangement
261. Advanced Design I—Continuation of 161; graphic design communication. Prerequisite: 161.
   3 or more units (Molenkamp)

263. Graphic Design Seminar—Advanced graphic design and research projects with emphasis on professional practice.
   3 or more units (Molenkamp)

268. Design Synthesis—Mature semi-elective problems in composite and multi-media design areas. Prerequisite: any two design courses above 160.
   3 or more units, Spr (Kahn)

269. Advanced Creative Studies Seminar—Intensive emphasis in areas of personal specialization, with comparative analysis.
   Aut, Win, Spr (Kahn) by arrangement

   Aut, Win, Spr (Holub, Parker) by arrangement

   Aut, Win, Spr (Staff) by arrangement

342. M.F.A. Project (Studio).
   Any quarter (Staff) by arrangement

360. Master's Project (Seminar): Design.
   Aut, Win, Spr (Staff) by arrangement

ASIAN LANGUAGES

Emeriti: S. Wing Chan, Frederic Spiegelberg (Professors)

Chairman: James J. Y. Liu

Professors: Albert E. Dien, James J. Y. Liu, David S. Nivison, Makoto Ueda (on leave autumn quarter 1974–75)

Associate Professors: William A. Lyell, John C. Y. Wang

Assistant Professors: Kung-yi Kao, Susan K. Matisoff. Acting: Phillip R. Harries

Lecturers: Yin Chuang, Hiroyasu Kubota, Kimie Nebrig, Hiroshi Sakamoto, Dorothy Shou, Hei-Tak Wu

Chinese-Japanese Language and Area Center

Director: Albert E. Dien


Lecturers: Yin Chuang, James Cole, Hiroyasu Kubota, Kimie Nebrig, Hiroshi Sakamoto, Dorothy Shou, Hei-Tak Wu

OFFERINGS

The Department of Asian Languages offers courses in the languages and literatures of China and Japan. The Department accepts candidates for the degrees of Bachelor of Arts, Master of Arts, and Doctor of Philosophy. It also gives a minor in Chinese or Japanese language and literature for the degree of Doctor of Philosophy.


PROGRAMS OF STUDY

Bachelor of Arts

The degree of Bachelor of Arts is granted both in Chinese and in Japanese. The following courses must be completed:

1. Concentration in Chinese: 103, 131, 132, 133, and two other content courses dealing with China at the 100 level, as approved by the Undergraduate Adviser.
2. Concentration in Japanese: 103, 136, 137, 138, and two other content courses dealing with Japan at the 100 level, as approved by the Undergraduate Adviser.

These requirements are in addition to the University's basic requirement for the Bachelor's degree.

Admission to Graduate Study

All students contemplating application for admission to graduate study must have a creditable undergraduate record at Stanford or elsewhere. The applicant need not have majored in Chinese or Japanese as an undergraduate, but must have had the equivalent of at least three years' training in the language in which he or she intends to specialize, and must also demonstrate a command of English adequate for the pursuit of graduate study. However, the Department is prepared to sponsor students with no previous knowledge of an Asian language as non-matriculated graduate students for one year.

Master of Arts

The degree of Master of Arts is granted in Chinese and in Japanese. The normal length of study for the degree is two years.

Applicants who wish to obtain the A.M. only but do not intend to proceed to the Ph.D. will only be considered if no financial aid is requested.

Students who wish to spend their first year of graduate study at the Taipei or Tokyo Center must obtain departmental approval first.

Candidates for the degree must be in residence at Stanford in California during the final quarter of registration.

A thesis is not required for the A.M. degree. Instead, the candidate must prepare, in Chinese 299 or Japanese 299, an annotated translation of a text of suitable literary or historical worth. Under special circumstances, a paper approved by the Graduate Adviser may be substituted.

The University's basic requirements for the Master's degree are given in the section "Degrees" in this bulletin. Departmental requirements are set forth below.

Master of Arts: Chinese

The candidate must:

1. Meet the Department's requirements for the Bachelor of Arts in Chinese or their equivalent.
2. Complete the following course work: 201, 202, 213, 223, 299; four courses in Chinese numbered between 241 and 292; and two courses on the upper division or graduate level in fields such as Chinese anthropology, art, history, philosophy, and politics, as approved by the Graduate Adviser in consultation with the student's individual adviser. Students may be exempted from 211, 212, 213 and 221, 222, 223 by passing examinations to demonstrate that they have attained equivalent language competence.

Master of Arts: Japanese

The candidate must:

1. Meet the Department's requirements for the Bachelor of Arts in Japanese or their equivalent.
2. Complete the following course work: 201, 202, 213, 248, 299; four courses in Japanese numbered between 256 and 297; and two courses in such fields as Japanese anthropology, history, politics, and religion, as approved by the Graduate Adviser in consultation with the student's individual adviser. Students may be exempted from 211, 212, 213 and 246, 247, 248 by passing examinations to demonstrate that they have attained equivalent language competence.

Doctor of Philosophy

The Doctor of Philosophy degree is granted in Chinese and in Japanese. Candidates for the degree are expected to acquire a thorough familiarity with Chinese or Japanese literature, an adequate command of both languages, and a comprehensive knowledge of East Asian history, social institutions, and thought. The University's basic requirements for the doctorate are given in the section "Degrees" in this bulletin. Departmental requirements are set forth below.

Admission to candidacy—During a stu-
dent's second year of graduate study, the graduate faculty of his or her major field (Chinese or Japanese) will evaluate his or her progress on the basis of the M.A. Translation and course work, and decide whether the student should be admitted to candidacy for the Ph.D. or terminated. Such evaluation will take place no later than the Spring quarter of the student's second year. In the case of a student who already has an M.A. when admitted to the department, the evaluation will be based on course work and written papers. If a student goes to the Taipei or Tokyo Center during his or her first two years, the department will consider requesting the Dean of Graduate Studies for approval of an exception to the rule that qualification procedure must take place during the student's first two years.

A candidate must fulfill the following requirements for the Ph.D.

1. He or she must demonstrate a reading knowledge of French or German within a year after completing the A.M. degree.

2. He or she must complete two seminars at the 300 level. These seminars must be in different subjects.

3. He or she must pass an examination in the supporting Asian language. A candidate whose field is Chinese, will be examined on his ability to read modern Japanese works relevant to his or her field of study. This requirement may be met by completing Japanese 103. A candidate whose field is Japanese will be examined on ability to read Classical Chinese works relevant to his or her field of study. This requirement may be met by completing Chinese 103.

4. He or she must pass comprehensive written examinations in four fields. One of these will emphasize the methodology of a discipline. The remaining three fields are to be chosen, with the approval of the Graduate Adviser in consultation with the student's individual adviser, from the following: Chinese literature, Chinese history, Chinese philosophy, Chinese linguistics, Chinese art, Japanese literature, Japanese history, Japanese religion, Japanese art.

University oral examination—General regulations governing the oral examination will be found in the section "Degrees" in this bulletin. The candidate will be examined on questions related to his or her dissertation, after acceptable parts thereof have been completed in draft form.

Dissertation—The candidate will write a dissertation demonstrating ability to undertake original research based on primary materials in Chinese or Japanese.

Minor for the Degree of Doctor of Philosophy—A student taking a minor in Asian languages shall complete at least 30 units of work within the Department to be chosen in consultation with a Departmental adviser. He or she must elect either Chinese 201–202 or Japanese 201–202 unless the Department is satisfied that work done elsewhere has provided similar training. He or she must also pass a written examination in the Chinese or Japanese language.

Special Programs for the Degree of Doctor of Philosophy—Properly qualified students may plan special interdepartmental programs in the Asian field for the degree of Doctor of Philosophy. See the section "Graduate Division Special Programs" in this bulletin.

Special Opportunities for Study Abroad—Attention is called to the programs of the Inter-University Program for Chinese Language Study in Taipei and the Inter-University Center for Japanese Studies in Tokyo (both of which are administered by Stanford University). They are described elsewhere in this bulletin.

Summer Program of Intensive Language Courses—A ten-week program, which begins at the same time as the University's general summer program and continues two weeks beyond it, is held each summer. Intensive instruction is offered, on three different levels, in both Chinese and Japanese. The intensive courses provide the equivalent in instruction to regular academic-year courses. (See courses Chinese 5, 25, 105, Japanese 5, 25, and 105 as described below.) For detailed information about these and other aspects of the summer program, apply directly to the Department of Asian Languages, preferably before the end of the preceding autumn quarter.

Courses Not Requiring Knowledge of an Asian Language

8. Languages of East Asia—A survey of East Asian languages, primarily Chinese and
Japanese, discussing structure, literary forms, development of the script and prospects. This is meant to provide background information for the beginning language student but others may also enroll.

3 units, Aut (Staff) W 3:15; one discussion section by arrangement

108. Asian Culture and Traditions—An attempt to give students a cultural perspective with which to view many of the major philosophical, artistic, and institutional expressions of the East Asian way of life. Special emphasis will be placed on the traditional conceptualizations of the natural world, history, the role and nature of man, the ideal order of society, and the role of art.

4 units, Spr (Staff) MWF 2:15-4:05

113. Chinese Poetry and Drama in Translation—Readings in traditional Chinese poetry and drama with discussions on background, theme, and style.

4 units, Aut (Liu) MWF 10

112. Chinese Fiction in Translation—A survey of Chinese prose fiction from early times to the late Ch'ing period, with emphasis on literary discussions of major representative works available in English translation.

4 units, Win (Wang) MWF 10

113. Modern Chinese Literature in Translation—Readings in representative twentieth-century works of fiction, drama, and poetry in translation.

4 units, Spr (Lyell) MWF 10

116. Early Japanese Literature in Translation—An introduction to the major works of prose and poetry from the Nara through the Kamakura periods (c. 750-1330).

4 units, Aut (Harries) MWF 1:15

117. Japanese Literature in Translation—The Middle Period—An introduction to the major works in prose, poetry, and the theater from the Muromachi through the Tokugawa periods (1330-1868).

4 units, Win (Matisoff) MWF 1:15

118. Modern Japanese Literature in Translation—An introductory course in Japanese poetry, drama, and fiction since 1868. Authors considered will include Tanizaki, Kawabata, Mishima, and many others. Knowledge of pre-modern Japanese literature not required.

4 units, Spr (Ueda) MWF 1:15

143. The Philosophy of Wang Yang-ming (1472-1529)—(Same as Philosophy 123.)

4 units, Win (Nivison) MWF 1:15

151. Chinese Historical Literature in Translation—(Same as History 196) A survey of the various modes of historical literature from earliest times, the development of historical consciousness and comparisons with other traditions.

4 units, Spr (Dien) MWF 1:15

152. Cultural History of Central Asia—(Same as History 195) Central Asia as an arena of conflict between agricultural and nomadic societies and the traces of cultural diffusion.

4 units, Win (Dien) MWF 1:15


4 units, Aut (Wang) MWF 1:15


4 units, Spr (Wang) given 1975-76

179 (279). Classical Japanese Drama—The development of Japanese drama from pre-nô popular and ritual forms through nô, puppet theatre and kabuki. Particular emphasis will be given to the social significance of each genre and to the transition from drama as ritual to drama as theatrical entertainment. Graduate students may register under 279, in which case they will be required to do additional readings in Japanese.

4 units, Aut (Matisoff) M 2:15-4:05

195. Modern Intellectuals in Japanese Literature—Reading and discussion of Japanese literary works that portray a modern intellectual facing philosophical, social, or moral problems characteristic of our time.

4 units, Win (Ueda) given 1975-76

197. Images of Woman in Modern Japanese Literature—The study of various types of ideal woman as envisioned by modern Japanese writers.

4 units, Win (Ueda) M 2:15-4:05

255A. The Nature of Literature: Japanese and Western Views—(Same as Comparative Literature 255A.) An attempt to study different attitudes toward literature in Japan and
in the West. Seminar with limited enrollment.

5 units, Aut (Ueda) given 1975-76

255B. Chinese and Western Theories of Literature—(Same as Comparative Literature 255B.) Study of traditional Chinese theories of literature in comparison with Western ones. Seminar with limited enrollment. Graduate students in Chinese may enroll in this seminar in lieu of 361 and will be required to read original texts.

5 units, Spr (Liu) W 2:15-4:05

I. COURSES IN CHINESE

1, 2, 3. First-Year Modern Chinese — Conversation, grammar, reading, elementary composition.

1. 5 units, Aut (Kao, Shou, Staff)
   Section 1 MTWThF 9
   Section 2 MTWThF 2:15
2. 5 units, Win (Kao, Shou, Staff)
   Section 1 MTWThF 9
   Section 2 MTWThF 2:15
3. 5 units, Spr (Kao, Shou, Staff)
   Section 1 MTWThF 9
   Section 2 MTWThF 2:15

5. Intensive First-Year Modern Chinese — Equivalent to 1, 2, and 3 combined.

15 units, Sum (Staff) MTWThF 8-12

21, 22, 23. Second-Year Modern Chinese — Further study in grammar, reading, conversation, composition. Prerequisite: 3 or equivalent.

21. 5 units, Aut (Chuang) MTWThF 9
22. 5 units, Win (Chuang) MTWThF 9
23. 5 units, Spr (Chuang) MTWThF 9

25. Intensive Second-Year Modern Chinese — Equivalent to 21, 22, 23 combined. Prerequisite: 3 or equivalent.

15 units, Sum (Staff) MTWThF 8-12

51. Chinese Calligraphy—Practice in writing Chinese characters with a brush and learning different scripts. Prerequisite: Chinese 3, Japanese 3, or equivalent.

1 to 2 units, Spr (Chuang) by arrangement

81, 82, 83. First-Year Cantonese—Conversation and grammar.

81. 5 units, Aut (Wu) by arrangement
82. 5 units, Win (Wu) by arrangement
83. 5 units, Spr (Wu) by arrangement

ADVANCED

101, 102, 103. Introduction to Classical Chinese—Reading, syntax, composition. Prerequisite: 23 or equivalent.

101. 5 units, Aut (Kao) MTWThF 11
102. 5 units, Win (Kao) MTWThF 11
103. 5 units, Spr (Kao) MTWThF 11

105. Intensive Introduction to Classical Chinese—Equivalent to 101, 102, 103 combined. Prerequisite: 23 or equivalent.

15 units, Sum (Staff) MTWThF 9-12

121, 122, 123. Advanced Conversation—Prerequisite: 23 or equivalent.

121. 2 units, Aut (Chuang) by arrangement
122. 2 units, Win (Chuang) by arrangement
123. 2 units, Spr (Chuang) by arrangement

199. Individual Reading in Chinese—(Asian Languages majors only). Prerequisite: 103 or consent of instructor.

4 units, Aut, Win, Spr (Staff)

by arrangement

GRADUATE

200. Directed Reading in Chinese—Prerequisite: 103 or equivalent.

Number of units to be arranged, Aut, Win, Spr (Staff) by arrangement

201, 202. Proseminar—Research methods in Chinese studies. Prerequisite: 103 or equivalent.

201. 5 units, Aut (Dien) T 2:15-4:05
202. 5 units, Win (Dien) T 2:15-4:05

211, 212, 213. Modern Expository Chinese—Scholarly and journalistic writings in Chinese. The materials read in these courses cover two years. By consent of the instructor, the courses may be repeated for credit in a consecutive year. Prerequisite: 103 or consent of instructor.

211. 5 units, Aut (Lyell) MWF 9
212. 5 units, Win (Lyell) MWF 9
213. 5 units, Spr (Lyell) MWF 9

221, 222, 223. Advanced Classical Chinese—Prerequisite: 103 or equivalent.

221. Historical Narration

4 units, Aut (Dien) MWF 9

222. Philosophical Texts

4 units, Win (Nivison) MWF 9
223. Literary Essays
4 units, Spr (Wang) MWF 9

243. The Philosophy of Wang Yang-ming—
(Same as 143 with additional work requiring
the knowledge of the language.)
4 units, Win (Nivison) MWF 1:15

253. Local Histories—History of Chinese local
historiography; survey of types of histories available; reading of sample texts of
different kinds found in local histories. Prerequisite: 223 or consent of instructor.
4 units, Win (Nivison) M 2:15-4:05

261. Chinese Poetry—Selected readings in
Han, Wei, and Six Dynasties Poetry (2nd
century B.C.–6th century A.D.), with emphasis on critical analysis. Prerequisite: 223
or consent of instructor.
4 units, Aut (Liu) MWF 11

262. Chinese Poetry—Selected readings in
T'ang and Sung Poetry (7th–13th centuries
A.D.), with emphasis on critical analysis. Prerequisite: 223 or consent of instructor.
4 units, Win (Liu) MWF 11

263. T'ang and Sung Lyrics—Selected read-
ings in the lyrics (t'zu) of the T'ang, Five
Dynasties, and Sung periods (8th-13th
centuries A.D.), with emphasis on critical analy-
sis. Prerequisite: 262 or consent of instructor.
4 units, Aut (Liu) given 1975-76

264. Yuan and Ming Songs—Selected read-
ings in the songs (san-ch'ü) of the Yuan and
Ming periods (13th–17th centuries A.D.), with emphasis on critical analysis. Prerequi-
site: 263 or consent of instructor.
4 units, Win (Liu) given 1975-76

265. Chinese Critical Texts—Readings in
traditional Chinese literary criticism. Prerequi-
site: 223 or consent of instructor.
4 units, Win (Liu) given 1975-76

271,272. Traditional Chinese Fiction—Se-
lected readings in short stories and longer
works of fiction from early times to late Ch'ing.

271. 4 units, Aut (Wang) given 1975-76
272. 4 units, Win (Wang) given 1975-76

273. Chinese Drama—Selected readings in
dramatic works of the Yuan, Ming, and
Ch'ing periods, with emphasis on literary
rather than theatrical qualities. Prerequisite:
103 or consent of instructor.
4 units, Win (Wang) by arrangement

274. Early Chinese Prose Literature — Se-
lected readings in pre-Han prose texts with
emphasis on their literary value in the study
of later literature. Prerequisite: 223 or con-
sent of instructor.
4 units, Spr (Wang) by arrangement

281. Modern Chinese Literature — Short
story and essay. Prerequisite: 213 or consent of instructor.
4 units, Aut (Lyell) TTh 1:15

282. Modern Chinese Literature — The
novel. Prerequisite: 213 or consent of instructor.
4 units, Win (Lyell) given 1975-76

289. Translation.
A total of 5 units, which may be taken in
one or more quarters, Aut, Win, Spr
(Staff) by arrangement

321. Seminar on Mencius
5 units, Aut (Nivison) M 2:15–4:05

351. Seminar in Chinese Traditional His-
toriography—May be repeated for credit.
5 units, Spr (Dien) not given 1974-75

361. Seminar in Chinese Literary Criticism
—May be repeated for credit. Prerequisite:
265 or consent of instructor.
5 units, Spr (Liu) given 1975-76

371. Seminar in Chinese Narrative—Thor-
ough studies of individual texts with em-
phasis on theoretical applications. May be
repeated for credit. Prerequisite: 272 or con-
sent of instructor.
5 units, Aut (Wang) by arrangement

381. Seminar—The Novels of Lao She—All
of the novels of Lao She, from The Philos-
ophy of Lao Chang through the trilogy, Four
Generations Under One Roof. The focus of
the course will be on tracing shifts and
changes in Lao She's ways of thought and
feeling, and also on Lao She as a non-intel-
lectual writer—with this regard, the writings
II. COURSES IN JAPANESE

1, 2, 3. First-Year Modern Japanese — Conversation, grammar, reading, elementary composition.
   1. 5 units, Aut (Sakamoto, Nebrig)
      Section 1 MTWThF 9
      Section 2 MTWThF 2:15
   2. 5 units, Win (Sakamoto, Nebrig)
      Section 1 MTWThF 9
      Section 2 MTWThF 2:15
   3. 5 units, Spr (Sakamoto, Nebrig)
      Section 1 MTWThF 9
      Section 2 MTWThF 2:15

5. Intensive First-Year Modern Japanese — Equivalent to 1, 2, and 3 combined.
   15 units, Sum (Staff) MTWThF 8–12

21, 22, 23. Second-Year Modern Japanese — Further instruction and practice in conversation, grammar, reading, and composition. Prerequisite: 3 or equivalent.
   21. 5 units, Aut (Kubota) MTWThF 9
   22. 5 units, Win (Kubota) MTWThF 9
   23. 5 units, Spr (Kubota) MTWThF 9

25. Intensive Second-Year Modern Japanese — Equivalent to 21, 22, and 23 combined. Prerequisite: 3 or equivalent.
   15 units, Sum (Staff) MTWThF 8–12

27, 28, 29. Intermediate Conversation — Prerequisite: 3 or equivalent.
   27. 2 units, Aut (Sakamoto) TTh 1:15
   28. 2 units, Win (Sakamoto) TTh 1:15
   29. 2 units, Spr (Sakamoto) TTh 1:15

41, 42, 43. Intensive Modern Japanese — Intensive study in grammar, reading, conversation, and composition, the equivalent of first-year and second-year Modern Japanese combined. The successful completion of this course will qualify the student to take 101.
   41. 10 units, Aut (Sakamoto, Nebrig)
       MTWThF 11 and 1:15
   42. 10 units, Win (Sakamoto, Nebrig)
       MTWThF 11 and 1:15
   43. 10 units, Spr (Sakamoto, Nebrig)
       MTWThF 11 and 1:15

ADVANCED

101, 102, 103. Modern Written Japanese — Reading texts representative of various modern written styles. Prerequisite: 23 or equivalent.
   101. 5 units, Aut (Kubota) MTWThF 11
   102. 5 units, Win (Kubota) MTWThF 11
   103. 5 units, Spr (Kubota) MTWThF 11

105. Intensive Modern Written Japanese — Equivalent to 101, 102, and 103 combined. Prerequisite: 23 or equivalent.
   15 units, Sum (Staff) MTWThF 9–12

121, 122, 123. Advanced Conversation — Prerequisite: 23 or equivalent.
   121. 2 units, Aut (Kubota) TTh 1:15
   122. 2 units, Win (Kubota) TTh 1:15
   123. 2 units, Spr (Kubota) TTh 1:15

199. Individual Reading in Japanese — (Asian Languages majors only.) Prerequisite: 103 or consent of instructor.
   4 units, Aut, Win, Spr (Staff) by arrangement

GRADUATE

200. Directed Reading in Japanese — Prerequisite: 103 or equivalent.
   Number of units to be arranged, Aut, Win, Spr (Staff) by arrangement

   201. 5 units, Aut (Matisoff) given 1975–76
   202. 5 units, Win (Harries) given 1975–76

211, 212, 213. Modern Expository Japanese — Scholarly and journalistic writings in Japanese. Prerequisite: 103 or equivalent.
   211. 5 units, Aut (Matisoff) MW 11–12:15
   212. 5 units, Win (Matisoff) MW 11–12:15
   213. 5 units, Spr (Matisoff) MW 11–12:15

246, 247, 248. Introduction to Classical Japanese — The basic principles of the classical literary language; the first quarter is devoted to a study of Heian grammar, while the subsequent quarters deal with later developments in style. Prerequisite: 103 or equivalent.
246. 4 units, Aut (Harries) TTh 2:15-4:05
247. 4 units, Win (Harries) TTh 2:15-4:05
248. 4 units, Spr (Harries) TTh 2:15-4:05
249. Japanese Historical Texts: An Introduction to Komonjo—(Same as History 494.) A course on early and medieval documents; where to find them, how to read them, and the ways they can contribute to an understanding of Japanese history. Emphasis will be on the Kamakura period. Prerequisite: 3 years of Japanese and at least one course in Japanese history.
5 units, Spr (Mass) by arrangement
256. Readings in Japanese Culture—Reading and discussion of modern Japanese essays on the identity of Japanese culture. Prerequisite: 103 or consent of instructor.
4 units, Spr (Ueda) WF 2:15-4:05
258. Major Haiku Poets—Reading and discussion of selected haiku by Bashô, Buson, Issa, and others. May be repeated for credit.
4 units, Win (Ueda) given 1975-76
259. Japanese Historical Texts: An Introduction to Komonjo—(Same as History 494.) A course on early and medieval documents; where to find them, how to read them, and the ways they can contribute to an understanding of Japanese history. Emphasis will be on the Kamakura period. Prerequisite: 3 years of Japanese and at least one course in Japanese history.
5 units, Spr (Mass) by arrangement
276. Readings in Medieval Prose—Readings from the major prose texts of the Kamakura-Muromachi periods. Emphasis on episodes from Heike monogatari and Konjaku monogatari which exemplify popular cultural traditions and inspire later writers. Prerequisite: 248 or equivalent.
4 units, Spr (Matisoff) M 2:15-4:05
279. Classical Japanese Drama—(Same as 179 with additional work requiring knowledge of the language. Prerequisite: 246 or equivalent.)
4 units, Aut (Matisoff) M 2:15-4:05
295. Modern Intellectuals in Japanese Literature—(Same as 195 with additional work requiring knowledge of modern Japanese.)
4 units, Win (Ueda) given 1975-76
296. Readings in Modern Japanese Literature—Poetry, prose, and drama after 1868. Prerequisite: 103 or equivalent. May be repeated for credit.
4 units, Win (Ueda) WF 2:15-4:05
297. Images of Woman in Modern Japanese Literature—(Same as 197 with additional work requiring knowledge of modern Japanese.)
4 units, Win (Ueda) M 2:15-4:05
299. Translation.
A total of 5 units, which may be taken in one or more quarters, Aut, Win, Spr (Staff) by arrangement
369. Seminar in Classical Japanese Literature—Students intending to enroll in the seminar are required to consult the instructor at the beginning of the preceding quarter.
5 units, Win (Staff) by arrangement
396. Seminar in Modern Japanese Literature—May be repeated for credit. Students intending to enroll in the seminar are required to consult the instructor at the beginning of the preceding winter quarter.
5 units, Spr (Ueda) given 1975-76
399. Dissertation.
(Staff) by arrangement

ADDITIONAL INFORMATION
For information concerning other opportunities for study in the Asian field, see listings under the following departmental headings: Anthropology, Art and Architecture, Economics, Graduate Division Special Programs, History, Humanities Special Programs, Philosophy, Political Science, Social Sciences (Special Program), Sociology. For additional offerings in literature, see Comparative Literature.

BIOLOGICAL SCIENCES
Emeriti: Lawrence R. Blinks, Arthur C. Giese, George S. Myers, Cornelis B. van Niel, Joseph F. Oliphant, Ira L. Wiggins (Professors); Roxana S. Ferris (Curator)
Chairman: Norman K. Wessells
Director of Undergraduate Studies: Richard W. Holm
Director of Graduate Studies: Paul R. Ehrlich
Wessells, Dow O. Woodward, Charles Yanofsky


Senior Research Associates: Naomi C. Franklin, Donald H. Perkel, Evelyn Shaw

Lecturers: Marcia K. Allen, Charles H. Baxter, Elizabeth M. Center

Directors of Systematic Collections: Paul R. Ehrlich (Entomological Collections), John H. Thomas (Dudley Herbarium)

OFFERINGS AND FACILITIES

The Department of Biological Sciences comprises facilities and personnel housed in the new Herrin Laboratories and Herrin Hall, the Museum Building on the campus, and in the Hopkins Marine Station in Pacific Grove on Monterey Bay.

The Department provides: (1) courses designed for the general student, (2) a major program leading to the degree of Bachelor of Science, (3) programs of graduate study and research leading to the degree of Doctor of Philosophy, and (4) a program of study leading to the Master of Science degree designed for students not intending to proceed to the Ph.D. degree at Stanford. The Department also administers a graduate program leading to the Ph.D. in Biophysics.

The Jasper Ridge Biological Preserve Area near the Stanford Campus provides a 960-acre reserve on the campus for physiological, ecological and population studies. Special laboratory facilities for marine research are described in the Hopkins Marine Station Bulletin.

The Dudley Herbarium, named in honor of Professor William Russel Dudley, a distinguished member of the original faculty of Stanford University, is especially rich in material of vascular plants from western North America from Alaska to Central America. Representative collections from other parts of the world, especially the Mediterranean region, furnish authentic comparative material. The collections in the Dudley Herbarium now number about 750,000 sheets and constitute one of the most important resources in existence for critical systematic and distributional studies of the vascular plants of North America. It is housed in the south wing of the Stanford Museum Building.

Entomological collections, restricted to those being used in particular research projects, are housed in the Herrin Laboratories. No general collections are maintained except for teaching purposes. Most of the entomological collections formerly housed at Stanford are now to be found either at the California Academy of Sciences, the Los Angeles County Museum, or at the Berkeley and Davis campuses of the University of California.

The Department formerly maintained large collections of fishes, reptiles, and amphibians, as well as smaller collections of birds, mammals, and invertebrates. These are now housed at the California Academy of Sciences in San Francisco, where they, as well as the other extensive collections of the Academy, are available for those interested in the systematics of these groups.

The Falconer Biology Library in Herrin Hall and its two branches contain over 1200 current subscriptions and back sets of journals, and an extensive collection of monographs and reference works. Smaller specialized libraries serve the needs of the Hopkins Marine Station and the botanical collections of the Dudley Herbarium.

PROGRAMS OF STUDY

BACHELOR OF SCIENCE

UNDERGRADUATE ADVISING

Most members of the biology faculty are available for advising. The Student Affairs Office maintains a current list of faculty advisors, their advising schedule, and relevant guidelines.

The Student Affairs Office is prepared to answer questions on administrative matters, such as requirements for the major, eligibility of courses as electives, necessity for petition, and the like. Academic advising is provided by members of the Faculty, on such matters as choice of courses and career plans.

Each declared major in biology is expected to select a regular advisor at an early date. The resultant continuity of academic advice is likely to be particularly advantageous to
students who anticipate applying to medical school or graduate school, enrolling in the honors or coterminal program, taking courses at Hopkins Marine Station, or attending one of the overseas campuses.

**COURSE REQUIREMENTS**

Candidates for the degree of Bachelor of Science must complete:

1. **Core Courses**
   - A group of specified core courses in biology or their equivalents.
     - Biology 1 5
     - Biology 21 4
     - Biology 22 3
     - Biology 23 3
     - Biology 24YZ 6
   - Total 21

2. **Elective Courses**
   - Electives 19
   - Total Core and Electives 40

   Elective courses may be selected from the offerings in the Department of Biological Sciences or from a list of courses in other departments. This list may be obtained from the Undergraduate Student Affairs Office. In completing the elective course requirement, a biology major must take approved elective courses from at least three faculty members (this does not apply to students in the class of 1973 or 1974).

   Not more than 10 units from a single faculty member or in a single specialized field from “in-depth” courses, such as 169, 175H, 176H, 178, 198, 199, 199H, 222H, 245, 251, 253, may be applied toward the total number (40) of required biology units.

   It is expected that many students will meet a portion of these requirements by advanced placement on the basis of their high school education. The following Stanford courses fulfill these requirements:
   - Chemistry 31, 33, 35, 36
   - 169, 175H, 176H, 178, 198, 199, 199H, 222H, 245, 251, 253
   - or Mathematics 5, 6, 7 or 10, 11, 21 or 41, 42
   - Physics 21, 23 or 51, 53, 55

   Physics 29 is not required by this department because it overlaps required courses in chemistry. Students should be aware, however, that many graduate schools and professional schools (e.g. Medicine and Education) have a requirement for a “year of general physics with laboratory.” Biology majors are therefore strongly urged to take the year-long Physics sequence Physics 21, 23, 29 (or Physics 51, 53, 54, 55, 56, 57, 58).

   It is strongly recommended that students intending to do graduate work in Biological Sciences acquire reading ability in an appropriate modern European language.

   It is also recommended that such students complete the mathematics requirement with Mathematics 10, 11, 21 or 41, 42 and take at least one additional course in statistics and probability.

**Typical Schedule for a Four-Year Minimum Program**

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<th>Course No. Subject</th>
<th>A</th>
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<tr>
<td><strong>First Year</strong></td>
<td>Chem. 31, 33, 35, 36. Introductory Chemistry</td>
<td>4</td>
<td>4</td>
<td>5</td>
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<td></td>
<td>Biology 1. Introductory Biology</td>
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<td>5</td>
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<tr>
<td></td>
<td>Writing &amp; Distribution Requirements or Electives</td>
<td>8</td>
<td>8</td>
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<td><strong>Totals</strong></td>
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<th>Course No. Subject</th>
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<tr>
<td><strong>Second Year</strong></td>
<td>Biology 21. Principles of Biology</td>
<td>4</td>
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<td>Biology 22. Principles of Biology</td>
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<td>Biology 23. Principles of Biology</td>
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<td>Biology 24. Experimental Biology</td>
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<td>Chem. 131, 132, 135. Organic &amp; Physical Chemistry</td>
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<td>Writing &amp; Distribution Requirements or Electives</td>
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<td><strong>Totals</strong></td>
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**Honors Program in Biological Sciences**

An Honors Program in Biology is open to a limited number of qualified undergraduate majors. The aim of the program is to aid students to gain 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 by the end of winter quarter preceding June Commencement, as well as completion of all requirements for the B.S. in Biological Sciences, leads to graduation “with Departmental Honors.” This designation appears on the student’s transcript and in the Commencement Program. An Honors Certificate is awarded. (See Biology 198 under “Courses.”)

**PREMEDICAL, PREDENTAL, AND PREPARAMEDICAL REQUIREMENTS**

It is recommended that premedical, pre-dental, and preparamedical students who are not biology majors take at least the following courses in biology: 1, 21, 22, 23, 24YZ, 110, 110L and (for those students applying to medical schools which explicitly require a course in embryology or developmental biology) 107 or 108, and such additions or substitutes as may be recommended by Stanford’s Premedical Advising Office (Academic Information Center, Old Union.)

**TRANSFER STUDENTS**

Transfer students should be aware that the curricula in biology and chemistry differ in important respects from those at many other institutions. For example, a year-long course in general biology may be equivalent to only a portion or more of the core curriculum in biology. Only rarely does a transfer student have the equivalent of Biology 24Y,Z. With respect to chemistry, after a year’s course in general chemistry at most institutions, a student is required to complete Chemistry 33, 35, 131, 132, and 135 at Stanford. After a year’s course in general chemistry plus a year’s course in organic chemistry, Chemistry 132 and 135 are required. Transfer units are not lost, but are applied to other requirements than core curriculum and cognate course requirements.

**TEACHING CREDENTIALS**

For information concerning the requirements for teaching credentials, consult the School of Education section of this bulletin or address inquiry to the Credential Secretary, School of Education.

**MASTER OF ARTS IN TEACHING**

The degree of Master of Arts in Teaching is offered jointly by this Department and the School of Education. The degree is intended for candidates who have a teaching credential and who wish further to strengthen their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. Detailed requirements for the course are outlined in the School of Education section or may be obtained from the Credential Secretary, School of Education.

**MASTER OF SCIENCE**

The Department of Biological Sciences at Stanford University offers a program leading to the Master’s degree. The program is designed for those students whose professional goals will be forwarded by advanced study in biology in an experimentally oriented department. Requirements for the degree include one year (three academic quarters) of registration, during which 45 units of credit are earned. Thirty of those units must be in advanced courses in biology; fifteen units of cognate course work is required in subjects such as statistics, biochemistry, behavioral psychology, and various courses in the Stanford Medical School. No financial support derived from Stanford University funds is available for either tuition or living expenses associated with the Master’s program. Appropriate application materials for the program can be obtained from the Graduate Admissions Office.

**DOCTOR OF PHILOSOPHY**

*Preparation for graduate study—* Students seeking entrance to graduate study in biology ordinarily will have the equivalent of an undergraduate major in biology at Stanford (see above). However, we encourage students from other disciplines, particularly the physical sciences, to apply for graduate work in the Biological Sciences. Such students will be advised at the time of initial registration as to how they should complete their background training during the first year of graduate study. In addition to the usual basic undergraduate courses in biology, it is recommended that preparation for graduate work include courses in chemistry through organic chemistry, general physics, and mathematics through calculus.

*Application, Admission, and Financial Aid—* Prospective graduate students should apply formally through the Graduate Admissions Office, which will submit their names
to the Department for approval when application requirements are completed. The deadline for receipt of applications with all supporting materials is January 15.

An applicant must file a report of scores on the aptitude tests of the Graduate Record Examination as part of the application. The advanced biology test is recommended but not required.

It should be noted that, due to a high level of applications to graduate study, competition for admission has become keen and that in recent years it has been possible to act favorably upon less than ten per cent of applications received. For that reason it seems prudent to advise that only well-qualified students apply for admission. All admitted students are normally offered financial support in the form of Biology Fellowships or Graduate Research Assistantships. Such awards are for one year and are renewable as funds permit, assuming continuing excellent performance. It is current policy not to offer financial support from University-derived funds beyond the fourth year of graduate study. Qualified applicants are urged to take the initiative in applying for predoctoral national fellowships in open competition, especially those from the National Science Foundation, and to consult their Financial Aid Officers for information and applications.

Students who have had their undergraduate training in biology at Stanford are ordinarily encouraged to undertake graduate study elsewhere to ensure breadth of experience. Printed information regarding choice of a graduate school can be obtained from the Student Affairs Office of the Department.

It should be noted that graduate programs in specialized areas of biology are offered in other departments on the campus, e.g., Genetics, Physiology, Psychology, Medical Microbiology, Pharmacology, Anatomy, Biochemistry, Neurological Sciences. Students interested in these areas should contact the appropriate department. A Biophysics Program is offered in this Department.

An admitted applicant is required to conform to the requirements of the University as outlined in the section "Degrees" in this bulletin and to the Department requirements stated below:

Courses required of all Ph.D. candidates—Each student must take at least three units of work as a graduate under each of four or more Stanford faculty members. Course work to be taken in preparation for the qualifying examination will be determined in consultation with the graduate advisor.

Teaching Experience and Training are part of the graduate curriculum. Each student assists in teaching eight sections, usually during the first year in residence. This normally involves two afternoons a week for four quarters and assignments are made in consultation with the student. Graduate students with departmental support are called upon to teach one-fourth time (2 units per year) in each of the 2nd, 3rd, and 4th years. Students on non-University fellowships or grants are not required to carry out this additional teaching.

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. These seminars are presented under individual course listings or as announced by the various research groups.

The Biology Seminar meets on most 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 Campus Report. Graduate students are expected to attend.

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 present a satisfactory oral seminar before one of the departmental research groups (Population Biology, Developmental Biology, etc.), to prepare a satisfactory paper on a subject of interest to the student, and to pass a qualifying examination. The examination is normally taken near the beginning of the autumn quarter in a student's second year of residence. The status of the student remains probationary until the seminar, paper, and examination are completed satisfactorily. At that time his or her eligibility to continue work toward the Ph.D. degree is determined on the basis of his or her total academic performance during the first four quarters of graduate study. (Entering students are encouraged to take this examination prescriptively in order to plan first year course work. For entering students, the exam is reviewed but not graded, and cannot be "passed.")

Language Requirement—A foreign lan-
Dissertation Proposal—Each student will prepare, by the end of his second year in residence, a Dissertation Proposal which will include a definition of the problem, the goals of the particular work, and the proposed methods of procedure. Work should be planned so as to complete the entire Ph.D. program within four years. The proposal will be endorsed by the major professor and circulated to a three-member faculty committee prior to an oral presentation and review.

Application to Candidacy should be made as early as departmental preliminary procedures are completed and not later than the end of the sixth quarter of residency.

The Dissertation Reading Committee can be appointed at any time between the filing of the application to candidacy and the beginning of the fourth year.

Residency Requirement—A minimum of three years (nine quarters) of full-time graduate registration is required of each candidate. The Department normally accepts only full-time students for study leading to the Ph.D. However, it recognizes that because of family and child-bearing responsibilities, military or alternative service obligations, or other personal reasons, students may wish at various times to interrupt their graduate education or to pursue their studies on a half-time basis. The Department is willing to undertake such arrangements, which can include partial stipends if the student is being supported from departmental funds.

Dissertation—A contribution to knowledge which is the result of independent work, expressed in satisfactory form. Abstracts of Ph.D. theses are published in Dissertation Abstracts.

The Oral Examination—This consists of a formal seminar open to the public, followed by a closed session of questioning. This examination is taken after the dissertation is completed in draft form and approved by all members of the Reading Committee.

Minor for the Degree of Doctor of Philosophy—Candidates for the degree of Doctor of Philosophy in other departments who wish to minor in Biological Sciences may meet this requirement by successfully passing the Departmental Qualifying Examination.

Courses

Additional courses not listed here are frequently offered in the areas of their special research competence by selected postdoctoral or terminal Ph.D. personnel. These are listed in the quarterly time schedules, and course descriptions are circulated in advance.

Introductory Courses

1. Introductory Biology—A consideration of three major unifying themes in biology, namely; the cell theory and some of its chemical ramifications, the principles and mechanisms of Mendelian heredity, and Darwin’s principle of natural selection. Serves as introductory quarter of the Biological Sciences major core sequence; also open to non-majors interested in a first course in biology. Some previous experience with chemistry is strongly recommended.

5 units, Spr (Watt) TThF 11;
   discussions (Staff) (1) M 1:15–3:05,
   (2) M 3:15–5:05, (3) T 1:15–3:05,
   (4) T 3:15–5:05, (5) W 1:15–3:05,
   (6) W 3:15–5:05, (7) Th 1:15–3:05,
   (8) Th 3:15–5:05, (9) T 7:30–9:30 p.m.
   (10) Th 7:30–9:30 p.m.


3 units, Win (Ehrlich, Holm) TTh 11
   alternate years, given 1975–76

21, 22, 23. Principles of Biology—A comprehensive study of the principles of modern biology from the molecular to the population level of organization, including cellular and organismal biology. These courses must be taken in sequence, although not necessarily in the same year. Prerequisites: 1, and Chemistry 31, 33, 35. Required cognate courses in calculus may be taken concurrently.

21. 4 units, Aut (Allen, Yanofsky, Simoni) MWF 11
22. 3 units, Win (Heller, Ray) MWF 9
23. 3 units, Spr (Roughgarden) MWF 9

24. Experimental Biology—Introduction to experimental methods and experimental analysis of problems in the major areas of biology. A two-quarter course designed to be taken concurrently or subsequently to Biology 21, 22, and 23. Prerequisites: 1, and Chemistry 31, 33, 35, 36.

24Y. 3 units, Win (Allen, Center)
laboratories and discussion
(1) T 1:15-3:05, Th 1:15-5:05;
(2) T 3:15-5:05, Th 1:15-5:05;
(3) T 1:15-5:05, Th 1:15-3:05;
(4) T 1:15-5:05, Th 3:15-5:05;
(5) W 1:15-3:05, F 1:15-5:05;
(6) W 3:15-5:05, F 1:15-5:05;
(7) W 1:15-5:05, F 1:15-3:05;
(8) W 1:15-5:05, F 3:15-5:05

24Z. 3 units, Spr (Allen, Center)
laboratories and discussion
(1) T 1:15-3:05, Th 1:15-5:05;
(2) T 3:15-5:05, Th 1:15-5:05;
(3) T 1:15-5:05, Th 1:15-3:05;
(4) T 1:15-5:05, Th 3:15-5:05;
(5) W 1:15-3:05, F 1:15-5:05;
(6) W 3:15-5:05, F 1:15-5:05;
(7) W 1:15-5:05, F 1:15-3:05;
(8) W 1:15-5:05, F 3:15-5:05

95. Practical Plant Biology—Experience in phenomena and techniques of food crop growth by participation in student organized field garden project accompanied by reading and discussion of pertinent botanical background. Prerequisite: consent of instructor.

3 units, Spr (Ray) TTh 10 plus 6 hours per week by arrangement

UPPER DIVISION COURSES

100H. Marine Algae—See Hopkins Marine Station.

106. Cell Biology—A correlation of the substructure of cells to biochemical and developmental processes. Included will be the following: the cell theory, organization and transport in membranes, cellular energetics, form and function of the organelles and inclusions of the cell, and an introduction to cell development. Prerequisite: 21 or Human Biology 2A.

3 units, Win (Hepler) MWF 10

107. Cell Development and Morphogenesis—A study of those controls which account for the progression of a cell through the cell cycle and into the differentiated state. Current theories for the generation of pattern and form will also be covered. Prerequisites: 21 and 22 or Human Biology 2A and 3A, college math, some physics is involved in the analysis.

3 units, Spr (Green) MWF 10

108. Organismal Development—A study of those processes responsible for development of multicellular organisms. Morphogenesis, cytodifferentiation, growth control, and regulatory phenomena will be discussed. Prerequisite: 110.

3 units, Win (Wessells) MWF 9,
given 1974-75 and 1977-78

110. Vertebrate Biology—Structure, function, behavior, and evolution of vertebrates. Prerequisites: 1, 21, 22, 23; or Human Biology 1, 2A, 3A, 4A.

3 units, Aut (Wessells) MWF 9,
given 1974-75 and 1976-77

110L. Vertebrate Biology Laboratory—Dissection of selected vertebrates. Pass/No Credit only. Discussion sections to be arranged. Prerequisites: same as for 110.

2 units, Aut (Wessells, Center) labs
TWTThF 1:15-5:05

111H. Marine Invertebrates—See Hopkins Marine Station.

112H. Marine Invertebrates—See Hopkins Marine Station.

114H. Marine Biology—See Hopkins Marine Station.

115H. Subtidal Ecology—See Hopkins Marine Station.

116H. Phytoplankton—See Hopkins Marine Station.

117H. Marine Ecology—See Hopkins Marine Station.

120H. Marine Ecology—See Hopkins Marine Station.

121. Microbial Ecology—This course will provide an introduction to the major physiological types of microorganisms with an emphasis on bacterial metabolism. The role of microorganisms in the biogeochemical cycles as well as the processing of foods will be investigated by laboratory work employing elective culture, isolation, and characterization technique. The course will consist of one lecture, followed by a three hour laboratory and discussion period. One additional laboratory period for examination and transfer of cultures will be required but can be arranged to meet the student’s schedule. The class will be limited to 20 students.

4 units, Aut (Phillips) F 1:15-5:00,
plus lab; by arrangement

122. Natural History of Coastal Waters—Introduction to the biology of intertidal and subtidal organisms of the central California Coast. Lecture and lab will treat organismal
diversity and relationships. Selected aspects of life history, ecology, physiology, and behavior will be considered for the major groups. Field trips will be conducted on weekends, and intertidal and subtidal (SCUBA certification required for the latter) will alternate. The course is 4 units with one set of field trips; 5 units with both. Prerequisite: consent of instructor.

4-5 units, Aut (Baxter) Th 10-12; lab. Th 1:15-4:05 plus field trips by arrangement

127. Plants and the Fossil Record—History of plant life from the earliest known identifiable organisms of nearly three billion years ago up to the Ice Age. A major portion of the course will be devoted to tracing the emergence and development of the major groups of vascular plants and changing vegetational patterns in time and space.

3 units, Win (Page) WF 10-12

128. Systematics and Ecology of Vascular Plants—Lectures, laboratory, field studies. Prerequisite: consent of instructor.

4 or 5 units, Spr (Thomas) WF 1:15; lab. WF 2:15-5:05; field trips by arrangement

130. Algae and Fungi—These lower plants are studied in selected habitats: a pond, an ocean cove, and a wet forest slope, as well as in the laboratory. Field recognition of several of the most common genera is involved. Pertinent ecological theory is presented. Students develop talks/projects using these organisms in the analysis of questions of ecology and development. Lectures, laboratory, and field trips (one to Hopkins Marine Station). Prerequisites: 22 and 23.

4 units, Win (Green) MWF 9
lab. T 1:15-4:05

131. Mosses and Ferns—Structure, development, evolutionary relationships of mosses and ferns. Lectures, laboratories, and field trips. Prerequisite: consent of instructor.

5 units, Aut (Thomas) WF 2:15-5:05

132. Seed Plants—Structure, development, evolutionary relationships of seed plants. Lectures, laboratories, and field trips. Prerequisites: 22 and 23.

5 units, Spr (Holm) TTh 1:15-5:05

134. Seminar on Replication of Nucleic Acids—Modes of replication and their control in prokaryotic and eukaryotic systems. Critical review of current literature. Prerequisite: 21 and/or consent of instructor.

3 units, Spr (Hanawalt) by arrangement

135. Seminar on Developmental Genetics—Genetic expression and its developmental basis, especially in such representative organisms as Drosophila, mice and men. Prerequisites: 1 and 22 or consent of instructor.

3 units, Spr (Center) Th 2:15-4:05

137. Topics in Comparative Animal Physiology—Reading and discussion on selected topics dealing with functional analyses of physiological functions in whole animals. Background through 22 is necessary and any additional experience is helpful.

3 units, Spr (Baxter) M 1:15-3:05

141. Biostatistics—An introduction to the statistical analysis of biological data. Lectures, discussion and student exercises.

3 units, Win (Feldman) TWF 4:15-5:05

146. Cell Differentiation—Lectures and discussions for graduate and advanced undergraduate students covering the original literature of selected problems in the cellular and molecular biology of cell differentiation. Prerequisites: 21, and 22 or consent of instructor.

3 units, Spr (Stockdale) by arrangement

151. Evolutionary Genetics—Application of genetics to study of evolution. Prerequisite: a knowledge of basic genetics.

3 units, Spr (Regnery) TTh 10, alternate years, given 1975-76

152. Neurophysiology—Electrical properties of excitable membranes; physiology of receptors, muscles, and synapses; operations of simple networks of neurons relevant to behavior. The approach to neuronal systems will be comparative and developmental (This course may be taken after Psychology 107; it treats the cellular material in substantially greater depth. It also serves as the
basis for the 160 series of behavior courses in biology.) Prerequisites: 21, 22, 23 or Psychology 107.

3 units, Win (Getting, Kennedy) MWF 8

156. Plant Physiology—Principal functions of green plants, including photosynthesis, gas exchange, water and nutrient transport, mineral metabolism, growth, and environmental responses. Prerequisites: 21 and 22 or equivalent, and Chemistry 121 and 123 or Biochemistry 200 and 201 or equivalent.

3 units, Aut (Ray) MWF 10

158. Introduction to Behavior Genetics — (Same as Psychology 158.) Designed for students of anthropology, biology, and psychology. Principles and methods of animal and human behavior genetics research. Discussion of the social implications of gene-behavior relationships. Prerequisites: Psychology 1 and Genetics 201 or Human Biology 130 or their equivalents.

4 units, Win (Kessler) TTh 1:15

162. Biogeography—Survey of major principles of ecological and historical geography of plants and animals. Prerequisite: 23.

3 units, Aut (Holm) TTh 11, alternate years, given 1975–76

163. Animal Behavior: Developmental Aspects—Theories of behavioral development; naive behaviors, critical periods, imprinting; early experiences; parental-young interactions; processes of socialization; development of perceptual capacities; causal mechanisms. Emphasis on vertebrates. This course is intended to be part of a sequence of behavior courses, 163, 164, 165, which may be taken in any order. Prerequisites: 22 and 23, or consent of instructor.

3 units, Aut (Shaw) MWF 11

164. Animal Behavior: Neurobiological Aspects—(Same as Psychology 147) Ethological viewpoints of behavior will be presented, with an emphasis on recent advances in understanding their physiological substrates. This course is intended to be part of a sequence of behavior courses, 163, 164, 165, which may be taken in any order. Prerequisite: Psychology 107, or 153; 163 is recommended.

4 units, Win (Wine) by arrangement

165. Animal Behavior: Ecological and Evolutionary Aspects—A comparative survey of principles and patterns of animal behavior stressing their evolution and adaptive significance. Emphasis will be placed on vertebrates. Lecture and discussion. This course is intended to be part of a sequence of behavior courses, 163, 164, 165, which may be taken in any order. Prerequisites: 1 and 22.

3 units, Spr (Heller) MWF 11

166. Genetics (Eukaryotes) — The principles of genetics as developed in and applied to studies of eukaryotic organisms. Emphasis will be placed on the transmission of genetic factors. Prerequisite: 1 or consent of instructor.

3 units, Win (Regnery) MWF 11

167. Genetics (Prokaryotes) — Continuation of 166 with emphasis on prokaryotes. Basic genetic principles applied to bacteria and viruses. Methods of genetic mapping; correlation of genetic and physical structure; mechanism of recombination. Prerequisite: 166.

3 units, Spr (Campbell) MWF 11

168. Vegetation and Fire—An examination of the past and present role of fire in the evolution and maintenance of vegetation types, with particular reference to the diverse California flora. Prerequisite: consent of instructor.

3 units, Win (Thomas) W 2:15–4:05; field trips by arrangement, alternate years, given 1974–75

169. Advanced Cellular and Molecular Biology Laboratory—This laboratory will be offered autumn and/or winter quarters for 3 to 15 units of credit. Individual research projects will be carried out at differing levels commensurate with student’s background, experience and choice. A wide range of experiments can be dealt with, limited only by expense and availability of equipment. See unit limitation under “Bachelor of Science Course Requirements.” Prerequisite: 24Y.

3 to 15 units, Aut, Win (Woodward) by arrangement

175H. Problems in Marine Biology — See Hopkins Marine Station.

181. Darwin—A seminar dealing with the contributions of Charles Darwin to the Biological Sciences and the impact of this work upon society. Prerequisite: consent of the instructor.

3 units, Win (Thomas) W 2:15–4:05, alternate years, given 1975–76
184. Biology of Insects—An introduction to the functional biology of insects. Insect anatomy, biochemistry, behavior, ecology, physiology and systematics will be considered, as well as more specialized topics intended to illustrate or emphasize unusual features of insects which make them attractive as objects of research. Lab sometimes meets for the full time as a lab or field exercise, and at other times only for the first hour as a lecture-discussion. Much of the laboratory work will take the form of individual projects. Prerequisites: 1, 21, 22, and 23, or consent of instructor.

4 units, Win (Watt) MTh 2:15; lab. T 1:15-5:05; alternate years, given 1975-76

185. Coevolution—Evolutionary interactions among different kinds of organisms—plants and herbivores, models and mimics, predators and prey, parasites and hosts, etc. Emphasis will be on the importance of these interactions in understanding problems of community structure and human ecology. Lectures, discussion and library research. Prerequisites: 23 or Human Biology 4A and consent of instructor.

3 units, Spr (Ehrlich) MWF 10, alternate years, given 1975-76

186. Advanced Topics in Geographical Ecology—Will deal in depth with the biogeography and ecology of specific regions or special habitats. The subject matter will vary from year to year and the course may be repeated for credit. The subject for 1974-75 will be the geographical ecology of the polar regions. Prerequisite: 23 or Human Biology 4A.

3 units, Spr (Ehrlich, Holm) M 2:15-4:05, alternate years, given 1974-75

187. Topics in Epizootiology — Lectures, discussions, and readings on the effects of particular diseases on infra-human animal populations. Prerequisite: 23 or consent of instructor.

3 units, Spr (Regnery) TTh 10, alternate years, given 1974-75

189. Introduction to Visible and Electron Optical Methods in Biology—After study of the appropriate elementary theory, the student employs the following sequence of light optical techniques on biological material: light microscopy, still and time-lapse photography, phase, fluorescence, polarized light, Nomarski, and interference microscopy. Two weeks are devoted to beginning methods in electron microscopy. Two hours of lecture, one three-hour laboratory. Prerequisites: 21 and 22; 24A and 24B (or 24Y instead of A and B); high school physics.

3 units, Aut (Green, Hepler) lec. TTh 1:15; lab. T 2:15-5:05 or Th 2:15-5:05

197. Student Seminars—Intensive study of specific areas of the biological literature by means of oral presentation by the students, discussion, and term papers. Topics covered will vary from year to year. Prerequisites: 21 and 23.

3 units, Win (Campbell) W 2:15-4:05, given 1975-76

198. Honors Program — Research in some phase of biology of special interest to the individual. Successful completion of a minimum of 10 units of 198 is required for graduation with Departmental Honors. Units taken in another numbered research course in biology may be counted toward this minimum by arrangement between the student and the course instructor and with approval of the Committee on Undergraduate Studies upon written recommendation by the instructor to the Committee on a form provided. Biology 198 may be taken with an out-of-department faculty member only with the prior approval of the Committee on Undergraduate Studies by petition. An essay based on the research in each course taken for Honors must be presented to, and accepted by, both the research director and the Department. The essay, to be submitted in duplicate, will be deposited in the Department Library and in the University Archives. See unit limitation under “Bachelor of Science Course Requirements.”

(Staff) by arrangement

199. Special Problems—Individual study or research undertaken by arrangement with instructor (out-of-Department instructor arrangement only for Biology majors). See unit limitation under “Bachelor of Science Course Requirements.”

(Staff) by arrangement

199H. Special Problems—See Hopkins Marine Station.

GRADUATE COURSES

200. Seminar in Animal Communication—
(Same as Hearing and Speech Sciences 281
and Psychology 228.) A general survey of the communicative aspects of social behavior of animals including man. Emphasis will be placed upon diversity of signal systems and the contrasts between these systems and human linguistic behavior. Prerequisite: consent of instructor.

4 units, Win (Dewson) by arrangement

201. Biological Effects of Radiation—(Same as Radiology 201.) Basic physical and chemical events, vulnerable biochemical pathways and molecules, repair of radiation lesions, factors governing cellular radiosensitivity, dose modifiers, tissue and organ effects, carcinogenesis and radiation hazards, and permissible dose standards. Prerequisite: Biochemistry 200, or consent of instructor.

2 units, Win (Kallman and Staff) by arrangement

204. Bacterial Genetics—(Same as Medical Microbiology 204.) Lectures on inheritance in bacteria. Prerequisite: Medical Microbiology 101 or equivalent.

3 units, Win (Stocker) MWF 11:00

208. Advanced Topics in Genetics — Will deal in depth with topics of current interest. The subject matter will vary from year to year, and the course may be repeated for credit. The general theme in 1974–75 will be the origin, behavior, and significance of duplications. Prerequisites: 166, 167 or equivalent, and consent of instructor.

2 units, Aut (Perkins) by arrangement

210. Membrane Molecular Biology — The structural organization and properties of lipids and proteins in artificial and biological membranes, membrane isolation techniques, physical techniques for studying lipid and membrane structure, membrane transport, assembly of membranes and organelles, and cell surface interactions of viruses, antibodies, and hormones and cells. Prerequisites: 21, Biochemistry 200 recommended.

3 units, Spr (Simoni) TTh 11-12, given 1975–76

213. Viruses — Principles of virus growth, genetics, architecture and assembly. Relation of temperate viruses and other epimemes to the host cell. Prerequisite: 21.

3 units, Aut (Campbell) MWF 11, given 1975–76

215. Advanced Topics in Evolution—Current methods of approach to such evolution-ary subjects as tempo and mode, origin of major categories, cytogenetics, hybridization. Prerequisites: 22, 23.

3 units, Aut (Holm) TTh 11, alternate years, given 1974–75

221. Advanced Topics in Plant Physiology and Development—Will consider in depth currently important aspects of plant physiology such as growth and its hormonal regulation, transport phenomena, and environmental responses. Topic will vary from year to year and the course may be repeated for credit with consent of instructor. Prerequisites: 156, Biochemistry 200, or equivalents, and consent of instructor.

3 units, Spr (Green, Hepler, Ray) MW 1:15–3:15

245. Laboratory in Biological Clocks—Individual or group experiments on circadian clocks in organisms ranging from single cells, fungi and green plants to insects and vertebrates. Whenever possible, the experimental work consists of genuine research projects. Limited to students taking 259 or by consent of instructor.

3 to 15 units, Aut, Win (Pittendrigh) by arrangement; minimum of two quarters’ work. Given 1975–76

247. Protein Synthesis and Degradation in Eukaryotes—A lecture and student discussion course on various aspects of the regulation of protein synthesis and degradation in higher organisms, with special emphasis on molecular mechanisms involved in developmental processes and actions of hormones. Prerequisites: 252 desirable but not necessary; Biochemistry 201 and 202.

3 units, Spr (Schimke) TTh 4:15

249. Cytogenetics—(Same as Genetics 249.) Principles and modern biochemical methods of chromosome analysis. The structure, function, and replication of pro and eukaryotic chromosomes. The influence of chromosomal changes in development and evolution of organisms. Human chromosomes and their behavior in hybrid cell cultures. Prerequisites: 21, 22, and 23; knowledge of genetics and biochemistry.

3 units, Aut (Ganesan) MWF 10

250. Molecular Biophysics — Physical biochemistry and physical approaches to biological problems at the molecular level. Lectures include discussion of macromolecular structure and intermolecular interactions,
physical methods for characterizing proteins and nucleic acids, the interaction of electromagnetic radiation with biological molecules, isotopic tracer techniques, and classical physics of cellular processes. Open to qualified advanced students upon consent of instructor.

4 units, Win (Hanawalt) TTh 10 and T 7:15–10:00 p.m., alternate years, given 1975–76

251. Biophysical Measurements — Selected laboratory research problems to provide experience with modern biophysical instruments and experimental techniques, including: spectrophotometry, chromatography and electrophoresis, radioactive tracers, sedimentation, etc. Open to limited number of advanced students, by consent of instructor.

3 or more units, Spr (Hanawalt and Staff) by arrangement


4 units, Spr (Yanofsky) TTh 9–10:50

253. Laboratory in Neurophysiology—Experimental approaches to the electrical properties of neurons, muscle cells, and receptors, and to the organization of central nervous systems. Enrollment limited to students considering careers in neurobiology.

4 to 15 units, Spr (Kennedy, Getting) by arrangement

255. Advanced Topics in Neurobiology: Biophysics of Excitable Membranes—Extensive coverage of current problems in neurobiology. The subject material will vary from year to year, and the course may be repeated for credit. Subject material for 1974–75: biophysical approaches to unit properties of excitable membranes, neurons, and synapses. Prerequisites: 153 or equivalent and elementary calculus.

3 units, Aut (Getting) by arrangement

257. Molecular Photobiology — Fundamentals of photochemistry, photon effects on biological macromolecules, photoactivation of biological systems, cellular recovery from radiation damage, photodynamic action, and comparisons with ionizing radiations. Prerequisite: consent of instructor.

3 units, Spr (Hanawalt, K. Smith) TTh 1:15, alternate years, given 1974–75

258. Physiological Basis of Adaptation — Lectures, reading, and discussion on recent research concerning biochemical and physiological bases of evolutionary adaptations to environment. Subjects covered will include invertebrate and vertebrate thermal biology, biochemical population genetics, respiratory physiology, and other topics. Prerequisites: biology core and cognates.

3 units, Aut (Watt, Heller) TTh 8:30–10:00, alternate years, given 1974–75

259. Biological Clocks—Innate oscillations in physiological systems that measure environmental time. The phenomena considered will range from biochemical to behavioral, and the time periods from daily to annual. Lectures and discussion. Prerequisites: 21 and consent of instructor.

3 units, Win (Pittendrigh) TTh 1:15, alternate years, given 1975–76

260. The Physiology and Behavior of Thermoregulation — Lectures and student presentations of recent research and literature reviews. Topics will range from the central nervous system regulation of body temperature to the ecology of thermoregulation. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr (Heller) Th 12–1

261H. Comparative Biochemistry of Marine Microorganisms—See Hopkins Marine Station.

269H. Ecological Physiology—See Hopkins Marine Station.

277. Theory and Models of Biological Processes—Formulation and solution of difference and differential equations from population biology mass transfer, reaction kinetics, morphogenesis, elements of probability, stochastic processes and linear algebra as applied to population genetics, neural systems, and epidemiology. Guest lecturers will present examples from their specialties. Prerequisites: elementary calculus, probability or statistics, and consent of instructor.

3 units, Aut (Feldman) MWF 1:15, alternate years, given 1974–75

280. Mathematical Modeling of Biological Systems — Formulation of quantitative descriptions of the dynamics of living systems, including both deterministic and stochastic models. Digital-computer techniques for numerical prediction and comparison with experiment. The roles of mathematical models
in biology. Term projects will be chosen from students' fields of special interest. Prerequisites: intermediate calculus, probability or statistics, basics of computer programming, and consent of instructor.

3 units, Spr (Perkel and Staff) TTh 10–11:30, alternate years, given 1975–76

283. Theoretical Population Genetics — A detailed survey of models in population genetics to include aspects of selection, random drift, gene linkage, migration, and inbreeding. The influence of these on evolution of gene frequencies and chromosome structure is analyzed and some data evaluated. Prerequisite: consent of instructor.

3 units, Aut (Feldman) MWF 3:15, alternate years, given 1975–76

286. Theoretical Population Ecology — An examination of papers on current issues, including r and K-selection, niche theory, life history and foraging strategies, the spatial structure of populations, and systems ecology. Term paper required which develops a mathematical or computer model of some ecological problem. Prerequisites: 23 and consent of instructor.

3 units, Win (Roughgarden) TTh 11, alternate years, given 1975–76

287. The Testing of Ecological Theory— An examination of the natural history of several groups of organisms with a view toward testing ecological theory and finding topics for further theoretical work. Term paper required which tests some element of ecological theory using existing data from the literature or using new data obtained from local populations such as those in the Jasper Ridge Preserve. Prerequisites: 23 and consent of instructor.

3 units, Aut (Roughgarden) TTh 10, alternate years, given 1974–75

300. Research.
(Staff) by arrangement

300H. Research—See Hopkins Marine Station.

325. Seminar in Evolutionary Mechanisms — Presentation and discussion of current research results and literature dealing with mechanistic studies of evolutionary adaptation. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr (Watt) F 12:00–1:15

345. Seminar in Genetics and Molecular Biology— Prerequisite: consent of instructor.
3 units, Aut, Win, Spr (Staff) by arrangement

346. Seminar in Regulatory Biology—Literature review of elected topics in eukaryote regulatory biology. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr (Schimke) T 12–1

347. Seminar in Photoperiodic Time-Measurement— An analysis of current literature on the diverse mechanism involved in recognizing season by the measurement of daylength. Prerequisite: 259 or consent of instructor.

3 units, Win (Pittendrigh) by arrangement

348. Graduate Seminar in Population Ecology— Prerequisite: consent of instructor.
1 unit, Aut, Win, Spr (Ehrlich) by arrangement

351. Seminar in Neurobiology — Prerequisite: consent of instructor.
3 units, Aut, Win, Spr (Kennedy, Perkel, Getting) M 12:00–1:15

352. Seminar in Developmental Biology — Literature and research review of selected topics in development. Prerequisite: consent of instructor.
3 units, Aut, Win, Spr (Green, Hepler, Ray, Wessells) by arrangement

353. Seminar in Plant Physiology— Presentation of current research projects and topical literature by faculty, graduate students, and visiting speakers. Prerequisite: consent of instructor.
3 units, Aut, Win, Spr (Ray and Staff) W 3:30–5:00

354. Seminar in Population Biology— Prerequisite: consent of instructor.
3 units, Aut, Win, Spr (Staff) by arrangement

355. Seminar in Population Genetics— Literature review and research discussion of current problems in the theory and practice of population genetics. Student participation required. Prerequisite: consent of instructor.
3 units, Aut, Win, Spr (Feldman) by arrangement
BIOPHYSICS PROGRAM

Committee on Biophysics:
Philip C. Hanawalt, Professor of Biological Sciences, Chairman; Donald Kennedy, Professor of Biological Sciences; Harden M. McConnell, Professor of Chemistry; David A. Clayton, Assistant Professor of Pathology; Donald H. Perkel, Senior Research Associate, Biological Sciences; one student member elected annually by the students from the group.

The Biophysics Program offers instruction and research opportunities leading to the Ph.D. in biophysics. Students admitted to the Program may perform their graduate research in the Department of Biological Sciences or, through special arrangements, in other University departments.

PROGRAM OF STUDY

A small number of highly qualified applicants will be admitted to the Program each year. Applicants should present strong undergraduate backgrounds in the physical sciences and mathematics. The graduate course program, beyond the stated requirements, will be worked out for each student individually with the help of appropriate advisers from the Committee on Biophysics.

The requirements for the Ph.D. degree include the following:

1. Training in physics equivalent to that of an undergraduate physics major at Stanford.

2. A graduate minor in physics, chemistry, or biology (or in a related field). Consult appropriate Departmental announcements for minor requirements.

3. Completion of the following courses (or their equivalents):
   a) Biology 250; and 252 or 153, depending upon interest.
   b) Biochemistry 200, 201.
   c) Chemistry 121, 171, 173 and 175.
   d) Additional courses as required for the individually tailored program.

4. Proficiency in one or more foreign languages and/or a computer language may be required at the discretion of the major professor.

5. The completion of eight sections of teaching apprenticeship during the first nine quarters (e.g., as teaching assistant in courses such as Biology 251 or 253).

6. Successful passing of a comprehensive qualifying examination in biophysics is required for admission to Ph.D. candidacy. This examination is normally taken early in the second year of study and it emphasizes the area of specialization in biophysics.

7. Preparation of a Dissertation Proposal defining the research to be undertaken, including methods of procedure. This proposal should be submitted by Spring Quarter of the second year and it must be approved by a committee of at least three members including the principal research adviser and at least one member from the Committee on Biophysics. The candidate may be called upon to defend the dissertation proposal in an oral examination. The dissertation reading committee will normally evolve from the dissertation proposal review committee.

8. The presentation of a Ph.D. thesis as the result of independent investigation and expressing a contribution to knowledge in the area of biophysics.

9. The successful passing of the University oral examination which is to be taken only after the student has substantially completed the research. The examination will be preceded by a public seminar in which the research will be presented by the candidate.

Courses of interest to biophysics students:

- Biol. 201. Biological Effects of Radiation.
- Biol. 249. Cytogenetics.
- Biochem. 200 and 201. Biochemistry Lectures.
- Biochem. 213. The Arrangement of Information in Chromosomes.
- Chem. 171, 173, and 175. Physical Chemistry.
- Chem. 221. Advanced Organic Chemistry.
- Chem. 271, 273, and 275. Advanced Physical Chemistry.
- Computation Center 1. Introduction to a Programming Language.
- Engr. 177. Radio-activation Analysis.
- Genetics 216. Selected Topics in Neurobiology.
DIVISION OF MARINE BIOLOGY
HOPKINS MARINE STATION

Emeriti: Lawrence R. Blinks, Arthur C. Giese, Cornelis B. van Niel (Professors)

Acting Director: Norman K. Wessells

Associate Director: Donald P. Abbott


Lecturer: Robin D. Burnett, Charles A. Baxter

Affiliated Faculty: Frederick A. Fuhrman (Physiology)

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 about eleven acres, consisting of the main portion of Cabrillo Point, and including a sheltered landing place and storage for small boats. Buildings include the "Marinostat," the Alexander Agassiz Laboratory and the Jacques Loeb Laboratory. The 15,000 volume library subscribes to approximately 450 journals, and its collections are particularly good in marine biology, oceanography, microbiology, and embryology.

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 February, or write Hopkins Marine Station, Pacific Grove, Ca. 94950.

AUTUMN, WINTER, AND SPRING QUARTER COURSES

Although few formal courses will 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.

114H. Marine Biology—A broad survey of the biology of marine forms focusing on local organisms and habitats. Topics treated will include classification, basic body plan, group diversity, and relationships. Within this framework the course will concentrate on aspects of adaptation for life in specific habitats, and consider in some detail the physiology and behavior of local forms. The organization of the course will be lecture, discussion, lab, and field trips, and each person will explore several areas of interest with individual or small group projects. Prerequisite: consent of instructor. By application only.

15 units, Win (Baxter, Burnett) MTWThF

175H. Problems in Marine Biology—Lectures, laboratory work, field studies, and individual problems. The course is designed primarily to give advanced undergraduates an opportunity to engage in research. Students will spend the entire spring quarter in residence at the Marine Station, Pacific Grove. For further description see Hopkins Marine Station Bulletin. Prerequisites: junior or senior standing in biology and permission of instructors.

15 units, Spr (D. Abbott, I. Abbott, Baxter, Burnett, Fuhrman, Phillips) MTWThF 8–5

199H. Special Problems—Properly qualified undergraduate students may undertake individual work in the fields indicated under course 300H, listed immediately below. Such studies are intended to give the serious student experience in biological research. Preference is given to Stanford students who have already completed Biology 175H and wish to continue their studies, and to Stanford biology students enrolled in the Coterminal A.M. Program. Arrangements must be made by consultation or correspondence.

(Staff) by arrangement

300H. Research—Graduate study involving original work may be undertaken with members of the staff in the fields indicated below.


F. Fuhrman: Physiology and Pharmacology—Toxins from marine organisms and comparative pharmacology.

SUMMER QUARTER COURSES

The summer program is open to all advanced undergraduate, graduate, postdoctoral students and teachers whose biological background, teaching or research activities can benefit from a summer's study of marine life. Application blanks may be obtained by writing directly to the Director, Hopkins Marine Station, Pacific Grove, Ca. 93950. Completed applications should be submitted by March 31. Applications received later are considered if space is still available in classes.

The summer quarter is divided into two terms of five weeks each. Those courses requiring the lower tides of early summer are scheduled in the first term. It is possible to register for either term, or for the full quarter.

Most classes meet regularly, all day, on three alternate days each week, and some activities may be scheduled on the days in between. Registration for more than six units (one course) each term is not ordinarily recommended, owing to the intensive work schedule.

First Term

100H. Marine Algae—Lectures, laboratory, and field work on the various classes of algae. Particular attention will be given to the benthic marine algae of the Pacific Coast. Prerequisite: elementary botany or general biology.

6 units (I. Abbott) TThS

111H. Marine Invertebrates—Survey of the lower marine invertebrates, echinoderms, and protochordates. Emphasis is placed on basic body plan, functional anatomy, pattern of development, higher classification, and phylogenetic relationships, rather than on detailed morphology and species identification. Prerequisite: at least two courses in zoology. Preference is given to students registering for both 111H and 112H.

6 units (D. Abbott) TThS

115H. Subtidal Ecology—Group and individual studies on the structure and function of a selected subtidal community. All participants must be certified SCUBA divers and have their own diving equipment (including wet suit and buoyancy vest). Background which would be appropriate are courses in organismic biology, ecology, statistics, and ocean diving experience.

6 units (Baxter) MWF

119H. Marine Ecology—Ecological studies of selected marine associations and habitats. Emphasis will be on intertidal ecology. Prerequisites: at least two courses in general biology or zoology. Chemistry and invertebrate zoology are recommended. Preference will be given to students registering for both 119H and 120H.

6 units (Staff)

282H. Marine and Amphibian Toxins—(Same as Physiology 282.) Lectures, laboratory work, and discussion on the biology, chemistry, and mechanism of action of toxins from marine plants and animals and from amphibians. Special emphasis will be given to neurotoxins such as tetrodotoxin, saxitoxin, and batrachotoxin. The course will include discussion of the basic principles of evaluation and mode of action of toxic substances in general, and a systematic presentation of various aspects of marine and amphibian toxins.

6 units (Fuhrman) MWF

300H. Research—(See above, autumn, winter, and spring quarters.)

Second Term

112H. Marine Invertebrates—Continuation of 111H, covering the molluscs, annelids, arthropods, and allied lesser phyla. While the two courses form a continuous sequence, either half may be taken separately when space permits. Prerequisite: same as for 111H, preferably also 111H.

6 units (D. Abbott) TThS

118H. Phytoplankton—Lectures, laboratory, and field work. Prerequisite: one year of biological science at the college level.

6 units (Staff) MWF

200H. Marine Ecology—Continuation of 119H with emphasis on individual and group research projects. Prerequisite: 119H.

6 units (Staff)

199H. Special Problems—(See above, autumn, winter, and spring quarters.)

269H. Ecological Physiology—Physiological responses of animals to variations in en-
vironmental factors and to organisms. Most of the work will deal with marine invertebrates. Prerequisites: general zoology or organismic biology and general chemistry.

6 units (Staff) MWF

300H. Research—(See above, autumn, winter, and spring quarters.)

CHEMISTRY*

Emeriti: Frederick O. Koenig, Philip A. Leighton, Hubert S. Loring, J. Murray Luck, Carl R. Noller (Professors)

Chairman: Eugene E. van Tamelen

Vice Chairman: Douglas A. Skoog


Associate Professors: Hans C. Andersen, Robert Pecora

Assistant Professors: Keith O. Hodgson, Leonard M. Stephenson, Frank A. Weinhold

Lecturers: Karen P. Long, Suzanne Hudson

ENTRANCE PREPARATION

Students who intend to major in chemistry are expected to offer entrance credit in the preparatory subjects of chemistry, physics, and mathematics (including algebra and plane trigonometry). Those who do not have entrance credit or equivalent training in the foregoing subjects, particularly mathematics, may experience some difficulty in meeting the Department requirements for graduation in four years, especially if they expect to pursue a program leading to professional certification by the American Chemical Society or to the B.S. degree with Honors. A year or more of secondary school preparation in German is desirable.

Students who have taken the College Board Advanced Placement Examination in Chemistry and receive a composite score of 4 will be excused from Chemistry 31 or 41. Those receiving composite scores of 5 may be excused from Chemistry 43 on the recommendation of the Committee on Undergraduate Study.

PROGRAMS OF STUDY

MINIMUM REQUIREMENTS FOR THE BACHELOR OF SCIENCE DEGREE

University writing and distribution requirement; Mathematics 10, 11, 21, 22, 23, or 41, 42, 43; Physics 51, 53, 54, 55, 56, 57, 58; Chemistry 31, 33, 35, 36, 131, 132, 133, 134, 137, 171, 173, 174, 175, 176. For Class of 1975 and earlier the requirements may be fulfilled by Chemistry 1, 2, 3 (or 4, 5) 113, 116, 121, 122, 123, 124, 125, 137, 171, 173, 175, 176. In addition, a reading knowledge of scientific German is strongly recommended. Premedical students majoring in chemistry may substitute Physics 21, 23, 29 for Physics 51–58 provided they also complete Biology 1, 21, 22, 23. Students interested in attending overseas campuses should consult their advisers as early as possible in order to avoid scheduling problems. Note that it is particularly convenient to attend an overseas campus during spring and summer of the second year, since the courses listed in these quarters may be delayed to subsequent years without disadvantage. No required course may be taken on a pass/no credit basis.

AMERICAN CHEMICAL SOCIETY CERTIFICATION

Students who wish to be certified as having met the minimum requirements of the American Chemical Society for professional training must complete, in addition to the above requirements, at least six units from Chemistry 136, or 190; and at least three additional units from one of the following: Chemistry 136, 143, any chemistry course numbered above 200 for which permission to register has been granted by the instructor; Biochemistry 200; or an advanced course in mathematics or physics. A reading knowledge of scientific German or Russian is required. This requirement may be fulfilled by completing one year of college level courses or by passing the graduate language examination.

HONORS PROGRAM IN CHEMISTRY

A limited number of undergraduates may be admitted to the Chemistry Honors Pro-
gram at the beginning of the senior year. Those completing the program satisfactorily will receive the degree of Bachelor of Science in Chemistry with Honors.

To be admitted to the program, the student must have a grade average of at least B in all course work in the University. In addition to the minimum requirements for the B.S. degree, the student must complete nine units of Chemistry 190 to be taken three units per quarter for three quarters; and nine additional units from Chemistry 136, 221, 223, 225, 227, 251, 253, 255, 271, 273, 275, Biochemistry 200, 201, Mathematics 130, 131, 132, physics lecture courses numbered 100 and higher, or other advanced courses approved by the student's adviser and by the supervisor of his work in Chemistry 190.

Students who wish to be admitted to the Honors Program but who do not meet all of the above formal requirements, may petition the Department for admission.

**Typical Schedule for Four-Year Program**

(Class of 1976 and later)

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<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
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<tr>
<td>Chem. 31.</td>
<td>Chemical Principles</td>
<td>4</td>
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<tr>
<td>Chem. 33.</td>
<td>Structure and Reactivity</td>
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<td>4</td>
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<td>Chem. 35.</td>
<td>Functional Groups and Stereochemistry</td>
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<td>Chem. 36.</td>
<td>Theory and Practice of Separations</td>
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<td>3</td>
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<td>Writing Requirement</td>
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<td>German 1, 2, 3. First-Year German</td>
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<td>Math. 10, 11, 21. Analytic Geometry and Calculus</td>
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<tr>
<td>Chem. 131.</td>
<td>Chemical Synthesis and Properties</td>
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<tr>
<td>Chem. 132.</td>
<td>Theory and Practice of Identifications</td>
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<tr>
<td>Chem. 133.</td>
<td>Special Topics in Organic Chemistry</td>
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<tr>
<td>Chem. 134.</td>
<td>Theory and Practice of Quantitative Chemistry</td>
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<td>Chem. 136.</td>
<td>Synthesis Laboratory</td>
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<td>Chem. 137.</td>
<td>Inorganic Chemistry</td>
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<td>Math. 22, 23. Analytic Geometry and Calculus</td>
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<td>Physics 51, 53, 54. Mechanics, Sound, Electricity</td>
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<td>Electives (see Note 1)</td>
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<td>Chem. 171, 173, 175. Physical Chemistry</td>
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<td>Chem. 174, 176. Physical Chemistry Laboratory</td>
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<td>Physics 55, 56, 57, 58.</td>
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<td>Writing Requirement</td>
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<td>Math. 10, 11, 21. Analytic Geometry and Calculus</td>
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Note 1. — Elective courses must be used to complete the University Writing and Distribution Requirement. They may also be used to broaden the student's background in science and non-science areas and to provide an opportunity for advanced study in chemistry. Courses offered by other departments that may be of interest to chemistry majors include: Chem. Engr. 20, 120, 130; Econ. 1; English 104; Math 44, 106, 113, 130, 131, 132; Physics 110, 111, 132; Stat. 40, 110, 116; Geol. 1; Engr. 50; Appl. Earth Sci. 105; Mat. Sci. and Engr. 50; Med. Micro. 101; Biol. Sci. 1, 21, 22, 23; Biochem. 200, 201; Comp. Sci. 106, 135; Civil Engr. 170, 175, 278.

**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**

**General Requirements**

Qualifying examinations are given prior to the first week of the autumn quarter and in the first week of the winter quarter. Each new graduate student must take these examinations on entrance. Satisfactory performance is required for permission to begin thesis research and to continue work for an advanced degree. Students who do not complete the remaining requirements for an advanced degree within six years after entrance as a graduate student must repeat and pass the qualifying examinations and must meet any other requirements established by the faculty before the degree will be granted.

Candidates for advanced degrees must have a minimum grade average of B for all
chemistry lecture courses as well as for all courses taken during graduate study. Required courses may not be taken under the pass/no credit option. All students are expected to give full time to their graduate work once they have begun thesis research. All prospective Ph.D. candidates, regardless of the source of their financial support, will be expected to gain teaching experience as an integral part of their graduate training. During the period in which a thesis is being read by members of the staff, candidates must be available for personal consultation until the thesis has had final Departmental approval. In addition to Departmental requirements, candidates for advanced degrees must meet the general University regulations as stated in the section “Degrees” in this bulletin.

QUALIFYING EXAMINATIONS

These examinations will consist of four written exams of two hours duration each in the fields of analytical, inorganic, organic, and physical chemistry, and will cover such material as ordinarily is given in a rigorous one-year undergraduate course in each of these subjects. Students who fail to pass these examinations in the autumn will be advised to repeat them during the first week of the winter quarter. All qualifying examinations will be given during the period September 20, 21, 1974, and all must be taken at this time.

MASTER OF SCIENCE

All applicants for the degree of Master of Science in Chemistry are required to complete, in addition to the requirements for the Bachelor’s degree, a minimum of 39 units of work. Of the 39 units approximately two-thirds must be in the Department and must include at least 12 units of advanced course work in chemistry exclusive of the thesis. Of the 12 units, at least three units must be from Chemistry 221, 223, 225, 251, 253, 255, 271, 273, or 275.

MASTER OF ARTS IN TEACHING (CHEMISTRY)

In cooperation with the School of Education, the Department offers a program leading to a degree, Master of Arts in Teaching (Chemistry). This degree is intended for candidates who have a teaching credential and who wish to strengthen further their academic preparation. Detailed requirements are outlined in this bulletin under “School of Education, the Master of Arts in Teaching.”

DOCTOR OF PHILOSOPHY

The graduate student does not become a formal candidate for the Ph.D. degree until he has passed the Department qualifying and language examinations and has been admitted to candidacy by the University Committee on the Graduate Division. Doctorate candidates 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 30 units of advanced lecture courses, exclusive of research. The foreign language requirement for the Ph.D. in organic chemistry ordinarily will be met in German and in French or Russian. The foreign language requirement in physical or inorganic chemistry ordinarily will be met in either German or Russian. Proposals to substitute for French or Russian another language or a program of course work will be considered by the Department on petition by the candidate. Candidates for the Ph.D. degree are required to participate continually in the Department seminar (Chemistry 300), and in the division seminar of the major subject. In addition, continuous enrollment in Chemistry 301 is expected after the student has passed the qualifying examinations and chosen a research supervisor.

All students majoring in inorganic chemistry are required to take (1) Chemistry 271, 273, and 275 (or be exempted therefrom by passing special examinations administered by the professors in charge of these courses); (2) two courses from Chemistry 251, 253, or 255; (3) Chemistry 221 or 223 or 225; (4) six additional units of approved advanced lecture courses.

All students majoring in organic chemistry are required to (1) take Chemistry 221, 223 and 225 during the first year, irrespective of background; those who fail to make a grade average of at least B in these three courses may not become candidates for the Ph.D. degree in organic chemistry; (2) take three units of Chemistry 227; (3) take Chemistry 271 (or be exempted therefrom by passing a special examination administered by the professor in charge of this course); (4) take Chemistry 233 in the second year (3 units); (5)
take six units of advanced lecture courses outside of the field of organic chemistry.

All students majoring in physical chemistry are required to take (1) Chemistry 271, 273, and 275 (or be exempted therefrom by passing special examinations administered by the professors in charge of these courses) during the first year, irrespective of background; those who fail to make a grade average of at least B in these three courses may not become candidates for the Ph.D. degree in physical chemistry; (2) six units of advanced lecture courses in physical chemistry, biophysical chemistry, or inorganic chemistry; (3) Chemistry 221, or 223, or 225; (4) six additional units of advanced lecture courses outside of the fields of biophysical chemistry, physical chemistry, and inorganic chemistry.

Students with an exceptionally strong background in physics and mathematics may, upon special arrangements, pursue a program of studies in chemical physics.

Before a candidate may request scheduling of the University oral examination, clearance must be obtained from the major Professor and the chairman of the Department Graduate Study Committee. Conditions that must be fulfilled before clearance is granted vary with the different divisions of the Department and may be ascertained by consulting the chairman of the Committee.

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. Information concerning staff members with lists of their recent research publications will be found in the Directory of Graduate Research published by the American Chemical Society.

Minor in Chemistry—Candidates for the degree of Doctor of Philosophy in other departments who wish to minor in chemistry must complete with a grade average of B or better, at least 12 units of chemistry courses more advanced than those that meet the minimum requirements for the Bachelor's degree in chemistry. At least 3 units must be from Chemistry 221, 223, 225, 251, 253, 255, 271, or 273.

FELLOWSHIPS AND SCHOLARSHIPS

In addition to the University fellowships and scholarships that are open to properly qualified students, there are at present several Departmental fellowships in chemistry. The Edward Curtis Franklin Fellowship, James W. McBain Memorial Fellowship, Frederick P. Whitaker Fellowship and William H. and Myrtle B. Sloan Scholarship are granted only to graduate students. The William H. Nichols Scholarships, David L. and Lavinia E. Sloan Memorial Scholarship and John Maxson Stillman Scholarship are open to graduates and undergraduates; the Robert M. and Katherine F. Loeser Scholarship and the Frank Gard Scholarship are available to undergraduates only.

There also are teaching assistantships and research assistantships open to advanced students. Application forms for fellowships, scholarships, and teaching assistantships may be obtained from the office of the Department of Chemistry.

COURSES

Note — Deposits required in laboratory courses, against which charges are made for breakage are from $10 to $30 per quarter.

UNDERGRADUATE COURSES

31. Chemical Principles — Preparation for chemistry, chemical engineering, medicine, biochemistry, biology, and related fields. Atomic and molecular orbital theory, periodicity, bonding, properties of matter, stoichiometry. Prerequisite: high school algebra; high school chemistry and physics desirable.

4 units, Aut (Andersen, Weinhold, Golden, Staff) lecs. (1 and 2) MWF 8, lec. (3) MWF 9, lec. (4) MWF 10; one recitation by arrangement


4 units, Win (Brauman, Collman, Eastman, Staff) lecture and recitation sections same as 31

35. Functional Groups and Stereochemistry — Organic Chemistry, carbonyl compounds, bifunctional molecules, stereochemistry, carbohydrates, nitrogen, sulfur, and phosphorus compounds, amino acids and proteins, kinetics. Prerequisite: 33 or 41, 43.

3 units, Spr (Eastman, Mosher, Staff) lecs. (1 and 2) MWF 8, lec. (3) MWF 9
36. Theory and Practice of Separations—
The course will deal with techniques for separations of compounds including distillation, crystallization, extraction, and various chromatographic procedures. The lecture will treat the theory of these processes while the laboratory will provide practice in their use. Prerequisites: 33 and concurrent or previous enrollment in 35.

2 units, Spr (Hodgson) lec. M or W or F 1:15; lab. M, T, W, Th or F 2:15–5:05

41. General Chemistry—A course emphasizing the quantitative and physical aspects of general chemistry. Primarily for engineering and science majors. Properties of solutions; chemical equilibrium; electrolyte solutions; galvanic cells; oxidation-reduction systems; chemical thermodynamics.

Some prior knowledge of physics is assumed; e.g. the laws of motion, the properties of gases; some knowledge of elementary chemistry is assumed; e.g. stoichiometry, simple chemical formulas. Good knowledge of algebra is desirable and concurrent enrollment in calculus recommended.

5 units, Aut (Hutchinson) lec. TWTh 8; lab. T or Th 2:15–5:05; lec. T 1:15

43. General Chemistry — Continuation of Chemistry 41. Chemical kinetics and reaction mechanisms; atomic structure; molecular structure and bonding; molecular spectra; introduction to organic chemistry.

5 units, Win (Hutchinson) lec. TWTh 8; lab. T or Th 2:15–5:05; lec. T 1:15

130. Biosocial Aspects of Birth Control—
(Same as Human Biology 150.) The problems of introducing a new, practical birth control agent or procedure involve legal, political, cultural and economic factors in addition to purely biological ones. The course will deal with a critical evaluation of the logistic aspects of practical human fertility control. Groups of 5 to 8 students of diverse backgrounds will develop a series of position papers dealing with new birth control procedures suitable for populations of different cultural and socioeconomic backgrounds. The selection of students admitted to this class will be based in part on the desire to create a multi-disciplinary student group so that each position paper will be prepared by task forces consisting of participants with different undergraduate backgrounds (e.g., Pre-medicine, Pre-law, Biological Sciences, Anthropology, Chemistry, etc.) who will focus on specific logistic aspects of a common topic in the birth control field. Limited to 40 students. Pre-registration during fall quarter essential. Prerequisite: At least junior standing and completion of pre-registration questionnaire available from Human Biology Office.

5 units, Win (Djerassi) MW 2:15–4:05, alternate years, given 1975–76

131. Chemical Synthesis and Properties—
Polymers, heterocyclic compounds, natural products, dyes, purines, pyrimidines, DNA, RNA. Prerequisite: 35.

3 units, Aut (van Tamelen, Bonner, Johnson) lec. (1) MWF 11, (2) TTh 11:00–12:15, (3) MWF 12

132A. Theory and Practice of Identification—
The course will deal with the theory and practice of identification of compounds. A part of the lecture will be devoted to the interpretation of infrared, mass, and nmr spectroscopy; the remainder will cover elementary theory of absorption spectroscopy as well as instruments for measurement of spectra. The laboratory work will be devoted to the synthesis and identification of compounds. Prerequisite: 35, 36 and concurrent enrollment in 131. Chemistry majors and prospective majors should register for 132B.

3 units, Aut (Staff) lec. (1) TTh 9; (Staff) lec. (2) TTh 10; lab. M, T, W, Th or F 1:15–4:05 or M, T, W or Th 6:30–9:05 p.m.

132B. Theory and Practice of Identification—
The course is similar to 132A, involves an additional unit of laboratory work, and is required for but not limited to chemistry majors. Prerequisite: 35, 36 and concurrent enrollment in 131.

4 units, Aut (Staff) TTh 1:15; lab. MW 1:15–4:05 or TTh 2:15–5:05 or TTh 9–12

133. Special Topics in Organic Chemistry—
Primarily for chemistry majors. Mechanisms, orbital symmetry, physical methods, biogenesis, synthesis. Prerequisites: 131 and calculus.

3 units, Win (Bonner, Staff) MWF 11, given 1973–74 for the first time

134. Theory and Practice of Quantitative Chemistry—The course will deal with the theory and practice of quantitative analysis. Methods considered will include gravimet-
ric, volumetric, spectrophotometric, and electrometric. Prerequisite: 132 or 5.
4 units, Win (Jurs) lec. (1) TTh 10, lab. TTh 1:15–4:05

135. Physical Chemical Principles—Terminal physical chemistry for non-chemistry majors. Emphasis is on those portions of physical chemistry most useful for students of the life sciences. Introduction to chemical thermodynamics, heterogeneous equilibria, thermodynamics of solutions, electrolytes, chemical kinetics, macromolecular solutions and colloidal dispersions. Prerequisites: 131 and calculus.
3 units, Win (Pecora, B. Hudson, Staff) lec. (1) MWF 11, lec. (2) TTh 11:00–12:15, lec. (3) MWF 12

3 units, Spr (Bonner) by arrangement, given 1973–74

137. Inorganic Chemistry—Intended for undergraduates. Survey of the chemistry of transition metal compounds. Bonding, structures, and reactivities of transition metal complexes. Prerequisite: 171 or 131.
3 units, Spr (Taube) MWF 10

171. Physical Chemistry—Chemical thermodynamics: fundamental principles, Gibbsonian equations, equilibrium conditions, phase rule, systematic deduction of equations, gases, solutions. Prerequisites: 35 or 53, Mathematics 10, 11, 21 (or equivalent) and Physics 51, 53, 54 and previous or concurrent registration in Physics 55 (or Physics 21, 23, 29 in the case of premed students majoring in chemistry; see under “Minimum Requirements”).
3 units, Aut (S. Hudson) MWF 11

173. Physical Chemistry—Quantum Chemistry, molecular structure and spectroscopy including atomic spectroscopy, molecular rotation, molecular vibration and infrared spectroscopy, electronic states of molecules and magnetic resonance spectroscopy. Prerequisite: 171.
3 units, Win (B. Hudson) MWF 11

174. Physical Chemistry Laboratory—Use of modern chemical instrumentation to study fundamental areas of physical chemical concern—kinetics, spectroscopy, and properties of molecules. Experiments include X-ray powder diffraction, dipole moment determination, determination of polymer molecular weight by light scattering and viscosity; rotational-vibrational, microwave, laser raman, and nuclear quadrupole resonance spectroscopy; enzyme kinetics, gas phase ion-molecule kinetics, and solution kinetics studied with electron paramagnetic resonance (EPR) and nuclear magnetic resonance (NMR). Prerequisite: concurrent enrollment in 173.
3 units, Win (Staff) lec. TTh 10; lab. T 1:15–4:05 or W 1:15–4:05

3 units, Spr (Pecora) MWF 11

176. Physical Chemistry Laboratory—(Continuation of Chemistry 174.) Prerequisites: 174 and previous or concurrent enrollment in 175.
3 units, Spr (Staff) lec. TTh 10; lab. T 1:15–4:05 or W 1:15–4:05

GRADUATE COURSES

Undergraduates may register for chemistry courses numbered 200 and above only if admitted to the Honors Program or if special permission has been granted by the instructor in the course.

221. Advanced Organic Chemistry—Introduction to physical organic chemistry. Basic M. O. theory and application. Methods of determining organic reaction mechanisms from a theoretical and experimental point of view. Prerequisites: 125 and 175.
3 units, Aut (Brauman) MWF 9

223. Advanced Organic Chemistry—Continuation of 221: Applications of physical methods, notably mass spectrometry and optical rotatory dispersion, to organic chemical problems; synthetic reactions in the steroid field, and degradative organic chemistry with illustrations from the field of natural products. Prerequisite: 221 or consent of instructor.
3 units, Win (Stephenson) MWF 9
225. Advanced Organic Chemistry — Continuation of 223: Organic reactions, new synthetic methods, conformational analysis, and exercises in the syntheses of complex molecules. Prerequisite: 223 or consent of instructor.

3 units, Spr (Johnson) MWF 9

227. Selected Topics in Organic Chemistry — May be repeated for credit. Possible topics include synthetic organic chemistry, photochemistry, inorganic-organic chemistry, biorganic chemistry, reaction mechanisms, structural chemistry of organic and biological molecules. Prerequisite: 225 or consent of instructor.

3 units, Aut, Win, Spr (Staff) MWF 10

229. Organic Chemistry Seminar — Attendance is required of all graduate students majoring in organic chemistry.

1 unit, Aut, Win, Spr (Staff) Th 4

233. Creativity in Organic Chemistry — The art of formulating, writing, and orally defending a research progress report will be practiced and criticized with the student using his own research as a vehicle. Required of all 2nd year Ph.D. candidates. Winter and spring: the art of formulating, writing, and orally defending an original research proposal will be practiced and criticized.

1 unit, Aut, Win, Spr (van Tamelen, Brauman, Hodgson) by arrangement

251. Advanced Inorganic Chemistry — The chemistry of complex ions. Prerequisite: one year of physical chemistry.

3 units, Aut (Hodgson) TTh 11

253. Advanced Inorganic Chemistry — Solvation of ions; substitution and electron transfer reactions, emphasizing the principles of kinetics and other approaches to defining reaction mechanisms. Prerequisite: one year of physical chemistry.

3 units, Win (Staff) TTh 11


3 units, Spr (Collman) TTh 11; one hour by arrangement

271. Advanced Physical Chemistry — Principles of quantum mechanics. General formulation, mathematical methods, and elementary applications of quantum theory to the structure of atoms and molecules, including variational procedures, perturbation theory, operator and matrix methods, theory of angular momentum, and elements of the electronic structure of atoms. Prerequisite: 175.

3 units, Aut (B. Hudson) MWF 11

273. Advanced Physical Chemistry — Molecular spectroscopy and molecular structure. Examination of the experimental and theoretical basis for various models of molecular structure: review of quantum theory of atomic and molecular structure, Born-Oppenheimer approximation, molecular energy levels, interaction of radiation with matter, microwave, infrared, and ultraviolet spectroscopy of molecules. Also, special topics to be chosen according to the interests of the students and instructor; for example, scattering of light by fluids, correlation function methods, spectra of molecules in solution, Mossbauer spectroscopy, magnetic resonance, Raman spectroscopy. Prerequisite: 271.

3 units, Win (Weinhold) MWF 11

275. Advanced Physical Chemistry — Basic principles and methods of statistical mechanics from the ensemble point of view, statistical thermodynamics, heat capacities of solids and polyatomic gases, chemical equilibria, equations of state of fluids, phase transitions. Prerequisite: 271.

3 units, Spr (Andersen) MWF 11

277. Selected Topics in Physical Chemistry — May be repeated for credit. Possible topics include structure elucidation using diffraction techniques, advanced statistical mechanics, crystal field theory, advanced quantum mechanics, magnetic relaxation, advanced thermodynamics, chemical applications of group theory. Prerequisite: 275 or consent of instructor.

3 units, Aut, Win, Spr (Staff) MWF 10

283. Research Proposals in Physical Chemistry — Students will present research proposals and progress reports on their research in physical chemistry, using oral and written forms. Topics may be drawn from the student's research or a related area in physical chemistry. Written form, oral presenta-
tion and scientific merit will be evaluated. May be required of 2nd- and 3rd-year graduate students at the discretion of the research advisor.

1 unit, Aut, Win, Spr (B. Hudson, Pecora, Weinhold)

287. Biophysical Chemistry—Covers theoretical and experimental aspects of biophysical phenomena, with emphasis on magnetic resonance methods, and problems in membrane biology. Special lectures on x-ray diffraction, low-angle scattering and electron microscopy will also be included. Minimal prerequisites are previous or concurrent registration in Chemistry 173, or the equivalent.

3 units, Aut (McConnell) MWF 9, alternate years, given 1975-76

289. Biophysical Chemistry—(Continuation of Chemistry 287.)

3 units, Win (McConnell) MWF 9, alternate years, given 1975-76

291. Biophysical Chemistry—(Continuation of Chemistry 289.)

3 units, Spr (McConnell) MWF 9, alternate years, given 1975-76

300. Department Seminar—Attendance is required of all graduate students, and all undergraduates registered for 190.

1 unit, Aut, Win, Spr (Staff) M 4

301. Research in Chemistry—Seminars and directed reading dealing with newly developing areas in chemistry and experimental techniques. Open to qualified graduate students with the consent of the instructor. May be repeated for credit. Registration required of all graduate students who have passed the qualifying examination.

2 units, Aut, Win, Spr, Sum (Staff) sec. 2 through 30, W 7:30-9:30 or by arrangement

RESEARCH AND SPECIAL ADVANCED WORK

190. Introduction to Methods of Investigation—For general character and scope, see 200, below. Limited to undergraduate students admitted under the Honors Program or by special arrangement with a member of the teaching staff. Concurrent attendance in 300 required.

(Staff) by arrangement, register for sec. 2-30 according to professor

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 200 (or 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 chemistry: previous or concurrent registration in 134.

(Staff) by arrangement, register for sec. 2-30 according to professor

CLASSICS

Emeriti: Hermann F. Fränkel, Lionel Pearson (Professors)

Chairman: Mark W. Edwards (on leave, Autumn Quarter)

Professors: Mark W. Edwards, Edwin M. Good (Religious Studies and, by courtesy, Classics), Antony E. Raubitschek, Michael Grant (Visiting)

Associate Professors: Andrew Devine, Michael Wigodsky

Assistant Professors: N. Gregson Davis, Ronald Mellor. Acting: Helene P. Foley, Joel P. Lidov

Lecturers: Robert Hamerton-Kelly (Classics and Religious Studies), Edward W. Spofford

The Department of Classics offers work in the Greek and Latin languages and literatures (both in the original languages and in translations), in Greek and Roman History, and in Classical Art and Archaeology. It affords an opportunity for the student to develop three things: a competence in the classical languages, an appreciation, comprehension, and enjoyment of classical literature, and an understanding of the history and culture of the ancient world. The Department is interested both in students who wish to do their major work in Classics and in students who wish to relate Classics to work in such other departments as English, Philosophy, History, and the Modern Languages.

Study of the Classics is a very important
part of a liberal education and should be undertaken with that thought in mind. The Department hopes that some students who make it their major subject will devote themselves to teaching Latin and Greek in high schools or colleges.

**Admission to the Department**

Those who are considering a major in Classics (Latin and Greek) should enroll in the Department as early as possible, since at least three years of work in Latin or Greek or both will generally be required of them, and those with no previous knowledge of Latin (or Greek) should begin the study of the language in their freshman year, or as early as possible in their sophomore year. Prospective majors in Classical Studies should normally enroll not later than the beginning of their junior year, but are urged to discuss their plans with a member of the department at an earlier stage if possible.

**Programs of Study**

**Bachelor of Arts in Classics**

The Degree of Bachelor of Arts with a Major in Classics may be taken in the following alternative ways:

1. Greek and Latin.
2. Greek or Latin.
3. Greek or Latin with a related Minor, e.g., Latin, Greek, English, History, Philosophy, or one of the Modern Languages.
4. A Combined Major, with emphasis divided equally between Classics (Greek or Latin) and another subject, e.g. English, History, French, etc.
5. An Extended Major, which requires work in Classics, combined with work in two other subjects in different departments.

More detailed descriptions of the requirements follow. All major students will be assigned a departmental adviser, who will help them prepare a program of study; they should discuss their program with him at regular intervals.

1. Greek and Latin. Six or more courses in Greek numbered 100 or higher and an equal number in Latin. Credit towards the Major for Second-Year courses (101, 102, 103) will be accepted only with the approval of the Undergraduate Studies Committee. So far as possible, students should follow the sequence of Greek and Latin courses, 111, 112, 113, 151, 152, 153 (in alternate years 161, 162, 163), so as to acquire an acquaintance with the major authors in both languages. In addition, as recommended by their adviser, they may do some work in Greek and Latin Composition, one of the Senior Undergraduate Seminars, or some work in Graduate Courses. Some work will also be expected in Ancient History or Art or some other aspect of classical civilization.

This is the most exacting course of study in the department, preparing students to go on to graduate work in Classics, and involves between 50 and 60 units in departmental courses and directed reading. It is particularly recommended for students with good preparation in secondary school, but it is within the range of those who have had no previous training in one of the languages (Greek or Latin), if the elementary work is completed in freshman or sophomore year, thus leaving time for the six courses at the level of 100 or above.

2. Greek or Latin

a) Latin: 30 units in Latin courses, all at the 100 level or higher (including, if recommended by the student's adviser, some work in Latin Composition); two courses in ancient history; some work in Greek, or two related courses, acceptable to the department, in ancient art and archaeology, classical civilization, or the Humanities program. (See note 1)

b) Greek: 30 units in Greek courses, all at the 100 level or higher (including, if recommended by the student's adviser, some work in Greek Composition); two courses in ancient history; some work in Latin, or two related courses, acceptable to the department, in ancient art and archaeology, classical civilization, or the Humanities program. (See note 1)

3. Greek or Latin with a related Minor. Courses in Greek or Latin, Ancient History, and other subjects as in 2), with an additional Minor program of 20 units in any field acceptable to the department.

4. Combined Major. A student may divide the time equally between work in Classics
and work in another department, e.g. English, Philosophy, History, or one of the Modern Language departments, with the consent of the Chairmen of both departments concerned. Interested students should consult the departmental chairmen for details of requirements. They may be formally enrolled as major students either in the Classics department or in the other department. The Classics Department will require about two-thirds of one of its major programs, 1) or 2) above, and a comparable demand may be expected from the other department.

5. Extended Major. This is similar to 4), except that two other departments besides Classics are concerned. Further details may be obtained from department chairmen. The student may be enrolled as a major student either in Classics or in one of the other departments; he or she will arrange his or her program of study with the departmental adviser where he or she is enrolled. This program may be particularly attractive to a student who has a broader interest in History and Literature, and wishes, for example, to combine the study of a classical language and its literature with the study of another literature, history, and civilization. If Greek or Latin is one of the subjects chosen, the student will be expected to reach a standard similar to what is expected in 4) above.

A high degree of flexibility is possible in this Major, but the total of units demanded will be quite high, and the student must be prepared to restrict the number of his or her elective courses.

6. Classical Studies. This major is recommended for students who wish to study the classical civilization in depth as part of their general educational experience, but do not have the time or the desire to study the languages to the extent required by the major in Classics. The required minor is intended to assist students in relating their work in Classics to particular aspects of modern civilization. This major is suitable for students who think of proceeding to Law, Business, or Medical School, or to graduate work in History, Archaeology or Comparative Literature. It is not suitable for those who may wish to teach Latin or Greek in high school or college, as the language work is insufficient for this purpose. Additional language work would be necessary before entering graduate school in Classics.

Requirement: 40 units in the major, including (a) at least two courses in Latin or Greek at the 100 level or higher; or one course in one of the languages at the 100 level or higher, plus the 1, 2, 3 or 51, 52 series in the other language: (b) at least one course in the Department from each of the following groups: Literature; Philosophy and Political Theory; Ancient History; Religion and Mythology; Art and Archaeology, Senior Seminars. Students are required to take not less than 15 units in a relevant minor field outside the Department; such fields might include not only other humanities subjects but also anthropology, psychology, sociology, or political science.

Note 1. University units earned by placement tests or advanced placement work in secondary school will not be counted towards any major program in the department and work done in other universities or colleges will be subject to departmental evaluation.

Note 2. Students who are contemplating graduate work in Classics, or a professional career as teachers of Greek and Latin, might suitably follow any of the first three programs, 1), 2), or 3), provided they do some work in both languages. Programs 4) and 5) cover a wider field, and may be recommended particularly to students who look towards graduate work in other humanistic subjects, e.g., History, Philosophy, or some field of literature other than the classical.

MINORS

For an Undergraduate Minor in Classics (Greek or Latin) the Department recommends the following: 20 units in Greek or Latin courses at the 100 level or above, including at least one of the More Advanced Courses, and an additional 4 units in related courses (ancient history, ancient art and archaeology).

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.”
TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the "School of Education" section of this bulletin and the Credential Secretary, School of Education.

ROME CLASSICAL CENTER

Classics majors are strongly urged to attend the Intercollegiate Classical Center at Rome. The program in Rome is specially designed for classical undergraduates. The Center is managed by Stanford University for 53 constituent colleges and universities including Stanford. It is open to Stanford majors in Classics and Art History (see the Center brochure) and all courses given in the Center receive full credit at Stanford and count toward a Stanford major in Classics.

All students interested in this program should consult the Chairman of the Department.

STANFORD IN GREECE

The Classics Department is operating a program of summer study in Greece, in which students take a preparatory course in Greek art and archaeology at Stanford in the Spring Quarter and then spend a period of direct study of the monuments in Greece during the summer. Students who are not Classics or Art majors are eligible, but should have some previous study of Greek history, language or art. Those interested should see the Chairman of the Classics Department early in the academic year.

ADVANCED DEGREES

MASTER OF ARTS

Students who have completed an undergraduate major in Classics (Latin and/or Greek) or its equivalent may be accepted as candidates for the degree of Master of Arts, and expect to complete the program in one year. Students without an undergraduate major in Classics may also be accepted as candidates, though they may require a longer period of study before completing the requirements for the degree. These requirements are:

1. Satisfactory demonstration of competence in Greek and/or Latin composition.

2. Attainment of a standard of scholarship such as would normally be reached by three quarters of study in the Department after fulfilling the requirements for an undergraduate major in the Department. This would normally mean the completion of at least 18 units of graduate courses and 18 units of work at the 150 or 170 levels.

3. The satisfactory completion of one Greek course at the 100 level (if the undergraduate major has been Latin) or one Latin course at the 100 level (if the undergraduate major has been Greek).

4. The passing of an examination testing the candidate's ability to translate into English from a selected list of Greek or Latin authors.

5. The writing of a thesis, or the passing of an examination on a particular author or topic.

6. A reading knowledge of French or German is required.

Students who are candidates for the Ph.D. degree may also (on the recommendation of the Department) become candidates for the A.M. degree. In their case requirement 5 above will be waived provided that they have completed some work beyond the course requirements listed under 2 and 3 above.

DOCTOR OF PHILOSOPHY

University regulations regarding admission and application for candidacy are discussed in the section "Degrees" of this Bulletin.

All candidates for the Ph.D. degree in Classics must fulfill the following requirements:

1. They must complete at least three years (nine quarters) of full-time work, or equivalent, in study beyond the Bachelor's degree. At least 72 approved units in graduate courses or seminars at 200 level or above must be completed in addition to the doctoral dissertation. At least three consecutive quarters of graduate work and the final units of credit in the program must be taken at Stanford. More detailed information on the Advanced Degree Program is available in mimeographed form in the Classics Department Office.

2. Candidates will be required to pass examinations as follows:
a) Reading examinations in French and German. In some circumstances Italian may be substituted for French.
b) Examinations in translation into English from Greek and Latin authors included in an approved list (drawn up by the Department and available from the Departmental secretary).
c) Final written examinations in two classical authors (one Greek and one Latin) and in two fields, one of which must be historical. Each student must submit a syllabus for each author and each field. The examinations will be drawn up on the basis of this syllabus after it has been approved by the Department.
d) An oral examination on the candidate's dissertation subject and on two or more special topics, such as selected authors or selected aspects of Greek or Roman literature, history, archaeology, philosophy, epigraphy or palaeography.
e) Candidates must pass examinations in the reading and writing of Greek and Latin unless they receive a satisfactory grade in Greek 205 and Latin 205.

3. The examinations in translation from Greek and Latin authors will normally be taken in the autumn term of the second year of graduate work, the final written examinations in the spring term of the second year and the autumn term of the following year, the oral examination in the spring following. The period between the translation and final written examinations will be devoted largely to an intensive preparation for the latter examination, during the course of which candidates will be expected to make full use of relevant secondary material in modern languages. They should therefore plan to satisfy the requirements in composition and French and German as soon as possible, preferably before the time of the translation examination. Except in very special circumstances they will not be allowed to take the final written examination until the other three sets of examinations have been successfully completed.

4. Each candidate (not later than the end of the quarter in which the final written examination is taken) must submit to the Chairman of the Department a statement of his or her dissertation topic as approved by his or her dissertation committee. This committee will normally be appointed (for each candidate) by the Chairman of the Department at least one quarter before the student's dissertation topic is due to be submitted. At the same time or earlier a senior member of the Department will be appointed as the candidate's adviser who will thereafter supervise the candidate's writing of the dissertation. An acceptable dissertation must be a genuine contribution to classical scholarship and should be written in an acceptable style. All theses must be written in English.

Minor for the Degree of Doctor of Philosophy—The Department recommends for a graduate minor at least 18 units in Latin or Greek at the 100 level or above, and at least one course at the graduate (200) level.

GRADUATE PROGRAM IN INDO-EUROPEAN STUDIES

This program is administered by the Classics Department. It involves work in general Indo-European and a language of specialization. Interested students should contact Professor Devine of the Classics Department.

GRADUATE PROGRAM IN HUMANITIES

The Department of Classics participates in the Graduate Program in Humanities leading to the joint Ph.D. degree in Classics and Humanities. For a description of that program see the section "Humanities Special Programs" in this bulletin.

COMPARATIVE LITERATURE

The Classics Department cooperates closely with the Graduate Program in Comparative Literature. Interested students should consult the Chairman of the Department.

COURSES IN GREEK

FIRST- AND SECOND-YEAR COURSES

Students with no previous experience may begin the study of Greek with either Greek 1 or Greek 51. The series 1, 2, 3 begins in Autumn quarter (4 units a quarter), the series 51–52 in Winter quarter (5 units a quarter), and is intended to cover the same ground at a more rapid pace, so that the series 101, 102, 103 forms a sequel equally
to Greek 3 and Greek 52. During the first year some Xenophon or Plato will be read, so as to prepare the student in the following year for further reading of Plato, Homer, and Euripides. These courses all form part of a series, but qualified students may be admitted to the class in winter or spring by consent of the instructor.

Students who have done previous work in Greek elsewhere should consult a member of the department to determine for what course they are qualified.

Students whose major work is in another department and who wish to fulfill a departmental language requirement by taking Greek should consult their departmental advisers to determine what courses will be required, but most departments will be satisfied if part of the series 101, 102, 103 is completed.

1. First-Year Greek—For beginners.
   4 units, Aut (Foley) MTWTh 9
2. First-Year Greek—Continuation of 1.
   4 units, Win (Foley) MTWTh 9
3. First-Year Greek—Continuation of 2.
   4 units, Spr (Foley) MTWTh 9
51. First-Year Greek—Accelerated course.
   5 units, Win (Lidov) MTWThF 1:15
52. First-Year Greek—Continuation of 51.
   5 units, Spr (Lidov) MTWThF 1:15
101. Second-Year Greek—Reading of Plato, Apology, and other selections.
   4 units, Aut (Lidov) MWF 10:00
102. Second-Year Greek — Continuation of 101. Homer, Odyssey.
   4 units, Win (Edwards)
103. Second-Year Greek—Continuation of 102. Euripides, one play.
   4 units, Spr (Raubitschek)
   2 units, Win (Kelly) by arrangement

The intensive Greek course (Greek 10) offered in summer quarter should prepare students to enter Greek 101 in autumn quarter.

THIRD- AND FOURTH-YEAR COURSES

The series 111–113 is offered every year. 151–153 and 161–163 are offered in alternate years and may be taken in succession.

111. Tragedy — Sophocles, one or more plays.
   3 to 4 units, Aut (Wigodsky)
112. Euripides.
   3 to 4 units, Win (Staff)
113. Attic Prose.
   3 to 4 units, Spr (Mellor)
151. Greek Lyric Poetry.
   3 to 4 units, Aut (Davis) given 1975–76
152. Homer.
   3 to 4 units, Win (Edwards) given 1975–76
153. Aristophanes.
   3 to 4 units, Spr (Foley) given 1975–76
160. Individual Work.
   By arrangement
164. Aristotle.
   3 to 4 units, Aut (Raubitschek) MWF 11:00
162. Aeschylus.
   3 to 4 units, Win (Foley)
163. Herodotus.
   3 to 4 units, Spr (Raubitschek)

The sequence of authors in undergraduate courses is intended to provide an initial acquaintance with the best of classical literature and to meet each student's level of competence in the language. Modifications may be made to suit the needs and interest of each class.

COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

175. Greek Composition.
   2 units, Aut (Raubitschek)

GRADUATE COURSES

202. Tutorial in Greek Literature.
   2 units, Aut, Win, Spr (Staff)
205. Greek Language and Style.
   2 units, Win, Spr (Staff)

The above courses are offered every year. Other courses alternate or vary from year to year. In 1973–74 there were courses in the following authors or topics: Athenian Democracy, Pindar, Homer, Homeric Archaeology. The following courses will be offered in 1974–75:
213. Greek Tragedy: Aeschylus.  
4 units, Spr (Edwards)

216. Thucydides.  
4 units, Win (Raubitschek)

222. Topics in Greek Literature.  
4 units, Spr (Edwards)

230. Greek Lyric Poetry.  
4 units, Aut (Lidov)

260. Directed Reading.  
By arrangement

270. Greek Prose or Verse Composition.  
By arrangement

Note: Some of the courses listed above may be continued in the following quarter when arrangement is made with the instructor. This will usually require the writing of a research paper based on work directly related to the course.


COURSES IN LATIN

FIRST-YEAR COURSES

Students with no previous experience may begin the study of Latin with either Latin 1 or Latin 51. The series 1, 2, 3 begins in autumn quarter (4 units a quarter), the series 51, 52 in winter quarter (5 units a quarter) and is intended to cover the same ground at a more rapid pace, so that the series 101, 102, 103 forms a sequel equally to Latin 3 and Latin 52. During the first year some Caesar or other simple Latin prose will be read so as to prepare the students in the following year for Cicero, Virgil, and Ovid. These courses all form part of a series, but qualified students may be admitted to the class in winter or spring quarters by consent of the instructor.

Students whose major work is in another department and who wish to fulfill a departmental foreign language requirement by taking Latin should consult their departmental advisers to determine what courses will be required, but most departments will be satisfied if part of the series 101, 102, 103 is completed.

1. First-Year Latin—For beginners.  
4 units, Aut (Spofford) MTWTh 9

2. First-Year Latin—Continuation of 1.  
4 units, Win (Spofford) MTWTh 9

3. First-Year Latin—Continuation of 2.  
4 units, Spr (Spofford) MTWTh 9

51. Accelerated Beginners' Course.  
5 units, Win (Devine) MTWThF 1:15

52. Accelerated Beginners' Course—Continuation of 51.  
5 units, Spr (Devine) MTWThF 1:15

The intensive Latin course (Latin 10) offered in summer quarter should prepare students to enter Latin 101 in the autumn quarter.

INTERMEDIATE COURSES

Students will be admitted to these courses by completing Latin 3 or Latin 52 or on the basis of previous work done in high school or elsewhere. Usually two years of high school Latin qualifies a student for 101, three or four years for 111. New students should determine for which course they are best fitted by writing the Latin placement examination, which is set every autumn in orientation week, or by consultation with a member of the Department. These courses form two consecutive series, but students may be admitted to the class in the winter or spring quarters by consent of the instructor.

101. Second-Year Latin (Sequel to Latin 3 or 52.)—Latin Poetry. Ovid, Catullus.  
4 units, Aut (Staff)

102. Second-Year Latin (Continuation of 101.)—Reading in Latin prose. Cicero, Sallust.  
4 units, Win (Devine)

103. Second-Year Latin (Continuation of 102.)—Latin Poetry. Virgil, Aeneid. One or more books will be studied.  
4 units, Spr (Staff)

104. Christian or Mediaeval Latin Authors.  
Spr, by arrangement

111. Third-Year Latin (Sequel to Latin 103.)—Literature of the Augustan Age. Horace, Odes, a selection.  
4 units, Aut (Davis)

112. Third-Year Latin (Continuation of 111.)—The Augustan Age. Virgil, Eclogues and Georgics.  
4 units, Win (Spofford)
113. Third-Year Latin (Continuation of 112.)—The Augustan Age. Livy and the elegiac poets, a selection.
   4 units, Spr (Edwards)

MORE ADVANCED COURSES

The series 151–153 and 161–163 will be offered in alternate years and may be taken in successive years.

151. Roman Comedy.
   3 to 4 units, Aut (Mellor) given 1975–76

152. Cicero, Oratory.
   3 to 4 units, Win (Mellor) given 1975–76

   3 to 4 units, Spr (Wigodsky) given 1975–76

160. Individual Work.
   By arrangement

161. Tacitus.
   3 to 4 units, Aut (Mellor) TTh 11

   3 to 4 units, Win (Davis)

163. Lucretius.
   3 to 4 units, Spr (Wigodsky)

The sequence of authors in undergraduate courses is intended to provide an initial acquaintance with the best of classical literature, and to meet each student's level of competence in the language. Modification may be made to suit the needs and interest of each class.

COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

175. Latin Composition.
   2 units, Aut (Davis)

GRADUATE COURSES

   2 units, Aut, Win, Spr (Staff)

205. Latin Language and Style.
   2 units, Win, Spr (Staff) by arrangement

The above courses are offered every year. Other courses alternate or vary from year to year. In 1973–74 there were courses in the following authors or topics: Cicero, De Finibus, Vulgar Latin Inscriptions, the 2nd Century A.D. The following courses will be offered in 1974–75:

208. Post-Classical Latin—(Same as English 208 and Comparative Literature 208.) Careful reading of Latin texts of graded difficulty, beginning with the Vulgate Bible, working through various patristic writings and medieval literature toward Latin of the Renaissance. Intended primarily for students not in classics. Prerequisite: two years high school Latin or equivalent.
   5 units, Aut (Damon) MTWTh 11:00

211. Petronius.
   4 units, Win (Davis)

   4 units, Win (Berg)

218. Horace, Odes.
   4 units, Aut (Wigodsky)

231. Roman Historiography.
   4 units, Spr (Mellor)

240. Topics in Roman Civilization.
   4 units, Win (Grant)

260. Directed Reading.
   By arrangement

270. Latin Prose or Verse Composition.
   By arrangement

Note: Some of the above courses may be continued in the following quarter by arrangement with the instructor. This will usually require the writing of a research paper based on work directly related to the course.


COURSES IN HEBREW

For courses in Hebrew, see Religious Studies, page 144.

COURSES IN CLASSICAL STUDIES

No knowledge of Greek or Latin is required for these courses.

COURSES FOR FRESHMEN

Topics in Classical Civilization

In this program a number of courses are offered specifically intended to acquaint first-year students with certain ways of looking at the ancient world which will be of use to them in their general educational experience in the university. They introduce the student to the value of classical learning as a means of rapidly widening one's knowledge and experience, and as an opportunity
to observe how the universal problems of human nature, human society, and the circumstances of human life were viewed and grappled with by the brilliant civilizations of Greece and Rome.

2. The World of Greece and Rome — This course is designed to give a general picture of the civilization of Greece and Rome, by comparing certain aspects of the two cultures. In turn, epic poetry, the use of audial and visual media to propagate ideas, drama, poetic theory, and philosophy will be studied—comparing in each case the Greek element with the Roman—in order to produce a general picture which may form the background for further study of other cultures.

3 units, Win (Grant) TTh 11

3. New Democracy and New Imperialism— In one century Athens developed from an ordinary Greek city-state, just freed from dictatorship, into the leader of an offensive coalition of Greek states against Persia, and finally became the ruler of a reluctant empire. Another bloc, this time of oligarchical states, formed around Sparta and Corinth, and after a long war Athens was defeated. This course will study, mainly in the original sources, the development and interrelationships of democracy and imperialism, with the purpose of identifying the universal principles involved.

3 units, Spr (Edwards) TTh 10

7. Rome and the Romans in the Age of Augustus—The course will deal with various aspects of public and private life in ancient Rome: the family, religion, the arts, politics, housing, commerce, leisure activities. Attention will be paid to the city plan and architecture of ancient Rome, in an attempt to relate the everyday life of the Romans to their physical environment.

3 units, Aut (Mellor) TTh 10


3 units, Win (Raubitschek) TTh 10

9. Women in the Ancient World — The course will identify the image of the female in ancient myth and religion, and discuss the actual status of women at various periods of antiquity. In addition to ancient literature, readings will include some modern psychological studies.

3 units, Aut (Foley) TTh 11

10. The Alphabet — A study of the origin and development of alphabetic writing systems, with emphasis on the role of Greek and Latin in the transmission of the alphabet to the languages of Europe.

2 units, Spr (Devine) Th 3:15

GENERAL COURSES

Literature

121. The Literature of Ancient Rome — A critical study of major Latin authors, with attention to their influence on modern literature.

3 to 4 units, Spr (Davis)

160. Individual Work.
By arrangement

161. The Classical Epic: Homer, Apollonius, Virgil—A study of classical (and other) epics with respect to structure, character, common motifs, and imagery.

3 to 4 units, Win (Edwards) given 1975-76

162. Greek Tragedy: Aeschylus, Sophocles, Euripides—A study of the history, social function, and development of ancient tragedy.

3 to 4 units, Win (Spofford)

172. Classical Influences in Modern Literature—Themes from classical myth and history in selected Renaissance and later writers; parallel readings from ancient literature.

3 to 4 units, Win (Wigodsky)

Philosophy and Political Theory

164. Plato—The meaning of Plato's thought will be discovered in the dramatic form of selected dialogues as well as in direct philosophical statement.

3 to 4 units, Spr (Staff) given 1975-76

165. Hellenistic Philosophy—Epicurus, Stoics and minor schools, their relation to earlier Greek thought, and their influence in the Roman Empire.

3 to 4 units, Spr (Wigodsky) given 1975-76

173. Classical Political Theory — Ancient political ideas (Plato, Aristotle, Polybius, Cicero) and their impact on modern theory.

3 to 4 units, Win (Raubitschek) given 1975-76
Ancient History

These courses are accepted by the History Department for credit toward a major in History.

INTRODUCTORY COURSES

102. History of Greece — A survey of the history of ancient Greece from the Bronze Age through the Age of Pericles down to the death of Alexander the Great (323 B.C.).

4 to 5 units, Aut (Raubitschek)
MTWTh 2:15

103. History of Rome—A survey of the history of the Roman people from the founding of Rome (c. 753 B.C.) to the fall of the Roman Empire in the West (476 A.D.).

4 to 5 units, Win (Mellor) MTWTh 2:15

104. The Tradition of Hellenism—From the death of Alexander (323 B.C.) to the fall of Constantinople (1453 A.D.). The rise of the Hellenistic States and the transformation of Hellenic culture, and the absorption of this civilization by the Romans and the Byzantine Empire.

4 to 5 units, Spr (Raubitschek) MTWTh 2:15

MORE SPECIALIZED COURSES

113. The Roman Revolution—The collapse of the Roman Republic from the rise of the Gracchi to the death of Julius Caesar.

4 units, Spr (Mellor) given 1975-76

115. Historiography and Ancient History—An examination of the nature and purpose of history as well as the aims and methods of historians. Reading and discussion will focus on historians of antiquity (Thucydides, Herodotus, Polybius, Livy, Tacitus) and a modern historian of Rome (Gibbon).

3 to 4 units, Win (Mellor)

See also Religion 120, Religion in the Ancient Near East.

160. Individual Work in Ancient History.

By arrangement

174. Roman Law and Political Institutions—An introductory study of Roman private and public law; the family, the administration of justice, the practice of government.

3 to 4 units, Spr (Mellor)

261. Individual Work in Greek History.

By arrangement

Religion and Mythology

117. Greek Religion — The origins and development of Greek religious phenomena from Mycenae to Byzantium.

3 to 4 units, Spr (Staff) given 1975-76

138. Hellenistic Religions—Major religions of the eastern Mediterranean world in the Greco-Roman period: Judaism, Christianity, Gnosticism, Mithraism, Isis, and the ruler cults.

5 units, Spr (Kelly)

163. Comparative Mythology: Topics from Greek and Roman, Near-Eastern and African Culture—(Same as Comparative Literature 163.)

3 to 4 units, Spr (Davis)

Art and Archaeology

101. Archaic Greek Sculpture and Painting.

2 to 3 units, Aut (Staff)

102. Classical Greek Sculpture and Painting.

2 to 3 units, Win (Staff)

103. Hellenistic Greek Sculpture and Painting.

2 to 3 units, Spr (Staff)

105. Athenian Everyday Life.

2 to 3 units, Aut (Staff) given 1975-76

106. Art and Monuments of the Romans.

4 units, Spr (Wigodsky) given 1975-76

107. Greek Theatre Production.

2 to 3 units, Win (Webster) given 1975-76

Art 108. Topography and Monuments of Greece.

3-4 units, Aut, Spr (Raubitschek)

See Greek 254.

See also Art 100 A, B, C, and 103.

Senior Seminars

Advanced seminars designed to give senior Classics and Classical Civilization majors an opportunity to use their Classical education in an intensive study of a topic or period of the ancient world. Such topics might include justice, literature and social change, the use of myth in literature and philosophy, death, and politics and litera-
SCHOOL OF HUMANITIES AND SCIENCES

ture. Alternatively, a seminar might concern itself with an interdisciplinary study of a historical period such as Periclean Athens, the Hellenistic world, Augustan Rome. Historical, literary, and philosophical works appropriate to the problems will be read in translation. Since enrollment will usually be limited to seniors in the department of Classics, a general familiarity with the history and literature of the ancient world will be assumed.

One or more seminars will be offered each year. In 1974-75 the offerings are:

181. Senior Seminar—Topics in Greek civilization.
   4 units, Win (Foley)

182. Senior Seminar—Topics in Roman civilization.
   4 units, Spr (Spofford)

Other Courses

153. Introduction to Indo-European Linguistics—(Same as 253.) Suitable for undergraduate majors or minors in Classics. Prerequisite: Latin 103, Greek 103, or equivalent.
   4 units, Aut (Devine) TTh 9

201. Introduction to Classical Scholarship.
   1 unit, Aut, Win, Spr (Staff)

213. Introduction to German Classical Scholarship.
   4 units, Spr (Staff) given 1975-76

253. Introduction to Indo-European Linguistics—(Same as Linguistics 253.) This course is recommended for students in Classics as an introduction to the scientific study of language, especially topics such as the relationship of writing to speech and the common origins of Latin, Greek, and English.
   4 units, Aut (Devine) TTh 9

   3 units, Aut, Win (Devine) given 1975-76

COMMUNICATION

Emeriti: Wilbur Schramm, Clifford F. Weigle (Professors)
Chairman: Lyle M. Nelson
Director, Institute for Communication Research: Nathan Maccoby

Director, Professional Journalism Fellowship Program: Lyle M. Nelson. Managing Director: Harry N. Press


Associate Professors: Henry S. Breitrose, William J. Paisley

Assistant Professors: Cedric C. Clark, Dan G. Drew, Steven Kovács, John K. Mayo, Emile McAnany, Donald F. Roberts, Edward J. Sondik. Acting: Don Dodson, Robert C. Hornik

Senior Lecturer: Ronald Alexander


The Department of Communication engages in research in communication and offers curricula leading to the A.B., A.M. and Ph.D. degrees. The Master of Arts degree prepares students for careers in journalism or documentary film. The Ph.D. degree leads to careers in teaching and research or other related specialties.

The Institute for Communication Research is the research arm of the Department and offers research experience to advanced students.

The Professional Journalism Fellowship Program brings promising young journalists to study at the University in a non-degree course of study under a program which is sponsored by The National Endowment for the Humanities.

ADMISSION

All prospective undergraduate students should write the University's Office of Admissions.

All prospective graduate students should write to the Graduate Admissions Office, Stanford University, Stanford, California 94305.

The Department requires that applicants for graduate admission include verbal and quantitative scores from the Graduate Record Examination (area scores are optional). Applicants who hope to work toward a Ph.D. are also required to submit scores from the Miller Analogies Test. These test
requirements may be waived after written petition to the Department only in exceptional circumstances where the applicant is prevented from taking the tests.

Preference is given to those applicants for the Master of Arts in Journalism who have not had extensive media experience or courses in journalism.

**Programs of Study**

**Bachelor of Arts**

Undergraduate students must complete Communication 1 before they are accepted as a major. They normally should enroll in the department during either their sophomore or junior years.

A student planning a major in Communication is strongly urged, in consultation with his adviser, to select courses in humanities, social sciences, and sciences. Most commonly, majors take elective courses in psychology, sociology, anthropology, political science, history, economics, and English, and in such interdepartmental studies as Urban Affairs, Human Biology, and African and Afro-American Studies.

One Department degree program is offered with the opportunity to concentrate in the general study of communication and the mass media or in pre-professional study in journalism or film and broadcasting. The undergraduate major is considered a preprofessional program and is designed to provide a variety of offerings within the Department combined with a flexible program of breadth and depth in courses outside the Department. Burden of program development rests with the student in consultation with his or her advisor.

To be recommended for the Bachelor of Arts degree in communication, the student must take at least 30 and not more than 40 units within the department. The student must also meet University distribution requirements and complete a unified program of advanced courses (100 level or above), totaling at least 20 units, in another department, an interdepartmental program, an interdisciplinary honors program, or a second major.

As part of the 30 to 40 units a student takes within the department, he or she must complete Communication 1 and one of the following sequences:

1. Students concentrating in the social science sequence must complete:
   a. Communication 70
   b. Communication 100–102 or Communication 90
   c. Psychology 60 or Statistics 60
   d. Communication 131, or 123, 126, 127, 128, 135 or 192 (any two of these)

2. Students concentrating in the film and broadcast sequence must complete:
   a. Communication 142
   b. Communication 101 and 180 (133 and 134 are recommended but not required and may be used to fulfill this requirement)

3. Students concentrating in the journalism sequence must complete:
   a. Communication 100–102
   b. Communication 107
   c. Communication 175

An alternative degree is a Bachelor of Arts degree in Social Science (Communication). Requirements for this degree are a total of 30 units in Communication courses as specified in (1) above and 20 units of advanced courses in one or more other social science departments. Students electing Communication as a secondary major must declare with the department.

Although the Department offers no courses in such subjects as science reporting, technical writing, or public relations, appropriate programs of study can be arranged for interested students. For example, a prospective science writer could be permitted to substitute a unified program of courses in the physical sciences in lieu of other recommended courses.

**Master of Arts**

The Master of Arts degree is awarded by the Department in the fields of Journalism, Film and Broadcasting, and Communication Media and Social Change. Requirements are as follows:

1. The candidate must earn at least 45 units in graduate residence at Stanford; he must be enrolled as a major in the Department for at least two quarters; he must maintain a high academic performance during his entire program of study. At least 20 of the 45 units must be in courses numbered 200 or higher, and the other units in courses numbered 100 to 199. An independent project (on occasion a thesis) under the direc-
tion of a major professor must be undertaken. Three to six hours of credit in independent study may be applied to this requirement. A report of the project must be made to the professor directing the independent study. Completion of the entire program (45 units, including independent project, plus an internship experience for those who do not have professional experience) normally takes three to five quarters depending on the nature of the project. Tuition usually is charged only for the quarters of regular class attendance.

2. A unified program of advanced course work is to be arranged with the approval of the adviser. This includes appropriate grounding in research methodology and communication theory and training in one or more communication media. Students with insufficient undergraduate background in the appropriate social sciences will be required to take Comm 203 or another Communication Theory or Methods course.

3. Typically, students concentrating in film will take Communication 206A,B,C and Communication 223A,B,C, together with additional work in film aesthetics, history, criticism, and such other courses in the social sciences and humanities as would be useful to them. The graduate seminar 203A,B,C is required. Students having an interest in broadcasting will also take 242 and 242A. The rest of the curriculum will be worked out in consultation with his or her advisor.

4. Students in the Journalism A.M. program with neither undergraduate journalism instruction nor professional experience are required to take: Communication 100, 102, 107, 150 or 175, 203, 220, two quarters of 225, 249 or Political Science 273, 309, and an internship with a media organization. The remainder of the program is to be a cohesive group of at least two or three courses outside the Department. Students with undergraduate journalism training or media experience should check with their advisers to determine which of the above departmental courses will be required and which can be replaced with electives.

5. The Master’s program in Communication Media and Social Change is designed primarily for students from Asia, Africa, and Latin America. It will entail a two-year commitment on the part of most students and include course work in Communication and development theory (255, 256), research methods (205, 257) and statistics. Much of a student’s second year will be spent in the design, implementation, and write-up of a field research project.

**DOCTOR OF PHILOSOPHY**

The Department offers the Doctor of Philosophy in Communication Theory and Research with emphases in Attitude Formation and Change, Communication Behavior Through the Life Cycle, Communication Media and Social Change, Information Sciences, and Public Affairs Communication. Regardless of the area of specialization, the Ph.D. program is designed primarily for persons interested in teaching and research careers or policy formation positions.

The Ph.D. program is designed to encompass four years of graduate study (subsequent to completion of the B.A. degree) during which, in addition to fulfilling University residence requirements, Ph.D. candidates are required to:

1. Satisfactorily complete all departmental course requirements.

2. Pass general preliminary examinations by the beginning of the second academic year of study and specialization examinations by the completion of the third academic year of study.

3. Demonstrate proficiency in tools required in area of specialization. Chosen with the advice of the faculty, such tools may include foreign languages, statistics, computer programming, etc.

4. Complete both a Master’s research project (first-year project) and a pre-dissertation research project (second-year project).

5. Teach or assist in teaching at least two courses.

6. Have at least one year of work experience in the mass media or in another activity relevant to the area of specialization, prior to writing the dissertation.

7. Complete a dissertation satisfactory to an advisory committee of three or more members and to the University Committee on the Graduate Division.

8. Pass the University oral examination, which may be either a comprehensive examination covering the same area as the written specialization examination or a defense of the dissertation.
Because the multidisciplinary nature of the Department makes it possible for the Ph.D. student to emphasize one of several areas of communication study, there tend to be several "typical" programs of course work followed by various students depending on their area of specialization. Generally, the variation in course programs tends to occur after the first year of graduate study, the first year primarily being devoted to basic "core" courses required of all students.

The department requires that all students, regardless of their area of specialization, fulfill the following course requirements:

Communication 211: Theory of Communication

A minimum of four other advanced Communication Theory courses (numbered 212 and higher). Specification of these courses depends on (a) individual student needs in order to prepare for preliminary examinations, and (b) the requirements of the particular area of specialization chosen by the student.

Psychology 60: Statistical Methods or Statistics 60: Introduction to Statistical Methods I

Communication 213: Computer Analysis of Communication Research Data

Communication 218: Communication Research Methods I

Communication 219: Communication Research Methods II

Communications 309: First-year Research Project

Communication 319: Pre-dissertation Research Project

Depending on the area of Communication study the student chooses to emphasize, additional courses are selected, with the assistance of the advisor, from within the Department's offerings and from other University departments. Requirements vary depending on the area emphasized.

Ph.D. candidacy expires five years after admission to candidacy by the University Committee on the Graduate Division. Reapplication will require reexamination.

Other programs leading toward the Ph.D. and involving communication may be pursued in the Graduate Division Special Programs. These are individually planned for unusually well-qualified students.

Minor for the Degree of Doctor of Philosophy—Candidates for the degree of Doctor of Philosophy in other departments who elect a minor in Communication will be required to complete a minimum of 20 units of graduate courses in the Communication Department, including a total of three theory or research methods courses. The balance among communication theory, methods, and applications courses will be determined by the candidate and his senior advisor. Communication 211, 218, and 219, together with advanced theory and methodology courses, are often chosen to satisfy the minor requirement.

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 other departments, on grants from foundations, communication media, and other agencies, on government grants and 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. For further information write to the Director.

COURSES OPEN TO UNDERGRADUATES AND GRADUATES

GENERAL


   5 units, Win (Roberts, Dodson)
   MWF 10 and Sections T or Th 10

70. Introduction to Survey Research — An introductory course in survey research methods. Formulation of problems, study design, sampling, interviewing, data processing and analysis, and writing of reports of public opinion surveys. Designed primarily for undergraduate non-majors. Prerequisite: Psychology 60 or equivalent.

   3 units, Spr (Maccoby) W 3:15-5:05
123. Communication and Community Psychology I—(Same as Psychology 123.) This course is designed for undergraduates interested in relating theory and action with respect to community involvement activities. Primary emphasis is placed on student initiative in selecting community-related projects which will be the basis of a two-quarter written report. Students will be expected to survey both the theoretical and practical literature dealing with the theory of social organization and community development.

4 units, Aut (C. Clark) TTh 10
and by arrangement

124. Communication and Community Psychology II—(Same as Psychology 124.) This is a continuation of 123.

4 units, Win (C. Clark) TTh 10
and by arrangement

126. Images, Media, and the Construction of Reality—Images of women and men, racial groups, politics and government, other nations, the future, etc., help to structure individual reality. Media and interpersonal channels convey and color these images. The course emphasizes wide reading in the literature of images.

4 units, Spr (Butler-Paisley) F 3:15-5:05


4 units, Win (Paisley) M 3:15-5:05

128. Communication in Science and Technology—Overview of the information systems of science, their origins and post-war development. Analysis of "horizontal" versus "vertical" information flow. Review of cognitive, social, and political factors that mediate flow.

4 units, Spr (Paisley) F 3:15-5:05

131. Communication and Children—How children come to use the mass media, what information they obtain from the media, and how their behavior is influenced by the media. Prerequisite: consent of the instructor.

3 units, Spr (Roberts) by arrangement

135. General Systems Theory and Communication Research—Introduction to general systems theory through readings, discussion, and papers. Systems approaches to communication—theory building and research problems. Applications of systems theoretic principles to problems of communication in organizations, international development. Prerequisite: Consent of instructor.

4 units, Aut (Richards and Parker)


199. Individual Work—Major students with high academic standing are permitted to undertake individual work.

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

JOURNALISM

100. Editorial Techniques I — A writing course emphasizing various forms of journalism: news, interpretation, features, opinion. Detailed criticism of writing. Communication 102 must be taken concurrently.

4 units, Aut (Rivers) TTh 11
Win (——) by arrangement
Spr (——) by arrangement

102. Editorial Techniques I Laboratory—Practice in journalistic writing. Must be taken concurrently with Communication 100. Open to non-majors. Prerequisite: typing speed of 35 words a minute.

1 unit, Aut (Rivers) by arrangement
Win (——) by arrangement
Spr (——) by arrangement

107. Editorial Techniques II — Copy editing, headline writing, news display, illustration, typography, printing processes. With laboratory that includes editing daily teleprinter reports of Associated Press, news evaluation and page make-up. Prerequisites: 100 and 102.

4 units, Win (Stewart) MW 2:15-4:05
4 units, Spr (Stewart)

111. Humor as Communication—Seminar analyzing wit, humor, and satire in the mass media. Enrollment preference given to senior and graduate majors. Consent of the instructor.

3 units, Spr (Rivers) TTh 11

140. History of American Journalism—Evolution of the democratic mass media in their social, political, economic, technological and professional aspects, with special attention to significant trends and personalities. En-
rollment preference given to senior and graduate majors. Consent of instructor.

3 units, Aut (Stewart) TTh 11

150. Magazine Writing—Practice in writing magazine articles, with emphasis on marketing manuscripts. Conferences. Prerequisites: 100 and 102.

4 units, Win (Rivers) TTh 11

152. Magazine Editing — Planning, writing, production studied with local magazine editors, correspondents. Prerequisite: 150.

3 units, Spr (——) W 1:15-3:05

175. Reporting of Public Affairs — Local, state, federal courts; municipal, state, federal administration in the local community. Prerequisites: 100 and 102 and junior or graduate standing.

4 units, Aut (——) by arrangement


4 units, Win (Dodson) TTh 9

185. Internship Experience — Professional journalism experience in the print media. Open only to Communication majors.

0 units (for graduate students) 1 to 4
units (for undergraduate students)

Aut, Win, Spr, Sum (Dodson)
by arrangement

220. Mass Communications in Society — The nature and social responsibilities of the media, the structure of the industry, problems of regulation, management, educational and commercial interests. Prerequisite: Communication 100 and 102.

4 units, Aut (Drew) by arrangement

Sum (Staff) by arrangement

225A. Problems of the Mass Media—Visiting lecturer series. Prerequisite: any other Communication course. May be repeated for credit.

1 unit, Aut (Rivers, Nelson) T 4:15-5:15

225B. Problems of the Mass Media — Continuation of 225A. Prerequisite: 225A. May be repeated for credit.

1 unit, Win (Rivers, Nelson) T 4:15-5:15


4 units, Spr (Rivers) TTh

FILM AND BROADCASTING

90. Introduction to Film and Video—A basic introduction to the theory and technique of film and television mediated communication, including production exercises in video, film, and sound, and consideration of the fundamentals of script research and writing, and production management. The course is designed mainly for undergraduates, and is a prerequisite for all further film production course work.

4 units, Aut, Win, Spr (Staff) TTh

3:15-5:15 and tutorials by arrangement

101. Film Aesthetics—A theoretical, historical examination of the nature of the film medium. Attention is given to the problems of aesthetics and communication from the viewpoints of practitioner, critic, and audience.

4 units, Aut (Kovács) MWF 10; evening screenings by arrangement

133. Visual and Aural Communication Techniques—An investigation of the techniques of cinematography and sound from the standpoint of the communication of ideas. Students will produce short exercises and a short film. The course is designed mainly for undergraduates. Prerequisites: 90 and consent of instructor. Concurrent registration in 134.

5 units, Win, Spr (Alexander and Blaustein) Sum (Staff)

MW 1:15-3:15 and tutorials by arrangement

134. Writing for the Visual Media—Script writing techniques for film and television. Emphasis is placed on both nondramatic and dramatic forms. The course is mainly designed for undergraduates with serious preprofessional concerns. Prerequisite: 90 and consent of instructor for winter and spring, consent of instructor only for summer. Concurrent registration in 133.

4 units, Win, Spr (Blaustein and Alexander) Sum (Staff)

TTh 1:15-3:15 and screenings by arrangement

141. History of Film—Studies in the development of the motion picture as an art form
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and a means of communication. Lab.: screenings of films announced in class.

4 units, Win (Mayer) MWF 9;
evening screenings by arrangement

142. Broadcast Communication—The development of American broadcasting and its contemporary problems. (Graduate students register for 242.)

4 units, Aut (Dundes) MWF 11

142B. Broadcast News—Writing, delivery and direction of radio and TV news. Prerequisites: 100, 102, 142, and consent of the instructor.

4 units, Aut (Drew) MW 11 and lab by arrangement

180. Broadcasting and Film Criticism—An attempt to develop a critical view of film. Readings and discussion will consider models of artistic and literary criticism as points of comparison. The student will be introduced to journalistic, psychoanalytical, Marxist, structuralist, and semiological approaches. Weekly reviews will stress the meaning of the films and a lucid writing style. Prerequisites: 101, 141, or 142.

4 units, Spr (Kovács) MWF 9

189. Uses of Ethnographic Film—Critical examination of the problems of validity and reliability involved in reporting and interpreting aspects of a culture using essentially non-verbal forms. Evaluation of the uses of ethnographic films as research reports, as research instruments and as instructional materials. Students will prepare a series of written exercises and a term paper. Prerequisite: Anthropology 1 and consent of instructor.

4 to 5 units, Spr (Staff) MW 10;
lab. Th 7:30–10:00 p.m.

205A. Television Production I—Production and direction of news and documentary television programs. Prerequisite: consent of instructor.

4 units, Sum (—)

206A. Film Production I—The first quarter of a three quarter continuing sequence designed for professional training in all phases of the production of motion pictures. The emphasis in production is largely on nondramatic and documentary forms. Each student will be required to complete a series of exercises and a very short film. Prerequisite: admission to the film M.A. program, and concurrent registration in 223A.

5 units, Aut (Alexander and Blaustein)
MW 1:15–3:05 and tutorials by arrangement

206B. Film Production II—The second quarter of a three quarter continuing sequence designed for professional training in all phases of the production of motion pictures. The emphasis in production is largely on nondramatic and documentary forms. Each student will be expected to produce a short film during the term. Prerequisite: successful completion of 206A and concurrent registration in 223B.

5 units, Win (Alexander and Blaustein)
MW 1:15–3:05

206C. Film Production III—The third quarter of a three quarter continuing sequence designed for professional training in all phases of the production of motion pictures. The emphasis in production is largely on nondramatic and documentary forms. Each student will be expected to produce a short film of professional quality during the term. Prerequisite: successful completion of 206B, consent of instructor, and concurrent registration in 223C.

5 units, Spr (Alexander and Blaustein)
MW 1:15–3:05

208A. Seminar in Film and Broadcasting I—Limited to Film and Broadcasting A.M. students.

1 to 2 units, Aut (Staff) by arrangement

208B. Seminar in Film and Broadcasting II—Limited to Film and Broadcasting A.M. students.

1 to 2 units, Win (Staff) by arrangement

208C. Seminar in Film and Broadcasting III—Limited to Film and Broadcasting A.M. students.

1 to 2 units, Spr (Staff) by arrangement

210A, B, C. Topics in Film Study—Each quarter during the academic year a different aspect of film history, criticism, aesthetics, and institutional development will be examined in detail. Admission is by consent of the instructor. Topics for the academic year 1974–75 are the following:

210A. American Experimental Film—A survey of achievements of outstanding American independent filmmakers with an empha-
sis on the works of the last decade. They will be discussed in terms of the aims of various parallel movements in the plastic arts.

3 to 5 units, Aut (Kovács) by arrangement

210B. Classics of Modern European Cinema—A consideration of key works by the most influential auteur directors. Through the specific movies the director's gestalt, aims and style will be discussed. Selected criticism will be examined for its ability to interpret the meaning of the films and to place them in a larger cultural context. Special attention will be given to structuralist and semiological methods of interpretation. Bunuel, Bergman, Fellini, Godard, Resnais, Pasolini, and Renoir will be the focus of the course.

3 to 5 units, Win (Kovács) by arrangement

210C. The Movies of Hollywood: Their Making and Meaning—The course will feature two approaches to the phenomenon of Hollywood movies: those of the producer and the critic. The dialogue of the two instructors will focus on selected movies representative of various genres from different periods of Hollywood productions. The following specific aspects will be discussed: the role of the studios past and present; the interaction of producer, director, screenwriter and actors; the star system; the role of the agent; and the validity of certain critical approaches to the films. Permission of the instructor is required for admission.

4 units, Spr (Blaustein, Kovács) by arrangement

216. The Broadcast Editorial—Analyses of radio and television editorials. Students will research, write, deliver and direct their own editorials. Prerequisite: 142 and consent of instructor.

3 units, Aut (Dundes) MW 2:15-4:05

223A. Writing for Film and Broadcasting I—Techniques of research and writing for the visual media. To be taken concurrently with 206A. Open to graduates only.

4 units, Aut (Blaustein and Alexander) TTh 1:15-3:15

223B. Writing for Broadcasting and Film II—Structure and style in the construction of factual film and television scripts. To be taken concurrently with 206B. Prerequisite: 223A.

5 units, Win (Blaustein and Alexander) TTh 10-12

223C. Writing for Film and Broadcasting III—Seminar in dramatized documentary and fictional forms of film and television scripts. To be taken concurrently with 206C. Prerequisite: consent of instructor.

5 units, Spr (Blaustein and Alexander) TTh 10-12

242. (See 142), 4 units, Aut (Dundes) MWF 11

242A. Seminar in Government, Industry and Consumer Relations in Broadcasting—The legal, economic and societal factors in both commercial and noncommercial broadcasting today. Prerequisites: 142 and consent of the instructor.

4 units, Win (Dundes) MW 1:15-2:05

242B. Broadcast News Techniques and Production—Writing, delivery and direction of radio and TV news. Prerequisites: 100, 102, 142, and consent of the instructor.

4 units, Win (Dundes) MW 11 plus lab W 2:15-4:05

242C. Seminar in Broadcast Management—An advanced examination of the managerial aspects of commercial and public broadcasting. Prerequisites: 142 or concurrent registration in the School of Law or Graduate School of Business and consent of the instructor.

4 units, Spr (Block) by arrangement

Summer Film and Broadcasting Institute

(See the 1975 Summer Session Bulletin, available in February, 1975.)

COURSES FOR GRADUATES


3 units, Win (Maccoby, Drew)

207. Introduction to Communication Research Methods—Formulation of research problems, research design, sampling, data collection and analysis. Examples will be drawn from the communication and national development literature. Designed primarily for students in the Communication and Social Change M.A. program. Prerequisite: Psychology 60 or equivalent.

5 units, Win (Hornik) TTh 1:15-3:05

211. Theory of Communication—Approach-
es to communication theory, seminar and tutorial meetings; extensive reading and papers. Required of all Communication doctoral students; others by consent of instructor.

4 to 5 units, Aut (Roberts) TTh 3:15-5:05

212. Persuasive Communication — An advanced seminar on ongoing theory and research in attitude change. Designed for Ph.D. students in Communication. Prerequisites: 211 or consent of instructor.

4 units, Spr (Maccoby) by arrangement

213. Computer Analysis of Communication Research Data — An introduction to computer programming and data analysis in Communication research. Includes an introduction to the Stanford computer facilities, interactive text editing, statistical programming in BASIC and FORTRAN, and use of statistical packages such as BMD and SPSS. Prerequisite: consent of instructor.

0 to 3 units, Aut (Mick) by arrangement

214. Advanced Analysis of Communication Research Data — Advanced statistical programming for data analysis. Emphasis on algorithms and statistical programming in FORTRAN. Prerequisite: successful completion of 213 and consent of instructor.

0 to 3 units, Win (Mick) by arrangement

218. Communication Research Methods I — Methods of research in mediated and interpersonal communication. Application of scientific method to communication research. Logic of inquiry, conceptualization of variables, design of experiments. Prerequisite: elementary statistics.

4 units, Win (Parker) MW 3:15-5:05


4 units, Spr (Paisley) MW 3:15-5:05

222. Documentary Film — Analysis of the techniques and strategies of films designed to effect attitudinal and behavioral change. Prerequisite: consent of instructor.

4 units, Spr (Staff) by arrangement

226. Images, Media, and the Construction of Reality — Same as 126, but graduate students are expected to complete an independent project of "potentially publishable" quality.

4 units, Spr (Butler-Paisley) F 3:15-5:05

227. Communication and Public Knowledge — Same as 127, but graduate students are expected to complete an independent project of "potentially publishable" quality.

4 units, Win (Paisley) M 3:15-5:05

228. Communication in Science and Technology — Same as 128, but graduate students are expected to complete an independent project of "potentially publishable" quality.

4 units, Spr (Paisley) F 3:15-5:05

231. Developmental Communication I — Changes with age in how people use the mass media, what information they obtain from the media, and how they are influenced by the media. Particular emphasis on children and the media. Prerequisite: consent of instructor.

4 units, Spr (Roberts) by arrangement

240. Mass Media History — Review of the literature and research in the historical development of newspapers, magazines, broadcasting and film.

4 units, Spr (Staff) by arrangement

241. The New Journalism — Analysis of the "New Journalism" with individual practice in writing. Prerequisite: A.M. candidates only, with professional writing experience.

4 units, Aut (Dodson) MW 1:15-3:05

242. Broadcast Communication — See 142.

251. Teaching Seminar — Discussions of effective teaching methods led by Stanford teachers from several departments. Prerequisite: graduate standing.

1 unit, Aut (Rivers) T 12-1

252. Research Seminar — Discussions of research projects — research design, field work, problems, etc. — led by Communication teachers and advanced graduate students who are conducting research. Prerequisite: graduate standing.

1 unit, Win (Rivers) T 12-1

255. Communication Theory and Social Change — This is a seminar for students in the new Communication Media and Social Change M.A. program and for other students with the instructor's consent. Various theoretical approaches to the communication process and its effects are examined. Student papers, exercises and tutorial meetings supplement the weekly seminar meetings.

4 units, Aut (Mayo) F 1:15-3:05

256. Communication Media and Social
Change — Seminar on the communication problems of economic and social development, and on the uses of the mass media for national integration, social change, and education in the developing countries. Special uses and difficulties of communication research in these countries. Case studies and planning exercises.

3 to 5 units, Win (Mayo and McAnany)
T 4:15-6:05

257. Evaluative Research Methods for Mass Media Project in Developing Countries—Nature of evaluation and evaluation design, problems of field work, construction of instruments. During the quarter each student will prepare a complete evaluation design for a project using mass media in a developing country. Prerequisites: Psychology 60, Comm. 207 (or equivalents), Comm. 256.

4 units, Spr (McAnany and Hornik)
F 1:15-3:05

260. Introduction to Information Science—Techniques for describing the organization, utilization, and growth of data collections whether stored in the mind, in society, or in computers.

3 units, Aut (Staff) by arrangement

263. Computer Information Systems—Analysis of computer systems and techniques for information retrieval, library automation, and specialized applications such as medical information systems.

3 units, Win (Staff) by arrangement

264. Applications of Information Science in Health—Applications of information science and quantitative analysis techniques to health-related areas including medical decision-making, health information systems, regional health planning, and clinical research.

3 units, Win (Sondik) by arrangement

265. Information Technology and Society—The social history of information technology will be used as background against which to examine the social, economic and public policy implications of current and potential changes in information technology and in the institutions controlling that technology. Policy options associated with cable television, communication satellites and computer information systems will be discussed.

3 units, Spr (Parker) by arrangement

270. Advanced Communication Theory and Method Seminar I — May be repeated for credit. Topic and instructor change each year. Prerequisites: 211 and 219.

3 units, Aut (Staff) by arrangement

271. Advanced Communication Theory and Method Seminar II—May be repeated for credit. Topic and instructor change each year. Prerequisites: 211 and 219.

3 units, Win (Staff) by arrangement

272. Advanced Communication Theory and Method Seminar III—May be repeated for credit. Topic and instructor change each year. Prerequisites: 211 and 219.

3 units, Spr (Staff) by arrangement

274. Application of Communication Theory and Research to Persuasive Campaign Strategies—Seminar designed to bring together the theory and research of communication with the problems and techniques of mass communication, advertising and marketing. How the behavioral findings can actually be used to deal with problems in mass communication strategy for products, services, candidates, and causes will be explored. The focus of the course will be on application; students will be required to use behavioral knowledge to develop persuasive campaigns of various types.

4 units, Spr (Ray) by arrangement

276. Research in Teleconferencing—Introduction to the technologies of electronic person-to-person communication and a short survey of existing systems, both operational and prototype. The main focus of the seminar will be on behavioral and social research that has been, is now being, and should be conducted in order to evaluate such systems with respect to system users and user communities. Questions of teleconference system policy and specific application may also be discussed.

3 units, Aut (Miller, Parker) T 2:15-4:05

280. Telecommunications Systems and Public Policy—(Same as Engineering-Economic Systems 280.) Structure of the U.S. and international communications industry. Regulation of common carriers, TV and radio broadcasters, and users of the frequency spectrum. Analysis of social consequences and public policy issues arising out of the rapidly changing technology in this field. Case studies of international satellite communications systems, cable television sys-
tems, land-mobile radio systems, and computer-based teleprocessing systems.

3 units, Spr (Parker, Dunn)
MW 11:00-12:15

299. Advanced Individual Work—Graduate majors may supplement certain courses with individual projects of distinctly advanced order.

1 to 8 units, any quarter (Staff) by arrangement

300. Thesis.

6 to 10 units, (Staff) by arrangement


3 to 6 units (Staff) by arrangement

319. Pre-Dissertation Research Project — Advanced research for Ph.D. candidates.

3 to 6 units (Staff) by arrangement

330. Public Affairs Thesis Seminar — For Public Affairs Ph.D. candidates only.

1 to 6 units, Aut, Win, Spr (Rivers) W 12

331. Public Affairs Comprehensive Review — For Public Affairs Ph.D. candidates only.

1 to 6 units, Aut, Win, Spr (Rivers) Th 12

347. Management of Marketing Communications. Enroll in Graduate School of Business.

449A. Consumer Behavior. Enroll in Graduate School of Business.

COMPARATIVE LITERATURE

Committee in Charge: Herbert Lindenberg-
er, Chairman; Joaquim F. Coelho, Robert G. Cohn, Gerald Gillespie, David G. Halliburton, James Y. Liu, Charles R. Lyons.

Professors: Jean Franco (Spanish and Comparative Literature), Gerald Gillespie (German Studies and Comparative Literature), Herbert Lindenger (Comparative Literature and English), Charles R. Lyons (Drama and Comparative Literature), N. Scott Momaday (English and Comparative Literature), Makoto Ueda (Japanese and Comparative Literature)

Visiting Professor: Mikel Dufrenne (Comparative Literature), autumn, 1974-75.

Associate Professor: David G. Halliburton (English, Comparative Literature, and Modern Thought and Literature)

Assistant Professors: N. Gregson Davis (Classics and Comparative Literature), John B. Foster (English and Comparative Literature)

The interdepartmental program in Comparative Literature admits students for the Ph.D. It also supervises a minor program for students working toward the Ph.D. in individual language departments and, in conjunction with the Humanities Honors Program, offers a concentration in Comparative Literature for undergraduates.

UNDERGRADUATE HONORS PROGRAM

The undergraduate program is designed for students who combine a strong commitment to literary study with the drive and the ability to master foreign languages. Students planning to concentrate in Comparative Literature must apply for admission to the Humanities Honors Program and for graduation with Honors in Humanities.

Freshmen and sophomores interested in the program must first consult with the Director or the Associate Director of the Humanities Honors Program. Because of the strong language requirements, the consultation should take place at the earliest opportunity, preferably during the freshman year. Students who have not started their second foreign language by the sophomore year have little chance of fulfilling the program requirements on schedule. No student may declare a major later than two weeks after the start of the junior year. After admission to the program, the student will be assigned an adviser drawn from the Committee on Comparative Literature.

Students in the program do not need to complete a formal major in another field but, in order to satisfy the final requirement listed below, they will normally have a major, or the equivalent of a major, in a single national literature. Requirements are as follows:

1. Western Thought and Literature — Humanities 61 or 62. Completion of the full Humanities 61, 62, 63 series is strongly recommended.

2. Two seminars drawn from the series Hu-
manities 191–196, of which one must be Humanities 194.

3. At least three literature courses in a foreign language and at least one advanced course—preferably a literature course—in a second foreign language.

4. One literature course—not necessarily in the original language—drawn from a cultural tradition distant from that of the student's main areas of interest.

5. Two additional literature courses drawn from the following:
   a) Courses listed under Comparative Literature.
   b) Courses offered in translation by the foreign language departments in languages outside the student's two languages.
   c) Advanced literature courses offered at the overseas campuses.

6. Honors essay—an essay in literary criticism (2 units, spring, junior year; 5 units, autumn, 5 units, winter, senior year). A grade of at least B is required on the essay for graduation with Honors in Humanities.

7. Two courses related to the student’s total program, but drawn from disciplines outside literature.

8. Course distribution should be designed in such a way that students develop an extensive background (about six courses covering a large range of periods) in a single national literature read in the original language. Students may fulfill this requirement through work either in the English Department or in one of the language departments.

**GRADUATE PROGRAM**

The Ph.D. program is designed for a small group of students whose linguistic background, breadth of interest in literature, and curiosity about the problems of literary scholarship and theory (including the relation of literature to other disciplines) make this program more appropriate to their needs than the Ph.D. in one of the individual literatures. Students will take courses in at least three literatures (one of which may be English), to be studied in the original languages.

A considerable part of a student's work will consist of individual study toward the Ph.D. examination, for which each student uses his or her own reading lists. The examination is centered not on national lines, but on the study of particular periods, genres, and problems of literary study. Students are admitted to the program as Comparative Literature Fellows on a plan which attempts to integrate their financial support and their completion of residence requirements with training as prospective university teachers. Tenure as a Fellow, assuming satisfactory academic progress, will be for a maximum of four years (graduate-level work in literature completed elsewhere being counted as part of this four-year period). All Fellows, whatever their sources of financial support, are required to do three and a half quarters of supervised teaching at Stanford.

**REQUIREMENTS**

**Residence**—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 of Arts degree. The student will be expected to offer at least 72 units of graduate work in addition to the doctoral dissertation. At least three consecutive quarters of course work must be taken at Stanford.

**Languages**—Students must know three foreign languages, two of them sufficiently to qualify for graduate courses in these languages and the third sufficiently to demonstrate ability to read a major author in this language. One of the three languages must be French or German, and one of the other two must be Latin (for which Creek, Chinese, or Japanese may be substituted when appropriate), if the period in which the student concentrates is earlier than the Roman period. Students’ language preparation must be sufficient before entrance so that they can take a graduate level course in at least one foreign language during their first year and in the second during the second year. Students must demonstrate a reading knowledge of the third foreign language no later than the beginning of the third year.

Of the three literatures in which a student takes courses, no more than two may be in the same department at Stanford. Literatures written in the same language (such as Spanish and Latin-American) are counted as one in the planning of the student’s program. One of the student’s three literatures
will be designated as the primary field; the other two as secondary fields.

**Minimum Course Requirements**

1. Comparative Literature 369 (Major Modern Critics) and three additional seminars of a primarily comparative nature; at least one of these additional seminars must be on literary theory or criticism.

2. At least three graduate courses in each of two foreign literatures.

3. A sufficient number of courses in the student's primary field to assure his knowledge of the basic works in one national literature from its beginnings until the present day.

Minimum course requirements must be completed before the student is scheduled to take the University Oral Examination. These requirements are kept to a minimum so that students will have sufficient opportunity to seek out new areas of interest.

**Foreign Study**—Students are urged, whenever it can be conveniently arranged, to spend two quarters at one of the Stanford programs in foreign countries.

**Examination**—The examination will consist of three sections, the last of which will constitute the University Oral Examination. Each student's reading lists for the examination must be approved by an examining committee. The examination will consist of the following sections, each of which takes the form of an oral colloquy between the student and a committee of faculty members with interests in the subject area of the particular section:

1. A literary genre, to consist of (1) a knowledge of a substantial number of literary works in a single genre, the list to include works from a number of centuries and from at least three national literatures, and (2) a grasp of the theoretical problems involved in dealing with this genre and with the question of genre in general. This examination must be taken no later than the first quarter of the student's third year of graduate work (or the third quarter of the second year for students who enter with a year of graduate work). Students may elect to take this section of the examination before the genre section, in which case it must be taken at the time designated for the latter.

3. A literary period, to consist of a knowledge of a literary period of at least a century in three or more literatures. The reading list for these two sections will cover not only the major literary texts of this period but also studies of intellectual backgrounds, trends in the other arts, and modern critical discussions of the period. Students must demonstrate a grasp of how to discuss and define this period as well as the concept of periods in general. Students whose course work combines an ancient with a modern literature, or an Eastern with a Western literature, have the option of dividing the period sections into two wholly separate periods. This examination, which will normally be taken before the end of the student's third year (or second year for students who enter with a year of graduate work), will serve as the University Oral Examination, which will also include a short section on the student's plans for the dissertation.

**Qualifying Procedures**—The qualification procedures for students in Comparative Literature will take place during the quarter that the student takes the first section of the Ph.D. examination. Ordinarily this will be the first quarter of the second year, but students who enter with a year of graduate work elsewhere must take the examination no later than the third quarter of the first year. Any student may elect to take the examination during the third quarter of the first year.

Students are judged qualified to proceed to the Ph.D. on the basis of this section of the Ph.D. examination as well as other aspects of their academic work. As soon as the student has completed the qualifying procedures, the chairman will recommend him for admission to candidacy for the Ph.D. At this time he will also be recommended for the A.M. in Comparative Literature if he has completed 36 units of work at Stanford and has not already completed an A.M. before entering the program.
Dissertation—The student will propose a dissertation topic for approval by the Committee on Comparative Literature, which in turn will appoint a dissertation committee to be drawn from at least two departments.

Minor—Students interested in the minor should apply for admission to the individual departments of literature. They may apply to the Committee on Comparative Literature for entrance to the minor after they have completed their first quarter of graduate work at Stanford. Requirements are as follows:

1. A knowledge of at least two foreign languages, one of them sufficient for the student to qualify for graduate-level courses in that language, the second sufficient for the student to read a major author in the original.

2. A minimum of six graduate courses, of which three must be in the department of the second literature and three in Comparative Literature, the latter to include a seminar in literary theory or criticism. Except for students in the Asian Languages, students must choose a second literature outside the department of their major literature.

This minor is designed for students working toward the Ph.D. in the various foreign language departments. Students working toward the Ph.D. in English are directed to the program in English and Comparative Literature described among the English offerings.

Courses
Courses primarily of a comparative nature are listed below:

30. The Novel—(Enroll in English 30.) The objectives of this course are to present the novel as a significant, distinct genre, and by close, sympathetic reading to increase the student's appreciation of individual novels.

4 units, Aut (Fifer)

40. Drama—(Enroll in English 40.) Principal dramatic forms; development of dramatic art, masterpieces of the theater from various periods, countries.

4 units, Win (L'Heureux)

50. Poetry—(Enroll in English 50.) An introduction, through the study of language, figures of speech, metrics, critical theory, and careful reading of poems.

4 units, Aut (Middlebrook)

61, 62, 63. Western Thought and Literature
(Enroll in Humanities Special Programs 61, 62, 63.) An introduction to fundamental ideas of the past; lectures, discussions, reading of selected masterpieces.

61. The World of Pagan Antiquity.
5 units, Aut (Raubitschek, Staff)

5 units, Win (Evans, Staff)

63. From the Enlightenment to the Present — Blake, Kierkegaard, Dostoevsky, Kafka, Virginia Woolf, Sartre, Ellison.
5 units, Spr (Lindenberger, Staff)

67B. King Arthur in History, Legend, and Literature—(Enroll in English 67B.) A survey of Arthurian literature from the earliest medieval legends and pseudo-histories. Some attention to more recent authors such as Tennyson and T. H. White, but the main emphasis will be on medieval works. All readings will be done in modern English translation.
5 units, Spr (Emerson, Brown)

118A,B. Russian Intellectual History — (Same as History 118A,B, Slavic Languages and Literatures 118A,B, and Modern Thought and Literature 231A,B.)
8 units (Brown, Emmons) given 1975–76

121. Literature of Ancient Rome—(Enroll in Classics 121.) A critical study of major Latin authors with attention to their influence on modern literature.
3 to 4 units, Spr (Davis)

138. The Autobiographical Narrative — (Enroll in English 138.) A study of several important first-person writings which are centered upon a particular period or area of experience in the writer's life rather than upon his life as a whole. To include Out of Africa by Isak Dinesen, The Words by Jean-Paul Sartre, A Sort of Life by Graham Greene, Speak, Memory by Vladimir Nabokov, and Good-bye to All That by Robert Graves.
4 to 5 units, Win (Momaday)

145. The Tragic—(Enroll in English 145.)
5 units, given alternate years

147. Twentieth Century Theater — (Enroll in English 147 and Modern Thought and
Literature 147. Major dramatic works and innovations in staging, design, and acting. We will also discuss influential theorists such as Stanislavski, Artaud, and Grotowski. Dramatists include: Chekhov, Shaw, Strindberg, Brecht, Pirandello, Coward, Beckett, Pinter, Bond, Durrenmatt, Genet.

5 units, Win (Friedlander)

153. Leo Tolstoy — (Enroll in Slavic Languages and Literatures 153.) Reading of major works in English translation including War and Peace, Anna Karenina, and Resurrection. Some comparative reference to the European novel in general, English and French. Open to all students.

4 units, Aut (Stahlberger)

160. American Jewish Writing—(Enroll in English 160.) European heritage (works of Sholom Aleichem and Isaac B. Singer); relationship between the historical situation of the American Jew and his literature; sudden emergence of major writers in the nineteen fifties and sixties (Malamud, Salinger, Bellow, Roth, Mailer, etc.); special and changing position of the Jewish intellectual.

5 units, Win (Friedlander)

162. Chicano Literature—(Enroll in English 162.) An intensive study of the emergence of a body of literature. Novels, poems, journals, underground and unpublished materials will be read and discussed. Knowledge of Spanish helpful but not essential.

4 units, Aut (Islas)

163. Comparative Mythology — (Enroll in Classics 163.) Topics from Greek and Roman, Near-Eastern and African Culture.

3 to 4 units, Spr (Davis)

164. Introduction to Caribbean Literature: English, French, Spanish.

5 units (Davis), to be arranged

167. Typology and Universals of Language —(Enroll in Anthropology 164 and Linguistics 208.) The methodology of structural comparisons of languages; the connection between typological analyses and generalizations about language; universals of language in phonology, grammar, and semantics; problems concerning deductive explanation of universals. Limited enrollment. Prerequisite: elementary linguistic course or consent of instructor.

5 units, Spr (Greenberg)

168. American Indian Mythology, Legend, and Lore—(Enroll in English 168.) An introduction to American Indian oral tradition, centering upon an investigation of the nature of native American prose and poetry, and especially the relationship between oral tradition and writing.

4 units, Aut (Momaday)

172. Classical Influences in Modern Literature—(Enroll in Classics 172.) Themes from classical myth and history in selected Renaissance and later writers, parallel readings from ancient literature.

3 to 4 units, Win (Wigodsky)


5 units, Aut (Fox)

183. History of Anthropology Theory—(Enroll in Anthropology 183 and Modern Thought and Literature 247.) Undergraduate lecture course in the history of anthropological theory; introduction to seminal controversies and opposed traditions in the analysis of society and culture.

5 units, Spr (O’Laughlin)

185. Modern Theater and Its Theory—(Enroll in French and Italian 185.) The course will deal with some of the fundamental figures in modern theater, exploring a number of plays as well as theoretical works and statements on theater, its function and its techniques. Pirandello, Brecht, Genet, Artaud, Beckett, Stanislavski, Grotowski.

4 units, Win (Braghieri)

186. Turgenev: The Significance of his Work in 19th Century Literature and Intellectual History—(Enroll in Slavic Languages and Literatures 186 and Modern Thought and Literature 186.) A significant portion of assigned readings and reports to deal with Western novelists who were members of Turgenev’s circle, and whose work invites comparison with his, e.g., Henry James and Flaubert. Course will also treat Turgenev’s work as a conscious effort to reflect dominant intellectual currents of his time.

4 units, Spr (Brown)
194. Literature and the Humanities—(Enroll in Humanities Special Programs 194.) The critical study of major texts; theory and practice of criticism.

5 units, Aut (Foster)
Spr (Lindenberger)

194A. Colloquium on National and International Identity—(Enroll in English 165 and Modern Thought and Literature 194A.) Intensive study of national and international dimensions of literature, drama and thought with emphasis on modern problems of identity in Anglo-American and European cultures. Topics will include nationalism and national revivals in the British Isles, the United States and Europe. Enrollment limited to 15.

5 units, Spr (Halliburton)

200. Major Modern Poems—(Enroll in Spanish and Portuguese 200.) Close readings and comparative study of poems from the Symbolist Movement to the mid-20th century in English, French, German, Italian, Portuguese, and Spanish. Bilingual texts will be used. Prerequisite: reading knowledge of one of the foreign languages to be read.

5 units, Win (Coelho and Lindenberger)

208. Post-Classical Latin—(Enroll in English 208 or Classics 208.) Careful reading of Latin texts of graded difficulty, beginning with the Vulgate Bible, working through various patristic writings and medieval literature to the Latin of the Renaissance. Intended primarily for students not in classics. Prerequisite: two years’ high school Latin or equivalent.

5 units, Aut (Damon)

210B. Classics of Modern European Cinema—(Enroll in Communications 210B or Modern Thought and Literature 281.) A consideration of key works by the most influential auteur directors. Through the specific movies the director’s gestalt, aims, and style will be discussed. Selected criticism will be examined; special attention will be given to structuralist and semiological methods of interpretation. Bunuel, Bergman, Fellini, Godard, Resnais, Pasolini, and Renoir.

3 to 5 units, Win (Kovács)

212A,B. Medieval to Renaissance: The Development of Literary Forms—(Enroll in English 212A.)

10 units, Win, Spr (W. Trimpi)

218A. The Culture of England, 1890–1914—(Same as English 218A or History 244.)

5 units, given alternate years

220. Representation—(Enroll in English 261 and Modern Thought and Literature 217.) Broad study of the mimetic mode in the several arts, including poetry, drama, and painting, with emphasis on theory.

5 units, Aut (Dufrenne)

228. Theory of the Novel—(Enroll in English 230 and Modern Thought and Literature 240.)

5 units, Win (Levine)

230. Russian Formalist and American “New” Criticism—(Enroll in Slavic Languages and Literatures 230.)

4 units (Brown), given 1975–76

231A. 18th Century Fiction and the “Great Confinement”—(Enroll in English 231A.) Themes of confinement and escape in the novel. Some attention to other genres.

5 units, Aut (Carnochan)

235. The Impressionist and Experimental Novel—(Enroll in English 235.)

5 units, given alternate years

251. Masks of Violence in Myth, Literature and Contemporary Culture—(Enroll in Modern Thought and Literature 251.) Themes and structures common to primitive and modern modes of expression. The plague, for instance, will be traced and interpreted from its mythical origins to its contemporary formulations.

5 units (René Girard) given 1975–76

253. Greek and Roman Drama—(Enroll in Drama 251.)

4 units, Spr (Chioles)

255A. The Nature of Literature: Japanese and Western Views—(Enroll in Asian Languages 255A.)

5 units, given 1975–76

255B. Chinese and Western Theories of Literature—(Enroll in Asian Languages 255B.) Study of traditional Chinese theories of literature in comparison with Western ones. Seminar with limited enrollment.

5 units, Spr (Liu)

256. Modern Drama from 1918—(Enroll in Drama 256.)

4 units, Win (Hampton)
259A. French Symbolist Poets and Some Americans—(Enroll in English 259A.)
   5 units, given alternate years

259B. North American and Latin American Poetry—(Enroll in English 259B or Spanish 262.)
   5 units, given alternate years

260. The History of Literary Theory—(Enroll in English 260.)
   5 units, Spr (W. Trimpi)

261. Nineteenth Century Poetry as Myth-Making—(Enroll in English 255A or Modern Thought and Literature 255A.)
   5 units, Win (Mellor)

262. Nietzsche and the Literary Imagination—(Enroll in English 262 or Modern Thought and Literature 262.) A basic introduction to Nietzsche's philosophy with additional attention given to his experiments with literary form. His impact upon Gide, Shaw, Mann, Belyj, Yeats, Rilke, D. H. Lawrence, Malraux and Sartre. Reading knowledge of French or German desirable but not essential.
   5 units, Aut (Foster)

263B. The Existential Hero in Modern Literature—(Enroll in English 263B.)
   5 units, given alternate years

267. Gothicism in Literature and Art—(Same as English 267.)
   5 units, given alternate years

269A. Toward an Understanding of Romanticism—
   5 units, given alternate years

269B. Toward an Understanding of Modernism—(Enroll in English 269B or Modern Thought and Literature 269B.)
   5 units, given alternate years

271. Symbolist Poets—(Enroll in French and Italian 271.) Baudelaire, Mallarmé, Verlaine, Rimbaud, Yeats, George, etc. Lectures and discussions in English; readings in original language and/or bilingual editions.
   4 to 5 units, Spr (Cohn)

274. Latin American Literature in a Social Context I — (Enroll in Spanish and Portuguese 274 or Modern Thought and Literature 274.) The elites and culture in a dependent society: Romantics, Positivists, and Arealists.
   4 units, Aut (Franco)

   4 units, Win (Franco)

   4 units, Spr (Franco)

286. Structuralism and After — (Enroll in French and Italian 286 or Modern Thought and Literature 286.) The notion of structure in the sciences, linguistics, literary criticism; its pre-20th century antecedents; Lévi-Strauss and structural anthropology; Jacques Derrida's "de-construction."
   5 units, (René Girard) given 1975-76

289B. Yeats, Eliot, Neruda—(Enroll in English 289B.)
   5 units, given alternate years

291. The Poem Itself — (Enroll in Spanish and Portuguese 291.) Practical criticism based on the famous poems of Spain, Portugal, Brazil, and Spanish America. Students will be expected to write short papers on text discussed. Classroom debates; poetry readings encouraged. Reading knowledge of Spanish and/or Portuguese required.
   3 to 5 units, Spr (Coelho)

293. Workshop in Verse Translation—(Enroll in English 293.)
   5 units, given alternate years

   3 to 5 units, Aut (Algería)

302. Poetics and the Poetic—(Same as Modern Thought and Literature 302.) Intensive study of poetry as theory, and of various poetic manifestations. May include study of relation of poetry to other types of language, poetry and music, the being of the poet, the poetic in nature, and the poetic as an aesthetic category.
   5 units, Aut (Dufrenne)

304. Contemporary Critical Approaches—
(Enroll in Drama 302 or Modern Thought and Literature 213.)

4 units, Spr (Lyons)

311. Seminar: Methods and Materials for the Study of Medieval Literature—(Enroll in English 311.)

5 units, given alternate years

313. Seminar: Methods and Materials for the Study of Renaissance Literature—(Enroll in English 313.) A theoretical and practical study of such research problems as the establishment of a reliable text, the interpretation of classical and biblical allusions, the literary relevance of psychological, biological and cosmological systems, the analysis of semantic and grammatical difficulties, the concepts of imitation and translation, and the discovery and evaluation of biographical resources.

5 units, Win (Evans and Rebholz)

315F. Seminar: The Enlightenment and Its Literary Traditions—(Enroll in English 315 or Modern Thought and Literature 315F.)

5 units, Aut (Watt)

316C. Seminar: Romantic Irony—(Enroll in English 316C.)

5 units, given alternate years

333. European Novel I: Renaissance to Pre-Romantic—(Enroll in German Studies 254 or German Studies 333.)

3 to 5 units, Spr (Gillespie)

335. Seminar: The Modern Novel—(Enroll in English 335.)

5 units, given alternate years

347. Seminar on Baroque Poetics—(Enroll in Spanish and Portuguese 347.) Imitation and deconstruction in the lyric poetry of Gongora. Readings include 17th and 20th-century theories of imitation and parody, as well as poems by Donne, Tasso, Marino, and Theophile de Viau. Taught in English; reading knowledge of Spanish required.

5 units, Aut (Ball)

350. Marivaux—(Enroll in French and Italian 350.) Le dramaturge, le romancier, l'essayiste seront successivement analysés au sein de leur contexte littéraire, intellectuel et historique.

4 units (René Girard) given 1975-76

353. Seminar in Contemporary Drama—(Enroll in Drama 353.)

4 units, Aut (Hampton)

354. Comparative Seminar: The Novels of Galdós, Eca de Queiréz, and Machado de Assis—(Enroll in Spanish and Portuguese 354.)

3 to 5 units, Spr (Franco, Coelho)

360A. Seminar: History of Literary Theory: Ancient—(Enroll in English 360A.)

5 units, given alternate years

360B. Seminar: History of Literary Theory: Medieval/Renaissance—(Enroll in English 360B.) Prerequisite: 360A.

5 units, given alternate years

360C. Seminar: Neoclassicism: Ancient Origins and Later Developments—(Enroll in English 360C.)

5 units, given alternate years

361. Seminar: The Modern Tradition—(Enroll in English 361 or Modern Thought and Literature 361.) Introduction to the interdisciplinary study of modern thought and literature with emphasis on such modern developments as structuralism, phenomenology, and Marxism.

5 units, Win (Halliburton)

366. Mimesis—(Enroll in Modern Thought and Literature 366.) The Aristotelian interpretation of Platonic mimesis as desire, and its relationship to the modern idea as "realist" or "copier of reality"; its effects on the avant-garde as well as on traditional aesthetic dogma.

5 units (René Girard) given 1975-76

368A. Seminar: American Critics—(Enroll in English 368A.)

5 units, given alternate years

369. Seminar: Major Modern Critics—(Enroll in English 369 or Modern Thought and Literature 369.) Reading and discussion of critical writings and theories of influential modern figures such as Auerbach, Spitzer and Freud. Emphasis on 20th century (e.g., existentialism, structuralism, Marxism), but course will also place modern critics in tradition beginning with Aristotle.

5 units, Aut (Halliburton)

381. Seminar on Contemporary Latin American Poetry—Pablo Neruda (Enroll in Spanish and Portuguese 381.)

3 to 5 units, Aut (Alegria)
382. German and European Romanticism—
(Enroll in German Studies 382.)
3 to 5 units, given 1976–77

389. The Shorter Narrative — (Enroll in Spanish and Portuguese 389.) A seminar on critical approaches to the shorter narrative with special reference to Spanish American writers.
3 to 5 units, Win (Franco)

393. Workshop in Verse Translation—
(Enroll in English 393.)
5 units, given alternate years

400. Methodenlehre der Literaturwissenschaft—(Enroll in German Studies 400.)
4 units, Spr (Mueller-Vollmer)

COMPUTER SCIENCE

Chairman: Robert W. Floyd


Visiting Associate Professor: James Eve

Assistant Professors: Forest Baskett III, Vinton Cerf, Václav Chvátal, C. Cordell Green, Joseph Oliger.

Senior Research Associates and Lecturers:
Kenneth M. Colby, Arthur L. Samuel

Research Computer Scientists and Lecturers:
Bruce G. Buchanan, Lester D. Earnest, David C. Luckham

Lecturers: John R. Ehman, Jerome H. Friedman, Bertram Raphael, Gio Wiederhold, Charles T. Zahn, Jr.


Affiliated Faculty:
Assistant Professors: Thomas H. Bredt (Electrical Engineering), John T. Gill III (Electrical Engineering)

OFFERINGS AND FACILITIES

The Department aims to acquaint students with the technological and intellectual roles of automatic digital computers, and to educate research workers in computer science. In spite of the diversity of the applications, the methods of attacking problems with computers show a considerable unity, and computer science is concerned with the underlying principles. The field is still young, and the student will find many more questions than answers.

The Department has competence in artificial intelligence, combinatorics and analysis of algorithms, design of computer and program systems, mathematical theory of computation, and numerical analysis.

Courses in data processing are offered by the Industrial Engineering Department and in the Graduate School of Business. Courses in optimization and mathematical programming will mainly be found in the Operations Research Department. Courses in the theory of switching and the logic design of digital systems are mainly offered in the Electrical Engineering Department, whose program is closely coordinated with ours.

Special Ph.D. programs with other departments are possible, either as a Ph.D. in Computer Science or otherwise (see “Graduate Division Special Programs” in this bulletin). For example, a joint program with Operations Research is designed for students interested in numerical analysis techniques that arise in optimization theory. Students interested in special programs should apply for admission to the department of primary interest.

Since computer science is inherently interdisciplinary, graduate students of computer science are encouraged to include in their study program a good deal of work in other departments; see the list of suggested courses below.

There is no Bachelor’s degree in Computer Science. Undergraduates who wish to enter the field are advised to major in Mathematics or in the Program in Mathematical Sciences (see page 536) and include Computer Science 106, 109 or 111, 137A, 144A, B, and 155 in their course of study.

In connection with its courses and research, the Department makes considerable use of the Center for Information Processing. See the section “Center for Information Processing” in this bulletin. For use in research and teaching, the Department has an HP-2116 computer and a PDP-11 computer.

The Artificial Intelligence Laboratory is
located in the D. C. Power Building. Its research is in artificial intelligence, mathematical theory of computation, time sharing, human higher mental functions, semantics of natural languages, symbolic computation, and related topics. It operates a time-sharing system with PDP-6 and PDP-10 computers, 64 display consoles, computer controlled television cameras, computer controlled artificial hands, a computer controlled vehicle, etc. The Laboratory is part of the Computer Science Department, but its facilities are used by the departments of Electrical Engineering, Mechanical Engineering, Linguistics, Psychology, Music, and others for projects that contribute to the research goals of the Laboratory. Research appointments at the pre- and post-doctoral levels are available to students with relevant interests.

The Department conducts a weekly colloquium, presented by the staff and visiting scientists, which covers a spectrum of current topics.

**PROGRAMS OF STUDY**

**MASTER OF SCIENCE**

The University's basic requirements for the Master's degree are discussed in the section "Degrees" in this bulletin. The Department offers two distinct programs. In either of these the candidate must attain at least a 2.50 average in his course work and a 3.00 (= B) average in courses taken in the Computer Science Department.

**MASTER OF SCIENCE IN COMPUTER SCIENCE**

A candidate is expected to complete a course program of 42 units, at least 36 of which will be in this Department or in related areas, and 24 of these 36 units must be graded units. A list of suggested courses in other departments appears at the end of the course offerings in Computer Science. These 36 units must include 6 units of course 293 and 15 additional units of courses numbered 200 or above. The course program must be approved by the Computer Science Department's Committee on Graduate Study.

A candidate is also required to demonstrate a suitable level of competence on the departmental Comprehensive Exam.

**MASTER OF SCIENCE IN COMPUTER SCIENCE: COMPUTER ENGINEERING**

The degree of "Master of Science in Computer Science: Computer Engineering" may be conferred upon students who have developed a competence in the design of substantial software-hardware computer systems. This degree will be administered by the Committee on Computer Engineering, composed of faculty from the Computer Science and Electrical Engineering Departments. In 1973–74 the members were Vinton G. Cerf, chairman, Edward J. McCluskey, and John McCarthy.

A student who wishes to enter the Computer Engineering program should indicate his or her preference for this degree when applying for admission. Programs of at least 42 quarter units that meet the following guidelines will normally be approved:

1. A required sequence of courses in Computer Science and Electrical Engineering to provide depth in hardware and software design. This sequence includes courses 140A, B and one of the following: (a) 211A,B and 311; (b) 211A,B and 246; (c) 112, 246 and 311.


3. At least one course in numerical analysis or, alternatively, at least one course in Finance or Accounting at the Graduate School of Business. Acceptable courses: 135, both 137A and 137B, 210 Management Accounting I, 220 Business Finance I.


6. At least 3 units of seminar with a total not to exceed 6 units. Acceptable courses: 300, 319, Electrical Engineering 380.

7. Additional courses to bring the total to 42 or more quarter units, at least 36 units of which must be in courses in which letter grades are given. These courses may be in departments other than Computer Science and Electrical Engineering.

Computer engineering programs that deviate from one or more of the above guidelines in order to meet the valid objectives of individual students will be considered by
the Computer Engineering Committee on an individual basis. The student should submit a written statement of his or her individual objectives and how his or her program and previous preparation meet these objectives.

This program is normally open to students with a bachelor's degree in Mathematics, Statistics, Physics, or Engineering. A bachelor's degree in another field may be accepted provided the applicant has a knowledge of calculus, linear algebra, and probability. Some knowledge of programming is required.

Students with very little background in programming should enroll in the basic programming course 106 during the summer quarter preceding entrance into this program.

The Computer Engineering program will begin in autumn quarter each year to enable a full-time student to complete the degree in one academic year. It is advisable, however, for the student to plan on remaining for a complete calendar year with the thought of completing the laboratory courses in the summer term. Honors Cooperative students able to take two courses each quarter should be able to complete the program in two academic years and one summer quarter.

The degree of "Master of Science in Computer Science: Computer Engineering" is intended as a terminal degree. Students planning to obtain the Ph.D. degree are advised to apply directly for admission to the Ph.D. program.

**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:

1. A student should plan and successfully complete a coherent program of study covering the basic areas of computer science and related disciplines. The student's adviser has primary responsibility for the adequacy of the program, which is subject to review by the Graduate Study Committee of the Department.

2. Each student is expected to enroll in course 204 at the first opportunity to do so.

3. Each student must pass a comprehensive exam covering introductory level graduate material in major areas of Computer Science, and thereafter apply for admission to candidacy for the Ph.D., by the end of six quarters of full-time study. By the end of nine quarters (excluding summers) each student normally must pass a qualifying exam on the general area of his or her expected dissertation. The Department Secretary has further details.

4. The most important requirement for the Ph.D. degree is the dissertation. The Department is currently conducting research in analysis of algorithms, automatic programming, automatic theorem proving, complexity theory, data structures, design of computer networks, design of program systems, graph theory, heuristic programming, measurement and performance evaluation, natural language understanding, numerical linear algebra, operating systems, optimization, partial differential equations, program verification, programming languages, reliability of computer systems, robotics, spline functions, and vision and perception.

5. As part of the training for the Ph.D., each student is required during one or more quarters to perform some teaching equivalent to that normally performed by teaching assistants, and during one or more quarters to carry out some research equivalent to that normally performed by research assistants.

**Ph.D. Minor**

For a minor in Computer Science the candidate must complete 15 quarter units of Computer Science courses, following a program approved by the Computer Science Department Committee on Graduate Study. In addition the candidate must take and pass a special minor examination. Automatic approval will be given for any program comprising 15 quarter units, not including courses 105 or 106, but including 135 (or 137A,B), 111 (or 109), and 206.

**Teaching and Research Assistantships**

There are graduate student assistantships available in the Computer Science Department. Assistants receive a tuition scholarship for up to nine units of study per quarter during the academic year, and in addition receive stipends for the nine-month academic year ranging approximately from $2800 to $3200. Some may work full time in the sum-
mer for between $650 and $750 per month.

Duties in the academic year involve 20 hours of work per week. Teaching assistants help an instructor teach a course by meeting discussion sections, consulting with students, grading examinations, etc. Research assistants help senior staff members with research in computer science. Approximately two hours of the work week are spent in attendance at Computer Science Department colloquia and seminars.

Students with NSF fellowships and traineeships have the opportunity to supplement their stipends by serving as graduate student assistants.

Further information may be obtained from the Chairman of the Computer Science Department.

COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

103. Programming in Fortran — An introduction to Fortran IV for students with experience in programming in Algol W or Algol 60. Prerequisite: 105 or 106 or equivalent.

1 unit, Aut (—) MWF 12, first 4 weeks only
Win (—) MWF 12, first 4 weeks only

104. Programming in Algol W — A shortened alternative to 105 or 106, for students with previous knowledge of computer programming.

1 unit, Aut (—) MWF 12, first 4 weeks only
Win (—) MWF 12, first 4 weeks only

105. Introduction to Computing — Design and construction of computer programs; use of a specific programming language to solve problems over a wide range of applications on a digital computer. The applications are selected from problem areas in which no detailed knowledge of mathematics is required. Not intended for students with substantial mathematical training or with a previous knowledge of programming. Alternates: 104, 106. Prerequisite: Mathematics 21 or 42 or equivalent.

*3 or 4 units, Aut (——) MWF 11,
(——) MWF 1:15
Win (Herriot) MWF 10
Spr (——) MWF 9
Sum (——) MTWTh 9
(——) MTWTh 11

* Normally 4 units for undergraduates, 3 units for graduate students.

106. Introduction to Computing — Design and construction of computer programs; use of a specific programming language to solve problems over a wide range of applications on a digital computer. This course is essentially the same as 105 except that some of the applications are mathematical in nature. Intended for students with some mathematical training. Not intended for students with a previous knowledge of programming. Alternates: 104, 105. Prerequisite: Mathematics 21 or 42 or equivalent.

109. Assembly Language Programming—Based on IBM System/360. Representation of numbers and other types of data. Binary arithmetic. Instruction execution. Assembly concepts: symbols; addressing expressions; data types and declarations; address resolution; binding times; macroinstructions. Simple data structures: arrays, lists. Accepted but not recommended as preparation for 144A, B. Not accepted as preparation for 112, 140A, B, or 311. Alternate: 111. Prerequisite: 105 or 106 or equivalent.

3 units, Win (Ehrman) MWF 1:15

111. Introduction to Computer Organization, Machine and Assembly Languages—(Same as Electrical Engineering 181, which is offered each quarter.) The organization of a simple digital computer. Binary arithmetic. Instruction execution. Machine language programs. Symbolic assembly language. The assembly process. Subroutines and coroutines. Simple data structures: arrays, stacks, queues. Input-output programming. Interrupts. Introduction to the IBM System/360. Students will program and operate a small computer such as the HP 2116. Enrollment limited to 50. Alternate: 109. Prerequisite: 105 or 106 or equivalent.

3 units, Aut (Cerf) MWF 11
Win (——) MWF 1:15
Spr (——) MWF 1:15
Sum (——) MTWTh 10

112. Digital Computer Organization—(Enroll in Electrical Engineering 182.) Basic digital circuits. Introduction to switching theory and logic design. Computer arith-
metic. Memories, processors, control, and input-output. Data formats, addressing, and instruction sets. Detailed study of the logic design of a small computer. Recommended: 111 (may be concurrent).

3 units, Aut (——) MWF 9
Win (——) MWF 9

125. Nonnumerical Methods — This survey course is designed to acquaint students in the humanities, social sciences, and behavioral sciences with methods and techniques for solving scientific problems of a nonmathematical type on digital computers. Emphasis is given to practical problems and pragmatics. Program libraries are studied and used. Problems to be discussed include text processing, information retrieval, system simulation, graphics, elementary statistical calculations. Prerequisite: 105 or 106 or equivalent.

3 units, Win (——) TTh 11:00-12:15

135. Numerical Methods — This survey course is designed to acquaint students in science and engineering with methods and techniques for solving scientific problems of a mathematical type on digital computers. Emphasis is given to practical problems and pragmatics. Program libraries are studied and used. Problems to be discussed include interpolation and approximation of data, solution of differential equations, numerical integration, solution of linear and nonlinear systems of equations, fast Fourier transform. Pitfalls in automatic computation and their remedies are discussed. Not intended for students with further interests in Numerical Analysis. Alternate: 137A, B. Prerequisites: FORTRAN; Mathematics 113 and 130; or equivalents.

3 units, Win (——) TTh 11:00-12:15

140A,B. Systems Programming—(Same as Electrical Engineering 286A,B, which is offered winter and spring quarters.) This two-quarter sequence is intended for those who wish to develop competence in the design of complex program systems. The course begins with a review of fundamental program design concepts such as systematic program design, modular programs, program verification, data structure, algorithms for sorting and searching, and translators including compilers and interpreters. Emphasis is on basic ideas illustrated through programming assignments. Specific systems programs and problems are then considered including: macro facilities, bootstrapping and portability, linkers and loaders, text editors, debugging systems, input/output systems, and file systems. The course concludes with a study of the facilities and structure of an operating system. Prerequisite: 111 or equivalent. Co-requisite: 104.

140A. 3 units, Aut (Bredt) TTh 1:15-2:30
140B. 3 units, Win (Bredt) TTh 1:15-2:30

144A,B. Data Structures—This two-quarter sequence is intended for those who wish to study computer programming techniques intensively. Topics include basic concepts of data and its representation inside a computer; linear lists, strings; arrays, orthogonal lists; tree structures; data structures in programming languages. Detailed study of a variety of techniques for sorting and searching; use of external memory devices; data base management. Analysis of algorithms to determine which is more efficient in a given situation. Prerequisites: 109 or 111; Mathematics 11 or 41; or equivalents. Course 155 is recommended but not required.

144A. 3 units, Win (Knuth) MWF 3:15
144B. 3 units, Spr (Knuth) MWF 3:15

150. Introduction to Combinatorial Theory — Permutations, combinations, partitions,

3 units, Win (Chvátal) MWF 2:15

151. Introduction to Discrete Mathematics — (Enroll in Electrical Engineering 284.) An introduction to the algebra and combinatorics required for theories of sequential machines and coding, and advanced study of digital systems and computer science. Sets, relations, functions, and homomorphisms. Semigroups and relevance to sequential machines. Groups and relevance to coding. Fields and relevance to linear sequential machines and codes. Prerequisite: Electrical Engineering 280 or Mathematics 113.

3 units, Win (——) MWF 9

155. Concrete Mathematics — Finite difference calculus; manipulation of sums and products; properties of binomial coefficients, Stirling numbers, harmonic numbers, Fibonacci numbers; use of generating functions to solve complex recurrence relations; asymptotic expansions; analysis of computing algorithms. An emphasis on obtaining simple closed-form answers to problems when it is possible to do so. Prerequisites: Mathematics 22, 42, or equivalent.

3 units, Aut (Knuth) MWF 3:15

156. Introduction to the Mathematical Theory of Computation — Mathematical logic, including propositional calculus and the first-order predicate calculus. Computability, recursive functions, undecidable problems.

3 units, Aut (Kurki-Suonio) MWF 10

191. Computer Systems Laboratory — (Enroll in Electrical Engineering 288.) Individual and group projects on the design and implementation of computer systems consisting of programs and/or logic circuits. Emphasis is on the design process and design evaluation. Areas of particular interest are logic subsystem design, interfacing, systems programming, and operating systems. Students are encouraged to suggest and define their own topics, and normally work on one project for the entire academic quarter. Computer facilities including a PDP-11 computer are available. A written report is required. Limited enrollment. Prerequisite: previous or concurrent registration in any one of the following: 140B, 144A,B, 212, 240B, or 246.

3 units, Spr (——) by arrangement

192. Programming Service Project — Appropriate academic credit (without financial support) will be given for volunteer computer programming work of public benefit and educational value.

1 to 3 units, any quarter (——) by arrangement

193. Digital Logic Laboratory — (Enroll in Electrical Engineering 282.) Experiments in digital logic design using integrated circuits commercially available. Usage of different circuit families and designs using more than one family, small scale and large scale integrated circuit applications, and design of synchronous and asynchronous circuits are considered. Laboratory offers flexible choice of projects.

1 to 3 units, Aut, Win, Spr (——) by arrangement

199. Independent Work.

Any quarter (Staff) by arrangement

COURSES INTENDED PRIMARILY FOR GRADUATE STUDENTS

204. Problem Seminar — Solution of various problems, numeric and symbolic, on a computer, using various languages. Emphasis on efficiency of programming, proofs of correctness, and clarity of documentation. Presentation of solutions by students. Limited to degree candidates in Computer Science. Recommended for entering students in the Computer Science Ph.D. program. Enrollment limited to 20.

3 units, Aut (Floyd) TTh 9:30-10:45

206. Computing with Symbolic Expressions — The LISP programming language. Computing wherein the data are symbolic expressions rather than numbers, including algebraic expressions (simplification, differentiation), graphs, compiling. Preparation for work in Artificial Intelligence will be emphasized. Syntax-directed computation. Other list-processing systems. Prerequisite: 105 or 106 or equivalent.

3 units, Aut (McCarthy) TTh 11:00-12:15

Spr (Green) TTh 11:00-12:15

209. Topics in Computer Science — Given
only when a suitable faculty member is available.

By arrangement

211A,B. Switching Theory and Logic Design—(Enroll in Electrical Engineering 381 A,B.) Analysis and synthesis of digital circuits with emphasis on basic design techniques and general concepts. Boolean algebra; simplification of switching functions; sequential circuits; simplification of sequential machines. Characteristics of switching, memory, and input/output devices. Comparison of digital integrated-circuit families. Introduction to large-scale integration. Logic design of a system such as a stored program computer, digital differential analyzer, desk calculator, or radar signal processor. Basic knowledge of Boolean algebra and number systems is assumed.

211A. 3 units, Aut (Peterson) MWF 9 and
(M)—MWF 11
Win (——) MWF 11
Sum (——) MTWTh 11

211B. 3 units, Win (——) MWF 11 and
(Peterson) MWF 1:15
Spr (——) MWF 10

219. Topics in Digital Systems—Given only when a suitable faculty member is available.

By arrangement

224. Models of Thought Processes—Introductory survey of concepts and problems in artificial intelligence research; heuristic processes in problem solving, and heuristic programming; information processing models as explanations of human cognitive and affective behavior. Prerequisite: 105 or 106, or equivalent.

2 units, Spr (Green) TTh 1:15–2:30

225. Artificial Intelligence Research — Intermediate-level examination of problems of artificial intelligence research. Generality in problem-solving systems; theorem proving by computer; semantic information processing; problem representation; perceptual and effector processes; scientific reasoning processes. Not recommended for first-year graduate students. Research project involving computer program will be required. Prerequisites: 206 and 224 or equivalents.

3 units, Aut (Feigenbaum) by arrangement

226. The Representation Problem in Artificial Intelligence — Formalisms for representing what a general intelligent program must know about the world including facts of causality, ability, knowledge. Programs for manipulating these formalisms. Prerequisite: 225.

3 units (——) alternate years, given 1975–76

227. Robotics—Theory and practice of constructing integrated Artificial Intelligence systems. Emphasis will be placed on perception problems for gathering of visual, tactile, and other information and its use in modeling the environment. Also considered are navigation and manipulation problems, automatic strategy generation, and systems design. Prerequisites: 206 and 224 or consent of instructor.

3 units, Spr (——) TTh 11:00–12:15

229. Topics in Artificial Intelligence—Given only when a suitable faculty member is available.

3 units, Spr (Feigenbaum) by arrangement

234. Numerical Methods of Optimization—Introduction to the numerical analysis, data processing, and software problems associated with decision problems, which form a significant proportion of all scientific computation. Unconstrained and constrained minimization, gradient methods with special metrics, pivotal optimization techniques, solving large-scale systems, partitioning methods, combinatorial search procedures, shortest path and other graph algorithms. No prior knowledge of Operations Research is necessary. Prerequisite: 137A or equivalent.

3 units, Aut (Danzig) TTh 9:30–10:45


3 units, Aut (Danzig) TTh 9:30–10:45

237B,C. Advanced Numerical Analysis—Selected topics are covered in depth from the theory and practice of using automatic digital computers for solving ordinary and partial differential equations, approximating functions, and computing eigenvalues and eigenvectors. Testing and automation of
methods on a digital computer. Prerequisite: 237A or consent of instructor.

237B. 3 units, Win (Brent) MWF 1:15
237C. 3 units, Spr (Oliger)
   by arrangement

239. Topics in Numerical Analysis—Given only when a suitable faculty member is available.
   By arrangement

240A. 3 units, Win (Eve) TTh 2:40-3:55
240B. 3 units, Spr (——) TTh 2:40-3:55

246. Operating Systems—(Same as Electrical Engineering 386, which is offered spring quarter.) Multi-programming and time-sharing system design. Topics covered include processes and process communication, control of input-output, memory management, scheduling, file systems, protection, resource allocation, design methodologies. Prerequisites: Statistics 116 or equivalent; 140B or systems programming experience.
3 units, Aut (——) MWF 11

247. Computer System Evaluation—(Enroll in Electrical Engineering 388.) Performance criteria in computer systems, queueing theory; queueing models of multiprogramming; analysis of bottlenecks, measurements via hardware and software; simulation; models of program behavior, storage devices, memory hierarchies, and file structures; allocation and scheduling of jobs and computer system resources.
3 units, Spr (Baskett) alternate years, given 1975-76

249. Topics in Programming Systems — Given only when a suitable faculty member is available.
   By arrangement

255. Analysis of Algorithms—An advanced course primarily for students who will be doing specialized work in the analysis of algorithms. The intent is to present each of the important paradigms used to analyze algorithms. The course studies combinatorial approaches, generating functions, techniques for exact solution of recurrences, and asymptotic methods in connection with important algorithms for sorting and searching.
3 units, Win (Knuth) alternate years, given 1975-76

3 units, Win (Gill) MWF 10

257. Advanced Computability—Mechanical theorem proving. Gödel theorems. Program schemata. Automatic program construction. Continuation of topics listed for 256. Prerequisite: 256 or equivalent.
3 units, Spr (——) alternate years, given 1975-76

3 units, Win (McCarthy) TTh 11:00-12:15

259. Topics in Theory of Computation — Given only when a suitable faculty member is available.
   By arrangement

4 units, Aut (Winograd) TTh 10:30-12:00

266. Computational Models for the Semantics of Natural Language — (Same as Lin-
SCHOOL OF HUMANITIES AND SCIENCES

300. Computer Science Colloquium—Presentations of current research in Computer Science.

1 unit, Aut, Win, Spr

310. Seminar on Digital Systems—(Enroll in Electrical Engineering 380.) Discussion of current research in the area of digital systems including logic design, switching theory, machine organization, and operating systems.

1 unit, Aut, Win, Spr

311. Advanced Computer Organization—Machine algorithms for high-speed arithmetic. Analysis of hierarchical memory systems and their management. Data formats, instruction sets, addressing, and control. Comparison of advanced systems including multi-processors, stack-organized computers, and pipeline computers. Prerequisites: 111; 112 or 212 or equivalents.

3 units, Spr

319A. Digital Reliability Seminar—(Enroll in Electrical Engineering 385A.) Student-faculty discussions of research problems in areas of reliability, testing, diagnosis, and redundancy in digital systems. Prerequisite: consent of instructor.

1 to 4 units, Aut, Win, Spr

319B. Parallel Systems Seminar—(Enroll in Electrical Engineering 385B.) Student-faculty discussions of research problems in areas of hardware and software system design. Design methodologies for operating systems; system reliability including program verification, program testing, error detection, and error recovery; machine-independent system design; languages for systems implementation; models for parallel systems. Prerequisite: consent of instructor.

1 to 4 units, Aut, Win, Spr

319C. Computer Systems Analysis Seminar—(Enroll in Electrical Engineering 385C.) Student-faculty discussions on measuring, modeling and analyzing the performance of computer systems and computer system components. Prerequisite: consent of the instructor.

1 unit, Aut, Win, Spr

319D. Communications Network Seminar—(Enroll in Electrical Engineering 385D.) Student-faculty discussions on computer communication networks, including study of packet switching, loop systems, topology and capacity assignment, reliability, and performance measurement. Major focus on inter-process, communication methods and operating system design for distributed resource networks.

1 to 4 units, Aut, Win, Spr

320. Artificial Intelligence Seminar.

1 to 3 units, any quarter


1 to 3 units, any quarter


1 to 3 units, any quarter


1 to 3 units, any quarter

365. Seminar in Computational Linguistics.—(Same as Linguistics 365.)

3 units, Spr

390. Advanced Reading and Research.

Any quarter

The following courses offered in other departments may be of special interest to students of computer science:

Analog Computation—See Electrical Engineering 283.


Information and Communication Theory—

Mathematical Logic—See Philosophy 160A, B, 161, and Mathematics 292A,B, 293A,B.

Mathematical Models in Behavioral Sciences—See Behavioral Sciences courses.

Mathematical Programming — See Operations Research courses.


Recursion Theory—See Mathematics 292A,B.


Statistical Methods of Econometrics — See Economics 272.

Theory of Automata—See Philosophy 162 and Electrical Engineering 484.


Theory of Switching and Digital Computer Circuity — See Electrical Engineering 483, 484.

DRAMA

Emeriti: Helene Blattner, Elisabeth Buckingham (Associate Professors); Naomi Wrage (Assistant Professor)

Chairman: Charles R. Lyons

Professors: Wendell Cole, Charles R. Lyons, Eleanor Prosser, H. Donald Winbigler

Associate Professors: Shirlee Dodge, Douglas A. Russell, Helen W. Schrader

Senior Lecturer: Evelyn Draper

Assistant Professors: William S. Eddelman, John Choles, John Cochran

Lecturers: Michael Ramsaur, Juliellen Weiss

PROGRAMS OF STUDY

BACHELOR OF ARTS

The requirements for the degree of Bachelor of Arts with a major in Drama are planned to integrate the critical and historical study of drama with the study and experience of performance. The major provides aesthetic and critical opportunities for students to develop special aptitudes. Students are encouraged to declare their major in their sophomore year.

The minimum program required of all majors:

1. Introduction. Introduction to Contemporary Theater. Drama 1.


3. Literature and Criticism.
   Introduction to Criticism. Drama 100.
   Three courses to be chosen from the Dramatic Literature sequence Drama 151-158. Senior Seminar. Drama 250.


6. Performance. Each major must complete a minimum of 6 units in laboratory courses in departmental theater productions to be divided between Drama 29 and Drama 39 with a minimum of 4 units in Drama 39.

7. Electives. Electives offer opportunities for further work in acting, design, dramatic literature, or history or a combination of these. Nine units of work are to be chosen from Drama courses numbered 100 or above.

Two years of a foreign language at college level are strongly recommended.

HONORS PROGRAM IN DRAMA

Students who are planning to take the special Honors Program in Humanities may fulfill the requirements for the major in Drama by satisfactory completion of the following program:

Fundamentals of Acting. Drama 120A, 120B, 120C
Introduction to Criticism. Drama 100.
Dramatic Literature. Two courses from the sequence Drama 151-158, and 250.
Electives in literature, history, design, or acting to total at least eleven units at undergraduate level or at graduate level with the consent of instructor.
JOINT PH.D. IN DRAMA AND HUMANITIES

The Department of Drama participates in the Graduate Program in Humanities leading to a joint Ph.D. degree in Drama and Humanities. For a description of that program, see the section "Humanities Special Programs."

TEACHING CREDENTIALS

The degree of Master of Arts in Teaching of Drama is offered jointly by this Department and the School of Education. The degree is intended for candidates who have a teaching credential and who wish further to strengthen their academic preparation. The program consists of a minimum of 30 units in the teaching field and 12 units in the School of Education. Detailed requirements for the course are outlined in the School of Education section.

Standard Teaching Credential (Secondary)—Students wishing to obtain the Stanford Standard Secondary Credential should consult the Credential Secretary of the School of Education for the general requirements, and the teacher training adviser, Professor Helen Schrader, in the Department of Drama for Departmental requirements.

ADVANCED DEGREES

Doctor of Philosophy

All graduate study in the Department of Drama leads to the Ph.D. degree. The Ph.D. curriculum is based upon the need for integration between the critical and historical study of dramatic literature and the aesthetics of its performance. Each Ph.D. candidate is expected to function both as an artist and a scholar and perform these activities throughout his or her work in the Department of Drama. Two programs are offered: one with a concentration in criticism and directing; one, in theater history and design.

Applicants for the Ph.D. program should write directly to the Department of Drama for information and applications. In addition to the required statement of purpose, all applicants must submit a statement detailing their practical theater experience and a sample of their written critical work. Applicants for the program in design and theater history must also submit a portfolio. Graduate students in the Department of Drama begin their course of studies in the autumn quarter of each academic year; there are no mid-year admissions. All graduate students must be degree candidates.

University regulations regarding this degree 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.

Units and course requirements.

1. A minimum of 72 units of graduate courses and seminars in support of the degree in addition to the doctoral dissertation.
2. The course sequence in research and criticism (300A, 300B, 301, and 302).
3. A minimum of four seminars in dramatic literature, theater history, or critical theory. One of the graduate seminars is to be taken outside of the Department of Drama.
4. One or two years (depending upon previous graduate experience) in the 370 series in directing. Students in criticism/directing must complete the second-year workshop in directing (371A, 371B, 371C) and a third-year production project (372). Students in history/design must complete the series of advanced design courses (330A, 330B, 330C) and a third-year design project (331).

Language requirements.

The candidate must demonstrate reading knowledge of two foreign languages in both of which there is a major body of dramatic literature. The language requirement may be fulfilled in any of the following ways:

1. Achievement of a sufficiently high score (70th percentile) on the foreign language examination prepared by the Educational Testing Service. Latin and Greek are not tested by ETS.
2. A reading examination given each quarter by the various language departments, except for Latin and Greek.
3. Passage with a grade of B or higher of a course in literature numbered 100 or higher in a foreign language department at Stanford.

The requirement in one language is to be met by the end of the first year. The requirement in the other language must be met by the end of the third year.

Teaching requirement.

Three and one-half quarters of supervised teaching are a required part of the Ph.D.
program. The requirement is normally met by assisting a faculty member for one quarter during the first year, by teaching two courses during the second year, and by teaching one during the third.

Examinations.

1. A preliminary oral examination based on a problem defined by the student, to be taken during autumn quarter of the second year of residence.

2. Four written examinations, each four hours in duration, to be completed by the end of winter quarter of the third year. Examinations will be offered during the second week in May in each of the following periods of dramatic literature:
   - Classical
   - Medieval and Renaissance
   - Neoclassical
   - Romantic and early realistic
   - Modern, 1870-1918
   - Contemporary, 1918 to the present

Students in the criticism/directing program will be required to take the examinations in Classical, Medieval and Renaissance, and Modern drama. The fourth examination will be at the student's choice. Students in the theater history/design program will be required to take two examinations in theater history and one in design. The fourth examination will be in one of the periods of dramatic literature, the specific period to be defined in consultation with his or her advisor and approved by the departmental Graduate Study Committee. Students are urged to take examinations as early as possible: e.g., one in the first year, two in the second, and one in the third. At least two examinations must be completed by the end of the second year of residence. Those examinations remaining to be taken in the third year will be scheduled in either autumn or winter quarter, depending on the given student's production commitment.

3. A University oral examination, to be taken during autumn quarter of the fourth year. This examination will cover (1) the field of concentration, as defined by the candidate and his or her advisor, and (2) a dissertation prospectus. Both the field of concentration and a rough draft of the prospectus must be approved by the candidate's advisor and by the departmental Graduate Study Committee by the end of spring quarter of the third year.

Application for candidacy.

By the end of the second year of residence, the following requirements must be completed:

1. The course sequence in research and criticism and two years of advanced directing and/or design.
2. One language.
3. The preliminary oral examination.
4. At least two written examinations.

Based on its evaluation of the student's progress, the Graduate Study Committee will certify the student's qualifications for candidacy. Upon favorable action, the student will file formal application for candidacy, as prescribed by the University, by the end of spring quarter.

Dissertation.

Normally, this program should be completed in four years. The first year should be devoted to full-time graduate study; the second and third years to graduate study and teaching; the fourth year to writing the dissertation. Following formal admission to candidacy, the dissertation must be completed and approved within five years from the quarter in which candidacy is granted. A candidate taking more than five years will be required to reinstate his or her candidacy by re-passing the written examinations on dramatic literature.

Fellowships

The Department of Drama awards a number of fellowships to graduate students in the Ph.D. program. Completed application forms for fellowships should be filed before January 15 at the Office of Financial Aids at the same time as completed application forms for admission are filed with the Admissions Office.

Summer Session

A special brochure is available, with full details of courses given in the summer by the Department of Drama.

Introductory Courses

Courses numbered 1 through 99 are introductory courses open to all students. Although they include basic courses required
of the major, they are designed also for the student whose major is undeclared or is not in Drama.

1. Introduction to Contemporary Theater—Survey of the arts of contemporary performance; lectures, demonstrations and discussion of readings in contemporary drama.
   3 units, Aut (Staff) MWF 9

5. Play Production—An introductory course in the art and craft of play production, including script analysis, acting, directing, lighting, scenery, costumes, and management. A group class in which students experience the many aspects of play production.
   5 units, Aut (Ramsaur) MWF 3:15-5:05

20. Acting for Freshmen—Introduction to improvisational acting and basic acting techniques.
   3 units, Aut, Win, Spr (Staff) TTh 2:15-4:05

29. Theater Performance: Acting—Students who have been cast in departmental productions may receive credit for their participation as actors, the number of units to be determined by the instructor. May be repeated. No more than 10 units, however, may be counted by drama majors toward graduation requirements of 180 units. Prerequisite: consent of instructor.
   1 to 2 units, any quarter (Staff) by arrangement

30, 31, 32. Introduction to Design and Technical Production—a lecture-laboratory course that introduces the undergraduate to the theatrical arts and crafts of stage design, lighting design, costume design, and technical production. Need not be taken in sequence.

30. Introduction to Theatrical Design—An introductory course in the fundamental processes involved in theatrical design and execution.
   4 units, Aut (Eddelman, Ramsaur, Weiss) MWF 1:15 plus lab. by arrangement

31. Introduction to Stage Lighting: Mechanics—A lecture-lab course dealing with all of the practical aspects of lighting: electricity, light sources, instrumentation, control, color, and design process.
   4 units, Aut (Ramsaur) TTh 10-12 and F 1-3 plus lab. by arrangement

32. Introduction to Costume Design and Construction—An introductory course in the fundamental aesthetics of costume design, costume planning for production, and the place of costume in the amateur and professional theater.
   4 units, Spr (Weiss) MWF 1:15 plus lab. by arrangement

35. Stagecraft—A laboratory course in basic production practices. The student will be introduced to theory and use of standard tools and materials for stage scenery construction. It is recommended that Drama 7 be taken concurrently with Drama 39.
   4 units, Win (Ramsaur) TTh 1:15-5:05

39. Theater Performance: Crew—Students may receive credit for their participation in the technical areas of departmental productions. The number of units received is determined by the instructor. Prerequisite: consent of instructor.
   1 to 4 units, any quarter (Staff) by arrangement

INTERMEDIATE COURSES

Courses numbered 100-199 are intermediate courses designed primarily for the major but open to all undergraduates who have the necessary prerequisites.

100. Introduction to Dramatic Criticism—Approaches to textual analysis, dramatic structure and genre.
   4 units, Win (Staff) MWF 10

120A,B,C. Fundamentals of Acting I—An introduction to the elements of self-awareness, characterization, and theatrical expression for the beginning actor. Prerequisite: sophomore standing or consent of instructor. 120A,B,C must be taken in sequence.
   120A. 3 units, any quarter (Staff)
   120B. 3 units, Win (Staff) TTh 10-12
   120C. 3 units, Spr (Staff) TTh 10-12

121A,B,C. Fundamentals of Acting II—The study of characterization in workshop productions of complete plays. A company class. By audition. Prerequisites: 120A,B,C and 123.
   121A. 3 units, Aut (Staff) MWF 2:15-4:05
   121B. 3 units, Win (Chioles) MWF 2:15-4:05
121C. 3 units, Spr (Valenzuela)  
MWF 2:15-4:05

123. Movement and Imagination — It is recommended that 123 be taken concurrently with 120A,B,C. May be repeated for credit.  
1 unit, any quarter (Dodge)  
Section 1, T 3:15-5:05  
Section 2, W 2:15-4:05

124A,B,C. Stage Movement — It is recommended that 124A,B,C be taken concurrently with 120A,B,C and 121A,B,C. May be repeated for credit.  
124A. Creative Theater Rhythms  
2 units, Aut (Dodge) MW 10-12
124B. Creative Choreography  
2 units, Win (Dodge) MW 10-12
124C. Creative Mime  
2 units, Spr (Dodge) MW 10-12

125. Voice for the Theater—May be repeated for credit. It is recommended that 125 be taken concurrently with 121A,B,C. Prerequisite: consent of instructor.  
2 units, any quarter (Draper) by arrangement

126A,B,C. Black Performing Arts—Prerequisite: sophomore standing and consent of instructor.  
126A. 3 units, Aut (Cochran) TTh 10-12
126B. 3 units, Win (Cochran) TTh 10-12
126C. 3 units, Spr (Cochran) TTh 10-12

130A. Scene Design—Visual analysis of historical styles as interpreted for the modern theater and developed throughout various presentational media. Specific problems in spatial perceptions and compositions. One hour lecture per week in period interiors and furnishings from the Classical through Contemporary periods. Work in model building. Prerequisite: 30 or consent of instructor.  
3 units, Aut (Eddelman) MWF 10  
plus lab. by arrangement

130B. Technical Production — A lecture-discussion course on the problems of realizing the design, with emphasis on both standard production practices and utilization of modern technology. Prerequisite: Drama 35 or Drama 30.  
3 units, Win (Ramsaur) T 2:15-3:05 and Th 2:15-4:05

130C. Advanced Scene Design—Advanced projects in scenic design with an emphasis on complex theatrical presentations involving new materials and visual aesthetics. Prerequisites: Drama 130A and 130B.  
3 units, Spr (Eddelman, Ramsaur)  
MWF 10 and lab. by arrangement

131A,B. Lighting Design—Prerequisite: 31 or consent of instructor.  
131A. Lighting Design: Aesthetics — A lecture-discussion course concentrating on the aesthetic principles of lighting design; interpretation, concept, process, and practice. Prerequisite: Drama 31.  
3 units, Win (Ramsaur) TTh 10-12  
and F 1:15-3:05

131B. Advanced Stage Lighting Design — Projects in lighting and lighting design will be presented and resolved through experimentation, class discussion, and written reports. Areas of concentration will include color, special effects and projections. Prerequisite: Drama 131A.  
1 to 3 units, Spr (Ramsaur) W 2:15-4:05

132A,B,C. Costume Design  
132A. Costume Crafts—A discussion-laboratory course in basic techniques, materials, and methods of constructing historical stage costumes.  
3 units, Aut (Russell, Weiss)  
TTh 1:15-3:05

132B. Costume Design — A lecture discussion course in the technique and aesthetics of costume design with weekly design assignments.  
3 units, Aut (Russell) MWF 1:15

132C. Advanced Costume Design — Advanced design projects with an emphasis on more complex costume design problems presented weekly for analysis and discussion.  
3 units, Win (Russell) MWF 1:15  
Spr (Weiss) MWF 1:15

133A,B. Theatrical Makeup — Laboratory course in the art and craft of stage make-up.  
133A. Introductory course in stage make-up.  
1 unit, Aut (Weiss) T 10-12

133B. Three dimensional stage makeup and experimental media and techniques—Prerequisite: 133A.  
1 unit, Win (Weiss) T 10-12

134. Period Interiors — A lecture course in
period interiors and furnishings from the Classical through Contemporary periods.

1 unit, Aut (Eddelman) F

135. Project in Design and Technical Theater—Project in stage design, costume design, lighting design, or stage managing. Prerequisite: consent of instructor.

1 to 3 units, any quarter (Staff) by arrangement

151. Greek and Roman Drama.
4 units, Spr (Chioles) MW 9–10:30

152. Medieval and Renaissance Drama.
4 units, given alternate years

153. Neoclassic Drama.
4 units, given alternate years

154. Romantic and Early Realistic Drama.
4 units, given alternate years

155. Modern Drama (1880–1918).
4 units, given alternate years

156. Modern Drama from 1918.
4 units, Win (Hampton) MWF 9

4 units, Spr (Cole) MWF 11

160. Theaters and Staging—Survey of theaters, staging methods, styles of theatrical production from the Greeks to the Modern period.
4 units, Aut (Cole) MTWTh 9

162. History of Costume and Period Style—A lecture-survey course in the history of dress and period style in the Western world from ancient times to the present.
4 units, Aut (Russell) MTWF 11

170. Introduction to Directing—Prerequisites: 120A,B,C and 30, 31, 32.
3 units, Spr (Staff) TTh 2:15–4:05

190. Special Research—Individual project in the work of a playwright, period, or genre. Prerequisite: consent of instructor.
1 to 4 units, any quarter (Staff) by arrangement

Advanced Courses
Courses numbered 200–299 are designed for advanced undergraduates and graduates.

235. Projects in Design and Technical Production.
1 to 3 units, any quarter (Staff)

250. Senior Seminar in Genre.
4 units, Win (———) TTh 10–12

251. Greek and Roman Drama.
4 units, Spr (Chioles) MW 9–10:30

252. Medieval and Renaissance Drama.
4 units, given alternate years

253. Neoclassic Drama.
4 units, given alternate years

254. Romantic and Early Realistic Drama.
4 units, given alternate years

255. Modern Drama (1880–1918).
4 units, given alternate years

256. Modern Drama from 1918.
4 units, Win (Hampton) MWF 9

257. American Drama from 1920.
4 units, Aut (Cole) MWF 11

260. Theaters and Staging—Survey of theaters, staging methods, styles of theatrical production from the Greeks to the Modern period.
4 units, Aut (Cole) MTWTh 9

262. History of Costume and Period Style.
4 units, Aut (Russell) MTWF 11

270. Independent Project in Directing—Prerequisite: consent of instructor.
2 to 4 units, any quarter (Staff) by arrangement

290. Special Research—Individual project in the work of a playwright, period, or genre. Requirement for department honors.
1 to 4 units, any quarter (Staff) by arrangement

Graduate Courses
Courses numbered 300 and above are primarily for graduates but are open to advanced undergraduates with permission.

Ph.D. Courses

300A. Research Methods.
2 units, Aut (Lyons) T 10–12

300B. 2 units, Win (Cole) T 10–12

301. History of Dramatic Criticism.
4 units, given alternate years

302. Contemporary Critical Approaches.
4 units, Spr (Lyons) MW 2:15–4:05
330A, B, C. Design Workshop — Advanced course in design for the theatre.

330A. 4 units, Aut (Staff) by arrangement
330B. 4 units, Win (Staff) by arrangement
330C. 4 units, Spr (Staff) by arrangement

331. Design Project—Design of a full-length production in conjunction with directing project (Drama 372).

4 units, any quarter (Staff) by arrangement


350. Seminar in Dramatic Genre.

4 units, given alternate years

351. Seminar in the Work of a Playwright.

4 units, given alternate years

352. Seminar in Comparative Drama.

4 units, given alternate years

353. Seminar in Dramatic Period: Contemporary Drama.

4 units, Aut (Hampton) MW 2:15-4:05

354. Seminar in a Special Critical, Aesthetic, or Historical Problem: 20th Century Theatre Architecture.

4 units, Win (Cole) MW 2:15-4:05

370A, B, C. Directing Workshop I—Investigation of basic directorial problems in scenes, using a multi-form theatre space, designing actor/audience relationships and composing modular scenic units. Performances limited to class.

370A. 4 units, Aut (Staff) by arrangement
370B. 4 units, Win (Staff) by arrangement
370C. 4 units, Spr (Staff) by arrangement

371A, B, C. Directing Workshop II—Investigation of basic directorial problems in shorter plays or act units, working in a variety of styles, using a multiform theater space. Public performances.

371A. 4 units, Aut (Staff) by arrangement
371B. 4 units, Win (Staff) by arrangement
371C. 4 units, Spr (Staff) by arrangement


4 units, any quarter (Staff) by arrangement

390. Tutorial.

Any quarter (Staff) by arrangement

399. Dissertation Research.

Any quarter (Staff) by arrangement

M.F.A. COURSES

(Open to M.F.A. Students Only)

243M. Technical Production III.

1 unit, any quarter (Ramsaur) by arrangement

253M. Lighting III.

1 unit, any quarter (Ramsaur) by arrangement

271M. Costume I.

2 units, any quarter (Russell) by arrangement

273M. Costume III.

1 unit, any quarter (Russell) by arrangement

283M. Scene Design III.

1 unit, any quarter (Eddelman) by arrangement

INTER-PERSONAL AND SMALL GROUP COMMUNICATION

The following courses provide experience-based learning in inter-personal communication in small interacting groups. The members of the group learn a method of continually expanding competence in observing and assessing their own communication with others and of discovering their feelings, reactions, and perceptions about the processes of interaction.

110. Independent Study.

1 to 3 units, any quarter (Schrader) by arrangement

111. Exposition—Focuses on inter-personal communication in the small group.

3 units, Aut, Win (Schrader) MWF 11 and 1:15

112. Discussion—Focuses on inter-personal communication and group processes.

3 units, Win (Schrader) TTh 2:15-4:05

113. Group Communication — Focuses on inter-personal processes of communication as they relate to inter-group experience. Prerequisite: 111 or 112 or consent of instructor.

4 units, Spr (Schrader) TTh 2:15-4:05
EAST ASIAN STUDIES

Committee in Charge: The Committee on East Asian Studies, a subcommittee of the Committee on International Studies

Chairman: To be named
Director of Master’s Program: To be named

The Center for East Asian Studies administers the master’s program in East Asian Studies, an interdisciplinary program in the humanities and social sciences. The program includes faculty in Anthropology, Art, Asian Languages, Economics, History, Law, Philosophy, Political Science, Religious Studies, and Sociology.

Stanford’s program in East Asian studies is established with principal reference to three types of students:

1. those who wish to specialize in East Asia for the Ph.D. but have not yet decided on the discipline in which they wish to work;
2. those who have chosen a discipline for their Ph.D. preparation, but wish to have an intensive area and language training before beginning their disciplinary training;
3. those who wish to concentrate in East Asian studies as a preparation for careers in government, journalism, business, or teaching at pre-collegiate levels.

This program is designed to be completed in no more than two academic years. Since each student will enter the program with a unique background, interest, and capabilities, a certain degree of flexibility is provided for. Approximately one-half of the student’s work is to be devoted to studying either the Chinese or Japanese language; the other half consists of nine courses of substantive content other than language training. Although some requirements can be waived, e.g., by transferring credit from an undergraduate institution, the student is still expected to fulfill the basic nine-course requirement.

Minimally, the student is to achieve language competence equivalent to completion of third-year level in either Chinese or Japanese. Students entering without any language preparation may meet this requirement in a variety of ways by combining summer intensive courses with regular academic year work. The language requirement may be waived in part either by receiving credit for courses at other institutions or by passing examinations administered by the Asian Languages Department. Those who complete the minimum three-year language requirement before completing other requirements are expected to continue work involving the use of Chinese or Japanese as long as they are in the program.

The nine substantive courses required may be selected from the large number of East Asia related courses offered in various departments at Stanford. This partial list of current faculty in East Asian studies will provide some idea of the number and variety of course offerings:

- Anthropology: Profs. Befu, Skinner, Wolf
- Art: Profs. LaPlante, Sullivan
- Asian Languages: All faculty
- Economics: Profs. Gurley, Lau
- History: Profs. Cole, Duus, Kahn, Mancall, Mass, Van Slyke
- Law: Prof. Li
- Philosophy: Prof. Nivison
- Political Science: Profs. Harding, Ike, Lewis, North, Steiner, Ward
- Religious Studies: Profs. Davis, Lethcoe, Yearley
- Sociology: Prof. Olsen

Students are required to take at least one seminar in which they will write a research paper on some aspect of East Asia. This seminar must be taken in a department in which two other courses have been taken, regardless of the specific prerequisites of the seminar. These courses must be directly related to the study of East Asia, though theory-oriented or methodological courses are acceptable in some cases. In addition to these three courses in a single department the student must elect six courses (numbered over 100) related to East Asia. These courses must be completed at Stanford University or through credit exchange with the University of California at Berkeley. The latter must be approved by the student’s advisor and the Dean of Graduate Studies.

The A.M. degree in East Asian Studies is administered through the Committee on East Asian Studies, made up of all faculty in the East Asian Studies area. The Center for East Asian Studies serves as a central coordination and administration point for the entire East Asian Studies community. The Center sponsors a wide variety of activities...
open to all members of the Stanford community, including colloquia, film series, special presentations, advanced language programs, and exchange with other campuses. In addition, it is the informal meeting place for faculty and graduate students working in the East Asia area in various disciplines.

Those interested in applying for admission to the A.M. Program should write for application forms to the Office of Graduate Admissions, Old Union, Stanford University, Stanford, California 94305. The Graduate Record Examination (aptitude sections) is required; scores should be sent to the Graduate Admissions Office. Deadline for submission of applications for admission and financial aid is January 15, 1975.

ECONOMICS

Emeriti: Bernard F. Haley (Professor), Edward S. Shaw (Professor)
Chairman: James N. Rosse
Chairman Elect: Bert G. Hickman


Visiting: Joseph Steindl


Lecturers: Ronald Braeutigam, Avishay Braverman, Jens Christiansen, Martin Perry

Affiliated Faculty:
Professors: Roger W. Gray, Bruce F. Johnston, William O. Jones, Dudley Kirk, Benjamin F. Massell (Food Research Institute), Gerald M. Meier (Graduate School of Business), Clark W. Reynolds (Food Research Institute), Robert B. Wilson (Graduate School of Business), Pan A. Yotopoulos (Food Research Institute)

Associate Professors: Martin Carnoy (School of Education), Henry M. Levin (School of Education), Scott R. Pearson (Food Research Institute), C. Peter Timmer (Food Research Institute)

Assistant Professors: Omar Davies (Food Research Institute), Tetteh Kofi (Food Research Institute), Harold S. Luft (School of Medicine), Myra Strober (Graduate School of Business), James L. Sweeney (Engineering-Economic Systems)

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 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. Associated with the Department are the Research Center in Economic Growth in Encina Hall, for research and graduate training in problems of economic growth in both industrialized and developing countries, and comparable facilities in Encina Hall for mathematical economics and econometrics.

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 Institution, with its comprehensive collections of original and secondary materials on many foreign nations. The Food Research Library in Encina Hall is particularly valuable for International Trade and Economic Development.

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 under-
graduates are conducted by the Institute, as well.

**Bachelor of Arts**

To be recommended by the Department for the degree of Bachelor of Arts in economics, the student must have completed 45 units of economics:

1. The 45 units shall include Economics 51, 52, and 53 or their equivalents. Economics 51 and 52 should be completed if possible by the end of the junior year.
2. The 45 units shall include 25 units in courses numbered 100 or above, of which 15 units must be taken at Stanford.
   a) Two courses must be selected from the following list: 111, 141, 145, 157, 165.
   b) Selected courses in Engineering-Economic Systems and courses numbered 205 and above in the Food Research Institute will count as economics courses in satisfying these requirements. A list of these courses is available in the Economics Department office.
   c) Courses taken at other universities may be included in the 25 units of 100 level courses and 45 units of economics courses. The Director of Undergraduate Studies for the Economics Department will establish the amount of credit to be granted toward completion of the Departmental requirements. Students who have taken a year's elementary economics course at another university will normally be required to take Economics 51, 52, and 53.
3. An average grade of "C" or better shall have been received for all units completed at Stanford in economics.

Students who expect to undertake graduate study in economics, particularly prospective Ph.D. candidates, are strongly advised to take courses in quantitative methods beyond those recommended for other candidates for the Bachelor of Arts in economics. A list of recommended courses in Mathematics, Statistics, Operations Research, and Computer Science is available in the Economics Department office.

Students who completed Economics 5 and 10 under the previous requirements retain a choice of fulfilling either old or new versions of requirements 1 and 2. For these and other purposes, Economics 5 and 10 will be considered equivalent to 51 and 52, respectively.

**Honors Program in Economics**

Two programs are offered which lead to a Bachelor of Arts with Honors in Economics. Both programs are designed to encourage a more intensive study of economics than is required for the normal major, together with course and research work of exceptional distinction.

The central feature of Honors Program I is completion of an honors thesis of appropriate quality. Honors Program II requires an especially high grade average sustained through more than the usual number of units of economics, and also calls for the submission of at least two term papers of appropriate quality, in economics, written at any point in the student's course work.

Both programs require completion of all requirements of the Bachelor of Arts in economics. Both programs also require an average grade of at least "B" in all courses (except courses taken on a pass/no credit basis) at Stanford.

Additional requirements of the Honors Program I are:

1. Completion of 10 units of Economics 199, or an equivalent combination of individual research courses, in addition to the 45 units ordinarily required. Before embarking on writing the honors thesis in Economics 199, students are advised to have completed all lecture courses associated with the subject they intend to pursue, such as the requirements under 1 and 2 for the A.B. degree.
2. An average grade in economics courses other than Economics 199 of at least "B."

Additional requirements of the Honors Program II are:

1. Completion of 15 units of economics courses numbered 100 or above in addition to the units ordinarily required for the Bachelor of Arts in economics.
2. An average grade in economics at least midway between "B" and "A."
3. Submission of two term papers of appropriate quality. These will ordinarily have been written in economics courses. They must have been read and graded by a
faculty member in economics before being submitted.

Prospective candidates of Honors Program I should advise the Departmental Director of Undergraduate Studies of their interest and plans no later than the Spring Quarter of the junior year. Notice of the instructors and topic or topics offered for the next year in Economics 199 will be made available whenever possible by the beginning of the Spring Quarter. Students are encouraged to sign up in advance and to indicate as early as possible if they plan to ask for individual directed research on another topic. Admission to this Program is not automatic and may have to be restricted if there are too many applicants.

Prospective candidates for Honors Program II are also encouraged to consult the Departmental Director of Undergraduate Studies before the end of the junior year. Applications for honors under this Program may be made at any time up to the end of the next-to-last quarter in which the student is enrolled. Potential applicants are responsible for saving copies of high-quality term papers for submission with the applications.

CO-TERMINAL A.B./A.M. PROGRAM

Qualified undergraduates may, upon admission to the co-terminal A.B./A.M. program, begin the A.M. part of the program after completing 180 units of undergraduate work. For admission, a student must have an average grade in Economics courses of approximately one “A” grade for every two “B” grades or better. For intelligent program planning, students are strongly urged to seek admission to the program prior to the end of the third quarter of their junior year and must apply prior to the end of the first quarter of their senior year. Application should be made to the Director of Graduate Studies for the Economics Department. In addition to meeting the requirements for the Bachelor of Arts in economics, students are required to complete the requirements for the Master of Arts as stated below. If the student takes Honors Program I, he may submit his Honors thesis as one of the alternative two term papers.

ADVANCED DEGREES

Graduate programs in economics are designed to provide students with a sound basis in modern theory, with a broad background in applied fields as well as specialization within fields of interest, with needed analytic and empirical tools, and with the perspective on the current state and uses of their discipline that is obtained by studying the development of economic thought and the economics of other cultures or other times. The department considers each of these objectives to be essential in the development of qualified researchers, teachers, and practitioners in economics. While departmental requirements for advanced degrees have been structured to secure these objectives, in the final analysis it is the responsibility of students to plan their studies so that these objectives are served.

A student who has been admitted to graduate standing in economics does not automatically become a candidate for a graduate degree. Rather, admission carries with it the expectation that students are preparing themselves for the Doctor of Philosophy degree. Admission to Candidacy and Recommendation for the Degree (and for the Master of Arts degree) occur subsequently, upon satisfaction of departmental requirements outlined below. Recommendation for the Degree and, especially, Admission to Candidacy are Departmental procedures separate from the formal procedures of the University Committee on Graduate Studies. The University’s basic requirements for advanced degrees (residence, dissertation, etc.) are set forth in the section “Degrees” in this bulletin and must be satisfied along with the departmental requirements listed here.

An undergraduate major in economics or its equivalent is not required for admission to graduate standing, but is desirable and, in any event, some preparation in the social sciences is essential. Students admitted to graduate standing are expected to be prepared in mathematics at least to the level of one year’s intensive study of calculus. Advanced calculus, linear algebra, differential equations, analysis, and mathematical statistics are useful preparations separately or collectively, and students are encouraged to continue the development of such analytic tools during their graduate study. Narrowly specialized undergraduate programs are not recommended.

Well prepared students proceeding toward the Doctor of Philosophy degree may expect to spend approximately two years in
course work and another two years in seminars, independent study, and dissertation research, with some overlap in each direction. Exceptional progress may make a three-year program feasible and, occasionally, ambitious dissertation research cannot be completed within a four-year program.

Questions and petitions concerning admission to the program or the program itself should be addressed to the Director of Graduate Study, who together with his administrative assistants and the Graduate Studies Committee, of which he is chairman, has departmental responsibility for administering the graduate program. All entering students and second-year students are assigned individual faculty advisers, and where possible, an effort is made to assign advisers on the basis of sharing special interests within the field of economics. Students approaching their dissertation research are obliged to seek among the regular members of the Economics Department faculty a principal adviser who will supervise that research. Officers and members of the Graduate Economics Club actively participate in advising entering students and, in addition, provide an important channel through which student interests within the department are represented.

MASTER OF ARTS

The Department of Economics does not admit to advanced standing students who plan to terminate their graduate study with a Master of Arts degree. Students may (but need not) elect this degree in preparation for their Doctor of Philosophy degree. Students matriculated to graduate standing in other departments of the University may, however, be admitted to candidacy. The following are departmental requirements for the Master of Arts degrees:

Admission to Candidacy—Completion of the Stanford requirements for a Bachelor of Arts degree in economics, or approximately equivalent training, is required of students who undertake a program of study for the degree of Master of Arts in Economics. Admission to candidacy for the degree will be restricted to students whose record bears promise of successful graduate work. All programs must be approved by the Director of Graduate Study before filing the Application for Candidacy for the Degree of Master of Arts at least two quarters before expected completion of the degree. Programs lacking strength or coherence will not be approved.

Recommendation for the Degree — Students completing programs consistent with the departmental objectives listed in the introductory paragraph above will be recommended to the University Committee on Graduate Studies for the degree of Master of Arts in Economics, provided the following standards are satisfied:

1. Completion of a program of study at Stanford amounting to not less than 45 units of credit. Courses numbered below 100 and courses completed with a grade of less than C may not be counted toward the 45 units required. The program must include at least 30 units of economics taken in the Department of Economics, of which at least 15 units (or 10 units in addition to the thesis) must be in courses at the 200 level. The 200 level courses in the program must include either 202 or 210, whichever is recommended by the Director of Graduate Study. Courses in subjects closely related to economics may be included with the approval of the Director of Graduate Study in Economics. Seminar courses numbered 300 or above cannot be used to satisfy the basic 45 units.

2. Completion of a thesis acceptable to the department or of two term papers of acceptable quality at least one of which is for a course numbered 200 or over. Credit will be allowed for the thesis to a maximum of 10 units toward the 45 units required for the degree.

3. An average grade of B or better shall have been received for the first 45 units of course work completed and for additional units approved by the department.

DOCTOR OF PHILOSOPHY

Programs of study leading to the Doctor of Philosophy degree are designed by the student, in consultation with his advisers and the Director of Graduate Study, to serve his particular interests as well as to achieve the general departmental objectives outlined above. Simple satisfaction of a set of requirements is necessary but not sufficient for Admission to Candidacy or Recommendation for the Degree. Rather, programs of study will be weighed individually according to the following departmental standards or requirements:
Recommendation for the Degree — The Departmental Graduate Studies Committee will recommend to the University Committee on Graduate Studies that a student be granted the degree of Doctor of Philosophy in Economics when the student submits and the Graduate Studies Committee accepts a completed program of study which will satisfy the following set of standards. This summary list is elaborated upon below.

1. Qualification established by comprehensive examination in five fields of study (if no minor subject is offered) or in three fields and a minor subject
2. Proficiency in either at least two other areas within economics or the minor subject
3. Qualification in Mathematics
4. Qualification in Econometrics
5. Qualification in Economic History
6. Professional competence in a foreign language or course work developing a needed research skill
7. Teaching experience
8. Research training and specialized study in seminars
9. University oral examination
10. Completion of dissertation

It should be noted that the fourth and fifth standards need not involve course work in addition to that offered in satisfying the first and second. More detailed discussion follows:

1. Qualification in five fields of study (if no minor subject is offered) or in three fields of study and a minor subject. All candidates will be expected to qualify in “Price and Allocation Theory” and “Theory of Income and Economic Fluctuations.” Evidence of competence shall be at least equivalent to passing comprehensive examinations in each field.

Comprehensive field examinations will be scheduled annually, usually at the close of the sequence designed to prepare for them. The minimal standard of qualification in each field will be a grade of B on the appropriate examination. Successful candidates are expected to show distinction in at least one field of economics. Comprehensive examination papers become a part of each student’s permanent file.

In addition to the two theory fields, students may select remaining fields according to the following options:

**Option A—Without a Minor Subject.** Consistent with the objectives of their program, students may choose to prepare themselves in three of the following fields of study:

- Alternative Approaches to Economic Analysis
- Econometrics
- Economic Development
- Economic History
- International Economics
- Labor Economics
- Mathematical Economics
- Monetary Theory
- Public Finance
- Structure of Industry
- Theory of Choice
- Urban Economics

Students should complete at least four comprehensives by the end of their second year in residence. Many complete all five. Normally students exercise Option A unless there are strong reasons leading them to take a program with a minor.

**Option B—With a Minor Subject.** Consistent with the objectives of their program and advance consent of the Director of Graduate Studies, students may choose to prepare themselves in a minor field. Normally, they would also prepare themselves in two of the fields of study listed under Option A. Additional credit elsewhere in the economics part of his program for the minor may be obtained by consent of the Director of Graduate Studies.

2. Distribution Requirement. To achieve a balanced program, students are required to show proficiency in at least two fields other than those in which they will take comprehensive exams under options A or B. Normally, a total of three five-unit courses approved by the Director of Graduate Studies, passed by grades B or better, will be regarded as evidence of such proficiency. Besides selecting from the remaining fields listed under option A for this purpose, the student may choose from all graduate lecture courses numbered 200 or above offered by the Economics Department. Economics 171 and/ or Economics 172 may be counted as graduate courses for this purpose.
3. The student demonstrates competence in mathematics at least to the level of successful completion of Mathematics 7 or 43 with a grade of C or better or its equivalent (as judged by an examination administered by the department upon entrance). This standard should be satisfied as soon as possible after first graduate registration and those with little previous mathematical background are advised to register their first autumn quarter for Mathematics 5 or 41. Those who have more background but are not quite up to the level of Mathematics 7 or 43 may either complete Mathematics 7 or 43, or complete Economics 180, depending upon their level. Additional preparation in mathematics is strongly suggested, and students should consult with their advisers in choosing courses beyond the level of Mathematics 7 or 43.

4. Students shall submit evidence of competence in Econometrics at least to the level of Economics 171 with a grade of B or better. Electing Econometrics as a comprehensive field automatically satisfies this standard. Students who do take the Econometrics comprehensive may still offer Economics 172 as one of their courses satisfying the distribution requirement under 2 above.

5. Students shall submit evidence of competence in Economic History either by electing to take the comprehensive exam in the field or by taking a course at the 200 level for five units. Students not offering the comprehensive exam may offer as many as two economic history courses in partial fulfillment of the distribution requirement under 2 above.

In satisfying standards 1 through 4, in unusual circumstances a student may petition the Director of Graduate Studies to substitute courses from outside the Economics Department if they demonstrably contribute more to the Ph.D. program.

6. Consistent with the aims of his program, each student shall demonstrate research capability in a relevant foreign language or mastery of a body of specialized research methods other than Econometrics. Research competence in a foreign language will automatically satisfy this standard, but evidence of particular skills in other areas may be accepted as an alternative; e.g., computer science (programming, data analysis), statistics (sample theory), psychology (test theory of survey technique), mathematical and quantitative methods of demographic analysis, and advanced topics in mathematics may be accepted.

7. Candidates for the Ph.D. in Economics are expected to acquire minimal teaching experience equivalent to that of a teaching assistant in the department for one quarter or more. It is not recommended that this requirement be satisfied during the first year of graduate study, and it will normally be satisfied by the end of the third year of residence.

8. Seminar studies are designed to develop independent research skills, to permit specialized study, and to foster dissertation research. Students are expected to participate in at least two seminars by the end of their third year in residence. Presentation of a well developed proposal for dissertation research should take place in one of these seminars or, alternatively, in a departmental workshop. A dissertation prospectus and two research papers must be submitted as part of each student's permanent file. Students in the process of dissertation research and in residence shall continue to participate in at least one seminar.

9. When these standards have been satisfied and upon a recommendation from the student's dissertation adviser, the Director of Graduate Study will request that a University oral examination committee and time be set. The examination is based on the dissertation and on the field or fields of economics within which it lies.

10. Completion of a dissertation accepted by a departmental reading committee will be the final standard set in preparation for the Ph.D. degree.

Minor for the Degree of Doctor of Philosophy—To be recommended for the degree of Doctor of Philosophy with Economics as a minor subject, a student will qualify in three fields of economics, one of which must be either "Price and Allocation Theory" or "Theory of Income and Economic Fluctuations." Qualification in these fields is tested in the departmental comprehensive written examinations that are given once annually. The standard of achievement in these
examinations is the same for minor as for major candidates.

Admission to Candidacy—After a student has completed a substantial number of the formal requirements (other than the dissertation), the Graduate Studies Committee will make a judgment as to his qualifications to complete the Ph.D. program successfully. This judgment will usually be made at the end of spring quarter in the student's second year. If adjudged to be so qualified, the student will complete the University form “Application for Candidacy for the Degree of Doctor of Philosophy,” to be signed by him, the Director of Graduate Studies and his dissertation adviser—if one has been selected by that time.

If the Graduate Studies Committee judges the student not qualified to finish successfully, the student will be terminated from the Ph.D. program at the end of his second year, unless extenuating circumstances are shown to exist.

Admission to candidacy for the degree of Doctor of Philosophy is granted by the University Committee on Graduate Studies, and expires five years from the date the application is approved by the committee (if not terminated earlier by the major department because of unsatisfactory progress). After expiration, candidacy may be renewed by the submission of a new application or extended on the recommendation of the department.

The academic programs of students will differ, since not all will have proceeded in the same order or at the same rate. A representative minimum program on which the Graduate Studies Committee could make a judgment regarding qualification at the end of the second year is outlined below. Many students should expect to exceed this standard, whereas others may—in consultation with the Director of Graduate Studies—plan to meet it in a somewhat different manner.

1. Candidates will have successfully completed their two comprehensive exams in economic theory.
2. Either two out of the three remaining comprehensive exams will have been completed, or one plus completion of most of the minor requirement if the candidate elects option B.
3. Qualification in Mathematics.
4. Qualification in Econometrics or in Economic History.
5. The candidate will have shown “distinction” in some important aspect of his or her graduate program.

The Dissertation—By the end of his third year, normally encompassing the two dissertation seminars and remaining course work, students will have selected an adviser and a dissertation subject or area. A short dissertation prospectus written by the student and signed by his adviser will be placed on file with the Director of Graduate Studies. This prospectus is not binding on either party, but advisers should be informed of major changes in research directions.

As soon as a firm thesis proposal is agreed on between student and adviser, the second and third members of a reading committee are to be selected with the adviser's approval. The principal adviser and one other member of the reading committee must be from the Department of Economics.

When either a first draft of the dissertation is completed, or core theoretical and/or empirical aspects of the dissertation have been developed, a student may petition for an oral exam with his adviser's approval. The oral committee will normally consist of the three dissertation readers, a chairman drawn from outside the Department, and one additional examiner nominated by the Department. At least three out of these five examiners must be from the Economics Department.

For the candidate to pass the oral exam, the examining committee must be convinced that (1) he has mastered the existing literature and professional techniques in his dissertation area, and (2) that no major conceptual or empirical problems remain to be overcome in making his own significant contribution.

Joint Programs Leading to Dual Degrees—Attention is called to a joint program. The Department of Economics and the Stanford Law School offer a joint program leading to the Doctor of Philosophy in Economics and the J.D. degree in Law.

In the above case, the student's program objectives must clearly justify such a joint program; decisions by the Departmental Graduate Studies Committee will govern. In
this case, a student’s program in Economics must satisfy the same standards as a Ph.D. degree in Economics taken with a minor in Law. See the Law School catalogue for descriptions of its participation in the joint program. In this case, it is expected that dissertation research will cross departmental lines and that members of the dissertation committee will be drawn from both faculties.

Students may matriculate in Economics or Law, initially. After one year of study, they may apply for admission to a joint program by petition to the two appropriate faculty committees.

Similar joint programs involving the Master of Arts degree in Economics may be arranged upon application and following standards set up for that degree.

FELLOWSHIPS AND ASSISTANTSHIPS

The attention of prospective graduate students is directed to the fact that the Department awards a number of fellowships for graduate study of economics. Current stipends under these grants range up to $2200 for an academic year in addition to tuition allowance. Students whose record justifies continuation in the program may be assured of favorable consideration for further support for a period of up to three additional years.

Such support for subsequent years may take the form of employment as research assistants or as teaching assistants. The salary scale in each case depends upon experience and ability. In the case of research assistants, students are currently receiving $2835 plus an allowance for tuition. In the case of teaching assistants, students are currently receiving $2500, $2835, or $3000 per academic year, depending on appointment, in addition to a tuition allowance. In each case the appointments are for half-time employment.

Entering students are not normally considered for research or teaching assistantships.

Completed application forms for graduate fellowships should be filed before January 15 at the Office of Financial Aids at the same time as completed application forms for admission are filed with the Admissions Office.

COURSES

Note: 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 March for information about the exact times at which courses will be given in 1974-75.

1. Elementary Economics—The functioning of a modern market economy: the determination of national income and its distribution; the composition of output; growth of the economy.

5 units, Aut, Win, Spr (Scadding, Bach, Gurley) MTWThF
4 units, Sum (——) MTWThF

51. Economic Analysis I—The nature of economic systems; performance evaluation criteria. Consumer choice and production theory. The role of markets and prices in allocating resources in a decentralized system. Problems of equity and efficiency. (May be taken as 151 by graduate students.) Prerequisite: 1 or equivalent preparation.

5 units, Aut (Rosse, Knuss, Perry) MTWThF

52. Economic Analysis II—An analysis of equilibrium and instability in the economic system as a whole. National accounts and aggregate relationships among stocks and flows in markets for goods, services, and financial assets. (May be taken as 152 by graduate students.) Prerequisite: 51.

5 units, Aut, Win, Spr (P. Perry, Johnson, M. Perry) MTWThF

53. Economic Analysis III—Application of micro- and macroeconomic analysis to comparative economic systems and selected aspects of economic growth. Centralized versus decentralized decision-making; questions of ownership; the performance of socialist economies. Growth as an economic goal. Sources of economic growth. Allocation of investment and growth performance in different systems. Term papers are required. (May be taken as 153 by graduate students.) Prerequisite: 52.

5 units, Win, Spr (——) MTWThF

90. Introduction to Accounting—An introduction to the principles and concepts underlying financial reports such as the income statement, statement of financial position,
and the "funds" statement, and to the uses of such reports. No prior accounting is assumed. Students who have taken or are now taking a college-level accounting course may not enroll. (May be taken as 190 by graduate students.)

5 units, Aut (——)
Win (——)

91. Introduction to Cost Accounting—The use of internal financial data for managerial decision-making. Students who have had or are now taking a college-level cost accounting course may not enroll. (May be taken as 191 by graduate students.) Prerequisite: 90.

5 units, Win, Spr (——) MTWThF

100. Economic Theory in Historical Perspective—Concentration on the writings of the Physiocrats, Classical economists (Smith, Ricardo, Mill), Marx, Marshall, Walras, Keynes, and the American institutionalists (Commons, Veblen and Mitchell). Emphasis on the development of economic analysis as a particular branch of European and American social thought. Discussion of the influence of the German historical school on the development of American economics, as well as economic aspects of the writings of Pareto, Durkheim and Weber. Prerequisites: non-majors 1; majors 51 and 52.

5 units, Win, Spr (——) MTWThF

106. The World's Food Economy—(Same as Food Research Institute 103.) This course will examine the interrelationships between food, population, and economic progress. The emphasis will be on the role of agriculture in the economic and social development of low-income nations. Attention will also be given to the economic and nutritional characteristics of the major categories of food and changes in food consumption associated with economic development.

3 units, Aut (Johnston)

107A. Commodity Futures Markets and Prices—(Same as Food Research Institute 105.) Description of the uses and functioning of commodity futures markets, with emphasis upon business uses of the markets. The meaning of hedging and the evolution of hedging practice. Determinants of the level of market use, and the relationship between level of use and market usefulness. Consideration from the evidence of price behavior, trading composition, and external influences, of the performance of futures markets in price determination and other functions. The extent, influence, and importance of speculation in commodity futures.

3 units, Aut (Gray)

107B. Workshop in Commodity Price Analysis—(Same as Food Research Institute 106.) Applications of various approaches to commodity price analysis and forecasting. Student papers to report on analyses of particular commodities and markets. Prerequisite: 107A.

3 units, Win (Gray)

108A,B. Undergraduate Workshop in World Food Problems—(Same as Food Research Institute 150, 151.) The two quarter courses count as 5 units toward Economics major A.B. requirement. A two-quarter workshop to examine the current adequacy of world food supplies on a country and regional basis. Members of the workshop will examine concepts and measurement of the quality of nutrition, problems of measurement of food supplies, the incidence and causes of inadequate nutrition, and projections of nutritional problems over time. Each member of the workshop will investigate the sufficiency of food supplies in a particular less developed country or region and present a report on his findings. Enrollment limited to 12. Prerequisite: consent of instructors.

5 units each quarter, Win, Spr (Jones, Taylor)


5 units, Win (Scitovsky)

111. Money and Finance—An investigation of financial processes, with an emphasis on the role of the banking sector and monetary policy. Implications for economic growth and stability are developed in the light of modern theory. Prerequisites: 51 and 52.

5 units, Aut, Spr (Johnson, Scadding) MTWThF

115. European Economic History—Survey of growth and development in Western Europe from 1750 to World War II. Compar-
ative approach, with primary but not exclusive emphasis on British, French and German experience. Special reference to general theories of growth, the role of the state in economic development, and the response of labor movements to industrialization.

5 units, Spr (Field)

116. American Economic History—Growth and development in the American economy from colonial times to the present. Historical and analytical discussion of the factors contributing to the growth of per capita output and its distribution. Special emphasis on the interplay between market-mediated and collective activity in determining outcome.

5 units, Spr (Field) MTWThF

117. The Contemporary U.S. Economy in Historical Perspective—Recent departures in the functioning of the economy and their significance. Growth and composition of output and employment; population growth; urban concentration; labor-force participation; physical and human capital formation; technological progress; the expansion of government; economic instability.

5 units, Win (Abramovitz) MTWThF

118. The Economics of Underdevelopment—(Same as Food Research Institute 118.) This course presents an analysis of development within an historical perspective. The development process is analyzed with regard to the mechanisms of capital accumulation, technical change, and trade. Discussion is focused upon various theories and empirical evidence relevant for understanding the current structure and operation of underdeveloped economies.

5 units, Aut (Yotopoulos) MTWThF

119. Kalecki’s Analysis of the Capitalist Economy—This course deals with Kalecki’s analysis of capitalist economies, but not with his work on socialist planning. Kalecki’s theory overlaps with Keynes’ analysis (which he anticipated) but is a wider and more comprehensive system. Topics will include: the reproduction scheme of Marx; the savings function; money and interest; income distribution; the investment function; the trade cycle; the trend; and full employment policies. Prerequisite: Economics 1, 52 recommended.

5 units, Aut (Steindl) TTh 11–1

120. The Marxian and Radical Tradition—Theories and ideologies in relation to practices in capitalist and communist economies. An analysis of the views of influential economic thinkers in the Marxist and radical tradition. Prerequisite: 1.

5 units, Win (Garley) MTWThF

121. Economic Development in East Asia I—The economic development of China in this century, with emphasis on Communist China. The impact of Maoist ideology on economic development. Course also covers Korea, Taiwan, and Indonesia. Prerequisite: 1.

5 units, Aut (Lau) MTWThF

123. Economic Development in Latin America—(Same as Food Research Institute 218) —An examination of the historical problems of economic growth and structural change in selected Latin American countries. Emphasis is placed on the application of modern analytical methods to problems of savings and investment, income distribution, employment, trade and finance. Given seminar style with individual research papers. (Graduate students and advanced undergraduates.) (Graduate students enroll in 223.)

5 units, Win (Reynolds)

127A,B. Economic Development Problems of Third World Economies with Colonial Heritage I and II—(Same as Food Research Institute 133, 134.) The two quarter courses count as 5 units toward Economics major A.B. requirements. An analysis of development theories, problems, and policies common to third world economies, the evolution of these economies through the pre-colonial, colonial, and post-colonial eras, categorization of empirical growth models and patterns in terms of basic internal structures and institutions and international influences. Topics include development models of closed and open economies, problems associated with monocoeconomies, land tenure systems, agricultural development, foreign investment and multinational businesses, industrialization, balance of payments and debt servicing, terms of trade and remunerative incomes from sales of primary produce, commodity agreements and related problems. Contemporary theories of economic imperialism and dependency models of development will be analyzed.

Research papers initiated in the first or second quarter will emphasize area studies
or case studies of individual countries—hypotheses will be formulated and tested qualitatively or quantitatively. Prerequisite: 1.

5 units each quarter, Aut, Win (Kofi)

128. Marketing, Consumption, and Price Analysis—(Same as Food Research Inst. 120.) Applications of micro-economic theory to problems of commodity price determination, with major emphasis on methods of analyzing consumption and marketing channels. Agricultural examples are stressed and the marketing analysis has an economic development focus.

3 units, Aut (Timmer) TTh 1:15–3:05

129. Analytical Techniques for Development Planning—(Same as Food Research 129/229). This course will emphasize linear programming and benefit/cost analysis as methods of evaluating projects and sectoral programs. The focus will be on applications rather than on theory, and on technique rather than on mathematically sophisticated methodology. Examples will be drawn primarily from the agricultural sector of less developed countries, but the techniques that are examined will be applicable to a much wider set of problems and issues. (Graduate students enroll in 229.)

3 units, Aut (Timmer) MWF 11

130. Economics of the Household’s Life-Cycle—Many interesting and puzzling economic phenomena are associated with household decision-making. Some of the more prominent questions relate to secular changes in male and female labor force participation, the number and spacing of children, life-cycle consumption and savings decisions, the acquisition of human capital, and the characteristics of the process of spouse selection. The course begins with a historical summary of data from the United States concerning these and other aspects of household behavior. Economic models dealing with these matters are discussed and evaluated in terms of their consistency with the historical observations. Among the models considered in the course are explicit economic models of natality, assortative mating, and differential mortality. Prerequisite: Economics 1 or consent of instructor.

5 units, Aut (Sanderson) MTWThF

131. Population Problems—(Same as Food Research Institute 135 and Sociology 130.) Analysis of U.S. and world population growth. Economic and social causes and consequences of trends in births, deaths, and migration. Population in relation to food and development; population theories and policies; national family planning programs. Prerequisite: 1.

5 units, Win (Kirk) MTWTh

141. Public Finance and Fiscal Policy I—Effects of government expenditure, borrowing and taxation upon resource allocation, national income and employment, prices, and income distribution. Prerequisites: 51 and 52.

5 units, Aut, Spr (Shoven, Boskin) MTWThF

144. Economics of Agriculture: Policy, Poverty, and Politics—(Same as Food Research 144/244)—The course deals with American agriculture and its historical and contemporary role in the economy. Topics include the structure and characteristics of farming and processing units, the role of agriculture in American economic development, government policy toward commercial agriculture, poverty problems in rural America, and the international dimensions of United States agriculture. Emphasis is on policy alternatives rather than on farm management; special attention will be given to issues, involving California agriculture.

3 to 5 units, Aut (Falcon, Jones) MWF 9


5 units, Spr (Michael) MTWThF

146. The American Woman at Work—This course analyzes economic aspects of women’s changing role in the labor force. Present labor-force inequality between the sexes is assumed; the course then focuses on the causes and consequences of this inequality and on possibilities for its reduction. Particular topics examined are: determinants of labor-force participation; turnover, absenteeism and productivity; discrimination by exclusion; wage inequality; the role of the law; leisure and the value of housework; socialization and education of women; training for labor-force re-entry; women in the professions and in management; the econom-
ics of child care centers; and the implications of the women's liberation movement. (Same as Business 330.)

5 units, Win (Strober) TTh 3:15-5:05


5 units, Win (Willis) MTWThF

148. Economics of Urban Problems—Application of elementary tools of economic analysis to public policy issues in areas such as: poverty, employment, education, housing, urban transportation, and the local public sector. Prerequisite: 1.

5 units, Aut (Muth) MTWThF

149. Location Theory and Spatial Analysis—(Same as Food Research Institute 153.) This course will present the principal theories and techniques that have been found useful for the analysis of the spatial expression of social and economic systems. They include central place theory, models of spatial interaction, the economic theory of location, space in development planning, and certain aspects of spatial statistics. Theoretical and methodological developments will be related to their application to hypothesis testing and planning. Students will be encouraged to apply these theories and techniques to their current research interests and to present the preliminary results of their research toward the end of the quarter. Prerequisites: 51 and 52.

5 units, Spr (Davies)

151. Economic Analysis I—See 51.

152. Economic Analysis II—See 52.


3 to 5 units, Win (Massell) MWF 11

156. Economics of Health and Medical Care—Description of problems and institutions, review of analytical studies, and discussion of policy issues. Topics covered include mortality and morbidity, physicians and other personnel, hospitals, the drug industry, national health insurance and health maintenance organizations. Open to graduate students, undergraduate economics majors (seniors and juniors), or by permission of instructor. Prerequisite: Preparation in micro theory and some statistics desirable.

5 units, Win (Fuchs) MTWThF

157. Theory of Firms and Imperfect Markets—This course is designed to extend and develop the basic tools of price theory in the context of U.S. industrial market structure. Emphasis will be on the application of theoretical models and concepts to the behavior of firms and markets when the conditions of perfect competition are not satisfied. Among the subjects to be covered: monopoly, oligopoly, monopolistic competition, concentration measures, behavioral theories of the firm, advertising, innovation, externalities, economies of scale, and the role of information in markets. Prerequisite: Economics 51.

5 units, Win (Spence) MTWThF

158. Social Control of Industry—Building on the framework developed in Economics 157, this course considers the history, economics and legal background of those institutions under which U.S. industry is subject to government control. The two principal subjects of the course are antitrust law and economics and the economics and practice of public utility regulation in the communications, transportation, and energy sectors. The effects of licensing are also considered. Emphasis is placed on application of economic concepts in evaluating the performance and policies of government agencies. Prerequisite: Economics 157.

5 units, Spr (Braeutigam) MTWThF

160. Trade and Development Problems of Tropical Africa—(Same as Food Research Institute 160.) Analysis of selected international aspects of tropical African economic development. Topics include African/non-African international trade and economic co-
lations (theoretical background, historical perspective, case studies of export-led growth, and the impacts of international capital flows) and intra-African trade and economic integration (customs union theory, historical perspective, case studies of African economic integration). Prerequisite: 1.

3 to 5 units, Win (Pearson)

165. International Economics I—Comparative advantage in production and trade among nations; the international monetary mechanism; domestic monetary, fiscal, and tariff policies and their relationship to foreign trade. Prerequisite: 1. Should be taken by majors after 51 and 52.

5 units, Aut (Halstead) MW 11-1

168. Problems in International Political Economy — This course introduces the student to the complexity and controversy of international economic policy problems through the study of a selected number of specific policy-making situations relating to international trade policy, international monetary policy, and international development policy. Approximately one-half of the sessions will be devoted to small group policy conferences in which students will present and discuss “position papers” on the specific policy problems. Considerable independent study is encouraged in the preparation of the position papers. These problems are studied primarily through sets of specially prepared source materials. Lectures will present some international economic principles that can be applied to the problems and will place the problems in their wider context. Prerequisite: 1.

5 units, Aut (Halstead) MW 11-1

170. Introduction to Econometrics I—Review of probability, random variables, distribution theory. Theory of estimation and hypothesis testing. Introduction to regression and correlation analysis. Applications to economics. Prerequisites: 51 and 52; Mathematics 7 or 43 or the equivalent; Statistics 60 or the equivalent.

5 units, Aut (Amemiya) MTWThF

171. Introduction to Econometrics II—Application of regression analysis to time series and cross-section data. Problems in the formulation of econometric models and introduction to simultaneous equations. Prerequisite: 170.

5 units, Win (Hurd)

172. Applied Econometrics—Critical review of the literature in econometric applications. Discusses the estimation of production functions, demand functions, consumption functions, etc. Prerequisite: 171 or equivalent.

5 units, Spr (Lau) MTWThF

180. Mathematics for Economists — Training in areas of mathematics which have frequent applicability to economic problems. Intended for students who have already had some calculus but lack a strong mathematical background. Topics covered include: functions of several variables; partial derivatives and differentials; mean value theorem and Taylor’s theorem, integral calculus; elementary matrix algebra, determinants, and characteristic roots; quadratic forms; and maximization of a function of several variables subject to equality constraints. Selected applications in economics are discussed. Prerequisites: 51 and Mathematics 41 or the equivalent.

5 units, Aut (Braverman) MTWThF

181. Optimization and Economic Analysis — The development of optimization techniques, including calculus, linear and nonlinear programming, the calculus of variations, and control theory. Emphasis on concepts and results rather than techniques and proofs. Examples will include static and dynamic theories of the household and the firm, and problems in aggregative planning and control. Prerequisites: 51, 150 or Mathematics 43 or equivalent and an introductory statistics course.

5 units, Win (Shoven) MTWThF

190. Introduction to Accounting—See 90.

Undergraduate Seminars in Economics—Courses 142 through 198 are quarter-long seminars on topics of current interest. Each will meet once a week for two or three hours. The preparation of a research or review paper together with collateral reading will be the principal task of each. Consult the listed instructor or department for more information about seminars of interest.

142. Topics in Public Finance: The Role of Government in Economic Life.

5 units, Spr (Krauss)

192. Economics of Information.

5 units, Spr (Spence, Rosse)
   5 units, Aut (Rosenberg)

194. Economics of Professional Sports.
   5 units, Win (Demmert)

195. Workshop in the Economics of the Health Sector.
   5 units, Win, Spr (Luft)

196. The Economics of Transportation.
   5 units, Spr (Muth)

197. Imperialism and Dependency.
   5 units, Aut (Christiansen)

198. Investment Policy and International Trade.
   5 units, Win (Pearson)

199. Senior Honors Research in Economics—Individual research leading to the writing of a senior honors thesis. One or more seminars will be offered with all members writing on related topics and meeting throughout the year under the guidance of one instructor. Maximum number of students in such a seminar is ten. Alternatively, by special arrangement, an Honors student may be permitted to write on a topic of his choice in consultation with an appropriate faculty member. Prerequisites: admission to Honors Program (see requirements for appropriate grade point averages) and consent of instructor.
   Up to 10 units (Johnson, Starrett)

A. CORE THEORY CURRICULUM

202. Price and Allocation Theory I—Perfect competition. Meaning, conditions of efficiency in economic organization. General and partial equilibrium. Open to advanced undergraduates with consent of instructor. May be omitted by graduate students with adequate background in the subject. (May be taken as 202A by non-majors.) Prerequisite: consent of instructor.
   5 units, Aut (Pencavel)

203. Price and Allocation Theory II—Different forms of competitive and monopolistic behavior; their effect on efficiency of economic organization. (May be taken as 203A by non-majors.) Prerequisite: 202.
   5 units, Win (Starrett)

   5 units, Spr (Dasgupta)


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 and 211 are prerequisites for 212. Consent of instructor required for 210, 211, and 212.
   210. 5 units, Aut (Foley)
   211. 5 units, Spr (Scadding)
   212. 5 units, Win (Hickman)

301A,B,C. Seminar in Microeconomics.
   10 units (—) by arrangement

310A,B,C. Seminar in Macroeconomics.
   10 units (—) by arrangement

B. ALTERNATIVE APPROACHES TO ECONOMIC ANALYSIS

200. Topics in the History of Economic Thought—The philosophy of science; the nature of scientific revolutions; and the development of economic analysis. The classical school from Smith through Mill; Marxism; the marginalists; institutional economics; general equilibrium from Walras through Arrow-Debreu. Their relation to economic conditions in their time and to...
modern economics. Open to advanced undergraduates with consent of instructor.

5 units, Aut (Rosenberg)

219. Income Distribution—This course will examine alternative theories of income distribution. Topics will include: the classics (Smith, Ricardo, Marx), population, technology and property; marginal productivity theory from J. B. Clark to the present; deductive reasoning wrestling with empirical challenge; income distribution determined by market imperfections (Kalecki); the long-term problem; income distribution determined by investment (Kalecki); inflation as an unresolved struggle about income distribution; and the stochastic approach of Champernowne. Prerequisite: graduate standing, but open to advanced undergraduates with the consent of the instructor.

5 units, Spr (Steindl)

220. Marx and His Influence in Economics—Among the problems treated by Marx, two have continued prominently to occupy economists. First, the problems of value and distribution in a competitive system treated by Ricardo and Marx and reviewed by Sraffa and, more recently, by Morishima. Second, the dynamic economics of Marx, concerned with great secular changes. Many of this second class of problems, often in modified form, are of considerable interest today: the concentration of capital; the relation of accumulation, distribution, and technical progress; the survival of capitalism; etc. Many of these problems can be reformulated in Keynesian terms, and this will be a main topic of the course. Prerequisite: graduate standing, but open to advanced undergraduates with the consent of the instructor.

5 units, Win (Steindl)

305A,B,C. Seminar in Alternative Approaches to Economic Analysis
10 units (——) by arrangement

C. ECONOMIC DEVELOPMENT

315. Economic Development I—Comparative analysis of presently underdeveloped economies. The process of development. Alternative theories of growth. Prerequisites: 204 and 212 or consent of instructor.

5 units, Spr (Scitovsky)


5 units, Win (Dasgupta)

221. Economic Development in East Asia I—See 121.

223. Economic Development in Latin America—See 123.

229. Analytical Techniques for Development Planning—See 129.

10 units (——) by arrangement

D. ECONOMIC HISTORY

225. Technology, Economy and Society—Consequences of the diffusion of technological innovations in the economic history of the West from the ninth to the nineteenth centuries. Selected “clusters” of technical innovations will be examined for the light they throw upon the determinants of the rate and bias of innovative activity, economic and cultural conditions governing diffusion, and the problems of identifying and measuring the primary and second-order economic consequences of new modes of production and warfare.

5 units, Win (David)


5 units, Spr (David)

227. European Economic History—Analysis of economic growth in western European countries from the Age of Mercantilism with special reference to British experience.

5 units, given 1975–76

325A,B,C. Seminar in Economic History.
10 units (——) by arrangement

228. Economic Growth in Industrialized Countries—Historical and analytical treatment of the growth records of industrialized countries. Topics include the growth of resources and productivity, structural change in output, employment, and international
ECONOMIC RELATIONS AND THE INTER-CONNECTIONS
OF DEMAND AND POTENTIAL OUTPUT GROWTH.
5 UNITS, AUT (ABRAMOVITZ)

E. MONETARY THEORY AND INSTITUTIONS

265. INTERNATIONAL FINANCE—See 265 under International Economics, p. 325.

230. MONETARY THEORY—ADVANCED TOPICS IN MONETARY THEORY WITH SPECIAL REFERENCE TO POLICY CRITERIA AND CONTROL TECHNIQUES. PREREQUISITES: 211 AND 265.
5 UNITS, SPR (JOHNSON)

330A, B, C. SEMINAR IN MONETARY THEORY AND INSTITUTIONS.
10 UNITS (---) BY ARRANGEMENT

F. PUBLIC FINANCE

241, 242. PUBLIC FINANCE AND TAXATION I AND II—WELFARE CRITERIA FOR OPTIMAL GOVERNMENT EXPENDITURE, TAXATION AND DEBT; POSITIVE ANALYSIS OF THE EFFECTS OF TAXATION, EXPENDITURE AND DEBT ON RESOURCE ALLOCATION AND INCOME DISTRIBUTION; PROJECT EVALUATION; PRICING POLICIES IN GOVERNMENT ENTERPRISE; THE LOCAL PUBLIC SECTOR AND INTERGOVERNMENTAL FISCAL RELATIONS.
5 UNITS, AUT (STIGLITZ)
5 UNITS, WIN (BOSKIN)

341A, B, C. SEMINAR IN PUBLIC FINANCE—PREREQUISITE: 241 OR CONSENT OF INSTRUCTOR.
10 UNITS (---) BY ARRANGEMENT

G. ECONOMICS OF LABOR

246. LABOR ECONOMICS I—THEORIES OF HUMAN CAPITAL, TIME ALLOCATION, LIFE-CYCLE DECISION-MAKING AND UNCERTAINTY APPLIED TO OBSERVED BEHAVIOR OF PEOPLE AND SOCIAL INSTITUTIONS REGARDING MARRIAGE, FERTILITY, SCHOOLING, TRAINING, TIMES USES, LABOR FORCE COMPOSITION AND INCOME DISTRIBUTION.
5 UNITS, AUT (MICHAEL)

247. LABOR ECONOMICS II—THEORIES OF HUMAN CAPITAL, FACTOR DEMAND, MARKET STRUCTURE, AND UNCERTAINTY APPLIED TO BEHAVIOR OF PEOPLE AND SOCIAL INSTITUTIONS REGARDING JOB SEARCH, MOBILITY, MARKET SIGNALLING, UNEMPLOYMENT, PRODUCTIVITY, FUNCTIONAL DISTRIBUTION OF INCOME, UNIONS, DISCRIMINATION, MINIMUM WAGES AND LABOR REWARD SYSTEMS.
5 UNITS, WIN (SANDERSON)

345A, B, C. SEMINAR IN LABOR ECONOMICS.
10 UNITS (---) BY ARRANGEMENT

H. URBAN ECONOMICS

5 UNITS, SPR (SWEENEY)

5 UNITS, WIN (MUTH)

349A, B, C. SEMINAR IN URBAN ECONOMICS.
10 UNITS (---) BY ARRANGEMENT

I. ECONOMICS OF INDUSTRY

256. ECONOMICS OF HEALTH AND MEDICAL CARE—SEE 156.

257. ECONOMICS OF INDUSTRY I—THEORIES OF INDUSTRIAL STRUCTURE; THE ROLE OF ECONOMIES OF SCALE; COST PRODUCTION FUNCTIONS; MERGER ACTIVITY; MEASURES OF EFFICIENCY; INVESTMENT DECISIONS; INTER-INDUSTRY ANALYSIS; EMPHASIS ON EMPirical TECHNIQUE.
5 UNITS, SPR (ROBB)

258. ECONOMICS OF INDUSTRY II—MODELS OF IMPERFECT COMPETITION; BEHAVIORAL MODELS OF THE FIRM; ADVERTISING, INNOVATION, AND INFORMATION; MEASURES OF CONCENTRATION; ANTITRUST ECONOMICS, LAW, AND CASES; REGULATION OF PUBLIC UTILITIES; PUBLIC POLICY PROBLEMS.
5 UNITS, AUT (SPENCE)

359A, B, C. SEMINAR IN THE ECONOMICS OF INDUSTRY.
10 UNITS (---) BY ARRANGEMENT
J. INTERNATIONAL ECONOMICS

265. International Finance—Capital movements. Balance of Payments adjustments. Domestic economic effects of alternative international monetary institutions. Prerequisites: 204 and 212 or consent of instructor.
5 units, Aut (Scitovsky)

266. International Trade Theory—Causes of trade and its effects on the allocation of resources, income distribution, growth and development, commercial policies Prerequisite: 265.
5 units, Win (Krauss)

365A,B,C. Seminar in International Economics.
10 units (——) by arrangement

K. ECONOMETRICS

272. Econometrics I—Includes a review of classical least squares theory, problems pertaining to serial correlation of the residual, autoregressive models, distributed-lag models, and other single-equation methods and problems. Selected applications in economics. Prerequisites: Mathematics 113, Statistics 219 and 220, or the equivalent.
5 units, Aut (Hurd)

5 units, Win (Amemiya)

370A,B,C. Seminar in Econometrics.
10 units (——) by arrangement

L. MATHEMATICAL ECONOMICS

Field I: Theory of Choice

280. Foundations of the Theory of Choice—Choice behavior and revealed preference theory; axiomatic derivation of numerical measures of probability and utility; special topics in utility theory (additive utilities, extensive measurement theory, etc.); risk sharing and multi-person decision theory; social choice and Arrow's General Possibility Theorem.
5 units, Aut (Starrett)

281. Welfare Economics—General theory of welfare economics; social welfare functions and social choice processes; welfare measurement, the compensation principle, and benefit/cost analysis; theory of second-best; externalities and public goods; problems in social planning.
5 units, Spr (Wilson)

282. The Economics of Uncertainty—A systematic examination of the implications of uncertainty on microeconomic behavior using axioms of choice under uncertainty and the expected utility theorem. Topics include optimal static and dynamic portfolio choices, insurance, the effect of uncertainty on savings and production decisions, stochastic stability of markets, and general equilibrium and welfare considerations under uncertainty. Prerequisites: 181, Statistics 116, or equivalents.
5 units, Win (Stiglitz)

Field II: General Theory

283. Linear Models in Economics—The theory of linear models. Application of linear programming in economics, theory of positive matrices and its application to static and dynamic input-output analysis; activity analysis and the von Neumann model. Prerequisites: Mathematics 113 and 114, or equivalent.
5 units (——)

284. Advanced Dynamic Programming; Optimal Economic Growth—Current techniques for optimal policies of consumption and capital accumulation. Prerequisites: Mathematics 45, 113 and 114 or equivalent. Recommended: 283 and Mathematics 130 or consent of instructor.
5 units, Win (Kurz)

287. General Equilibrium Theory—Comprehensive treatment of utility and production theories, existence of competitive equilibrium; the theory of the core of the economy. Prerequisites: Mathematics 45, 115, and 116 and 117 or equivalent. Recommended: Mathematics 205A,B,C.
5 units, Spr (Kurz)

288. Special Topics—The topics for 1972-73 will be announced. May be repeated for credit. Prerequisites: consent of instructor and working knowledge of differential calculus.
5 units, given 1975-76
385A,B,C. Seminar in Mathematical Economics.

10 units (——) by arrangement

ENGLISH

Emeriti: Robert W. Ackerman, John W. Dodds, Paul H. Kocher, Herbert D. Meritt, George F. Sensabaugh, Claude M. Simpson, Jr., Wallace E. Stegner, Virgil K. Whitaker (Professors)

Chairman: John Loftis

Director of the Creative Writing Center: Richard P. Scowcroft


Associate Professors: John B. Bender (on leave winter quarter, 1975), William M. Chace, J. Martin Evans, John Felstiner (on leave 1974–75), Kenneth W. Fields (on leave autumn quarter, 1974), David Halliburton (English and Comparative Literature), Anne K. Mellor, Diane W. Middlebrook, Nancy H. Packer, Robert M. Polhemus (on leave 1974–75), Ronald A. Rebholz, Elizabeth C. Traugott (Linguistics and English)

Senior Lecturer: Larry Friedlander

Assistant Professors: Emerson Brown, Jr., George H. Brown (on leave 1974–75), John B. Foster (English and Comparative Literature), Joseph C. Harris (on leave spring quarter, 1975), Arturo Islas, Jr., John L'Heureux, Arnold Rampersad, David R. Riggs

Lecturers: Timothy Dekin, Barbara Charlesworth Gelpi, Charles Kinder, Albert Phillips, Helen Trimpi, Scott Turow

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 as a center for its work in Creative Writing. The Jones Room includes a library and facilities for small meetings.

PROGRAMS OF STUDY

BACHELOR OF ARTS

Before declaring an English major, students should have satisfied the University writing requirement and should have taken at least one course in English or American literature (not including Freshman English).

Any student who declares an English major should begin preparing to fulfill the Department's requirement of proficiency in a foreign language.

The following Departmental requirements are in addition to the University's basic requirements for the Bachelor's degree. (Any two of the required courses may be taken on a pass/no credit basis at the discretion of the instructor. Students intending to go to graduate school, however, should weigh the fact that a grade of pass will provide little evidence of their abilities.)

1. Students majoring in English are required to take one course from each of the six divisions listed below. The English Department recognizes that the interests of its majors are extremely various; for this reason the stated formal requirements are minimal. At the same time the Department strongly recommends that all English majors take courses with broad historical perspectives on language and literature such as English 102, 110, 111, 113, 115, 117, 119, 121, 122, and 125, and also more concentrated courses on the great major figures, notably courses in Chaucer, Milton, and Shakespeare. No one of these courses is mandatory, but those covering the background and the evolution of English and American literature, or focusing on the greatest writers, constitute the best preparation, not only of prospective candidates for admission to graduate schools of English, but of all students seriously interested in the study of English and American literature.

a) Language: English 100A, 101, 102, 200A, 205, 206; Linguistics 1, Linguistics 100, Linguistics 200.
b) Medieval: English 100B, 110, 111, 171, 211, 271.

2. Students are required to take at least three additional courses.
   a) Except for creative writing majors, students may choose additional courses from those offered by the English Department numbered 100 and above (though only one may be chosen from those numbered 148, 190, 190A, 191, 192, 291, 293, 390, 392, and 393). Students may also choose one course in a foreign literature read in the original.
   b) Students wishing to major in Creative Writing are required to take, in addition to the six courses in the six divisions, the following: for fiction writers, Narration (English 90), Development of the Short Story (English 137), plus 2 quarters of Directed Writing (English 190) or of a more advanced course, all with grades of B or better; for poets, Reading and Writing Poetry (English 92), The English Lyric (English 250), plus two quarters of Directed Writing of Poetry (English 192), or of a more advanced course, all with grades of B or better.

3. English majors are required to demonstrate proficiency in a foreign language. "Proficiency" means that the student is able to read at least at the level of facility expected in second-year college courses in a foreign language. As a minimum, the requirement may be fulfilled by passing a fourth-quarter foreign language course other than a "conversation" course or by demonstrating equivalent knowledge. English majors are strongly urged to continue with literature courses in whatever language or languages they study. Under rare circumstances, including a student's recent acquisition of Standard English, exemption from the requirement may be granted.

HONORS PROGRAM IN ENGLISH

Students who wish to undertake a more intensive and extensive program of study, including seminars and independent work, are invited to apply for the Honors Program during the spring quarter of their sophomore year, or early in the junior year. Applications during the junior year will sometimes be accepted. Admission will be selective.

Students in the program will take one course in each of the six divisions required of English majors. In their junior year students will take a Junior Honors Seminar (196A), focusing on the close reading of a literary text or series of texts. In exceptional cases, English 100A-G may meet this requirement. In the autumn of their senior year students will take a Senior Honors Seminar (196B), focusing on fundamental questions of critical theory and practice. Each Honors student will consult with the Honors adviser to define a concentrated program of four additional courses in one of the six required areas, or, according to the student's interests, in a combined field: for example, Middle English and Renaissance, Renaissance and Restoration, Neoclassic and Romantic, Drama, Fiction, Poetry. Alternatively, a student who wishes broad coverage may take one additional course in four of the six fields required of regular English majors.

Finally, in their senior year, students will write a Senior Honors Essay (197) under the guidance of a faculty adviser. In November, they should submit a detailed prospectus, a short annotated bibliography, and a more extensive prospective bibliography: these must be approved before the student receives credit for work on the Essay.

Students in the program will have completed work in English and American Literature, as follows:

Area requirements (a through f)—six courses
Junior and Senior Seminars—two courses
Program of concentration—four courses
Senior Essay—15 units

On the basis of their performance in the program as a whole, candidates for Honors will
be awarded either 'Highest Honors' or 'High Honors' or 'Honors'.

Note: Exceptional English majors who are not in the Honors Program but elect Senior Independent Study (199) may apply in their senior year for departmental 'Honors,' if their program of study has been approximately equivalent to that required of regular honors students.

COMBINED MAJOR IN CLASSICS AND ENGLISH

Students may with the consent of the Chairman of the departments concerned offer for the degree of Bachelor of Arts a combined Major in Classics (Latin and/or Greek) and English. Students interested in such a major should consult the Chairmen of both departments.

EXTENDED MAJORS

English and French Literatures—This major provides a focus in English literature with additional work in French literature, read in the original. Candidates for the A.B. in English and French Literatures complete eight courses in English, including, as in the regular English major, one course in each of six divisions: Language, Medieval, Renaissance, Neo-Classic, Romantic and Modern, and American literatures. In addition they must complete a coherent program of four courses in French literature, read in the original. The program of each student must be approved by the Director of Undergraduate Studies in English and by the Department of French and Italian.

English and Italian Literatures—This is arranged as in the major in English and French Literatures, requiring the completion of eight courses in English, including one from each of the six divisions, and a coherent program of four courses in Italian literature, read in the original. The program of each student must be approved by the Director of Undergraduate Studies in English and by the Department of French and Italian.

English and German Literatures—Candidates for the A.B. in English and German Literatures must complete a program exactly analogous to the two preceding majors, with eight courses in English, including one from each of the six divisions, and a coherent program of four courses in German literature, read in the original, with approval by the Departments involved as specified above.

English and Spanish Literatures—Candidates for the A.B. in English and Spanish Literatures must complete eight courses in English, including one from each of the six divisions, and a coherent program of four courses in Spanish literature, totaling at least twenty units and read in the original. The program of each student must be approved by the Departments involved as specified above.

HONORS PROGRAM IN HUMANITIES

An Honors Program in Humanities is available 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. Students wishing to take the Comparative Literature option within the Honors Program in Humanities should see the section "Comparative Literature."

VISITING STUDENTS

Students who do not wish to become candidates for a graduate degree, but who are qualified to meet the standards of admission to a Master's or Ph.D. program, may apply to the Graduate Study Office (118 Old Union) for admission as non-matriculated students for a period of not more than three consecutive quarters. Each quarter they may take up to three English courses numbered 101 to 299, or two such courses and (with the permission of the instructor) one English course numbered above 300. Such students are not eligible to apply for admission to the Ph.D. program.

TEACHERS' CREDENTIALS

Students wishing to obtain the Standard Teaching Credential (Secondary) entitling them to teach in grades 7–12 in the public schools of California, or a Community 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.

1. General Secondary Credential. Candidates for the Stanford General Secondary Credential with a teaching major in English are required to take the following courses or their equivalents before they
complete the program at the end of the fifth year. Undergraduates who are interested in preparing to teach English in public secondary schools should give first priority to the Departmental requirements for the A.B. with a major in English. But they should elect whenever possible some of the additional courses required for the "teaching major." The courses in the following list are in keeping with the Guidelines for the Preparation of Teachers of English developed cooperatively by the Modern Language Association, the National Association of State Directors of Teacher Education and Certification, and the National Council of Teachers of English:

### Teaching Major

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 102. The History of the English Language</td>
<td>5</td>
</tr>
<tr>
<td>English 101. The Structure of the English Language</td>
<td>5</td>
</tr>
<tr>
<td>English 191. Prose Writing</td>
<td>3</td>
</tr>
<tr>
<td>English 173A, B, C. Shakespeare</td>
<td>5</td>
</tr>
<tr>
<td>English 113. The Renaissance</td>
<td>5</td>
</tr>
<tr>
<td>English 115. The Neoclassic Period</td>
<td>5</td>
</tr>
<tr>
<td>English 117. Romantic and Victorian</td>
<td>5</td>
</tr>
<tr>
<td>Courses in American literature (preferably in the chief American poets and American novelists)</td>
<td>10</td>
</tr>
<tr>
<td>Education 184. Literature for Adolescents</td>
<td>3</td>
</tr>
<tr>
<td>Drama 160. Play Production (Autumn quarter)</td>
<td>5</td>
</tr>
<tr>
<td>Courses in American literature (preferably in the chief American poets and American novelists)</td>
<td>10</td>
</tr>
</tbody>
</table>

### Teaching Minor

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>English 102. The History of the English Language</td>
<td>5</td>
</tr>
<tr>
<td>English 191. Prose Writing</td>
<td>3</td>
</tr>
<tr>
<td>English 102. The History of the English Language</td>
<td>5</td>
</tr>
<tr>
<td>English 173A, B, C. Shakespeare</td>
<td>5</td>
</tr>
</tbody>
</table>

A candidate for the Stanford Community College Credential must begin the program during the summer or autumn quarter and should apply for admission with graduate standing before the stated deadlines. 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.

2. The Stanford Community College Credential. Candidates who wish to teach English in public community colleges in California must complete a Master's degree in English. They are not required by the State of California to complete courses in professional education. However, the California State Accreditation Committee points out that a "program of professional preparation for the standard community college credential should prove of great employment and professional value to those seeking that credential." To qualify for the Stanford Community College Credential, candidates must meet the following requirements:

**a)** Completion of the Master's degree in English, which, as described in the section on "Advanced Degrees" below, requires a minimum of 45 units of graduate work, one foreign language, and the successful completion of a qualifying examination. The candidate with the help of his or her adviser in the Department of English and of a representative of the School of Education selects a coherent program of courses chosen from those offered by the Department of English and closely related departments that are most appropriate for a prospective teacher of English in a two-year college. But among the courses for the A.M., Education 362 is required, and either Education 239 or a course in Linguistics is also required:
Education 362 (Teaching English in the Two-Year College, Autumn Quarter only).
Education 239 (Study Skills and Developmental Reading and Participation in a Study Skills Center in a nearby Community College).
English 101 (Structure of the English Language), or Linguistics 200 (The Goals of Grammar), or Linguistics 201 (Introduction to Formal Grammars).

b) Education 248 (Student Teaching in the Community College). This course is required but is not included in the minimum of 45 quarter units required for the A.M. The student must furnish his or her own transportation.

3. Master of Arts in Teaching. The degree of Master of Arts in Teaching is offered jointly by this Department and the School of Education. The degree is intended for candidates who have a teaching credential and wish further to strengthen their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. Detailed requirements for the course are outlined in the School of Education section.

ADVANCED DEGREES

For University regulations governing advanced degrees 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 or she received a Bachelor's degree of acceptable quality. (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 will be expected to make up deficiencies. Credits for previous graduate work at Stanford or elsewhere more than five years old may be reevaluated or rejected.

Graduate students are admitted only as candidates in one of the following programs: the Ph.D., the Master of Arts in English literature, the Master of Arts in an approved Credential Program, the Master of Arts in Teaching (MAT), or the Master of Arts in Creative Writing. Since Master's degree candidates are accepted for a specific terminal program, they will not normally be admitted to the Ph.D. program.

MASTER OF ARTS

Candidates may earn the Master's degree in English literature by passing satisfactorily 45 units of specified work, one foreign language, and an oral qualifying examination. The examination, which is taken in September, is based on the Ph.D. qualifying examination Reading Guide (except that Master's candidates may read the Old English selections in translation).

Candidates in an approved college-level Credential Program may earn the Master's degree by passing satisfactorily 45 units of specified work, one foreign language, and a qualifying examination. No thesis is required.

Candidates for the Master of Arts in Teaching must complete a minimum of two-thirds of their specified work in the English Department.

Candidates for the Master's degree in Creative Writing must submit a sample of their writing with their application. Should this sample be approved, the candidate will be provisionally admitted to the program, but will not be finally accepted until he or she has demonstrated ability through one quarter's work in an advanced writing course. A candidate may then earn the Master's degree by passing satisfactorily nine courses of specified work (including the qualifying advanced writing course) and one foreign language, and by submitting a piece of imaginative writing of substantial length and merit. This must be submitted at least four weeks before the close of the quarter in which the degree is to be granted. It is strongly advised that students planning further graduate study in English begin early to satisfy the Old and Middle English requirements for the Ph.D., and those planning a career in teaching English begin early to satisfy the language requirements for the teaching credential.

Candidates for the Master's degree in Creative Writing who, after a quarter's work, are not accepted as degree candidates in the writing program may earn the Master's degree in English by completing satisfactorily nine courses of specified work, by passing one foreign language and by passing the
qualifying examination for the Ph.D. in English.

DOCTOR OF PHILOSOPHY

University regulations regarding this degree are discussed in the section "Degrees" in this bulletin. The following Departmental requirements, dealing with such matters as residence, dissertation, and examinations, are in addition to the University's basic requirements for the doctorate.

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 or she will be expected to offer at least 90 units of graduate work in addition to the doctoral dissertation. At least three consecutive quarters of graduate work, and also the last course work in the doctoral program, must be taken at Stanford.

Normally, this program should be completed in four years. The first year should be devoted to full-time graduate study; the second and third years to graduate study and teaching; the fourth year to writing the dissertation. Three and one-half quarters of supervised teaching are a required part of the Ph.D. program.

A candidate may take the Ph.D. degree in English literature, in English and American literature, in English and comparative literature, in English and humanities, in English and linguistics, in English philology, or in English medieval literature.

Requirements of the Ph.D. program in English literature are as follows:

1. A five-unit course in Old English (usually to be 205) and a five-unit course in Middle English language or literature (read in the original)—or equivalent work elsewhere.

2. A minimum of four seminars, in different genres and periods as approved by the adviser. Among the four seminars, students are encouraged to take at least one in literary theory or criticism.

3. A minimum of 60 additional units of graduate courses and seminars (excluding 396, 396A, and 397) distributed according to the adviser's judgment and the candidate's needs.

4. An oral qualifying examination based on a Reading Guide, to be taken at the end of the summer after the first year of graduate work. The final decision as to qualification is made by the Graduate Studies Committee in consideration of the student's course record in conjunction with his or her performance in the examination.

A student coming to Stanford from graduate work in another university where he or she took a qualifying examination and received an A.M. may petition in the third quarter of residence for exemption from the qualifying examination here. In the student's third quarter, he or she may submit for approval by the Graduate Studies Committee an alternative list, endorsed by the student's adviser and comparable in breadth and range to the Reading Guide. A student may petition to take a written qualifying examination, but such a petition will be granted only in cases involving extraordinary circumstances.

A student who has isolated a topic or area which seems promising for a doctoral thesis subject and who wants to explore it right away, and to incur additional specific course requirements insuring coverage and balance in program, may petition upon entrance to qualify upon the recommendation of a committee of advisers who would oversee and evaluate a full year's course of study, but such petitions will be rigorously scrutinized by the Graduate Studies Committee and granted only in exceptional cases.

5. A University oral examination to be taken no later than the winter quarter of the student's third year of graduate work. This examination will cover (1) the field of concentration (as defined by the student and the student's adviser, subject to the approval of the Departmental Graduate Studies Committee) and (2) plans for the dissertation based upon a prospectus approved by the adviser.

Requirements of the Ph.D. program in English and American literature are as follows:

1. A five-unit course in Old English (usually to be 205) and a five-unit course in Middle English language or literature (read in the original)—or equivalent work elsewhere.

2. A minimum of 35 units of graduate courses in American literature and 35 units in English literature, including at least two seminars in each. The four seminars should be in different periods and genres as approved by the adviser. Among the four
SCHOOL OF HUMANITIES AND SCIENCES

seminars, students are encouraged to take at least one seminar in literary theory or criticism.

3. Qualification: (See paragraph 4 above.)

4. A University oral examination to be taken no later than the winter quarter of the student's third year of graduate work. This examination will cover the period of the dissertation, together with plans for the dissertation itself based upon a prospectus approved by the adviser.

The Ph.D. program in English and Comparative Literature is designed for students wishing an extensive knowledge of the literature, thought, and history of England and of at least one foreign country, for one period. Approximately half of the student's course work and reading will be devoted to this period, with the remainder of the time given to other periods of English and American literature since 1350.

This degree, administered by the Department of English, is to be distinguished from the Ph.D. in Comparative Literature. The latter program is intended for students unusually well prepared in foreign languages, and will involve advanced work in three literatures, of which one may be English. Students interested should consult Professor Herbert Lindenberger, Chairman of the Committee on Comparative Literature.

The requirements for the Ph.D. in English and Comparative Literature are as follows:

1. Qualification: (See paragraph 4 under requirements of the Ph.D. program in English literature.)

   For qualification in the doctoral program in English and Comparative Literature candidates are not held responsible for literature before 1350.

2. A knowledge of the basic structure of the English language and of Chaucer. This requirement may be met by examination, or by taking ten units of courses chosen from among those offered in linguistics, English philology, and early and middle English literature including Chaucer. No particular courses are required of all students.

3. A knowledge of one foreign language comparable to that demanded under the basic program and an advanced reading knowledge of a second language.

4. A minimum of 45 units in the history, thought, and literature of one period, in two or more languages, one of which must be English and one foreign. Students will normally include at least two courses in a foreign literature read in the original language and two courses listed under Comparative Literature or Modern Thought and Literature. As much as 20 units of this requirement may be satisfied through courses in Reading and Research.

5. A minimum of four seminars, of which at least three must be in the English Department. Among the four seminars, students will take at least one seminar in literary theory or criticism. No more than two of the four required seminars may be on the same genre or period.

6. A University oral examination covering the period of the dissertation and plans for the dissertation itself. This examination, based on a reading list established by the candidate in consultation with his or her adviser, would normally be taken no later than the winter quarter of the third year of graduate study. However, those who spend the third year studying abroad may take this examination after their return early in the fourth year.

Language Requirements—All candidates for the Ph.D. degree (except those in English and Comparative Literature and in English Philology, for whom special language requirements prevail) must demonstrate a reading knowledge of two foreign languages. Candidates in the earlier periods must offer Latin and one of the following languages: Greek, French, German, Italian, or Spanish. In some instances they may be required to offer a third language. Candidates in the later period (i.e., after the Renaissance) must offer either Latin or French or German as one language, and may choose the second language from the following: Greek, Latin, French, German, Italian, Spanish. In all cases the choice of languages offered must have the approval of the candidate's adviser. Any substitution of another language must be approved by the Graduate Studies Committee.

The candidate must satisfy one language requirement by the end of the first year (that is, before Registration in the following year), and the other by the end of the third year. Foreign language requirements for the
Ph.D. may be fulfilled in any of the following ways:

1. Achievement of a sufficiently high score (70th percentile) on the foreign language examination prepared by the Educational Testing Service. Latin and Greek are not tested by ETS.

2. A reading examination given each quarter by the various language departments, except for Latin and Greek.

3. For Latin and Greek, an examination by the English Department. The Latin examination will be given before registration in the autumn quarter in order to permit those who need the course to register for Latin 3. It will also be given in the eighth week of the winter and spring quarters, along with other departmental examinations for languages not tested by the Educational Testing Service.

4. Passage with a grade of B or higher of a course in literature numbered 100 or higher in a foreign language department at Stanford. As an alternative for Latin, French, and Spanish, passage of Latin 51 and 52, French 10, and Spanish 10, respectively, with a grade of B or higher.

Dissertation—As early as possible during their graduate study, Ph.D. candidates will be expected to find a topic requiring extensive original research and to seek out a member of the Department as his or her adviser. The adviser will request the Chairman to appoint a committee to supervise the dissertation. Candidates should take this crucial step as early as possible in their graduate careers. The committee may well advise extra preparation within or outside the Department, and time should be allowed for such work.

Immediately after the dissertation topic has been approved by the adviser, the candidate should 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. Candidates taking more than five years will be required to reestablish their candidacy by passing the written qualifying examination again.

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 the Ph.D. degree. Dissertations may not be submitted during the summer quarter.

JOINT PH.D. IN ENGLISH AND HUMANITIES

The Department of English participates in the Graduate Program in Humanities leading to the joint Ph.D. degree in English and Humanities. For a description of that program, see the section “Humanities Special Programs” in this Bulletin.

GRADUATE PROGRAM IN MODERN THOUGHT AND LITERATURE

Stanford also offers a Ph.D. degree in Modern Thought and Literature. Under this program students devote approximately half of their time to a modern literature from the Enlightenment to the present, and the other half in interdisciplinary studies. Students interested should see the section “Modern Thought and Literature” and consult Professor Lucio Ruotolo, Acting Chairman for 1974-75, in the English Department.

COURSE NUMBERING SYSTEM

1-9: Freshman Writing Courses; 101-109, 200-209, 300-309: English Language Courses
10-19, 110-119, 210-219, 310-319: English Period Courses
20-29, 120-129, 220-229, 320-329: American Period Courses
40-49, 140-149, 240-249, 340-349: Genre Courses: Drama
50-59, 150-159, 250-259, 350-359: Genre Courses: Poetry
60-69, 160-169, 260-269, 360-369: Topic Courses
70-79, 170-179, 270-279, 370-379: Author Courses
80-89, 180-189: Overseas Campuses Courses; 280-289, 380-389: Author Courses
90-99, 190-199, 290-299, 390-399: Writing Courses, Workshops, Individual Study, etc.

COURSES NUMBERED 1 THROUGH 99 ARE INTRODUCTORY COURSES DESIGNED PRIMARILY FOR STUDENTS WHOSE MAJOR IS UNDECLARED OR IS NOT IN ENGLISH

1, 2, 3. Freshman English—Writing, chiefly expository, emphasizing the control of mean-
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ing through critical and creative thinking, and through mastery of style. These courses satisfy the University writing requirement. (English for Foreign Students, see Undergraduate Writing Program.)

1. 3 units, Aut, Win, Sum (Staff)
2. Continuation of 1.
   3 units, Win, Spr (Staff)
3. 3 units, Aut, Win, Spr (Staff)
4. Freshman English — Creative writing. There will be small groups devoted to various kinds of writing, including fiction and poetry. This course may replace one quarter of regular Freshman English.
   3 units, Win (Staff)
5. Freshman English for Exempted Students.
   3 units, Aut, Win (Staff)

10. Studies in English Literature—Intensive study of selected masterpieces of English literature, including poetry, drama, and the novel.
   4 units (3 units if in conjunction with 10W), Spr (Riggs)
10W. Writing: English Literature — In conjunction with 10; with additional class meeting and instruction in writing. Satisfies one quarter of the Writing Requirement. Students must be enrolled in 10 for 3 units.
   3 units, Spr (Staff)

20. Studies in American Literature—Intensive study of selected masterpieces of American literature, including poetry, drama, the essay, the novel.
   4 units (3 units if in conjunction with 20W), Aut (Middlebrook)
20W. Writing: American Literature—In conjunction with 20; with additional class meeting and instruction in writing. Satisfies one quarter of the Writing Requirement. Students must be enrolled in 20 for 3 units.
   3 units, Aut (Staff)

30. The Novel— (Same as Comparative Literature 30.) The objectives of this course are to present the novel as a significant, distinct genre, and by close, sympathetic reading to increase the student's appreciation of individual novels.
   4 units (3 units if in conjunction with 30W), Aut (Fifer)
30W. Writing: The Novel — In conjunction with 30; with additional class meeting and instruction in writing. Satisfies one quarter of the Writing Requirement. Students must be enrolled in 30 for 3 units.
   3 units, Aut (Staff)

40. Drama— (Same as Comparative Literature 40.) Principal dramatic forms; development of dramatic art, masterpieces of the theater from various periods, countries.
   4 units (3 units if in conjunction with 40W), Win (L'Heureux)
40W. Writing: Drama — In conjunction with 40; with additional class meeting and instruction in writing. Satisfies one quarter of the Writing Requirement. Students must be enrolled in 40 for 3 units.
   3 units, Win (Staff)

45. The Tragic — (May be taken as 145 by English majors.)
   5 units, given alternate years

48. Literature and the Performing Arts— (May be taken as 148 by English majors.)
   5 units, given alternate years

50. Poetry— (Same as Comparative Literature 50.) An introduction, through the study of language, figures of speech, metrics, critical theory, and careful reading of poems.
   4 units (3 units if in conjunction with 50W), Aut (Middlebrook)
50W. Writing: Poetry — In conjunction with 50; with additional class meeting and instruction in writing. Satisfies one quarter of the Writing Requirement. Students must be enrolled in 50 for 3 units.
   3 units, Aut (Staff)

60. American Jewish Writing — European heritage (works of Sholom Aleichem and Isaac B. Singer); relationship between the historical situation of the American Jew and his literature; sudden emergence of major writers in the nineteen fifties and sixties (Malamud, Bellow, Roth, Mailer, etc.); special and changing position of the Jewish intellectual. (May be taken as 160 by English majors.)
   5 units, Win (Friedlander)

62. Chicano Literature— (Same as Comparative Literature 62.) An intensive study of the emergence of a body of literature. Novels, poems, journals, underground and unpublished materials will be read and discussed. Knowledge of Spanish helpful but
not essential. (May be taken as 162 by English majors.)

4 units (3 units if in conjunction with 62W), Aut (Islas)

62W. Writing: Chicano Literature — In conjunction with 62; with additional class meeting and instruction in writing. Satisfies one quarter of the Writing Requirement. Students must be enrolled in 62 for 3 units. Students will be urged to write fiction or poems or personal essays concerning the experience of Mexicans born in this country. Knowledge of Spanish and barrio dialects is essential.

3 units, Aut (Islas)

62A. Contemporary Mexican Writers — (in translation). An intensive study of Mexico's major twentieth-century novelists, poets, and philosophers. (May be taken as 162A by English majors.)

5 units, Spr (Islas)

63A. Masculine/Feminine in Literature—Readings in fiction by nineteenth- and twentieth-century writers whose works reveal direct intellectual and imaginative concern with the social definitions of masculinity and femininity: Ibsen, Colette, James, Wharton, Compton-Burnett, Mailer, and others. (May be taken as 163A by English majors.)

4 units (3 units if in conjunction with 63W), Win (Middlebrook and Islas)

63W. Writing: Masculine/Feminine in Literature—In conjunction with 63A; with additional class meeting and instruction in writing. Satisfies one quarter of the Writing Requirement. Students must be enrolled in 63A for 3 units.

3 units, Win (Middlebrook)

63B. Studies in Women's Consciousness—(Same as Modern Thought and Literature 63B.) An interdisciplinary approach to the relationship between women novelists' positions as women and their ways of interpreting and expressing reality. Concentration on George Eliot and Virginia Woolf, but including Jane Austen, Charlotte Bronté, and Doris Lessing as well. (Not open to graduate students.) (May be taken as 163B by English majors.)

5 units, Spr (E. Rogat)

65. Medieval Culture: An Interdisciplinary Introduction—(Same as Medieval Studies 65, History 65, German Studies 21A.) (See Medieval Studies.)

66. The English Bible as Literature—Readings in Old and New Testaments and selected books of the Apocrypha, with some attention to the history of the English Bible and the use made of Biblical themes in English literature. (May be taken as 166 by English majors.)

5 units, Win (Ford)

67B. King Arthur in History, Legend, and Literature—(Same as Comparative Literature 67B.) A survey of Arthurian literature from the earliest medieval legends and pseudo-histories. Some attention to more recent authors such as Tennyson and T. H. White, but the main emphasis will be on medieval works. All readings will be done in modern English translation.

5 units, Spr (E. Brown)

68. American Indian Mythology, Legend, and Lore—An introduction to American Indian oral tradition, centering upon an investigation of the nature of native American prose and poetry, and especially the relationship between oral tradition and writing. (May be taken as 168 by English majors.)

5 units, Spr (E. Brown)

69. Post-Modernism: The Literature of the Last Decade—An examination of the major shifts and trends in contemporary art and of the emergence of new kinds of literature and new attitudes towards culture. Some topics to be explored: the rejection of the "modern" tradition; the exhaustion of the avant-garde; the concern with new modes of consciousness—sexual, political, racial; the revival of romantic and religious literature; the importance of popular culture; the prominence of autobiography. Some authors: Oates, Barthelme, Mailer, Purdy, Reed, Weldon, Crumm, Castenada. (May be taken as 169 by English majors.)

5 units, Spr (Friedlander)

73. Shakespeare—A reading of representative comedies, histories, and tragedies; designed to introduce the general student, as well as the prospective English major, to Shakespeare's art.

5 units, Aut (Ford)

4 units (3 units if in conjunction with 73W), Spr (Friedlander)

73W. Writing: Shakespeare—In conjunction—
tion with 73; with additional class meeting and instruction in writing. Satisfies one quarter of the Writing Requirement. Students must be enrolled in 73 for 3 units.

3 units, Spr (Staff)

90. Narration—Basic problems of narrative and imaginative writing. Prerequisite: completion of the writing requirement.

5 units, Aut (Packer, Staff)
Win (L’Heureux, Staff)
Spr (Staff)

92. Reading and Writing Poetry—An introductory course in the understanding and writing of poetry. Prerequisite: completion of the writing requirement.

5 units, Aut (Momaday, Staff)
Win, Spr (Staff)


Courses Numbered 100 Through 199 Are Mainly Basic Undergraduate Surveys, Seminars, and Workshops

Note: Students who wish to take a course numbered 101–199 for graduate credit should receive consent of the adviser. Graduate students will receive credit for no more than 3 such courses.

100A-G. Basic Seminars—Basic seminars on the scholarly and critical study of literary texts; given each quarter and strongly recommended for beginning English majors. English 100A–F will satisfy the appropriate area requirements A–F (see program for Bachelor of Arts, 1, above). The subject matter of English 100A will be mainly linguistic studies; of English 100B, medieval literature; of English 100C, Renaissance literature; and so on. The subject matter of English 100G, which will count as one of three required electives (see program for Bachelor of Arts, 2, above), will be mainly the theory of literary genres. This course is limited to students who have previously declared an English major and have taken at least one course in English or American literature (not including Freshman English). Sign up at the English Department. (Instructors: E. Brown, Fifer, Foster, Friedlander, B. Gelpi, Grommon, Islas, Levine, L’Heureux, Lindenberger, Loftis, Mellor, Rebholz, Watt.) Consult the Time Schedule for specific offerings.

5 units, Aut, Win, Spr

101. The Structure of the English Language—(Same as Linguistics 180.) Study of what it means to be a “native speaker of English.” Emphasis on the semantic, syntactic, and phonological structure of English, with some attention to the application of linguistics to literature.

5 units, Spr (Traugott)

102. The History of the English Language—Studies in the evolution of the English language as a medium of literary expression.

5 units, Aut (Traugott)


110. The Earliest English Literature—Cultural backgrounds, reading (in translation), and critical analysis of Anglo-Saxon heroic legend, elegies, and other forms.

5 units, Aut (Harris)

111. Middle English Literature—Emphasis on major works, most of which will be read in the original language (often in simplified texts).

5 units, given alternate years

113. The Renaissance.

5 units, Aut (Ryan)

115. The Neoclassic Period.

5 units, Win (Fifer)

117. Romantic and Victorian.

5 units, Win (Mellor)

119. Modern British Literature.

5 units, Spr (Foster)

121. American Literature to 1855.

5 units, Aut (A. Gelpi)


5 units, Win (Rampersad)

125. American Literature, 1917 to the Present.

5 units, Spr (Fields)

128. The American Condition in the Twentieth Century—(Same as History 174 and Modern Thought and Literature 128.) This course will examine selected works of both fiction and discursive thought that treat the condition of American society since the end of the 19th century. The instructors will at-
tempt to combine the methods of historical and literary study; and therefore the course is particularly recommended for those interested in American studies. Among the works to be considered will be *The Education of Henry Adams*, Theodore Dreiser’s *An American Tragedy*, and Daniel Bell’s *The Radical Right*.

5 units, Aut (Chace and Kennedy)

135. Forms of the Modern Novel.
5 units, given alternate years

136. Trends in Modern Fiction.
5 units, Spr (Momaday)

137. Development of the Short Story—Required of creative writing students in fiction. Reading and discussion of American, British, and Continental short stories, with emphasis on changes and developments in the form.

5 units, Aut (Packer)

138. The Autobiographical Narrative — (Same as Comparative Literature 138.) A study of several important first-person writings which are centered upon a particular period or area of experience in the writer's life rather than upon his life as a whole. Includes work by Dinesen, Sartre, Graham Greene, Nabokov, and Robert Graves.

5 units, Win (Momaday)

145. The Tragic — (Same as Comparative Literature 145.) See 45.

147. Twentieth-Century Theater—(Same as Comparative Literature 147, Drama 147, and Modern Thought and Literature 147.) Major dramatic works and innovations in staging, design, and acting. We will also discuss influential theorists such as Stanislavski, Artaud, and Grotowski. Dramatists include: Chekhov, Shaw, Strindberg, Brecht, Pirandello, Coward, Beckett, Pinter, Bond, Durrenmatt, Genet.

5 units, Win (Eddelman, Friedlander)

148. Literature and the Performing Arts—See 48.

157. Chief American Poets, Nineteenth and Twentieth Centuries.
5 units, given alternate years

159. Twentieth Century British and American Poetry.
5 units, given alternate years

160. American Jewish Writing — (Same as Comparative Literature 160.) See 60.

161. Afro-American Fiction—A survey of the principal works of black novelists and short story writers in America, especially those of the twentieth century.

5 units, Win (Rampersad)

162. Chicano Literature—See 62.

162A. Contemporary Mexican Writers—(in translation.) (Same as Comparative Literature 162A.) See 62A.

163A. Masculine/Feminine in Fiction—See 63A.

163B. Studies in Women’s Consciousness—(Same as Modern Thought and Literature 163B.) See 63B.

164. Introduction to Caribbean Literature: English, French, Spanish — (Same as Comparative Literature 164.)

5 units, quarter to be announced later (Davis)

165. Colloquium on National and International Identity—(Same as Comparative Literature 194A.)

5 units, Spr (Halliburton)

166. The English Bible as Literature—See 66.

167. The Literature of Fantasy — (Same as Modern Thought and Literature 167.) Major forms of fantasy in literature and other arts. Examining science fiction, pornography, gothicism, and religious and romantic adventure, we will attempt to formulate a theory of the nature and uses of fantasy.

5 units, Aut (Friedlander)

168. American Indian Mythology, Legend, and Lore—(Same as Comparative Literature 168.) See 68.


5 units (E. Brown, Langmuir), given 1975–76

171. Chaucer.

5 units, Win (E. Brown)

Spr (Damon)

173A. Shakespeare — Intensive study of eight plays: *1 Henry IV, Midsummer Night's Dream, Merchant of Venice, Twelfth Night, Othello, Macbeth, Lear, The Tempest.* Stu-
173B. Shakespeare—Richard II, 1 Henry IV, Merchant of Venice, Twelfth Night, Troilus and Cressida, Othello, Antony and Cleopatra, The Winter’s Tale.
5 units, Win (Rebholz)

173C. Shakespeare—Richard III, Romeo and Juliet, Merchant of Venice, As You Like It, Julius Caesar, Hamlet, Measure for Measure, The Tempest.
5 units, Spr (Ryan)

190. Directed Writing: Fiction—Intermediate course. May be taken twice. Prerequisite: 90.
5 units, Aut (L’Heureux, Staff)

190A. Fiction Writing—Preference given to senior Creative Writing majors. Samples of writing should be submitted not later than registration day. Prerequisite: consent of instructor.
5 units, Win (Packer)

191. Prose Writing—Advanced course dealing with problems of writing expository prose. Prerequisite: 2 or the equivalent.
3 units, Spr, Sum (Grommon)

5 units, Aut, Win, Spr (Staff)

195. Ad Hoc Undergraduate Seminars—In any quarter a group of undergraduates (at least three but preferably more) who wish in the following quarter to study a subject or an area not covered by regular courses may plan an informal seminar and approach a member of the Department to supervise it. A syllabus for the course should be submitted to the director of undergraduate advising at least two weeks before the end of the quarter. No more than five units of credit will be given for English 195 and/or English 198 in any one quarter. English 195 may not be used to fulfill Departmental area or elective requirements without permission. Group seminars are not considered appropriate to English 198.
Any quarter, by arrangement

196A. Junior Honors Seminar—Required of all juniors in the English Honors Program.
5 units, Win (Lindenberger)
Spr (Ruotolo)

196B. Senior Honors Seminar—Required of all seniors in the English Honors Program.
5 units, Aut (Carnochan)

197. Senior Honors Essay.
15 units (during 2 quarters)
Aut, Win, Spr (Staff)

198. Individual Work—Advanced undergraduates who wish to study a subject or an area not covered by regular courses may, with permission, enroll for individual work under the supervision of some member of the Department. No more than five units of credit will be given for English 198 and/or English 195 in any one quarter. English 198 may not be used to fulfill Departmental area or elective requirements without permission.

COURSES NUMBERED 200–299 ARE MAINLY COURSES ON SPECIFIC TOPICS AND AUTHORS; FOR UNDERGRADUATE AND GRADUATE STUDENTS

Note—Graduate students in other departments who wish to broaden their programs will find many of these courses useful.

200A. Introduction to Old Norse—(Same as German 212.)
5 units, given alternate years

200B. Old Icelandic Sagas—(Same as German 213.) Prerequisite: 200A.
5 units, given alternate years
205. Old English—Elements of Old English grammar; critical reading of short poems and selected prose in Old English.
   5 units, Aut (Harris)
206. Middle English—No prerequisite; 205 suggested.
   5 units, given alternate years
208. Post-Classical Latin — (Same as Comparative Literature 208 and Classics 208.) Careful reading of Latin texts of graded difficulty, beginning with the Vulgate Bible, working through various patristic writings and medieval literature to the Latin of the Renaissance. Intended primarily for students not in classics. Prerequisite: two years' high school Latin or equivalent.
   5 units, Aut (Damon)
   5 units, given alternate years
211. Readings in Medieval English Literature.
   5 units, Win (Damon)
212A. Medieval to Renaissance: The Development of Literary Forms—(Same as Comparative Literature 212A.)
   5 units, Win (W. Trimpi)
212B. Continuation of 212A—(Same as Comparative Literature 212B.)
   5 units, Spr (W. Trimpi)
213. Literature of the Sixteenth Century.
   5 units, given alternate years
214. Literature of the Seventeenth Century: Backgrounds, Forms, Styles.
   5 units, given alternate years
215. Literature of the Eighteenth Century.
   5 units, given alternate years
216. Literature of the Nineteenth Century.
   216A. English Romantic Poetry and Prose.
   5 units, given alternate years
   216B. Victorian Poetry and Poetics.
   5 units, Aut (Ford)
217A. The Bloomsbury Group.
   5 units, given alternate years
   5 units, given alternate years
220. American Literature of the 1930's.
   5 units, given alternate years
227. Modern Southern Writers — Faulkner, Ransom, Tate, Porter, Welty, O'Connor.
   5 units, given alternate years
230. Theory of the Novel—(Same as Comparative Literature 228 and Modern Thought and Literature 240.) Focus on two aspects of the novel: the narrative superstructure, which participates in the long tradition of Western myth and narrative, and the commitment to verisimilitude. Study of Don Quixote, Robinson Crusoe, Northanger Abbey, The Mill on the Floss, Under Western Eyes, V., and essays by Frye, Kermode, Watt, and others.
   5 units, Win (Levine)
231. The English Novel through the Eighteenth Century—(Same as Comparative Literature 231.) Study of the most significant novels, with emphasis on development of the form.
   5 units, given alternate years
231A. Eighteenth-Century Fiction and the "Great Confinement"—(Same as Comparative Literature 231A.) Themes of confinement and escape in the novel. Some attention to other genres.
   5 units, Aut (Carnochan)
231B. Gothic and Comic: Jane Austen and Others—(Same as Comparative Literature 231B.) The early phase of two special fictional traditions. Readings include most of Jane Austen's novels, and selected novels in the Gothic tradition, including The Mysteries of Udolpho, The Monk, Frankenstein, Wuthering Heights. Prerequisite: English 231 or equivalent.
   5 units, Win (Watt)
232. The English Novel in the Nineteenth Century—Study of the most significant novels, with emphasis on development of the form.
   5 units, Spr (Stone)
233. The Twentieth-Century English Novel.
   5 units, Aut (Ruotolo)
234A. American Romanticism—A colloquium for graduate and advanced undergraduate students in English. Major aspects of the Romantic movement in America, with almost exclusive attention to prose, fiction and non-fiction.
   5 units, Win (A. Gelpi)
234B. Later Nineteenth Century American Fiction.
5 units, Aut (Rampersad)

5 units, Win (Dekker)

235. The Impressionist and Experimental Novel—(Same as Comparative Literature 235 and Modern Thought and Literature 261.)
5 units, given alternate years

237. Eighteenth Century Prose.
5 units, Spr (Fifer)

238. Victorian Prose.
5 units, Aut (Levine)

5 units, given alternate years

245. Drama of the Restoration and Eighteenth Century.
5 units, Win (Loftis)

250. The English Lyric.
5 units, given alternate years

5 units, Win (W. Trimpi)

254A. Some Eighteenth Century Poets.
5 units, Win (Carnochan)

254B. Poetry and Ideas: Johnson to Blake—(Same as Modern Thought and Literature 264.)
5 units, given alternate years

255. Form and Theme in the Modern English Lyric.
5 units, given alternate years

255A. Nineteenth Century Poetry as Myth-Making—(Same as Comparative Literature 261 and Modern Thought and Literature 255A.) Confronted with the historical disintegration of Christianity and the Great Chain of Being, nineteenth century poets were forced to use poetic language to shape their experiences into mythic structures. An examination of the personal myths constructed by Blake, Coleridge, Wordsworth, Shelley, Keats, Hopkins, Browning, and Yeats.
5 units, Win (Mellor)

255B. Twentieth-Century British Poetry—Hardy to Larkin.
5 units, Spr (Dekker)

256. The Poet in America: An Historical Survey—Any section of this course may be taken separately and independently without prerequisites, or the sections may be taken as a sequence.

256A. American Poetry Before 1900.
5 units, given alternate years

256B. American Poetry, 1900–1945.
5 units, given alternate years

256C. American Poetry, 1945 to the Present.
5 units, given alternate years

5 units, Win (Fields)

259A. French Symbolist Poets and Some Americans—(Same as Comparative Literature 259A.)
5 units, given alternate years

259B. North American and Latin American Poetry—(Same as Comparative Literature 259B and Spanish 262.)
5 units, given alternate years

260. The History of Literary Theory—(Same as Comparative Literature 260.)
5 units, Spr (W. Trimpi)

261. Representation—(Same as Comparative Literature 220 and Modern Thought and Literature 217.) Broad study of the mimetic mode in the several arts, including poetry, drama, and painting, with emphasis on theory.
5 units, Aut (Dufrenne)

262. Nietzsche and the Literary Imagination—(Same as Comparative Literature 262 and Modern Thought and Literature 262.) A basic introduction to Nietzsche’s philosophy with additional attention given to his experiments with literary form. His impact upon Gide, Shaw, Mann, Belyj, Yeats, Rilke, D. H. Lawrence, Malraux, and Sartre. Reading knowledge of French or German desirable but not essential.
5 units, Aut (Foster)

263B. The Existential Hero in Modern Literature—(Same as Comparative Literature...
263B and Modern Thought and Literature 263B.)
5 units, given alternate years

265. Ideas of Experience in American Prose—Chiefly fiction, from Edgar Allan Poe to the present. For graduate students and advanced undergraduate English majors.
5 units, Spr (Dupee)

266. Romantic Historical Literature—(Same as Comparative Literature 266.)
5 units, given alternate years

267. Gothicism in Literature and Art—(Same as Comparative Literature 267.)
5 units, given alternate years

269A. Toward an Understanding of Romanticism.
5 units, given alternate years

269B. Toward an Understanding of Modernism—(Same as Comparative Literature 269B and Modern Thought and Literature 269B.)
5 units, given alternate years

270. Beowulf—Reading and critical analysis of Beowulf, with some attention to other heroic poetry in Old English. Prerequisite: 205 or equivalent.
5 units, Win (Harris)

271. Chaucer.
5 units, given alternate years

5 units, given alternate years

273. Advanced Study of Shakespeare.
5 units, Spr (Riggs)

5 units, Spr (W. Trimpi)

276. Milton.
5 units, given alternate years

277. Swift and Pope.
5 units, given alternate years

278. Johnson and His Circle.
5 units, given alternate years

280A. Wordsworth and Coleridge.
5 units, given alternate years

280B. Byron, Shelley, and Keats.
5 units, Spr (Ford)

281. Dickens and Trollope.
5 units, given alternate years

282. Tennyson.
5 units, given alternate years

283. Pater and the Pre-Raphaelites—The Pre-Raphaelite aesthetic and the literature it helped to create. Reading will include works by Ruskin, Rossetti, Swinburne, Morris, Pater, and Hopkins.
5 units, Win (B. Gelpi)

284A. Emerson and Thoreau.
5 units, given alternate years

284B. Emerson, Whitman, and Emily Dickinson.
5 units, given alternate years

285A. Melville in Nineteenth-Century Contexts—Will include Moby Dick, The Confidence Man, and some of his stories.
5 units, Aut (H. Trimpi)

285B. Twain and James.
5 units, given alternate years

285C. Edgar Allan Poe—Intensive reading and discussion of basic works, including tales, poetry and criticism. Texts and contexts will be approached from a variety of critical and historical perspectives. This course is intended for graduate and advanced undergraduate students in English.
5 units, Aut (Halliburton)

287. Conrad and Faulkner.
5 units, given alternate years

288A. Joyce—Joyce's essential work up to Finnegans Wake.
5 units, given alternate years

288B. Virginia Woolf.
5 units, given alternate years

288C. Forster and Lawrence.
5 units, given alternate years

288D. W. B. Yeats—A lecture-course covering the literary career of Yeats from first to last, particularly in the context of the political and cultural history of Ireland.
5 units, Win (Davie)

289A. Eliot and Pound.
5 units, given alternate years

289B. Yeats, Eliot, Neruda—(Same as Comparative Literature 289B.)
5 units, given alternate years

291. Workshop in Creation and Criticism—
(Same as Modern Thought and Literature 291.)

3 to 5 units, given alternate years

293. Workshop in Verse Translation —
(Same as Comparative Literature 293.)
5 units, given alternate years

Curriculum and Instruction in Secondary School English I—See Education 262.

COURSES NUMBERED 300 THROUGH 399 ARE GRADUATE SEMINARS AND WORKSHOPS; OPEN TO UNDERGRADUATES ONLY WITH PERMISSION

Note—Some of these courses are relatively broad in scope; some focus on a single theme or genre. Students should consult the instructor before registering for any course in this category.

301. Seminar: Language and Literature.
5 units, given alternate years

310. Seminar: Problems in Old English Literature—Prerequisite: 205 or equivalent.
5 units, given alternate years

311. Seminar: Methods and Materials for the Study of Medieval Literature — (Same as Comparative Literature 311.)
5 units, given alternate years

312. Seminar: Middle English Literature —Prerequisite: 206 or equivalent.
5 units, Win (Damon)

313. Seminar: Methods and Materials for the Study of Renaissance Literature—(Same as Comparative Literature 313.) A theoretical and practical study of such research problems as the applications of analytical and descriptive bibliography, the establishment of a reliable text, the interpretation of classical and biblical allusions, the literary relevance of psychological, biological and cosmological systems, the analysis of semantic and grammatical difficulties, the concepts of imitation and translation, and the discovery and evaluation of biographical resources. Students who intend to specialize in the Renaissance will normally be expected to take this course.
5 units, Win (Evans and Rebholz)

314. Literary Problems of the Renaissance —Prerequisite: 113 or 213 or 214, or equivalent.

5 units, given alternate years

314B. Seminar: English Literature in the 1590's.
5 units, given alternate years

315. Literary Problems of the Restoration and Eighteenth Century—Prerequisite: 115 or 215, or equivalent.

315A. Seminar: Eighteenth Century Fiction.
5 units, given alternate years

315C. Seminar: Johnson and His Circle.
5 units, given alternate years

315D. Seminar: Neoclassical Drama.
5 units, given alternate years

315E. Seminar: Lyric Poetry of the Eighteenth Century.
5 units, Spr (Davie)

315F. Seminar: The Enlightenment and Its Literary Traditions—(Same as Comparative Literature 315F and Modern Thought and Literature 315F.)
5 units, Aut (Watt)

316. Literary Problems of the Romantic Period—Prerequisite: 117 or 216, or equivalent treatment of Romantic period.

316A. Seminar: Romanticism and Romanticsisms.
5 units, given alternate years

316B. Seminar: Nineteenth Century Poetry.
5 units, given alternate years

316C. Seminar: Romantic Irony—(Same as Comparative Literature 316C and Modern Thought and Literature 363.)
5 units, given alternate years

317. Literary Problems of the Nineteenth and Twentieth Centuries—Prerequisite: 117 or 216, or equivalent.

317A. Seminar: The Bloomsbury Group.
5 units, given alternate years

317B. Seminar: The Nineties.
5 units, given alternate years

5 units, given alternate years
332. Seminar: Nineteenth Century Comic Fiction.
   5 units, given alternate years

   5 units, given alternate years

335. Seminar: The Modern Novel—(Same as Comparative Literature 335.)
   5 units, given alternate years

   5 units, Win (Riggs)

   5 units, given alternate years

355B. Seminar: British Poetry Since Hardy.
   5 units, given alternate years

   358A. Seminar: American Poets of the Twenties and Thirties.
      5 units, Spr (Middlebrook)

      5 units, given alternate years

359. Seminar: Rediscovered Poets: 1900–1940
      5 units, given alternate years

360A. Seminar: History of Literary Theory: Ancient—(Same as Comparative Literature 360A.)
      5 units, given alternate years

360B. Seminar: History of Literary Theory: Medieval/Renaissance—(Same as Comparative Literature 360B.) Prerequisite: 360A.
      5 units, given alternate years

360C. Seminar: Neoclassicism: Origins and Later Developments—(Same as Comparative Literature 360C.)
      5 units, given alternate years

361. Seminar: The Modern Tradition—(Same as Comparative Literature 361 and Modern Thought and Literature 361.) Introduction to the interdisciplinary study of modern thought and literature with emphasis on such modern developments as structuralism, phenomenology and Marxism.
      5 units, Win (Halliburton)

362. Seminar: Death in Literature and Psychology — (Same as Modern Thought and Literature 362.)
      5 units, Spr (I. Yalom and M. Yalom)

364. Topics in British Literature.
   364A. Seminar: Literature of World War I.
      5 units, given alternate years

364B. Seminar: Capitalism and Literature in the Nineteenth Century—(Same as Modern Thought and Literature 364B.)
      5 units, given alternate years

365. Topics in American Literature.
   365A. Seminar: The Landscape in American Literature — (Same as Modern Thought and Literature 365A.)
      5 units, Win (Momaday)

365B. Seminar: American Historical Romance.
      5 units, given alternate years

366. Seminar: Poetics and the Poetic — (Same as Comparative Literature 302 and Modern Thought and Literature 302.) Intensive study of poetics as theory, and of various poetic manifestations. May include study of relation of poetry to other types of language, poetry and music, the being of the poet, the poetic in nature, and the poetic as an aesthetic category.
      5 units, Aut (Dufrenne)

368. Topics in Criticism.
   368A. Seminar: American Critics—(Same as Comparative Literature 368.)
      5 units, given alternate years

369. Seminar: Major Modern Critics — (Same as Comparative Literature 369 and Modern Thought and Literature 369.) Reading and discussion of critical writings and theories of influential modern figures such as Auerbach, Kenneth Burke, Spitzer, and Lukács. Emphasis on twentieth century (e.g., existentialism, structuralism, Marxism), but course will also place modern critics in tradition beginning with Aristotle.
      5 units, Aut (Hattiburton)

371. Seminar: Chaucer.
      5 units, Spr (Damon)

373. Seminar: Shakespeare — Prerequisites: the equivalent of 73, or 173A or B or C, or 213; and 242.
      5 units, Spr (Riggs)
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<td>376</td>
<td>Seminar: Milton.</td>
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<td>Spr (Evans)</td>
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<td>385</td>
<td>American Authors of the Nineteenth and Twentieth Centuries.</td>
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<td>385A</td>
<td>Seminar: T. S. Eliot.</td>
<td>5</td>
<td>given alternate years</td>
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<td>385B</td>
<td>Seminar: Pound.</td>
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<td>given alternate years</td>
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<td>385C</td>
<td>Seminar: Wallace Stevens.</td>
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<td>given alternate years</td>
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<td>385D</td>
<td>Seminar: William Carlos Williams.</td>
<td>5</td>
<td>given alternate years</td>
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<td>385E</td>
<td>Seminar: Henry James.</td>
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<td>Win (Staff)</td>
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<tr>
<td>385F</td>
<td>Seminar: Richard Wright and His Circle — A study of Wright’s novels and stories and of the response to his theories of literature and society in selected works of Baldwin, Ellison, Himes, Hurston, and Hughes.</td>
<td>5</td>
<td>Aut (Rampersad)</td>
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<tr>
<td>387</td>
<td>Seminar: James, Conrad, and Ford.</td>
<td>5</td>
<td>given alternate years</td>
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<td>388</td>
<td>British Authors of the Nineteenth and Twentieth Centuries.</td>
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<td>388A</td>
<td>Seminar: Conrad.</td>
<td>5</td>
<td>given alternate years</td>
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<tr>
<td>388B</td>
<td>Seminar: Virginia Woolf and Her Circle — (Same as Modern Thought and Literature 388B.)</td>
<td>5</td>
<td>Win (Ruotolo)</td>
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<td>388C</td>
<td>Seminar: James Joyce.</td>
<td>5</td>
<td>given alternate years</td>
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<td>388D</td>
<td>Seminar: Dickens.</td>
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<td>Win (Levine)</td>
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<td>388E</td>
<td>Seminar: George Eliot.</td>
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<td>Spr (Levine)</td>
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<tr>
<td>390</td>
<td>Advanced Fiction Writing — A workshop group open by permission to graduates and exceptionally advanced seniors. All applicants should leave samples of their writing with the Creative Writing secretary at least ten days before the beginning of each quarter.</td>
<td>3 to 5</td>
<td>Aut, Win (Scowcroft)</td>
<td>Spr (L'Heureux)</td>
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<tr>
<td>391</td>
<td>Advanced Work in Writing and Criticism.</td>
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<td>Any quarter, by arrangement</td>
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<td>392</td>
<td>The Writing of Poetry — Primarily for students seriously interested in the composition of poetry. May be repeated for credit. Prerequisite: consent of instructor.</td>
<td>3 to 5</td>
<td>Aut (H. Trimpi)</td>
<td>Win (Davie)</td>
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<td>Spr (Fields)</td>
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<td>393</td>
<td>Workshop in Verse Translation — (Same as Comparative Literature 393.)</td>
<td>5</td>
<td>given alternate years</td>
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<td>395</td>
<td>Ad Hoc Graduate Seminars — In any quarter, a group of graduate students (at least three but preferably more) who wish in the following quarter to study a subject or an area not covered by regular courses and seminars may plan an informal seminar and approach a suitable member of the Department to supervise it, either on a graded or pass/no credit basis.</td>
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<td>396</td>
<td>Introduction to Teaching Freshman English — A short seminar for first-year graduate students and other prospective teachers of Freshman English. Students will talk with experienced teachers, look at video tapes of classes, read freshman papers, and plan their own courses for the following year. At the end they will write their own descriptions for Approaching Stanford and help with editing. Students will be asked to visit classes in progress and, whenever possible, to do practice teaching.</td>
<td>2</td>
<td>Win (Director of Freshman English and Teaching Administrator)</td>
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<td>396A</td>
<td>Teacher's Workshop — Discussion of the methods new teachers of Freshman English are using in their classes and evaluation of the effectiveness of those methods. Consideration of ways of improving the teaching of writing. Open for credit to graduate students teaching Freshman English for the first time; experienced teachers may attend informally.</td>
<td>5</td>
<td>(2 to 4 by special arrangement), Win, Spr (Director and Teaching Administrator)</td>
<td></td>
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<tr>
<td>397</td>
<td>Seminar in the Teaching of Composition — A seminar, with meetings before fall quarter classes begin and weekly two-hour sessions thereafter. Beginning teachers will be joined by experienced teachers attending informally. Discussion of writing assign-</td>
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</table>
ments, marking and grading of essays, coordination of reading and writing in the course, the conduct of conferences, and other subjects. Video tapes of classes in progress will be shown. Open for credit to graduate students teaching Freshman English for the first time.

5 units (2 to 4 by special arrangement),

Aut (Director and Teaching Administrator)

398. 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

399. Thesis.

Any quarter, by arrangement

The following courses, listed separately in this catalog under Modern Thought and Literature, may be of interest to graduate students in English:

Modern Thought and Literature 229.
Art, Politics, and Society.

Modern Thought and Literature 230.
Biography and History.

Modern Thought and Literature 248.
Women in Cross-cultural Perspective.

Modern Thought and Literature 251.
Masks of Violence in Myth, Literature, and Contemporary Culture.

Modern Thought and Literature 260A,B.
“Modernisms.”

Modern Thought and Literature 286.
Structuralism and After.

Modern Thought and Literature 337.
European Intellectual History Since the Enlightenment.

Modern Thought and Literature 366.
Mimesis.

For additional offerings in literature, see Comparative Literature.

**FRENCH DIVISION**

**Professors:** Robert G. Cohn, René Girard (French and Modern Thought and Literature, on leave 1974–75), Raymond D. Giraud, Alphonse Juilland, John C. Lapp, Pauline Newman-Gordon, Leo Weinstein

**Associate Professors:** Marc Bertrand, Ralph M. Hester

**Acting Assistant Professor:** David Brostoff

**Senior Lecturer:** John G. Barson

**Lecturers:** Marguerite Bauer, Clio P. Dorr, Nelée Langmuir, Michelle Morran, Jacqueline Ollivier.

**ITALIAN DIVISION**

**Assistant Professors:** Michael Leone, Paolo Braghieri

**Lecturers:** Leda S. Mussio, Annamaria Napolitano, Emily Olmsted

The Department accepts candidates for the degrees of Bachelor of Arts in French and in Italian, Master of Arts and Doctor of Philosophy in French.

**PROGRAMS OF STUDY**

**FRENCH**

**BACHELOR OF ARTS IN FRENCH**

Candidates should normally have completed the series of first- and second-year courses through French 24 or its equivalent. Regular placement tests enable students who have begun their study of French elsewhere to be granted advanced standing.

Candidates are expected to take at least three advanced language courses (123, 124, 125), the introductory series to French literature (130, 131, 132) and three advanced courses (numbered above 132) in different periods of literature. Students may then select one of the two following areas of specialization to complete their A.B. in French.

**SPECIALIZATION IN LITERATURE**

Majors concentrating in literature must take in addition a minimum of four Literature or Civilization electives numbered above 132. Students who intend to pursue graduate studies are urged to take courses in all periods of French literature. They should note that most graduate schools require proficiency in at least one additional modern language.
SPECIALIZATION IN LANGUAGE

Majors primarily interested in language and culture must take in addition four of the following courses:
- Séminaire sur des problèmes contemporains
- Stylistique
- Phonétique et Orthoépie
- Histoire de la langue française depuis le Moyen Age
- Civilization I—Du siècle de Louis XIV à la Révolution
- Civilization II—de la Révolution à l'époque contemporaine

BACHELOR OF ARTS IN FRENCH STUDIES

The aim of this program is to allow students to plan a more broadly based major, combining the study of French language, culture and literature with such fields as History of Art, Musicology, Political Science, History, Economics, Anthropology and other literatures. Candidates should formulate their plans early in consultation with the Department of French.

HONORS PROGRAM IN FRENCH

In addition to the basic undergraduate program, qualified French majors in their junior year may apply for admission to an Honors Program in French. A “B” average in French courses is required; other prerequisites include having completed at least two courses of the language-composition series, French 123, 124, 125, and two of the literature series, French 130, 131, 132. Juniors may apply while still taking the second course of these two series. Ideally, then, the Honors program could be established by spring quarter of the junior year. The student’s application must include a proposal and general outline of a senior essay, which will be accredited between 9 and 12 academic units, at the student’s option; it may be either in English or French, depending upon the student’s preference and his adviser’s recommendation. Honors program students also fulfill all regular requirements for the A.B. in French. A faculty-student committee will consider all applications for admission to the program.

COMBINED MAJORS, JOINT DEGREES, MINORS

Combined Major in French and English Literatures (for French Majors)

In addition to the requirements for the A.B. in French Literature, candidates should complete four English literature courses numbered 100 or above, and related to their French courses. However, two English literature courses can count toward the four electives in French.

Combined Major in French and Italian Literatures (for French Majors)

In addition to reading proficiency in Italian, candidates should satisfy requirements similar to those stated in the previous paragraph.

Honors Program in Humanities

For majors who wish to supplement their departmental major by a related program of studies. See section “Humanities Special Program.”

Combined Major in English and French, and Italian and French

English majors and Italian majors interested in a combined degree with French literature should refer to “Combined Majors” in the English and Italian sections.

Minor in French Literature

Candidates should satisfy the following requirements:

1. Reading proficiency in French, i.e., ability to read in one quarter 5 to 8 major works of French literature.

2. Four French literature courses distributed over two centuries or two genres, two of which must be in the original. For this purpose the Department offers a number of advanced undergraduate courses with readings in French and discussion in English.

Teaching Credentials

For information concerning the requirements for teaching credentials, consult the “School of Education” section of this bulletin and the Credential Secretary, School of Education.

Departmental Program at the University of Paris

Each year, French majors in their sophomore or junior year, as well as other students with an adequate command of the French language, may apply for the Departmental program at the University of Paris during
the following autumn and winter quarters. If desired, studies may be continued during spring quarter. Students live in residence halls or with private families and attend courses at the University of Paris. A faculty supervisor accompanies the group and offers a supplementary program of studies. Applications must be received by April 15. Forms and information may be obtained from the Department.

**INTENSIVE LANGUAGE WORK AT STANFORD IN FRANCE (Open to All Students)**

Students attending Stanford in France, in Tours, have the opportunity to take courses in French language, literature, conversation, and civilization. Those students who need work in conversation, as determined by the Director of Studies at the Tours campus, will be required to take a language course or have equivalent training in conversation for the first quarter, and possibly the second quarter of the session overseas. All courses in language bear the designation French 80 or 90 with the successive levels indicated as a second digit. Assignment to a particular level is made by the Director of Studies and language faculty at the campus.

**ITALIAN**

**BACHELOR OF ARTS IN ITALIAN**

This major is oriented toward Italian Studies and offers students an opportunity to bring together in a unifying program a broad cross-section of disciplines other than language and literature having their common denominator in Italian culture and civilization. To allow maximum flexibility, pertinent courses taken in other fields, such as Classics, Humanities, Comparative Literature, History, Philosophy, Architecture, Romance Literatures, English, German, Anthropology, Social Sciences, Political Science, Drama, Art, and Music, will count toward satisfying the major requirement.

Upon completion of the Italian first- and second-year language courses, Italian 1, 2, 3, 51 and 52 (or the equivalent courses taken at the Florence center), students wishing to concentrate in Italian Studies may, under the guidance of a departmental adviser, select a course of study best suited to their individual needs and cultural interests. It should be noted that Italian 2A may be taken concurrently with Italian 2.

At least 45 additional units of courses are required, including:

a) 32 units of Italian courses beyond the 52 level.

b) Up to 15 units of courses outside the department, but in related fields.

In this perspective, the program at the Florence campus will offer students a selection of courses acceptable toward the fulfillment of the degree in Italian Studies. Further alternatives may be provided at the Florence center through directed work (in Italian and/or in the above mentioned disciplines) arranged by the students with their advisers. Although attendance at the Florence center is particularly advisable, valid alternative programs will be accepted.

Courses in Italian literature taken at Stanford in Italy will count, with the approval of the Italian division, toward the fulfillment of the requirements for combined majors.

Students are encouraged to structure their program individually in consultation with a departmental adviser.

**COMBINED MAJOR IN ITALIAN AND ENGLISH LITERATURES (for Italian Majors)**

In addition to the 32 units (beyond the 52 level) required for the A.B. in Italian, candidates should complete four English literature courses numbered 100 and above and related to their field of concentration in Italian literature.

**COMBINED MAJOR IN ITALIAN AND FRENCH LITERATURES (for Italian Majors)**

In addition to the 32 units (beyond the 52 level) required for the A.B. in Italian, candidates should complete four courses in French literature related to their field of concentration in Italian literature. Reading proficiency in French is required.

**HONORS PROGRAM IN HUMANITIES**

This program is offered for majors who wish to supplement their departmental major by a related, carefully guided program of studies. See section "Humanities Special Program."

**COMBINED MAJOR IN ENGLISH AND ITALIAN LITERATURES, AND FRENCH AND ITALIAN LITERATURES**

English and French majors who wish a combined degree in Italian literature should
refer to “Combined Majors” in the English and French sections.

**Intensive Language Work at Stanford in Italy (Open to All Students)**

Students attending Stanford in Italy, in Florence, have the opportunity to take courses in Italian language, literature, conversation, and civilization. Those students who need work in conversation, as determined by the Director of Studies at the Florence campus, will be required to take a language course or have equivalent training in conversation for the first quarter, and possibly the second quarter of the session overseas. All courses in language bear the designation Italian 80 or 90 with the successive levels indicated as a second digit. Assignment to a particular level is made by the Director of Studies and language faculty at the campus.

**Advanced Degrees in French**

Applicants should read carefully the general regulations governing advanced degrees (see the section entitled “Degrees” in this Bulletin). They should have preparation equivalent to an undergraduate major in French with a minimum average grade of “B” and should also have reached a high level of speaking proficiency, to be demonstrated either in a personal interview or by a tape recording sent to the Department. Previous study of a language other than French is highly desirable.

In addition to the Ph.D., the Department offers two different kinds of Master’s programs and participates with the School of Education in its Master of Arts in Teaching program.

**Master of Arts in Teaching**

The degree of Master of Arts in Teaching is offered jointly by this Department and the School of Education. The degree is intended for candidates who have a teaching credential and wish further to strengthen their academic preparation. The program consists of a minimum of 25 units of French courses selected in consultation with the M.A.T. departmental adviser, and 12 units in the School of Education. Detailed requirements for the course are outlined in the School of Education section.

**Master of Arts in French (Terminal Program)**

The Master of Arts provides a combination of language, literature, civilization and methodology courses designed to prepare secondary school, junior college, or college teachers.

Candidates must complete a minimum of 36 units of graduate work, with a "B" average, and pass a final examination. To fulfill the requirements in one year, they should enroll for an average of 12 units per quarter.

Candidates for this degree are not eligible for financial aid.

The basic course program, intended for those who plan to teach French (modifications are possible for those who do not), is as follows:

<table>
<thead>
<tr>
<th>Units</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>French 210.</td>
<td>Problèmes de l’expression écrite</td>
</tr>
<tr>
<td>French 211.</td>
<td>Phonétique et orthographe</td>
</tr>
<tr>
<td>French 212.</td>
<td>Histoire de la langue française depuis le Moyen Age</td>
</tr>
<tr>
<td>French 289.</td>
<td>Méthodologie</td>
</tr>
<tr>
<td>French 292.</td>
<td>Du Classicisme à l’Age des Lumières</td>
</tr>
<tr>
<td>French 290.</td>
<td>Du Siècle de Louis XIV à la Révolution</td>
</tr>
<tr>
<td>French 291.</td>
<td>De la Révolution à l’époque contemporaine</td>
</tr>
<tr>
<td>Two electives from courses numbered above 200</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

Candidates are advised to develop teaching skills by participating in supervised teaching of language courses. Practice teaching will be conducted in conjunction with the Methodology course. Candidates will occasionally assist in the teaching of languages.

**Master of Arts in French (Ph.D. Program)**

The Master of Arts in French is required from all Ph.D. candidates. All doctoral candidates must apply for M.A. candidacy upon arrival. Upon successful completion of a minimum of 36 graduate units and of the first Ph.D. qualifying examination, all candidates will receive an A.M.

**Doctor of Philosophy in French**

Normally the Ph.D. program should be completed in four years. The first and second years should be devoted to full-time study; the third and fourth years to study, teaching and dissertation work.

The Ph.D. graduate in French Literature
is expected to have attained a reasonable mastery of the literature and the language. Students will emphasize some areas or centuries rather than others, but knowledge of the whole field should be well advanced at the time of graduation. A primary goal of the Program is excellence in the art of writing scholarly articles and books. The Department also emphasizes competence in the teaching of language and literature.

All candidates, regardless of their field of specialization, are expected to fulfill the following general requirements:

1. **Course requirements.** A total of no fewer than 72 units of graduate work. A minimum of 36 graduate units (9 courses) during the first year of graduate study and a minimum of two courses or seminars per quarter for at least four of the six quarters following the first year (for a total of no less than 36 additional units). Additional units of graduate courses, seminars or individual work in the candidate's major or minor field are strongly recommended and will be determined according to the adviser's (or advisory committee's) judgment and the candidate's needs. French 210 "Problèmes de l'expression écrite" and one philology course are to be among the 72 required units.

All candidates, regardless of their area of specialization, must take in the Department at least ten literature courses exclusive of directed reading, covering four centuries. (For the purpose of this requirement the Middle Ages count as a century). In addition each candidate must take at least four seminars or colloquia, two of which are to be outside his or her special field of interest.

2. **Examinations.** Preliminary written examinations are in two parts: the first, on a broad literary period, is to be taken in January of the second year of study; the second, on a broad literary genre, in October of the third year. Success in these examinations qualifies a student for the University oral examination, which requires comment on a text in the student's area of specialization and a defense of the dissertation project.

3. **Dissertation.** The doctoral dissertation should demonstrate ability to carry out research, organize and present the results in publishable form. The scope of the dissertation should be such that it could be completed in one to one-and-one-half years of full-time work. However, the Department will encourage, in appropriate cases, projects requiring more time for completion.

Various kinds of dissertations are acceptable to the Department: a historical study of a particular phenomenon, the discussion of one or more representative works of a genre, a comparative study, etc.

4. **Teaching experience.** The Department expects Ph.D. candidates to demonstrate proficiency by teaching three language courses during his or her third year of study. The Department encourages students to participate in the teaching of literature whenever possible, usually by assisting a professor in conducting an undergraduate literature course.

5. There is no formal language requirement other than French and English. In areas of specialization in which additional languages are essential, students are expected to acquire the necessary knowledge before beginning work on the dissertation.

**Joint Degrees and Minors**

A candidate may also take a joint degree in French and Humanities (for a description of this program, see the section "Humanities Special Programs"). Minors are possible in Medieval Studies, in Linguistics, in Comparative Literature, in Modern Thought, and in departments offering related courses such as History, History of Art, Music, Philosophy, Social Thought, etc.

Students interested in a joint degree or a minor should plan their course of study with their adviser(s). Joint degrees and minors usually require 24 additional units. By carefully planning their programs, students may complete their course work for the Ph.D. and the minor in a total of nine quarters.

**Graduate Minor in French Literature**

The Department offers a minor in French Literature to students from other departments.

The requirements for a graduate minor in French Literature are:

1. A sound reading knowledge of French.
2. A minimum of 24 units of course work (six courses) covering at least two centuries or two genres (poetry, fiction, theater, or other prose) or a combination of both.
COURSES OPEN TO ALL STUDENTS

The courses in this section do not require a knowledge of any language other than English.

GENERAL COURSES

FRENCH

103. The Nineteenth Century French Novel—The major novelists of the century, including Stendhal, Balzac, Hugo, Flaubert, Huysmans, and Zola.
4 units, Aut (Giraud)

104. Contemporary French Novelists—Significant authors of contemporary France: Proust, Gide, Malraux, Sartre, Camus, etc. Lectures, readings in English.
4 units, Aut (Cohn)

105. The Writings of Albert Camus.
4 units, Spr (Cohn)

107. Sartre: Literature and Politics—Study of Sartre's view of the purpose and function of literature in the context of his philosophical and political thought, and also his own imaginative writing. (Reading and discussion in English.)
4 units (Giraud) given 1975-76

108. The Committed Writer in France from Montesquieu to Sartre—Literary writers who have incorporated a political or social point of view in their fictional works: Montesquieu, Voltaire, Stendhal, Anouilh, Sartre. Background reading in modern and intellectual French history.
4 units (Weinstein) given 1975-76

109. The Don Juan Legend in Literature and Music—(Same as Comparative Literature 109.) Reading and discussion of Don Juan versions by Tirso de Molina, Molière, Mozart, Grabbe, Musset, Zorrilla, Montherlant, Frisch, and interpretations by Stendhal, E. T. A. Hoffman and Kierkegaard.
4 units (Weinstein) given 1976-77

115. Introduction to Existentialism—Existentialism as a philosophical system (theory of knowledge, theory of being, theory of value) with reference to other philosophical systems; French Existentialism as reflected in the writings of Sartre, Camus, Céline, and Malraux. Readings in French, discussion in English.
4 units (Juillard), given 1975-76

FRENCH COURSES

FIRST- AND SECOND-YEAR

(Under the direction of John G. Barson)

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. Tests will be given September 21, 23, 25, and 30 (for autumn quarter); November 18, January 6 and 8 (for winter quarter); February 25, March 31, April 2 (for spring quarter); May 20 (for summer and autumn quarters). The placement test is not given in the summer.

1. Initiation au français—Étape 1—Basic French through a rationalist direct method. Systematic acquisition of vocabulary and grammar in the immediate reality of the classroom. Only French is used by both instructor and students. Multiple approach: listening-comprehension, oral expression, original oral and written composition.
5 units, Aut, Win, Spr (Staff) MTWThF

5 units, Aut, Win, Spr (Staff) MTWThF

25. Le français sans complexes—(Supplément du Français 2.) Cours de conversation au niveau linguistique du Français 2. Prerequisite: 1 or equivalent.
3 units, Aut, Win, Spr (Staff)

5 units, Aut, Win, Spr (Staff) MTWThF

35. Coup d'œil sur la France—(Supplément du Français 3.) Cours de conversation. Les étudiants utilisent leurs connaissances en les appliquant à l'étude de la culture et de la vie françaises: actualités, théâtre, cinéma, voyages, agences, etc. Renseignements utiles pour les étudiants qui partent pour le Campus de Tours ou qui projettent un voyage en France. Prerequisite: 2 or equivalent.
3 units, Aut, Win, Spr (Staff)

5. Intensive French for Beginners—(Equiv-
alent to 1, 2 and 3.) A rationalist direct method stressing simultaneous acquisition of listening, speaking, writing, and reading skills, introduces students to the essentials of first-year grammar and vocabulary. Classes are conducted entirely in French, with oral presentation immediately reinforced in small group conversation sections. Written exercises, original compositions, and daily work in the Language Laboratory are also an integral part of the course.

12 units, Sum (Staff) MTWThF

10. Reading French—An accelerated course designed specifically for the acquisition of reading ability. Primarily intended for graduate students seeking to meet the University reading requirement for advanced degrees. Also open to seniors. No auditors permitted.

4 units, Aut, Spr (Staff) MTWTh 8

20. L’art de la conversation — Le français dans les situations de la vie de tous les jours. Prerequisite: French 3 or equivalent.

3 units, Aut, Win, Spr (Staff)


4 units, Aut, Win, Spr (Staff) MTWTh

23. Le français en action II—Continuation du Français 22. Partant de lectures groupées selon des thèmes de portée universelle, les étudiants discuteront les idées et leurs points de vue personnels. Continuation de la grammaire essentielle.

4 units, Aut, Win, Spr (Staff) MTWTh


4 to 5 units, Aut, Win, Spr (Staff) MTWTh

26. Le français en action I et II — Cours accéléré de deuxième année. Révision complète de grammaire essentielle, lectures choisies de genres différents, et discussions. Correspond au Français 22 et 23. Prerequisite: one year of college French or equivalent. Two extra units offered for individual work.

6 to 8 units, Sum (Staff)

30. Conversation et Culture — La France vue par des écrivains français et étrangers. Présentation et discussion des opinions. Prerequisite: French 23 or equivalent. May be repeated once for credit after an interval of two quarters.

3 units, Aut, Win, Spr (Staff)

80-90. Intensive French—Given only at Stanford in France.

3 or more units, Aut, Win, Spr, Sum (Staff)

THIRD- AND FOURTH-YEAR

Language Courses

(Under the direction of John G. Barson)

120. Séminaire sur des problèmes contemporains—Conversation et discussion sur des problèmes actuels à partir de journaux, revues ou films français. Prerequisite: 30 or 82 through 86 or equivalent. May be repeated once for credit after an interval of two quarters.

3 units, Aut, Win, Spr (Staff) TTh

123. Composition, grammaire et étude de textes—Convergences et divergences de la langue orale et écrite, grammaire descriptive, analyse grammaticale, composition. Prerequisite: 24 or equivalent.

4 units, Aut (Ollivier) MWF 9

124. Langue, style et écriture — Continuation du Français 123. Le commentaire littéraire, les styles de la critique, composition.

4 units, Win (Bauer) MWF 9

125. Cours avancé de français — Exercices de style, traduction et explication de texte; enrichissement du vocabulaire. Prerequisites: 123 and 124 or equivalent.

4 units, Spr (Newman-Gordon)

Literature Courses

For literature courses in English, see also General Courses, page 323.

130. L’Amour, la société et la rébellion — Étude générale de la littérature française du roman courtois du Moyen-Age jusqu’à l’essai philosophique de la Renaissance (Chrestien de Troyes, Villon, poètes du 16ème siècle,
Rabelais, Montaigne). Prerequisite: 24 or equivalent.

4 units, Aut (Hester)

131. La Liberté, la volonté et la passion—
Etude générale de la littérature française de la tragédie classique jusqu’au roman érotique du 18e siècle (Corneille, Racine, Molière, Diderot, Rousseau). Prerequisite: 24 or equivalent.

4 units, Win (Hester)


4 units, Spr (Weinstein)

Note—Prerequisites for the following courses are normally 130, 131, and 132, or 85 and 86, or equivalent.

140. Platonisme et féminisme: Renaissance et Réforme—Les grands courants littéraires et philosophiques de la Renaissance. Études de Rabelais (Gargantua) et Montaigne (Les Essais).

4 units (Hester), given 1975-76


4 units, Spr (Hester)

150. Roman et anti-roman au 17ème siècle; la crise morale—Le roman aux prises avec la société; Sorel, Le Comique (extraits). Mme de La Fayette, La Princesse de Clèves, La Bruyère, Caractères et La Rocheoucauld, Maximes. Pascal, Pensées.

4 units, Spr (Lapp)


4 units (Lapp), given 1975-76

152. La Muse comique; le rire au 17ème siècle—Corneille, Le Menteur; Racine, Les Plaideurs; Molière, Le Malade imaginaire, Le Tartuffe, Dom Juan.

4 units (Lapp) given 1975-76


4 units, Aut (Giraud)


4 units (Giraud), given 1975-76

173. Symbolism— Characteristic poems of Baudelaire, Mallarmé, Rimbaud, and Verlaine will be discussed in the context of the late 19th-century literary and artistic climate in France. Lectures in English; readings in French.

4 units (Cohn), given 1975-76


4 units (Giraud), given 1975-76

177. Poètes de notre temps—Michaux, Char, Prévert, Supervielle, Verlaine, Léon-Paul Fargue, St. John Perse.

4 units, Aut (Giraud) given 1975-76

189. Le roman comme “point de vue sur les choses”—Alain Fournier, Proust, Mauriac, Sartre, Nathalie Sarraute.

4 units (Newman-Gordon) given 1976-77

190. Introduction à la poésie française—Analyse et étude de poèmes choisis, thèmes, images, versification, technique descriptive, depuis le 16ème siècle jusqu’à nos jours.

4 units, Aut (Lapp)

191. The Idea of Revolution in Modern French Literature—A study of the representation of revolution and attitudes toward it in French texts from the Romantic period to the twentieth century. Most readings in French. Discussion in English.

4 units (Giraud), given 1975-76

199. Individual Work—Open only to majors
in French and with special permission of the Department. May be repeated for credit.

1 to 3 units, any quarter (Staff) by arrangement

ADVANCED UNDERGRADUATE AND GRADUATE COURSES

205. Le français moderne—Le système phonétique français; valeur (voyelles ouvertes et fermées); quantité (syllabes normales, courtes et longues); liaisons et enchaînement; la question de l’œ muet; comparaison de la prononciation française et anglaise; la grammaire: tendances analytiques et synthétiques; l’ordre des mots; l’adjectif (morphologie et syntaxe).

3 units (Juilland) given 1975–76


4 units, Aut (Bertrand)

211. Phonétique et Orthoépie—Etude théorique et travaux correctifs: articulation, rythme, intonation. Pédagogie de la graphie traditionnelle et de la graphie phonétique. Prerequisite: 24 or equivalent.

4 units, Aut (Juilland)

212. Histoire de la langue française depuis le Moyen Age—Pour chaque siècle: le cadre historique, politique, social et culturel; prononciation et orthographe; grammaire (morphologie et syntaxe); vocabulaire; style; rapports entre langue et littérature; la langue des grands écrivains.

4 units, Win (Juilland)

213. Introduction to Old French Language and Literature.

4 units, Aut (Brostoff)

270. Modern Critical Thought: The Symbolist Heritage—(Same as Comparative Literature 270.) The development of the main stream of modern French (and allied) philosophico-critical thinking; from Baudelaire through Mallarmé, Valéry, Bergson, Proust, Edmund Wilson, Mauron, Blanchot, Richard, Frye, Benjamin and Derrida. Readings in French and English. Discussions in English.

4 to 5 units (Cohn) given 1975–76

283. Individu et société dans le roman français contemporain—De La Peste de Camus au “roman de contestation” actuel.

4 units, Spr (Bertrand)


4 units (Girard) given 1975–76

287. Rousseau—Psychologically oriented study of Rousseau’s social and political thought in the major self-revelatory works.

4 units, Win (Giraud)


4 units, Aut (Newman-Gordon) given 1975–76

289. Methodology Course—Analysis and discussion of classroom practices and related pedagogical material in the context of the rationalist direct method of teaching French language.

4 units, Aut (Hester)

CIVILISATION FRANÇAISE

Approches: civilisation matérielle et modes de vie; Etat et classes sociales; culture savante et traditions populaires; idéologies et mentalités.

290. Du Siècle de Louis XIV à la Révolution.

4 units, Win (Bertrand)

291. De la Révolution à l’époque contemporaine.

4 units, Spr (Bertrand)

GRADUATE COURSES

292. (A.M. Program. Open also to advanced Undergraduates) Du Classicisme à l’Age des Lumières — Les transformations du Classicisme dans les genres littéraires: de
Corneille à Voltaire, de Mme de La Fayette à Choderlos de Laclos, de Pascal à Diderot, de La Fontaine à Chénier.

4 units, Aut (Weinstein)

293. (A.M. Program. Open also to advanced Undergraduates) Du Romanisme à nos jours—Lecture et discussion de textes de Victor Hugo, Musset, Vigny, Baudelaire, Rimbaud, Mallarmé, Stendhal, Flaubert, Balzac, Gide et Proust.

4 units, Spr (Newman-Gordon)

310. Introduction to Romance Linguistics—Archaic Latin; Classical Latin; Vulgar Latin; source of knowledge; ancient, modern inscriptions; authors; borrowings; the comparative method; formation of the Romance languages; classification of Romance languages and dialects; earliest Romance literary monuments.

4 units (Juillard) given 1975–76

311. Introduction to Medieval Literature—Study of five masterpieces of medieval French literature from the perspective of modern criticism. No prerequisite.

4 units, Win or Spr

335. The Fifteenth Century.

4 units, Win or Spr

341. La Poésie de la Renaissance avant la Pléiade—Les Rhétoriqueurs, Marguerite de Navarre; les poètes de Lyon: Scève, Louise Labé, Pontus de Tyard.

4 units (Hester) given 1975–76

342. La Renaissance en France I—Les Prosateurs; Rabelais et Montaigne.

4 units (Lapp) given 1975–76

343. La Renaissance en France II—Les poètes de la Pléiade et les poètes baroques de la fin du 16ème siècle.

4 units, Spr (Hester)


4 units, given 1975–76

Rabelais.

4 units (Hester) given 1975–76

Montaigne.

4 units, Aut (Lapp) given 1974–75

Racine

4 units, Spr (Lapp)

Marivaux

4 units (Girard) given 1975–76

Stendhal.

4 units (Weinstein) given 1975–76

Balzac.

4 units, Aut (Weinstein)

Flaubert.

4 units, Win (Giraud)

Mallarmé.

4 units (Cohn) given 1975–76

Baudelaire.

4 units, Aut (Cohn)

Rimbaud.

4 units (Cohn) given 1975–76

351. La Poésie de Malherbe à La Fontaine.

4 units, Win (Lapp)

353. Le Théâtre classique français—Corneille, Molière, Racine.

4 units (Weinstein) given 1975–76

355. Les Chansons de geste.

4 units, Win (Brostoff)

356. L’amour courtois et le roman courtois: la Renaissance due XIIe siècle.

4 units, Spr (Brostoff)


4 units (Weinstein) given 1975–76

373. La Critique littéraire au 19ème siècle—Sainte-Beuve, Taine, Brunetière.

4 units (Weinstein) given 1975–76

375. La poésie lyrique de Victor Hugo

4 units, Spr (Giraud)

379. La doctrine de l’Art pour l’Art et la littérature sociale au 19ème siècle.

4 units (Giraud) given 1975–76

380. La “grande génération”—Proust, Gide, Péguy, Claudel, Romain Rolland, Valéry.

4 units, Win (Newman-Gordon) given 1975–76

381. Proust.

4 units (Newman-Gordon) given 1976–77


4 units (Giraud) given 1975–76


4 units (Newman-Gordon) given 1976–77
388. Apollinaire—*Alcools* et *Calligrammes.*  
4 units, Spr (Newman-Gordon)  
given 1975–76

389. Points de vue critiques au 20ème siècle—De Valéry à la Nouvelle Critique.  
Programme: Lanson et l'histoire littéraire; Valéry; les critiques de la *N.R.F.*; Gaston Bachelard; la psychocritique: Ch. Mauron; J. P. Weber; J. P. Sartre; la critique d'identification: G. Poulet; J. P. Richard; J. Starobinski; la critique formaliste: R. Barthes; G. Genette; J. Rousset; T. Todorov.  
4 units, Win (Bertrand)

4 units, Spr (Bertrand) given 1975–76

398. Tutorials—Initiated by a professor, Tutorials are intended for at least three (but preferably more) graduate students who wish to study on an informal basis a subject or an area not covered by regular courses.  
4 units, Aut, Win, Spr, by arrangement

399. Individual Work — Exclusively for graduate students in French working on thesis or engaged in special work.  
1 to 12 units, any quarter (Staff) by arrangement

**ITALIAN DIVISION COURSES**

*First- and Second-Year Language Courses*

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.

1. **First-Year Italian.**  
5 units, Aut, Win, Spr (Staff) MTWThF

2. **First-Year Italian—(Continuation of 1.)**  
5 units, Aut, Win, Spr (Staff) MTWThF

2A. **L'Italia d'Oggi**—Introduction to Italian life. Conversation and lectures on various aspects of contemporary Italy (politics, art, cinema, press, customs). Especially designed for students who plan to go to Italy. Prerequisite: Italian 1.  
3 units, Win, Spr (Staff)

3. **First-Year Italian—(Continuation of 2.)** A grammatical and linguistic approach to Italian through contemporary readings (short stories or novels) or viewing and studying of films and their scripts.  
5 units, Aut, Win, Spr (Staff) MTWThF

5. **Intensive Italian for Beginners—Equivalent to 1 and 2.** Offers preparation in speaking, writing, and reading the language.  
10 units, Sum (Staff) MTWThF

30. **Conversation**—This course is geared to students returning from Florence. For those students who did not go to Florence, minimum prerequisite is Italian 3.  
2 units, Aut, Win, Spr (Staff)

51. **Second-Year Italian**—Linguistic and literary introduction to contemporary Italian authors and review of essential linguistic and grammatical points. Prerequisite: 3 or equivalent.  
3 units, Aut (Braghieri) MWF

52. **Second-Year Italian**—Logical progression of Italian 51 with more emphasis on written work. Prerequisite: 51 or consent of instructor.  
3 units, Win (Staff) MWF

53. **Second-Year Italian**—Sequential progression of 51 and 52 with the addition of journalistic material and more emphasis on the spoken language. Prerequisite: 52 or consent of instructor.  
3 units, Spr (Staff) MWF

Note: Italian 51, 52, 53 are offered for 3 units. May be taken for 4 units by arrangement with instructor.

80–90. **Intensive Italian**—Given only at Stanford in Italy.  
3 units or more, Aut, Win, Spr, Sum (Staff)

Courses taken at the Florence campus will be evaluated according to their relationship with students' specific areas of concentration. Units earned through Italian colloquia (4 units per colloquium) will be evaluated by the departmental Italian adviser.

**Literature Courses**

161. **Facets of the Italian Renaissance**—Literature, philosophy, history and politics of one of the fundamental periods of western civilization. Alberti, Pico della Mirandola, Lorenzo il Magnifico, Ficino, Machiavelli,
Michelangelo, Castiglione, Bembo, Della Casa. In Italian.

4 units, Aut (Braghieri)

171. Literature of the Italian Romanticism — The course will examine late 18th and 19th Century Italian literature and its relationship to European romanticism (Alfieri, Foscolo, Leopardi, Manzoni, Mazzini, etc.). In Italian.

4 units, Win (Braghieri)

182. Dall'Ottocento al Novecento — The concept of Heroism and Alienation in representative writers of the 19th and 20th centuries (Foscolo, Verga, Pirandello, Svevo). In Italian.

4 units, Spr (Leone)

183. Il Romanzo moderno — Studio e interpretazione dei più importanti romanzi del Novecento.

4 units, Aut (Leone)

185. Modern Theatre and its Theory — (Same as Comparative Literature 185.) The course will deal with some of the fundamental figures in modern theatre, exploring a number of plays as well as theoretical works and statements on theatre, its function and its techniques. Pirandello, Brecht, Genet, Artaud, Beckett, Stanislawski, Grotowski.

4 units, Win (Braghieri)

199. Individual Work — Open to all students with special permission of the Department. May be repeated for credit.

1 to 3 units, any quarter (Staff) by arrangement

**GEOGRAPHY**

Undergraduate courses in Geography will be offered by the Food Research Institute.

**GERMAN STUDIES**

Emeriti: Helmut R. Boeninger, Kurt F. Reinhardt, Gertrude L. Schuelke, F. W. Strothmann (Professors)

Chairman: Walter F. W. Lohnes


Senior Lecturer: Gertrude Mahrholz

Assistant Professors: John M. Flores, Ann Mason, Orrin W. Robinson III, Ann Snow. Visiting: Rainer Rumold

Lecturers: Peter R. Frank (Curator, German Collection, Stanford Library), Josef Hutschineider, Ulrike Lieder, Kathryn Strachota

**OFFERINGS AND FACILITIES**

The Department accepts candidates for the degree of Bachelor of Arts, Master of Arts, and Doctor of Philosophy. The requirements for these degrees are given below under Programs of Study.

**MASTER OF ARTS IN TEACHING**

The degree of Master of Arts in the Teaching of German is offered jointly by the School of Education and the Department. The program includes 25 units of German in courses selected in consultation with the Department adviser. For a statement of requirements other than German see the section entitled "School of Education" in this bulletin.

**GRADUATE PROGRAM IN HUMANITIES**

The Department participates in the Graduate Program in Humanities leading to a joint Ph.D. degree in German Studies and Humanities. For a description of that program, see the section "Humanities Special Programs" in this bulletin.

**Overseas Studies**

Detailed information on the centers in the Rems Valley, in Berlin, and in Vienna is given in the booklet, Stanford Overseas Studies 1974. These programs cover a great variety of courses in language, literature, culture, and other fields of Central European Studies. Most credits earned at these centers can be applied to the undergraduate major in German Studies.

**Stanford Bonn Program**

The Department maintains a two-quarter program, Autumn and Winter, in Bonn, Germany, for the benefit of advanced students majoring in German or in such programs as German History, Humanities, Art History, Musicology, etc. To participate, applicants must demonstrate proficiency in German. Students can complete specific course re-
requirements as well as a number of courses in an elective area, chosen from courses offered by the University of Bonn. A.M. and Ph.D. candidates may also take part in the program.

PROGRAMS OF STUDY

BACHELOR OF ARTS

After completion of the courses offered for first- and second-year students, majors in German normally select, with the help of their adviser, a minimum of two German courses per quarter. The total requirement for the Bachelor of Arts degree in German is a minimum of 45 units of work beyond the basic first- and second-year courses (1 through 52) or equivalent, except in the area of German Studies, as described below.

Students have the opportunity to select any one of four areas of concentration, without, however, limiting their choices exclusively to that area.

1. German Language

   Students interested primarily in German as a language should take the language work listed under "Advanced and Graduate Courses."

2. German Literature

   Students concentrating in German literature must take the complete 150-series, in sequence if possible.

3. German Thought

   Students interested in German thought should take the Geistesgeschichte-series and one Senior Seminar.

4. German Studies

   The aim of this program, which permits maximum flexibility, is to allow students to plan a more broadly based major than is possible in the other areas of concentration. The student can combine the study of German language and literature with such fields as Art History, Musicology, Political Science, History, Economics, Anthropology, Comparative Literature, etc. The requirements are (a) at least 25 units of German courses beyond the 52 level, (b) at least 25 units of courses outside the Department, but in the Central European field, to be planned and presented to the Department by the student. Every student will participate in at least one Stanford Overseas Program.

Majors in German Studies must formulate their plans in quarterly consultation with an undergraduate major adviser.

HONORS IN GERMAN

Majors with a minimum grade average of "B" in German courses are eligible for departmental honors. In addition to requirements listed above, each honors student will write an essay representing six to nine units of academic work. This essay will be on a topic chosen by the student in consultation with a faculty member in the department.

CERTIFICATES IN TRANSLATION AND INTERPRETATION

Study leading to the award of a certificate in translation or a certificate in translation and interpretation may be combined with degree programs (A.B. and A.M.) in any subject matter area. The program provides students with an ancillary skill in the practice of their professions. The requirements for the Certificate in General Translation (with A.B.) may be met by completing all translating courses through the 200T-series and for the Certificate in Advanced Translation and/or Interpretation (with A.M.) by continuing in the 300T-series. The program should normally be started in the sophomore year. Each student will participate in at least one Stanford Overseas Program. In his or her final year, the student will produce an original translation of a literary or documentary work.

MASTER OF ARTS

This program is designed for those students who do not intend to continue their studies through the Ph.D. degree. By University regulation, students desiring the A.M. degree must complete a minimum of 36 units of graduate work. If students enroll for three quarters for a minimum of 12 units per quarter, they can fulfill the A.M. requirements in one year—which they are strongly advised to do. The A.M. program must include:

201 and 202. Language and Style
300. Proseminar
302. Methods of Teaching German
Two courses in German literature
Two courses in German thought

In addition, students must take graduate level courses in German and/or approved courses in related fields, such as Linguistics,
Comparative Literature, Philosophy, History, or History of Art. Students concentrating in German Studies should choose these related courses in the Central European field, in such departments as: Political Science, Economics, Anthropology, History.

Doctor of Philosophy

The requirements for the Ph.D. are: (1) a minimum of 36 graduate units during the first year of graduate study and a minimum of 9 units per quarter during the six quarters following the first year; (2) a reading knowledge of one language other than English and German, and (3) the writing of a dissertation.

The first year of graduate work, which leads to the A.M. degree, is designed to introduce each student to the three major areas of study. However, all students, regardless of their future field of concentration, are expected to acquire near-native proficiency in German and a thorough knowledge of the grammatical structure of German. During the first year at Stanford, all graduate students will be given the MLA-Cooperative Foreign Language Proficiency Tests (designed for teachers and advanced students) to give them an indication of their achievement in listening-comprehension, speaking, reading, and writing. The Department expects all of its Ph.D. candidates to demonstrate teaching proficiency in German.

302. Methods of Teaching German is required. All graduate students are strongly advised to start developing skill in the teaching of literature by participating, on a voluntary basis, in teaching of the undergraduate literature courses. Students can earn up to three units of graduate credit for practice teaching in literature.

During the first year, all graduate students who plan to continue through the Ph.D. normally take the following program:

201 and 202. Language and Style
205. Introduction to Modern German
228. Middle High German
241. Deutsche Geistesgeschichte I
242. Deutsche Geistesgeschichte II
300. Proseminar
Two courses in German literature
One seminar (325, 350, or 400)

Electives chosen from graduate level courses in German or approved courses in related fields may be added if the student desires.

1. Concentration in Language Studies

Students choosing this concentration will specialize in such fields as: the older dialects and medieval literature, comparative diachronic linguistics centering on early Germanic dialects, linguistics and language teaching.

2. Concentration in Literature

Course requirements are: a minimum of two courses or seminars per quarter for at least four of the six quarters following the first year. Lecture courses and colloquia will require final examinations but not term papers. Seminars, of which the student is expected to take a minimum of two after his or her first year, will require research papers.

Students may work toward a Ph.D. in German Studies and Humanities, German Studies with a minor in Comparative Literature, or German Studies with a minor in Modern Thought and Literature, etc. Usually such programs require more than a total of 9 quarters of course work.

3. Concentration in German Thought

Course requirements are a minimum of two courses per quarter, including four courses or seminars in the 351–375 and 376–400 series, and four additional courses or seminars from the 326–350 and 376–400 series. Lecture courses and colloquia will require final examinations but not term papers. Seminars, of which the student is expected to take a minimum of two after his or her first year, will require research papers. Students are advised to take some electives outside the Department.

Students may work toward a Ph.D. in German Studies and Humanities, German Studies with a minor in Comparative Literature, or German Studies with a minor in Modern Thought and Literature, etc. Usually such programs require more than a total of 9 quarters of course work.

General Courses

(given in English)

The courses in this section are given in English and do not require a knowledge of German. They are open to all students. German majors taking these courses as a part of their requirements must do the assigned readings in German.
11A. Literature I: From the Renaissance to the Enlightenment—This course will explore the origins of the modern lyric, drama, and novel in Renaissance Europe, and trace the evolution of Western literature from the Renaissance synthesis, when the Italian humanist, Pico, proclaimed “man the measure,” through the baroque crisis of consciousness, when Donne saw “all coherence gone,” to a renewed rise of individualism and noble sentiment on the threshold of the Enlightenment. “Counter-renaissance” forces and mystical and occult currents in literature will be examined; special attention will be paid to the cult of the artist and hero, to questers, brooders, and rebels as protagonists of Western culture, and to the interplay of reason, skepticism, and doubt in the formation of the modern mind.

5 units, Aut (Gillespie and Staff)

Lectures MWF 11 and one two-hour section T 2:15–4:05 p.m. or Th 4:15–6:05 p.m.

21A. Medieval Culture: An Interdisciplinary Introduction—(Same as Medieval Studies 65.) An introduction to the development of medieval culture through study of some of its salient religious, philosophical, literary, artistic, social, and political characteristics, with emphasis on the connections and tensions between them. Lectures by faculty from various departments and sections conducted by the faculty listed.

5 units, Win (E. Brown and Langmuir)

MTWTh 10

120A. Politics and Literature in East and West Germany.

3 units, Win (Rumold)

122A. Nietzsche—Reading and discussion of Nietzsche’s major works in historical, philosophical, and literary contexts. Nietzsche’s influence on later writers and the ways in which his ideas have been politicized and misused will also be considered.

3 units, Spr (Mason)

124A. The Modern German Novel—Reading and discussion of works selected from such authors as Thomas Mann, Heinrich Mann, Grass, Böll, Hesse, Frisch, Seghers, Döblin, Musil, and others.

3 units, Win (Mason)

130A. Brecht and the Modern Drama—The place of Brecht’s dramatic theory and practice in the development of the modern drama. Ibsen, Strindberg and Expressionism, Pirandello, Brecht, Beckett and the Theater of the Absurd.

3 units, given 1975–76

134A. Art and Utopia—Thematic reading and discussion of specific works from Kant and Schiller to Freud and Marcuse which deal with the dynamic function of aesthetics in political theory.

3 units, Aut (Flores)

137A. Nazism and Literature—Reading and discussion of the thematic treatment of Nazism and its after-effects in fiction, drama, and poetry by such writers as Thomas Mann, Brecht, Frisch, Böll, Grass, Rolf Hochhuth, Nelly Sachs, Paul Celan, Peter Weiss, and Jakov Lind. Analysis of the impact of Nazism on postwar literature and culture.

3 units (Mason) given 1975–76

148A. Austria from 1848 to the Present—A Political, Social, and Cultural History.

(Same as 248A.)

3 units, Spr (Frank)

248A. Austria from 1848 to the Present—A Political, Social, and Cultural History.

(Same as 148A.)

3 units, Spr (Frank)

GERMAN COURSES

UNDERGRADUATE COURSES

(1–199)

First- and second-year language courses are under the direction of Gertrude Mahrohlz.

Note—Students registering for the first time in a first- or second-year course must take a placement test if they have had any work in German before entering Stanford.

1. First-Year German.

5 units, Aut, Win, Spr, Sum (Staff)

1P. First-Year German—Individually programmed beginning German. Students proceed at their own speed.

2 to 5 units, Aut, Win, Spr (Staff)

2. First-Year German—Continuation of 1.

5 units, Aut, Win, Spr (Staff)
2B. German Conversation — (For students going abroad; open to others.) Prerequisite: 1.
   3 units, Aut (Staff)
   Spr (Staff)

2P. First-Year German — Individually programmed beginning German. Students proceed at their own speed.
   2 to 5 units, Aut, Win, Spr (Staff)

3. First-Year German—Continuation of 2.
   5 units, Aut, Win, Spr (Staff)

3P. First-Year German — Individually programmed beginning German. Students proceed at their own speed.
   2 to 5 units, Aut, Win, Spr (Staff)

5. Intensive First-Year German—Equivalent of 1, 2 and 3 combined. Enrollment limited.
   12 units, Sum (Staff) MTWThF 8:00-9:30 and 10:30-12:00

10. Elementary German for Seniors and Graduate Students — An accelerated course for beginners who want to learn how to read expository German. No auditors permitted.
   4 units, Win (Mahrholz) MTWTh 9
   Sum (Staff) MTWThF 9

51. Second-Year German — This course introduces the student to a wide variety of contemporary German prose. Speaking and writing are emphasized as well as listening and reading. Prerequisite: 3.
   5 units, Aut, Win, Spr (Staff)

52. Second-Year German—Continuation of 51. This course broadens the scope of 51 by including poetry and expository prose.
   5 units, Aut, Win, Spr (Staff)

53. Second-Year German—Continuation of 52.
   5 units, Win, Spr (Staff)

61T-63T. These courses are normally taken in the first year of the translator's program. May also be taken by students not in the program if space permits. Prerequisite: 3.
   61T. German for Translators.
   5 units, Aut (Staff)
   62T. German for Translators.
   5 units, Win (Staff)
   63T. Problems of Translation.
   5 units, Spr (Staff)

80-86. Intensive German — Given only at Overseas Studies Centers.
   Aut, Win, Spr

100. Listening and Speaking—Listening to original recorded material such as radio programs, plays and lectures. Discussion and oral presentation of assigned topics. Course may be taken twice for credit. Prerequisite: 52 or equivalent.
   3 units, Spr (Schulz)

101. Composition I—Prerequisite: 52 or consent of instructor.
   3 units, Aut (Mahrholz)

102. Composition II—Continuation of 101.
   3 units, Win (Mahrholz)

105. German Newspapers — Current newspapers from East and West Germany will be read and discussed in German. This course may be taken twice for credit. Prerequisite: 51 or equivalent.
   3 units, Aut (Staff)
   Spr (Hutschneider)

111-119. The subject matter of these courses will change from year to year. Students will read original German texts in various disciplines. Prerequisite: 52 or consent of instructor.

111. Readings in German History.
   3 units, given 1975-76

112. Readings in German Art History.
   3 units, Spr (Snow)

113. Readings in Political Science.
   3 units, given 1975-76

114. Readings in German Psychology.
   3 units, given 1976-77

116. Readings in German Philosophy.
   3 units, given 1976-77

117. Readings in German Music.
   3 units, given 1975-76

118. Readings in German Linguistics.
   3 units, given 1976-77

141-149. Courses in the 140-series introduce the student to German literature in various genres and to German culture. Prerequisite: 51 or equivalent.

141. Poetry from Goethe to Nietzsche.
   4 units, given 1975-76

142. Poetry from Nietzsche to the Present.
   4 units, Spr (Flores)
143. Drama from Storm and Stress to Expressionism.  
4 units, Win (Mason)

144. Drama from Expressionism to the Present.  
4 units, given 1975–76

145. The Novelle.  
4 units, Aut (Rumold)

146. Modern Fiction.  
4 units, given 1975–76

147. Zentren der deutschen Kultur.  
4 units, Win (Schulz)

151–153. These courses acquaint the student with the development of German literature from the Enlightenment to the present. Significant works of each period are studied intensively and related to their historical context. Prerequisite: 52 or consent of instructor.

151. The Classical Period.  
4 units, Aut (Mason)

152. Romanticism and Realism.  
4 units, Win (Rumold)

153. From Naturalism to the Present.  
4 units, Spr (Mommsen)

161T. Translation of Texts in the Social Sciences.  
3 units, Aut (Lieder)

162T. Translation of Texts in the Social Sciences.  
3 units, Win (Lieder)

163T. Documentary Translation.  
3 units, Spr (Lieder)

199. Individual Reading—Enrollment only by special permission of Department. Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit. Prerequisite: 3 or consent of instructor.

1 to 2 units, Aut, Win, Spr (Staff)  
by arrangement

ADVANCED AND GRADUATE COURSES  
(200–299)

201. Language and Style II—Continuation of 201.  
2 units, Spr (Schulz)

202. Language and Style II—Continuation of 201.  
2 units, Spr (Schulz)

204. History of the German Language—Introductory course on the phonological and syntactic development of Modern German from the Germanic parent language. Involves both the analysis of selected texts and the consultation of linguistic works on the subject.  
3–5 units, Aut (Robinson)

205. Syntax of Modern German—Contrastive analysis of English and German syntax.  
3–5 units (Lohnes)

206T. Advanced Translation.  
3 units, Aut (Lieder)

207T. Translation Seminar.  
3 units, Win (Lieder)

208T. Translation Seminar.  
3 units, Spr (Lieder)

209T. Introduction to a Note-Taking System.  
1 unit, Aut (Lieder)

212. Introduction to Old Norse—(Same as 312, English 200A.) Introduction to the language; reading of selected texts.  
5 units, given 1975–76

213. Old Icelandic Sagas—(Same as 313, English 200B.) Study of the sagas; reading of one or more in the original. Prerequisite: 212.  
5 units, given 1975–76

214. Old High German—(Same as 314.) Introduction to the early documents of High German.  
3–5 units, Win (Robinson)

222. Linguistics and the Analysis of German—(Same as 322, Linguistics 284.) An introduction to linguistic theory and analysis, with special emphasis on the analysis of Modern German.  
3–5 units (Robinson) given 1975–76

225. Linguistics Colloquium: Topics in German Linguistics—(Same as 325, Linguistics 380.) Specific topics determined by student interest. May include any aspect of modern German linguistics.  
3–5 units, Spr (Robinson)
227. Medieval Thought and Literature—
   (Same as 327.)
   3–5 units, Win (Snow)

228. Middle High German.
   3–5 units, Aut (Snow)

229. Readings in Middle High German—
   Prerequisite: 228.
   3–5 units (Foulkes) given 1975–76

230. Deutschland: Ost und West — Eine
   Einführung in die Probleme des zeitgenössischen
   Deutschlands an Hand von deutschsprachigen
   Dokumenten und literarischen Beiträgen.
   3–5 units, given 1975–76

241–243. These courses introduce the student to the
   continuum of German intellectual and cultural history, and its
   relationship to the intellectual life of the other nations of
   Europe from the 18th century to the present. Emphasis is given to authors whose
   ideas have had a significant influence on shaping the thinking of our modern world.
   Prerequisite: 52 or consent of instructor.

   241. Deutsche Geistesgeschichte I—Von
   der Aufklärung zur Romantik.
   3–5 units, Aut (Mueller-Vollmer)

   242. Deutsche Geistesgeschichte II—Von
   der Romantik bis Nietzsche.
   3–5 units, Win (Flores)

   243. Deutsche Geistesgeschichte III —
   Von Nietzsche zur Gegenwart.
   3–5 units, Spr (Rumold)

251. Renaissance and Reformation—(Same as 355.)
   Readings in fifteenth and sixteenth-century poetry, drama, fiction, and polemics;
   special attention to such topics as late medieval trends, the impact of Humanism
   and Protestantism, the development of genres out of national and international
   heritages, and Renaissance mysticism, syncretism, and nature philosophy.
   3–5 units, Aut (Gillespie)

252. From Baroque to Enlightenment—
   (Same as 356.) Readings in literary renewal,
   experimentation, and theorizing of the seventeenth century; analysis of masterworks
   of the lyric from Opitz to Günther, and of Baroque world theatre, romance, and novel;
   study of themes (e.g., theodicy, reason, sentiment) and modes (e.g., metaphysical, man-
  nerist, baroque, neo-classical, rococo) on the threshold of the Enlightenment.
   3–5 units, Win (Gillespie)

254. European Novel I—Renaissance to
   Pre-Romantic. (Same as 333, Comparative
   Literature 333.) Theory and practice of prose
   fiction in Europe from Rabelais and Cervantes to Sterne and the young Goethe; study
   of the evolution of form, subject matter, and terminology in the romance and novel.
   3–5 units, Spr (Gillespie)

255. Goethe—(Same as 335.)
   3–5 units, Win (Mommsen)

256. Schillers Dramen—(Same as 336.)
   3–5 units, Win (Mommsen)

259. Rilke und Hofmannsthal.
   3–5 units (Mason) given 1975–76

261. Kafka.
   3–5 units (Foulkes) given 1975–76

263. Thomas Mann.
   3–5 units, given 1975–76

265. Brecht.
   3–5 units, Win (Flores)

   3–5 units given 1975–76

272. Problems in 19th-Century German Literature.
   3–5 units (Foulkes) given 1975–76

275. Deutsche Literatur in Ost und West—
   (Same as 346.)
   3–5 units, Aut (Flores)

276. Law in East and West Germany—
   (Same as Law 307, Political Science 175.)
   Analysis of the legal systems of East versus
   West Germany with special emphasis on the
   typical ways in which a socialist state differs
   from a bourgeois state in the use of law as
   a means of social transformation. We will
   focus in particular on those areas of law
   which either directly confront the individual
   with state authority or require a ranking be-
   tween state and individual interests.
   3 units, Aut (I. Markovits)

279. Moderne Lyrik—(Same as 340.)
   3–5 units, Aut (Rumold)

290. Senior Seminar: Manners, Morals, and
Mores in the Middle Ages—A survey of political, social, and cultural life in the most fascinating period in Western history; we will examine heresies, philosophies, superstitions, great women, great men, witches, mystics, crusaders, scholars, artists, scientists; the roles played by the church, feudalism, medieval technology, economics, and education in interpersonal relations between king and subject, master and man, husband and wife. Some of the outstanding figures of the age—Abelard and Heloise, St. Augustine, John of Salisbury, Thomas Aquinas, Eleanor of Aquitaine, Friedrich Barbarossa, etc.—will be discussed against a background of the art, architecture, and music of the period. Audio-visual aids will supplement the readings and lectures.

3–5 units, Spr (Snow)

299. Individual Work—Open only to German majors and to students who are working on special projects. Students taking honors in German will use this number for the honors essay. May be repeated for credit.

1 to 15 units, each quarter (Staff)

by arrangement

299B. Individual Work — Exclusively for Bonn University courses completed by undergraduate students in the Stanford Bonn Program.

By arrangement

Graduate Courses

(300–400)

300. Proseminar.

3–5 units, Aut (Mueller-Vollmer)

300A. Introduction to Bibliographical Research—The purpose of this course is to improve the research capabilities of its participants in a subject area noted for the scope, variety, and sophistication of its bibliographical apparatus. Focus will be on both a knowledge of the available bibliographical resources and skill in assessing information by their means. Open to qualified students from every department, and adaptable to individual research needs.

3 units, Win (Frank)

301. Individual Work — Exclusively for graduate students in German working on thesis or engaged in special work.

1–12 units, Aut, Win, Spr (Staff)

by arrangement

301B. Individual Work — Exclusively for Bonn University courses completed by graduate students in the Stanford Bonn Program.

By arrangement

Language Studies (302–325)

302. Methods of Teaching German—(Same as Education 291.)

2 units, Spr (Lohnes)

303. Curricular Problems — Given on request only.

3 units (Lohnes) by arrangement

304T. Advanced Documentary Translation

— Texts will be taken from the fields of business, economics, law, science, and technology.

3 units, Aut (Lieder) by arrangement

305T. Advanced Documentary Translation

— Continuation of 304T.

3 units, Win (Staff) by arrangement

306T. Advanced Documentary Translation

— Continuation of 305T.

3 units, Spr (Staff) by arrangement

307T. Interpretation—Interpretation of conversations and negotiations; introduction to consecutive and simultaneous interpretation; conference terminology and parliamentary procedure; writing of reports and précis.

3 units, Aut (Staff) by arrangement

308T. Interpretation — Continuation of 307T.

3 units, Win (Lieder) by arrangement

309T. Interpretation — Continuation of 308T.

3 units, Spr (Lieder) by arrangement

312. Introduction to Old Norse—(Same as 212., English 200A.) Introduction to the language; reading of selected texts.

5 units, given 1975–76

313. Old Icelandic Sagas—(Same as 213., English 200B.) Study of the sagas; reading of one or more in the original. Prerequisite: 312.

5 units, given 1975–76

314. Old High German—(Same as 214.) In-
roduction to the early documents of High German.

3-5 units, Win (Robinson)

319. Early New High German—Introduction to the language and literature 1350-1600. Prerequisite: 228.

3-5 units, Spr (Staff) given 1975-76

322. Linguistics and the Analysis of German—(Same as 222, Linguistics 284.) An introduction to linguistic theory and analysis, with special emphasis on the analysis of Modern German.

3-5 units (Robinson) given 1975-76

325. Seminar: Topics in German Linguistics—(Same as 225 and Linguistics 380.) Specific topics determined by student interest. May include any aspect of modern German linguistics.

3-5 units, Spr (Robinson)

GERMAN LITERATURE (326-350)

326. Problems of Teaching Literature—Students may enroll for practice in literature teaching on a voluntary basis.

1 to 3 units, Aut, Win, Spr (Staff) by arrangement

327. Medieval Thought and Literature—(Same as 227.)

3-5 units, Win (Snow)

329. Gottfried von Strassburg — Prerequisite: 228.

3-5 units, given 1975-76

331. Mittelhochdeutsche Lyrik—Des Minnesangs Frühling und Walther von der Vogelweide. Prerequisite: 228.

3-5 units, given 1976-77

333. European Novel I—Renaissance to Pre-Romantic. (Same as 254, Comparative Literature 333.)

3-5 units, Spr (Gillespie)

335. Goethe—(Same as 255.)

3-5 units, Win (Mommsen)

336. Schillers Dramen—(Same as 256.)

3-5 units, Win (Mommsen)

340. Moderne Lyrik—(Same as 279.)

3-5 units, Aut (Rumold)

346. Deutsche Literatur in Ost und West—(Same as 275.)

3-5 units, Aut (Flores)

350. Seminars—All seminars dealing primarily with creative literature will be listed under this number. These seminars may also be taken as colloquia.

350C. Thomas Mann.

3-5 units, Spr (Mommsen)

GERMAN THOUGHT AND LITERATURE (351-400)

351. German Literature—Problems of Interpretation. Topic by arrangement with instructor.

3-5 units (Staff) by arrangement

355. Renaissance and Reformation—(Same as 251.)

3-5 units, Aut (Gillespie)

356. From Baroque to Enlightenment—(Same as 252.)

3-5 units, Win (Gillespie)

360. Religionskritik im 19. Jahrhundert—(Same as Modern Thought and Literature 373.)

3-5 units (Bark) given 1975-76

382. German and European Romanticism—(Same as Comparative Literature 382 and Modern Thought and Literature 374.)

3-5 units (Mueller-Vollmer)

given 1976-77

400. Seminars—All seminars in German Thought and Literature will be listed under this number. These seminars may also be taken as colloquia.

Methodenlehre der Literaturwissenschaft—(Same as Comparative Literature 400, Modern Thought and Literature 376.)

3-5 units, Spr (Mueller-Vollmer)

HISTORY

Emeriti: Thomas A. Bailey, William C. Bark, Carl F. Brand, Claude A. Buss, Harold H. Fisher, David Harris, George H. Knoles, Anatole G. Mazour, John C. Miller, Edgar E. Robinson (Professors). Rixford K. Snyder (Associate Professor)

Chairman: Gordon A. Craig


Associate Professors: Barton J. Bernstein, Frederick P. Bowser, Philip Dawson, Peter Duus, Terence Emmons, Harold Kahn, David M. Kennedy, Gavin I. Langmuir, Mark I. Mancall, Paul Robinson, Paul S. Seaver, Lyman P. Van Slyke, John D. Wirth (on leave 1974-75)


Lecturers: James C. Cole, George S. Rentz

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 duties as a citizen and to give instruction which will aid 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.

PROGRAMS OF STUDY

BACHELOR OF ARTS

The Department's program for the undergraduate major in history emphasizes breadth of training yet allows students to concentrate their studies in a selected field of history.

As a foundation requirement, each candidate for the A.B. in History: (1) should be enrolled in the Department for six quarters (counting the quarter in which the registration takes place), (2) should complete one small group course — undergraduate colloquium (reading and discussion involving an explicit historical theme) or undergraduate seminar (introduction to the principles of historical research), (3) and should complete at least ten courses in history with a minimum of three units each. Directed reading may not count toward the ten required courses in history.

To emphasize broad coverage in space and time, it is required that at least two courses must be completed in each of the following three fields: (a) Western Europe (including Britain) and North America (especially the colonial and national history of the present United States), all since 1700; (b) Africa and the Middle East, Asia, Latin America, Russia, and Eastern Europe; (c) the period before 1700, with at least one course in the field of Western Europe before 1700. No single course may be counted to fulfill more than one of these three fields. Western Civilization courses may not be used to meet the field requirement. Colloquia may meet the field requirement; the instructor may designate the field for which the colloquium is appropriate. The Department issues a detailed list indicating how each specific course is classified as to field.

Also, all History majors will be expected to demonstrate proficiency in a foreign language (the completion of at least 20 units of a single language at the college level or equivalent, e.g. passing a placement examination). Statistics 60, 61, 62 plus Computer Science 105 may be offered in place of a foreign language. There is no minor requirement for the A.B. in History.

HONORS PROGRAM IN HISTORY

For a limited number of undergraduate majors, the Department offers a special program of senior research leading to Honors in History. Students accepted for this program, in addition to fulfilling the general requirements stated above, will complete a 15-unit senior essay, the work for which will normally begin in spring quarter of the junior year and be completed by the end of winter quarter of the senior year. Much of the work of the first quarter will be of the nature of directed reading under the guidance of an essay adviser to provide an opportunity for background reading and formulation of the essay topic. To enter this program the student must be accepted by a member of the Department who will agree to advise him or her on the essay. In considering an applicant for such a project, the adviser and the director of the Honors Program will take into account the student's general preparation in the field of the project, will normally require that the student have completed or take at the beginning of Honors a research seminar in History, and will expect at least a B average in the student's previous work, both in history and in the University. Students satisfactorily completing the program will be eligible for Honors in History, depending upon the quality of work performed. For more detailed infor-
Situation, apply to Professor Barton J. Bernstein, Director of the Honors Program. James Birdsell Weter prizes may be awarded each year to students who submit outstanding essays.

**History in the Secondary Teacher's Credential**

Applicants for the Stanford Secondary Teacher's Credential in the social studies may get details of the requirements by applying to the Credential Secretary, School of Education.

**Co-Terminal A.B. and A.M. Program in History**

The Department admits each year a limited number of undergraduate History majors to work for a co-terminal A.B. and A.M. degree in History. Applications for admission to this program should be submitted during the Spring Quarter of the student's junior year and must be submitted no later than November 1 of his or her senior year. Applicants will be screened by a committee of three members of the History Department faculty, including the Director of Graduate Study. Students must meet all requirements for both degrees. They must complete 15 full-time quarters (or the equivalent) or 3 full quarters after completing 180 units for a total of 216 units. During their senior year they may, with the consent of the instructors, register for as many as two graduate courses. During the final year of study they must complete at least three courses that fall within a single Ph.D. field.

**Graduate Study**

**Admission to Graduate Standing**

All applicants for admission to graduate work are required to take the Aptitude Test of the Graduate Record Examination. This examination may be taken at most American colleges and by arrangement may be taken in nearly all foreign countries. For details concerning this test see the Information Bulletin. Overseas applicants, who may not receive the Information Bulletin promptly, should write directly to the Educational Testing Service, Box 955, Princeton, New Jersey 08540.

Students who have been admitted to graduate standing do not automatically become candidates for a graduate degree. With the exception of students in the Terminal M.A. program, they are admitted with the expectation that they will be working toward the Doctor of Philosophy degree, and may become candidates to receive the Master of Arts degree at the end of the first or second year of graduate study.

**Master of Arts**

The Department requires the completion of nine courses (totaling not less than 36 units) of graduate work; at least seven courses of this work must be History Department courses. Of these seven, one must be a graduate seminar, and three must be either graduate colloquia or graduate seminars. Directed reading can be counted for no more than 10 units. A candidate whose undergraduate training in history is inadequate, however, must complete nine courses of graduate work in the History Department. The Department will not recognize for credit toward the A.M. degree any work that has not received the grade of A, B, or plus.

**Terminal M.A. Program**

The Department admits applicants who do not wish to continue beyond the M.A. degree at the discretion of the individual fields (U.S., modern Europe, etc.). Students admitted to this program may not apply to enter the Ph.D. program in History during the course of their work for the M.A. degree.

**Master of Arts in Teaching (History)**

The Department cooperates with the School of Education in offering the Master of Arts in Teaching degree. For the general requirements, see description under section "School of Education" in this bulletin. For certain additional requirements made by the Department of History, inquiry should be made to the History Department Office. Note that this program is open only to those with at least one year's teaching experience. Candidates must possess a teaching credential.

**Doctor of Philosophy**

Students planning to work for the doctorate in history should be familiar with the general degree requirements of the University outlined in the section "Degrees" in this bulletin. Upon enrollment in the graduate program in History, the students will have
member of the department designated as an adviser and should plan the Ph.D. program in consultation with this adviser. During the first two years of graduate study, the students will spend much of the time taking courses, but should be aware from the outset that the ultimate objective is not merely the completion of courses, but the preparation for general examinations and for writing a dissertation.

Admission to the History Department in the Graduate Division does not establish any rights respecting candidacy for an advanced degree, and application must be made separately for admission to candidacy for the A.M. (not later than the end of the first four weeks of the quarter preceding the one at the end of which the degree is to be awarded) and also for the Ph.D. Applicants for the doctoral program must proceed by two steps: First, students must apply for admission to (not candidacy in) the Ph.D. program. Those seeking admission to the program should file application during their third quarter of enrollment in graduate work at Stanford. (Applicants who have already received the A.M. elsewhere should apply as soon as feasible after completion of one quarter at Stanford.) A committee of the Department will then determine either that the applicants shall be admitted to the Ph.D. program or that they must terminate their work in History at Stanford.

Second, after admission to the program and after the completion of certain further requirements, students must apply for acceptance for candidacy for the doctorate in the Graduate Division of the University.

The following requirements must be met:

(1) In consultation with the adviser, students will select a major field of study from the list below in which to concentrate their study and later take the University oral examination. The major fields are:

- Europe, 300–1400
- Europe, 1400–1789
- Europe since 1700
- Russia
- Eastern Europe
- Near East
- Middle East
- East Asia before 1600
- East Asia since 1600
- Africa
- Britain and the British Empire since 1460
- Latin America
- The United States (including Colonial America)

(2) The Department seeks to provide a core colloquium in every major field, in which the students will normally enroll in the first year of graduate study.

(3) Students are required to take two research seminars, at least one in the major field. Normally, research seminars should be taken in the second year.

(4) Students, in consultation with the adviser, define a secondary field lying outside the major field in one of three ways: (a) a field selected from the list given below; (b) one national history from an appropriately early date to the present, but excluding countries (such as the United States) with comparatively short histories; (c) comparative study of a subject across countries or periods.

The secondary fields are as follows:

- The Ancient Greek World
- The Roman World
- Europe, 300–1000
- Europe, 1000–1400
- Europe, 1400–1600
- Europe, 1600–1789
- Europe, 1700–1871
- Europe since 1848
- Russia to 1800
- Eastern Europe to 1800
- Russia since 1800
- Eastern Europe since 1800
- Near East to 1800
- Middle East to 1800
- Near East since 1800
- Middle East since 1800
- Africa
- China before 1600
- China since 1600
- Japan before 1600
- Japan since 1600
- England, 450–1460
- Britain and the British Empire, 1460–1714
- Britain and the British Empire since 1714
- Latin America to 1825
- Latin America since 1810
- The United States (including Colonial America) to 1865
- The United States since 1850

One national history may be selected as a portion of the major field to encompass
much of that country’s history as a secondary field, when that history is sufficiently long to span chronologically two or more major fields. Thus, for example, students choosing Europe since 1700 as a major field may elect France from about 1000 to the present as a secondary field.

The subject matter and scope for a comparative study are to be determined by the students in consultation with the adviser.

Secondary fields (a) and (b) may be completed either by taking two graduate courses relevant to the field, or one such graduate course and a written examination. Field (c) is completed by taking one relevant graduate course and writing a 6,000 word comparative essay acceptable to the student’s adviser. The secondary field must be completed before the students may take the general examination in the major field.

(5) Students should plan in consultation with the adviser a supporting program of courses outside the Department. Although the Department does not prescribe the number, subject matter, or kind of courses, the program should have coherence and either add to the students’ technical competence as historians or broaden their approach to the problems of the research field.

(6) Each student, before the Ph.D. is conferred, is required to teach for one quarter a small class of undergraduates. Normally this will be done in the third graduate year, and, normally, it will consist of leading two weekly discussion sections in a course given by a faculty member.

(7) There is no university or departmental foreign language requirement for the Ph.D. degree. A reading knowledge of one or more foreign languages is required in fields where appropriate. The faculty in the major field prescribes the necessary languages. In no field will a student be required to take examinations in more than two foreign languages; and examinations, administered by the appropriate language departments, must be passed before taking the oral examination in the major field.

(8) The student is expected to take the University oral examination in the major field early in the third graduate year.

(9) The student must complete and submit a dissertation which is the result of independent work and is a contribution to knowledge. It should evidence the command of approved techniques of research, ability to organize findings, and competence in expression. For details and procedural information, please apply to the Department.

JOINT PH.D. IN HISTORY AND HUMANITIES

The Department of History participates in the Graduate Program in Humanities leading to a joint Ph.D. degree in History and Humanities. For description of that program see the section “Humanities Special Programs” in this bulletin.

RESOURCES FOR GRADUATE STUDY

The above section relates to formal requirements, but the success of a student’s graduate program depends in large part upon the quality of the guidance which he receives from the faculty and upon the library resources available. Prospective graduate applicants are advised to study closely the list of History faculty and the course work which this faculty offers. As to library resources, no detailed statement is possible in this bulletin, but areas in which library resources are unusually strong include the following:

The rich, and in some respects unique, collections of the Hoover Institution on the causes, conduct, and results of World War I and World War II are being augmented for the post-1945 period. The materials include government documents, newspaper and serial files, and organization and party publications (especially British and German labor movements 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 contain 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; the personal papers of Herbert Hoover as United States Food Administrator; and the personal papers of other important individuals. 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 Hoover Institution also possesses some of the richest collections available anywhere on the British labor movement, on Eastern Europe, including the Soviet Union, on East Asia (runs of important newspapers and serials and extensive documentary collections, especially for the period of World War II) and on Africa since 1860, including especially French-speaking Africa, the former British colonies, and South Africa.

The University Library maintains strong general collections in almost all fields of history. It has a very large microtext collection, including, for instance, all items listed in Charles Evans' American Bibliography, and in the Short-Title Catalogues of English publications, 1475-1700, and virtually complete microfilmed documents of the Department of State to 1906. It also has a number of valuable special collections in the Bender Room, including the Borel Collection on the History of California, many rare items on early American and early modern European history, the Brasch Collection on Sir Isaac Newton and scientific thought during his time, and other such materials.

INTRODUCTORY COURSES

1. Modern Europe: From the Renaissance to the Enlightenment — An exploration of the birth of modern times in the Renaissance, the Reformation movement, the scientific revolution, and the beginnings of the Enlightenment. While including socioeconomic developments and political events, the emphasis will be upon the thought, religion, and culture of western man, based upon the belief that the loss of history means the loss of identity and that man attains self-knowledge and perspective only from the mirror of history. Three lectures and one two-hour section per week.
   5 units, Win (Craig, Staff) Lectures MTW 9; Sections W 2:15-4:05, Th 8-10 a.m., or Th 4:15-6:05

2. Modern Europe: Enlightened Despotism, Revolution, and the Age of Power and Progress — A survey of the evolution of the European state system after the Thirty Years War: political, social, and intellectual currents in the 18th century, the impact of the French Revolution and the Napoleonic wars upon politics and thought, the evolution of the industrial system in the 19th century and the social problems attendant on it, the mid-century unification movements, and the nature of international society at the zenith of European power. Three lectures and one two-hour section per week.
   5 units, Win (Craig, Staff) Lectures MTW 9; Sections W 2:15-4:05, Th 8-10 a.m., or Th 4:15-6:05

3. Modern Europe: the 20th Century — Although stress, conflict, and confusion mark the history of our time, historians go on trying to impose some structure and sense upon it, attempting to sort out the major trends in Europe's development from about 1890 to the present. The principal focus is on political and social change in the various national societies—on a variety of efforts, both gradualist and revolutionary, to adapt to the so-called mass age. International conflict, its causes and consequences, will receive almost equal time; some attention will be given to the changing intellectual climate. Three lectures and one two-hour section per week.
   5 units, Spr (Wright, Staff) Lectures MTW 9; Sections W 2:15-4:05, Th 8-10 a.m., Th 4:15-6:05

33. Urban Culture from Athens to Florence — A study in the relationship of urban environment to cultural expression in the premodern West. The course will assess the influence of the social and economic conditions prevailing in ancient Athens and Rome, medieval Paris, and Renaissance Florence upon the political, religious, artistic, and philosophical ideas emanating from these centers.
   5 units, Aut (A. Bernstein) MWF1:15, plus sections

65. Medieval Culture: An Interdisciplinary Introduction — (See Medieval Studies.) An introduction to the development of medieval culture through study of some of its salient religious, philosophical, literary, artistic, social, and political characteristics, with emphasis on the connections and tensions between them. Lectures by faculty from various departments and sections conducted by the faculty listed.
   5 units, Spr (Wirth) given 1975-76
   MTW 10; Sections W 2:15-4:05 or Th 2:15-4:05

80. Tradition, Change, and Revolution in Latin America Since 1750 — Designed for the
non-specialist, this introductory course will analyze the historical roots of contemporary Latin America by comparing and contrasting the history of Spanish America with that of Portuguese-speaking Brazil. Emphasis will be on social change and continuity, nation-building and dependency, and the political changes occurring in this first of Third-World areas to achieve sovereignty in modern times.

5 units, (Wirth) given 1975-76

ADVANCED COURSES

Courses numbered 100 through 199 are primarily lecture courses designed for advanced undergraduates.

102A,B. History of Social Theory, 1750 to Present — The course will explore the relationships between the Scientific, Industrial, and French Revolutions and the transformations wrought by these “revolutions” in the 19th and 20th centuries, paying particular attention to the social, intellectual and literary reactions to them and to the social and intellectual movements that embodied those reactions. In addition, it will consider the evolution and validity of the present organization of knowledge, and its effects on our understanding of the past as a response to, and product of, those “revolutions.” The course will be based on a holistic, rather than an atomistic, approach to the history of modern social theory.

102A. History of Social Theory, 1750–1850.
6 units, Aut (Mancall, Franco, Goheen, Hastorf, Woodward) MTWThF 9

102B. History of Social Theory, 1850 to Present — Prerequisite: History 102A is strongly recommended.
6 units, Win (Mancall, Franco, Goheen, Hastorf, Woodward) MTWThF 9

THE ANCIENT WORLD

See Classics, Ancient History Section, courses H102 (History of Greece), H103 (History of Rome), H104 (The Tradition of Hellenism), H113 (The Roman Revolution), H115 Historiography and Ancient History, H160 (Individual Work in Ancient History); all of which are accepted for credit toward a major in history.

MEDIEVAL AND RENAISSANCE EUROPE

107B. 13th Century Europe.
5 units, Spr (A. Bernstein) MTWThF 1:15

5 units, Spr (Langmuir) MTWThF 10

109A. Renaissance Society and Culture.
5 units, Win (Spitz, Forster, Ryan) MTWThF 9

109B. Renaissance Society and Culture.
5 units, Spr (Spitz, Forster, Ryan) MTWThF 9

110. Age of the Reformation.
5 units, Aut (Pauck) MTWThF 10

MODERN EUROPE

117A,B,C. Slavic Civilization — (Same as Slavic Languages and Literatures 117A,B,C and Political Science 117C (Spr).) An interdisciplinary introduction to the political, social, economic, and cultural history of the Slavic peoples of Bulgaria, Czechoslovakia, Poland, Russia, and Yugoslavia from the time of the Slavic migrations to the present. Readings and lectures will stress the similarities and differences among the Slavs themselves as well as the continuing tension of their relationship to the more familiar western experience. Three lectures a week will be offered by faculty from various departments, and one two-hour discussion section will be included as an integral part of the course.
5 units, Aut (Todd, Staff) Lectures MTW, Sections Th or F
5 units, Win (Atkinson, Staff) Lectures MTW, Sections Th or F
5 units, Spr (Triska, Staff) Lectures MTW, Sections Th or F

118A,B. Russian Intellectual History — (Same as Slavic Languages and Literatures 118A,B, Modern Thought and Literature 231A,B.
8 units (Brown, Emmons) given 1975-76

120A. The Development of Modern Russia to 1801.
5 units, Aut (Emmons) MTWTh 9

120B. The Development of Modern Russia, 1801–1917.
5 units, Win (Emmons) MTWTh 9
121. 20th Century Russia.
   4 to 5 units (Lederer) given 1975–76

122A. Russian Foreign Relations, 1700–1917.
   4 to 5 units (Lederer) given 1975–76

122B. Russian Foreign Relations Since 1917.
   4 to 5 units (Lederer) given 1975–76

123A. The Soviet Union: Politics and Society Since 1917—(Same as Political Science 119A.)
   5 units, Spr (Dallin) MTWTh 10

123B. International Communism.
   5 units, Aut (Dallin) MTWTh 10

   4 to 5 units, Spr (Atkinson) MTWTh 1:15

126. Eastern Europe Since 1914.
   4 to 5 units, Win (Vucinich) MTWTh 11

126B. Balkan History Since 1800.
   4 to 5 units (Vucinich) alternate years,
   given 1975–76

128. Germany in the 18th and 19th Centuries.
   5 units, Win (Büscher) MTWTh 10

128A. War and Society.
   5 units, Win (Paret) MTWTh 10

129. Germany in the Twentieth Century.
   4 to 5 units, Spr (Craig) MTWTh 10

130. France in the Age of Absolutism, 1610–1774.
   4 to 5 units (Lougee) given 1975–76

   5 units, Aut (Wright) MTTh 10

134. The Age of Reason and Enlightenment: European Intellectual History in the
   17th and 18th Centuries.
   4 to 5 units, Aut (Lougee) MTWTh 11

135. Diplomatic Revolution of Our Time—
   (See Political Science 135.)
   5 units, Win (Staff) MWTh 11

135C. How Nations Deal with Each Other.
   —(See Political Science 135C.)
   5 units, Aut (Keohane, Staff) MWTh 11

136A. European Intellectual History in the
   Nineteenth Century.
   5 units, Win (Robinson) MTWTh 11

136B. European Intellectual History in the Twentieth Century.
   5 units, Spr (Robinson) MTWTh 11

137. Women in Family, and Society.
   4 to 5 units, Win (Lougee) MTWTh 1:15

138A,B. Problems of Arms Control and Disarmament—(Same as Political Science 138A, B.)
   5 units, Win, Spr (Lewis, Barton, Staff) MTWTh 1:15

THE BRITISH COMMONWEALTH
AND EMPIRE

140. England to 1460.
   5 units, Aut (Langmuir) MTWTh 10

   4 to 5 units (Seaver) given 1975–76

   4 to 5 units, Win (Seaver) MTWTh 11

143. Britain: the 18th Century.
   5 units (Stansky) given 1975–76

144. Britain: the 19th Century.
   5 units, Spr (Stansky) MTWTh 11

   5 units, Aut (Stansky) MTWTh 11

AFRICA

147. Kingdoms of Africa: Society and History.
   4 to 5 units, Spr (Jackson) MTWTh 11

   5 units, Win (Jackson, Irwin) MTWTh 11

148A. The History of West Africa.
   5 units, Aut (Irwin) MTWTh 10

THE UNITED STATES

150. Rise of the American Colonies.
   4 to 5 units, Win (Macphail) MTWTh 11

153. Interpretive Overview of the United States.
   4 to 5 units, Spr (Degler) MTWTh 11

157A. Afro-American History to 1865.
   5 units, Aut (Carson) MTWTh 1:15

157B. Afro-American History Since 1865.
   5 units, Win (Carson) MTWTh 9
158. History of Education in the United States—(See Education 201.)
3 units, Win (Tyack) ThF 11 plus 1 hour by arrangement

159. History of California.
4 units (Fehrenbacher) given 1975–76

160. The American South, 1815–1900.
5 units, Aut (Degler) MTWTh 11

161. Civil War and Reconstruction.
4–5 units, Spr (Fehrenbacher) MTWTh 9

165A, B, C. United States History from the Revolution to the Present—An articulated sequence, general in focus, but with special attention given to political and institutional history. The series as a whole is designed to give students a broad foundation in United States history on which to base further work in history, literature, economics, political science, religious studies, art history, etc. Though the three parts of the series are intended to form an integrated whole, any portion may be taken independently of the others.

165A. The American Revolution and Early National Period from 1740.
4 to 5 units, Aut (Macphail) MTWTh 10

165B. 19th Century America from the War of 1812 to the End of Reconstruction.
4 to 5 units, Win (Fehrenbacher) MTWTh 10

165C. The United States in the 20th Century—1890 to the Present.
4 to 5 units, Spr (Kennedy) MTWTh 10

4 to 5 units (B. Bernstein) given 1975–76

172. American Foreign Policy and the Age of War: World War II and the Cold War.
4 to 5 units (Bernstein) given 1975–76

174. The American Condition in the 20th Century—(Same as English 128.) This course will examine selected works of both fiction and discursive thought that treat the condition of American society since the end of the 19th century. The instructors will attempt to combine the methods of historical and literary study; therefore, the course is particularly recommended for those interested in American studies. Among the works to be considered will be *The Education of Henry Adams*, Theodore Dreiser’s *An American Tragedy*, and Daniel Bell’s *The Radical Right*.
5 units, Aut (Kennedy, Chace) MWF 9

LATIN AMERICA

176. Latin America to 1825.
4 to 5 units, Aut (Bowser) MTWTh 11

177. Modern Latin America.
4 to 5 units, Win (Johnson) MTWThF 1

179. History of Mexico.
4 to 5 units, Spr (Johnson) MTWThF 1

180B. Modern Brazil, 1750–Present.
5 units (Wirth) given 1975–76

182. Latin America and the African.
4 to 5 units, Win (Bowser) MTWTh 10

MIDDLE EAST

186. Ottoman Empire.
4 to 5 units, Aut (Vucinich) MTWTh 11

3 to 5 units, Spr (Rentz) MWF 11

3 to 5 units (Rentz) given 1975–76

EAST ASIA

190. Imperialism and the International Order in Modern East Asia.
4 to 5 units, Aut (Van Slyke, Duus) MTWThF 1:15

192A. China from Earliest Times to the 9th Century.
4 to 5 units, Aut (Kahn) MTWThF 11

192B. China from the 9th to the 19th Centuries—(192A recommended as a prerequisite)
5 units, Win (Cole) MTWThF 11

192C. Modern China: 19th and 20th Centuries—(192A, B recommended as prerequisites)
4 to 5 units, Spr (Van Slyke) MTWThF 11

194A. Japanese History to 1800—Japan from earliest times to mid-Tokugawa. Treatment of political, economic, and cultural
themes, with the transition from a courtier-dominated system to a state and society controlled by warriors the principal concern.

5 units, Aut (Mass) MTWThF 10

194B. The Rise of Modern Japan—A survey of Japanese history from 1800 to 1945, stressing the political, social, and intellectual changes attendant upon Japan’s transformation from a traditional society into a modern state.

4 to 5 units, Win (Duus) MTWThF 10

195. Cultural History of Central Asia—(See Asian Languages 152.)

4 units, Win (Dien) MWF 1:15

196. Chinese Historical Literature in Translation—(See Asian Languages 151.)

4 units, Spr (Dien) MWF 1:15

UNDERGRADUATE SEMINARS AND COLLOQUIA

During 1974–75, a number of colloquia will be offered for undergraduate History majors. Each will ordinarily consist of reading and discussion involving an explicit historical theme. Short papers, reports, and a final examination may be required. A number of undergraduate seminars will also be offered during 1974–75. A seminar differs from a colloquium principally by its concentration on materials and methods of historical research rather than on reading and discussion of a given body of historical literature. The student, in writing a research paper based to a substantial degree upon original sources, will have the opportunity to learn how historians arrive at their conclusions, as well as what the results of their work are. In this sense, the subject matter handled in any given seminar is less important than the process of investigation, analysis, and writing. “How do you know?” becomes more important than “What do you know?” (See Time Schedule each quarter for a more detailed listing.)

Courses numbered 200 through 299 (undergraduate seminars and colloquia) are designed primarily for juniors and seniors majoring in history. Requests for admission to seminars and colloquia involve permission of the instructor.

Courses in senior research are intended primarily (though not exclusively) for Honors candidates engaged in writing senior theses.

200. Honors Reading Course in Comparative History.

5 units each for two quarters, Aut, Win, Spr (Staff) by arrangement

207. Undergraduate Core Colloquium: Medieval History—(Graduates enroll in 307.)

5 units, Aut (A. Bernstein) Th 2:15–4:05

208. Undergraduate Colloquium: The Christianization of Europe.

5 units, Aut (Langmuir) T 2:15–4:05

209. Undergraduate Colloquium: Christian, Islamic, and Jewish Political Philosophies in the Middle Ages—(Same as Medieval Studies 182, Religious Studies 182.) Comparative study of major political philosophers with attention to their differing social and religious backgrounds. Prerequisite: History 65 or permission of instructors.

5 units, Win (L. Berman, A. Bernstein) M 4:15–6:05

211A. Undergraduate Colloquium: The Protestant Reformers: Calvin—(Graduates enroll in 311A.) (Same as Religious Studies 174.)

5 units, Spr (Pauck) TTh 11–12:40

215H. Senior Honors: Research in Medieval History.

1 to 5 units (A. Bernstein, Langmuir) by arrangement

217H. Senior Honors: Research in Renaissance-Reformation History.

1 to 5 units (Spitz) by arrangement

218S. Undergraduate Seminar: Problems in International Communism—(Same as Political Science 130C.) (Graduate students enroll in 420B.)

5 units, Win (Dallin) T 2:15–4:05

219. Undergraduate Colloquium: Problems in Soviet History and Politics—(Graduate students enroll in 326.) (Same as Political Science 126C.)

5 units (Dallin) given 1975–76

219S. Undergraduate Seminar: Soviet Politics and Society Since 1917—(Same as Political Science 126B.)

5 units (Dallin) given 1975–76

220B. Undergraduate Colloquium: Society and the Sexes in Russia.

5 units, Aut (Atkinson) M 2:15–4:05
220S. Undergraduate Seminar: "Crisis of the 17th Century": Europe and Russia.  
5 units, Win (Atkinson) 2:15-4:05

221. Undergraduate Colloquium: 19th-Century Russian Intellectual History.  
5 units, Spr (Emmons) M 2:15-4:05

221S. Undergraduate Seminar: Russian Social Democracy and Marxism.  
10 units, Win, Spr (Naarden) W 2:15-4:05

222A. Undergraduate Colloquium: Non-Russian Peoples of the Soviet Union—(Graduates enroll in 322A.)  
5 units (Vucinich) given 1975-76

223. Undergraduate Colloquium: Soviet Foreign Policy.  
5 units (Dallin) given 1975-76

225. Undergraduate Colloquium: Eastern Europe—(Graduate students enroll in 325.)  
5 units, Spr (Vucinich) T 2:15-4:05

227. Undergraduate Colloquium: Germany Since 1945.  
5 units, Aut (Craig) Th 2:15-4:05

228B. Undergraduate Colloquium: Industrialization and Professionalization in 19th-Century Europe — (Graduates enroll in 328B.)  
5 units, Aut (Büschi) F 2:15-4:05

228C. Undergraduate Colloquium: Constitutional and Parliamentary History of Modern Europe—(Graduates enroll in 328C)  
5 units, Win (Büschi) F 2:15-4:05

229. Undergraduate Colloquium: Art, Politics, and Society — (Same as Modern Thought and Literature 229.) Topics of the course vary from year to year. In 1974-75 the course was devoted to "Irony and realism in 19th-century literary and graphic interpretations of European society." (Graduates enroll in 329A.)  
5 units, Aut (Paret) M 2:15-4:05

229A. Undergraduate Colloquium: Biography and History—(Graduates enroll in 303.) (Same as Modern Thought and Literature 230)  
5 units, Spr (Paret) T 2:15-4:05

229B. Undergraduate Colloquium: Comparative Studies in 18th and 19th Century Europe—(Graduates enroll in 329)  
5 units, Win (Paret) W 2:15-4:05

5 units, Win (Wright) W 2:15-4:05

232B. Undergraduate Colloquium: The European Family in Historical Perspective.  
5 units, Spr (Lougee) W 2:15-4:05

235. Undergraduate Colloquium: Studies in the Enlightenment—(Graduates enroll in 335.)  
5 units, Spr (Lougee) M 2:15-4:05

236. Undergraduate Colloquium: European Socialisms in the Nineteenth and Twentieth Centuries.  
5 units, Aut (Wright) W 2:15-4:05

239H. Senior Honors: Research in Modern European History.  
1 to 5 units (Büschi, Craig, Dallin, Emmons, Lougee, Naarden, Paret, Robinson, Vucinich, Wright) by arrangement

240. Undergraduate Colloquium: Henry VIII and the English Reformation.  
5 units, Aut (Seaver) W 2:15-4:05

241. Undergraduate Colloquium: Religion and Society in Early Modern England—(Graduates enroll in 341A.)  
5 units, Spr (Seaver) Th 2:15-4:05

5 units, Aut (Seaver) F 2:15-4:05

242S. Undergraduate Seminar: Research in Early Modern English Social History—(Graduates enroll in 442.)  
5 units, Win (Seaver) F 2:15-4:05

243A. Undergraduate Colloquium: The World of William Morris—(Graduates enroll in 343A.) (Same as Modern Thought and Literature 232A.)  
5 units, Aut (Stansky) T 2:15-4:05

243B. Undergraduate Colloquium: Into the World of William Morris—(Graduates enroll in 343B.) (Same as Modern Thought and Literature 232B.)  
5 units, Win (Stansky) T 2:15-4:05
244S. Undergraduate Seminar: William Gladstone—(Graduates enroll in 443.)
5 units, Win (Stansky) Th 2:15-4:05

246H. Senior Honors: Research in British History.
1 to 5 units (Seaver, Stansky)
by arrangement

5 units, Aut (Jackson) M 2:15-4:05

5 units, Spr (Irwin) T 2:15-4:05

249H. Senior Honors: Research in African History.
1 to 5 units (Irwin, Jackson)
by arrangement

5 units (Macphail) given 1975-76

250A. Undergraduate Colloquium: Conflict and Consensus in Colonial America.
5 units, Spr (Macphail) M 2:15-4:05

5 units, Spr (Carson) Th 2:15-4:05

254S. Undergraduate Seminar: Afro-American and Other Social Movements in 20th-Century America.
5 units, Aut (Carson) Th 2:15-4:05

259. Undergraduate Colloquium: The Presidency from Washington to Lincoln.
5 units, Aut (Fehrenbacher) W 2:15-4:05

261. Undergraduate Colloquium: America in the 1850's.
5 units, Spr (Fehrenbacher) W 2:15-4:05

263. Undergraduate Colloquium: Women in America—A discussion of the changing status and aspiration of women in the United States in the 19th and 20th centuries. The reading is interdisciplinary.
5 units, Win (Degler) W 2:15-4:05

5 units (B. Bernstein) given 1975-76

269S. Undergraduate Seminar: The Cold War.
5 units (B. Bernstein) given 1975-76

271S. Undergraduate Seminar: War and Society in 20th Century America.
5 units, Win (Kennedy) W 2:15-4:05

275H. Senior Honors: Research in United States History.
1 to 5 units (B. Bernstein, Carson, Degler, Fehrenbacher, Kennedy, Macphail, Tyack) by arrangement

5 units, Spr (Johnson) W 2:15-4:05

280. Undergraduate Colloquium: Dependency in Latin America—The Historical Perspective.
5 units (Wirth) given 1975-76

282. Undergraduate Colloquium: Race Relations in Latin America.
5 units, Spr (Bowser) M 2:15-4:05

285H. Senior Honors: Research in Latin American History.
1 to 5 units (Bowser, Johnson, Wirth)
by arrangement

291A. Undergraduate Colloquium: Modes of Marxian Analysis of Pre-Modern China.
5 units, Win (Kahn) M 2:15-4:05

292A. Undergraduate Colloquium: Traditional Chinese Socio-Political Thought—Focuses on the social and political concerns of Chinese thought from the Chou Dynasty to the late 19th century; does not treat “pure” philosophy, metaphysics, or religion.
5 units, Spr (Cole) W 2:15-4:05

293. Undergraduate Colloquium: Modern Chinese Intellectual History.
5 units, Win (Cole) Th 2:15-4:05

295. Undergraduate Colloquium: Capitalism, Industrialism, and Social Conflict in Modern Japan—Stress will be laid on the social aspects and consequences of the industrialization of modern Japan under a capitalistic economy. Among the topics dealt with are the traditional origins of modern capitalism, state policy and industrialization, the “capitalist spirit” in modern Japan, anti-capitalist movements, development of a working class, the effects of industrialization
on and capitalist development of rural communities.

5 units, Spr (Duus) T 2:15–4:05


5 units, Aut (Van Slyke) by arrangement

297. Undergraduate Colloquium: Comparative Feudalism: Japan and Europe—The study of feudalism as a common political structure in Japanese and European medieval history. Emphasis will be on the early stages of feudal growth, especially the Kamakura and Carolingian periods. Feudalism will be viewed as a logical, even efficient, way of organizing a society moving in the direction of localism.

5 units, Win (Mass) T 2:15–4:05

299H. Senior Honors: Research in East-Asian History.

1 to 5 units (Cole, Duus, Kahn, Mass, Van Slyke) by arrangement

GRADUATE COURSES

Courses numbered 300–399 are intended primarily for first-year graduate students, but other graduate students may be admitted by consent of the instructor.

301. Graduate Colloquium on the Historiography of American Education—(Same as Education 301.)

3 to 5 units, Aut (Tyack) Th 9–11 and by arrangement

302. Graduate Colloquium: History of American Urban Education—(Same as Education 302.)

4 to 5 units, Win (Tyack) W 9–11 and by arrangement

Spr (Tyack) W 7–9 p.m.
and by arrangement

303. Graduate Colloquium: Biography and History—(See 229A.)

5 units, Spr (Paret) T 2:15–4:05

304A,B. Historiography of Colonial Latin America.

10 units, Aut, Win (Bowser)
Th 2:15–4:05

307. Graduate Core Colloquium: Medieval History—(See 207.)

5 units, Aut (A. Bernstein)
Th 2:15–4:05

311. Graduate Colloquium: The Protestant Reformers: Calvin—(See 211A.)

5 units, Spr (Pauck) TTh 11–12:40

312. Graduate Colloquium: Latin Palaeography and Codicology.

5 units, Win (A. Bernstein) Th 2:15–4:05

314D. Directed Reading in Medieval History.

Units by arrangement (A. Bernstein, Langmuir)

315H. Graduate Research in Medieval History.

Units by arrangement (A. Bernstein, Langmuir)

316D. Directed Reading in Renaissance and Reformation.

Units by arrangement (Spitz)

322A. Graduate Colloquium: Non-Russian Peoples of the Soviet Union.

5 units (Vucinich) given 1975–76

323. Graduate Colloquium: Russian History (to be followed by 421).

5 units (Emmons) by arrangement

324. Graduate Colloquium: The Origin and Development of Nationalism in Eastern Europe.

5 units (Lederer) given 1975–76

325. Graduate Colloquium: Eastern Europe—(See 225.)

5 units, Spr (Vucinich) T 2:15–4:05

326. Graduate Colloquium: Problems in Soviet History and Politics—(Same as Political Science 226C.)

5 units (Dallin) given 1975–76

328A. Graduate Colloquium: Art, Politics and Society—(See 229.)

5 units, Aut (Paret) M 2:15–4:05

329A. Graduate Colloquium: The History of Military Thought, Institutions, and Policy.

5 units (Paret) given 1975–76

329B. Graduate Colloquium: Comparative Studies in 18th and 19th Century Europe—(See 229B.)

5 units, Win (Paret) W 2:15–4:05
335. Graduate Colloquium: Studies in the Enlightenment—(See 235.)
    5 units, Spr (Lougee) M 2:15-4:05

336. Graduate Colloquium: Latin Europe, 19th and 20th Centuries.
    5 units, Win (Wright) M 2:15-4:05

337. Graduate Colloquium: European Intellectual History Since the Enlightenment—
    (Same as Modern Thought and Literature 337.)
    5 units, Aut (Robinson) W 2:15-4:05

338D. Directed Reading in Modern European History.
    Units by arrangement (Büschi, Craig, Dallin, Emmons, Lougee, Naarden, Paret, Robinson, Vucinich, Wright)

339H. Graduate Research in Modern European History.
    Units by arrangement (Büschi, Craig, Dallin, Emmons, Lougee, Naarden, Paret, Robinson, Vucinich, Wright)

341A. Graduate Colloquium: Religion and Society in Early Modern England — (See 241.)
    5 units, Spr (Seaver) Th 2:15-4:05

341B. Graduate Colloquium: Society and Politics in Early Modern England—(See 241B.)
    5 units, Aut (Seaver) F 2:15-4:05

343A. Graduate Colloquium: The World of William Morris—(See 243A.)

343B. Graduate Colloquium: Into the World of William Morris—(See 243B.)
    5 units, Aut (Stansky) T 2:15-4:05

345D. Directed Reading in British History.
    Units by arrangement (Seaver, Stansky)

346H. Graduate Research in British History.
    Units by arrangement (Seaver, Stansky)

348. Graduate Colloquium: West African History.
    5 units, Aut (Irwin) W 2:15-4:05

348B. Graduate Core Colloquium: The Interpretation of African History.
    5 units, Win (Jackson) by arrangement

349D. Directed Reading in African History.
    Units by arrangement (Irwin, Jackson)

349H. Graduate Research in African History.
    Units by arrangement (Irwin, Jackson)

    5 units, Win (Macphail) M 2:05-4:05

351A,B,C. Joint Graduate Colloquium in American History.
    30 units, Aut, Win, Spr (B. Bernstein, Carson, Degler, Fehrenbacher, Kennedy, Macphail, Tyack)
    TF 2:15-4:05

352. Graduate Colloquium: Life of the Mind in Colonial America.
    5 units (Macphail) given 1975-76

374D. Directed Reading in United States History.
    Units by arrangement (B. Bernstein, Carson, Degler, Fehrenbacher, Kennedy, Macphail, Tyack)

375H. Graduate Research in United States History.
    Units by arrangement (B. Bernstein, Carson, Degler, Fehrenbacher, Kennedy, Macphail, Tyack)

376. Graduate Colloquium: New Findings in American History—(Open only to Coe Fellows.)
    6 units, Sum (Staff) MTh 2:15-4:05

380. Graduate Colloquium: Latin American History.
    5 units, Win (Johnson) W 2:15-4:05

384D. Directed Reading in Latin American History.
    Units by arrangement (Bowser, Johnson, Wirth)

385H. Graduate Research in Latin American History.
    Units by arrangement (Bowser, Johnson, Wirth)

388D. Directed Reading in the Middle East and in the Islamic World.
    Units by arrangement (Rentz)

390A. Graduate Colloquium: Topics in Modern Chinese History.
    5 units, Aut (Kahn, Van Slyke) W 2:15-4:05
390B. Graduate Colloquium: Topics in Modern Chinese History.
5 units, Win (Van Slyke, Kahn)
W 2:15-4:05

392. Graduate Colloquium: Topics in Chinese Economic History from Sung to Modern Times.
5 units, Spr (Kahn, Cole) M 2:15-4:05

395A. Graduate Colloquium: Early and Medieval Japan—Readings and discussions grouped around the major historical problems in pre-1600 Japan. Identification and analysis of issues important to the study of a traditional society will be stressed.
5 units, Aut (Mass) T 2:15-4:05

395B. Graduate Colloquium: Early Modern Japan—Readings and discussions centering on the different facets of Tokugawa history. In what way was pre-Perry Japan becoming an increasingly complex and sophisticated society despite its feudal encasement?
5 units, Win (Mass) Th 2:15-4:05

395C. Graduate Colloquium: Modern Japan—from the early 19th century to the 1930's.
5 units, Spr (Duus) Th 2:15-4:05

398D. Directed Reading in East Asian History.
Units by arrangement (Cole, Duus, Kahn, Mass, Van Slyke)

399H. Graduate Research in East Asian History.
Units by arrangement (Cole, Duus, Kahn, Mass, Van Slyke)

ADVANCED GRADUATE COURSES

Courses numbered 400–499 are intended primarily for second- and third-year graduate students, but other graduate students may be admitted by consent of the instructor.

4 to 5 units, Spr (Tyack) by arrangement

407. Graduate Seminar: The University of Paris in the Middle Ages.
5 units (A. Bernstein) given 1975–76

419. Graduate Seminar: 20th Century Russia.
5 units (Lederer) given 1975–76

420B. Graduate Seminar: Problems in International Communism.
5 units, Win (Dallin) T 2:15-4:05

421. Graduate Seminar in Russian History.
(To be preceded by 323.)
5 units, Win, Spr (Emmons, Atkinson) by arrangement

5 units (Vucinich) alternate years; given 1975–76

429. Graduate Seminar: Napoleonic and Restoration Europe.
5 units, Spr (Paret) W 2:15-4:05

440. Graduate Seminar: Medieval History.
5 units, Win (Langmuir) Th evening

442. Graduate Seminar: Research in Early Modern English Social History—(See 242S)
10 units, Win, Spr (Seaver) F 2:15-4:05

443. Graduate Seminar: William Gladstone—(See 244S.)
5 units, Win (Stansky) Th 2:15-4:05

5 units, Spr (Jackson) by arrangement

448A. Graduate Seminar: Colonial Africa.
5 units, Win (Irwin) by arrangement

5 units, Spr (Degler) Th 2:15-4:05

480. Graduate Seminar in Modern Latin American History.
5 units, Aut (Johnson) W 2:15-4:05

5 units, Spr (Bowser) Th 2:15-4:05

490. Graduate Seminar: Modern China: The Republican Period.
5 units, Spr (Van Slyke) by arrangement

5 units, Aut (Cole) by arrangement
493. Graduate Seminar: "Sprouts of Capitalism" in China, Sung to Ch'ing.
   5 units, Win (Kahn) by arrangement

494. Graduate Seminar: Japanese Historical Texts: An Introduction to Komonjo—
   A course on early and medieval documents: where to find them, how to read them, and
   the ways they can contribute to an understanding of Japanese history. Emphasis will
   be on the Kamakura period. Prerequisite: 3 years of Japanese and at least one course in
   Japanese history.
   5 units, Spr (Mass) by arrangement

495. Graduate Seminar: Research in Modern Japanese History.
   5 units, Win (Duus) by arrangement

HUMANITIES SPECIAL PROGRAMS

Emeriti: John W. Dodds, Paul H. Kocher, Philip H. Rhinelander, Jeffery Smith (Professors)
Chairman: Lawrence V. Ryan
Professors: William A. Clebsch (Religious Studies and Humanities), Lawrence V. Ryan (English and Humanities)
Assistant Professors: Robert E. McGinn (Humanities and, by courtesy, Philosophy), Eileen Serene (Philosophy and Humanities)

Humanities Special Programs include:
1. Experimental Courses
2. Honors Program in Humanities
3. Graduate Program in Humanities
4. American Studies
5. Medieval Studies

EXPERIMENTAL COURSES

109A. Renaissance Society and Culture —
   (Same as Art 109A and History 109A.) Civic life and humanism from the 14th to the early
   16th century in Florence, Milan, Urbino, Rome, and Nuremberg. An interdisciplinary
   study of the age of the Renaissance combining art, history, and literature. While 109A
   and 109B are designed as an integrated study of the Renaissance from 1300 to 1600,
   each quarter may be taken separately.
   5 units, Win (Ryan, Forster, Spitz)
   MTWTh 9; sections by arrangement

109B. Renaissance Society and Culture —
   (Same as Art 109B and History 109B.) Protestant and Catholic reform in the high Re-
   naissance in Germany, France, Italy, and England.
   5 units, Win (Ryan, Forster, Spitz)
   MTWTh 9; sections by arrangement

HONORS PROGRAM IN HUMANITIES

Committee in Charge: Lawrence V. Ryan (Director), Mark Edwards, J. Martin Evans, John B. Foster, Jr., David M. Kennedy, Eileen Serene

PURPOSE OF THE PROGRAM

The Humanities Honors Program aims to heighten the student’s sense of the relation between various humanistic disciplines, and to increase awareness of basic humanistic values—intellectual, aesthetic, literary, historical, social, and ethical.

ADMISSION TO THE PROGRAM

Freshmen and Sophomores interested in the Program should consult with the Director or Associate Director. The consultation should take place at the earliest opportunity, preferably during freshman year, and in every case before beginning the junior year.

The Program is open to majors in every field, and may be taken in addition to a departmental major or as a minor.

Students who are admitted to the Program may enroll as Humanities majors:

1. If they are taking the pre-medical curriculum
2. If they choose a major in Humanities concentrating in one of the following:
   (a) American Studies
   (b) Comparative Literature (see p. 284)
3. If they are permitted, upon petition granted by the Honors Committee, to plan a
   40-unit concentration of interdepartmental course work constituting a unified program
   of study.

Students who wish to major in Humanities must enter the Program and plan the concentration before registering for the first quarter of the junior year. Competence in reading a foreign language is required of Humanities majors.
Requirements of the Program

1. Western Thought and Literature—Humanities 61, 62, 63—15 units, freshman or sophomore year. (Students in Comparative Literature see p. 284.)

2. Two Humanities Seminars in the series 190–199—10 units, junior year.

3. Honors Essay — A critical essay on a topic of general importance and approved by the Committee (2 units spring, junior year; 5 units autumn and 5 units winter, senior year). A grade of at least B is required on the essay for graduation with Honors in Humanities.

COURSES

61, 62, 63. Western Thought and Literature — An introduction to fundamental ideas of the past; lectures, discussions, reading of selected masterpieces.


5 units, Aut (A. Raubitschek, Staff) MWF 11; two hours by arrangement


5 units, Win (Evans, Staff) MWF 11; two hours by arrangement


5 units, Spr (Lindenberger, Staff) MWF 11; two hours by arrangement

175. Individual Work—For students in the Humanities Honors Program with definite objectives not met by current course offerings.

2 to 5 units, any quarter (Staff) by arrangement

190–197. Interdepartmental Seminars on the Nature of the Humanities—Students in the Humanities Honors Program are required to complete two of these seminars; other students may enroll in them only by consent of the Director. Prerequisite: two courses in the series Hum. 61, 62, 63.

191. History and the Humanities.

5 units, Spr (P. Robinson) TTh 2:15–4:05

192. The Arts and the Humanities.

5 units, Aut (McGinn) MW 2:15–4:05

193. Philosophy and the Humanities.

5 units, Aut (Serene) TTh 2:15–4:05

194. Literature and the Humanities — (Same as Comparative Literature 194.) The critical study of major texts; theory and practice of criticism.

5 units, Aut (Foster) MW 4:15–6:05


5 units, Win (Clebsch, Kennedy) TF 2:15–4:05

195A. American Studies and the Humanities—(Same as Religious Studies 148A.)

5 units, Aut (Clebsch) TTh 10 plus W 4:15–6:05


5 units, Win (Yearley) MW 2:15–4:05

197. Ethics and International Relations — (Same as International Relations 197.)

5 units, Win (Serene) TTh 2:15–4:05

200A, B, C. Honors Essay—A critical essay of about 15,000 words. Limited to Humanities Honors students.

200A. Submission of Essay Proposal — Preliminary planning and study. Approval of proposal by Committee in Charge required for credit and for continuation in the Program.

2 units (Staff) by arrangement

200B. Continued Study and Writing — Regular meetings with tutor. Prerequisite: 200A.

5 units (Staff) by arrangement

200C. Further Work on Essay—Regular meetings with tutor; submission of complete first draft to tutor by end of quarter. Prerequisite: 200B.

5 units (Staff) by arrangement

GRADUATE PROGRAM IN HUMANITIES

Committee in Charge: Lawrence V. Ryan (Director), Diane G. Burke, William A. Clebsch, William E. King, Robert E. Mc-
Ginn, Kurt Mueller-Vollmer, David S. Nivison, Lewis W. Spitz

The Graduate Program in Humanities supplements the Ph.D. programs of certain Stanford students, especially in Classics, Drama, English, French and Italian, German Studies, History, Modern Thought and Literature, Philosophy, Religious Studies, Slavic Languages and Literatures, Spanish and Portuguese, with an interdepartmental program devoted to the study of the Western tradition as a whole. The degree offered is a joint Ph.D. in “Classics and Humanities,” “English and Humanities,” “German Studies and Humanities,” etc.

Because the Graduate Program in Humanities supplements, and does not substitute for, departmental specialties, its members must be students earning the Ph.D. in an academic department at Stanford.

Application for entrance into the Program should be made to the Director; selections are made to give broad representation to the participating departments. Members of the Program are given first preference in registration for all courses offered by the Program. The normal pattern of the Program involves one Humanities course in each of six successive quarters, but no particular pattern is enforced.

Graduate students who are not members of the Program may enroll, by consent of the Director, in courses whose enrollments are not filled by members of the Program.

Limits: 25 in Humanities 301-305; 18 in Humanities 306.

REQUIREMENTS

1. Continued satisfactory work in the student’s major field, in accordance with Departmental requirements.

2. Completion of the five historical courses (Humanities 301-305) in the Western Tradition series, for any one or two of which equivalent academic work may be substituted, if approved by the Committee in Charge; completion of Humanities 306, unless special exemption is given by the Committee in Charge.

3. Regular attendance and active participation in the bi-weekly Humanities Colloquium (Hum. 353) for at least one academic year, for which three units of credit are required and six units may be earned.

4. At least one quarter of teaching for the Humanities Department is required, but teaching of a similar sort may be substituted for this requirement by petition to the Committee in Charge.

5. Reading knowledge of at least one foreign language, ancient or modern.

6. Passing the University Oral Examination, with one representative of the Graduate Program in Humanities designated by the Director, as a member of the examining committee.

7. Submission of a Ph.D. dissertation that is acceptable to a committee which includes one representative of the Graduate Program in Humanities, designated by the Director.

COURSES

251. Basic Humanistic Problems—Open to graduate students and to advanced undergraduates with consent of the instructor; required of M.A.T. candidates whose teaching field is Humanities.

4 units, given 1975-76

275. Directed Reading.

2 to 5 units (Staff) by arrangement

301, 302, 303, 304, 305, 306. The Western Traditions—Required of students in the Graduate Program in Humanities. Open to other graduate students only by consent of the Director.

301. The Classical Period.

4 units, Aut (Spofford) TTh 4:15-6:05

302. The Roman and Early Christian Period.

4 units, Win (A. Raubitschek) TTh 4:15-6:05

303. The Middle Ages.

4 units, Spr (Serene) TTh 4:15-6:05

304. The Renaissance.

4 units, Aut (Ryan) MW 4:15-6:05

305. The Early Modern Period.

4 units, Win (Halliburton) MW 4:15-6:05

306. Modernism and the Consciousness of the Humanities—Normally taken after completion of 301-305.

4 units, Spr (Mueller-Vollmer) MW 4:15-6:05

353. The Humanities in the University—How the humanistic disciplines bear upon one another and upon other aspects of re-
search and higher education. A three-quarter colloquium of limited enrollment, required of students in the Graduate Program in Humanities. Prerequisite: Enrollment in or completion of one or more of the series Humanities 301–306.

1 or 2 units, Aut, Win, Spr (Clebsch) by arrangement

AMERICAN STUDIES

Steering Committee: William A. Clebsch, Convener (Religious Studies and Humanities); Henry S. Breitrose (Communication); William Chace (English); Albert H. Hastorf (Psychology); and David M. Kennedy (History).

Members of the Humanities Honors Program may major in Humanities with a concentration in American Studies by meeting the requirements of the Honors Program, including Humanities 195 as one of the junior seminars, completing 40 units of study in approved courses in American Studies, and writing the Honors Essay on an approved topic in American Studies. Students who are not members of the Honors Program may petition through the Academic Information Center for interdepartmental majors in American Studies, utilizing a list of approved courses.

MEDIEVAL STUDIES

Committee in Charge: Alan E. Bernstein, Chairman; Robert Ball, Gavin I. Langmuir, Suzanne Lewis, Lee H. Yearley.

Affiliated Faculty: Robert Ball (Spanish and Portuguese), Rina Benmayor (Spanish and Portuguese), Lawrence V. Berman (Religious Studies), Alan E. Bernstein (History), Emerson Brown (English), George H. Brown (English), Phillip Damon (English), John Freccero (French and Italian), Joseph C. Harris (English), Gavin I. Langmuir (History), Michael Leone (French and Italian), Suzanne Lewis (Art), William Mahrt (Music), Eleanor Prosser (Drama), George S. Rentz (History), Eileen Serene (Philosophy and Humanities), Ann Snow (German Studies), William Todd III (Slavic Languages and Literatures), W. Wesley Trimp (English), Wayne Vucinich (History), Lee H. Yearley (Religious Studies).

BACHELOR OF ARTS

The Medieval Studies Major is designed to provide students with an interdisciplinary program concentrating upon the European Middle Ages as a civilization, culture, or period in its own right. The major would normally be declared by the beginning of the student’s third year. To help students develop their own syntheses and methods, the faculty will undertake to provide two types of interdisciplinary courses in Medieval Studies: first, “Medieval Culture: An Interdisciplinary Introduction,” and second, a number of upper level courses conducted by two or more professors from different disciplines. In addition, a faculty advisor will help each student choose courses that complement the interdisciplinary core of the program, while still providing depth in one area. To that end the following guidelines are provided.

Each student will take a minimum of ten courses dealing directly with the Middle Ages and distributed as follows:

The introductory course, Medieval Studies 65, “Medieval Culture”
Two upper level interdisciplinary courses in Medieval Studies
Four courses in one of the following categories:
   I. Literature
      A. English
      B. German and Scandinavian
      C. French
      D. Spanish
      E. Italian
      F. Slavic
      G. Latin
   II. History
   III. Art History, Drama, Music
   IV. Philosophy, Religious Studies, Humanities (certain Humanities courses may fulfill requirements within other categories)

Two courses in a second category chosen from the above list.
One course in a third category chosen from the above list.

In addition to the ten courses of the major, a language proficiency equal to two years of college-level study is required in Latin or one of the following: French, German, Spanish, or Italian.
MEDIEVAL STUDIES HONORS PROGRAM

Students wishing to obtain a degree in Medieval Studies with honors, shall attain a language proficiency equal to one year of college-level study either in Latin, if they have fulfilled the first language requirement in a modern language, or in a modern language if the first requirement was met in Latin. In addition, honors candidates shall write an interdisciplinary essay under the direction of one professor and with the collaboration of a second professor from a different discipline. The research and writing will be scheduled as two courses of independent study from each of the two professors and will be equivalent to four four-unit courses.

COURSES

65. Medieval Culture: An Interdisciplinary Introduction—(Same as English 65, German Studies 21A, and History 65.) An introduction to the development of medieval culture through study of some of its salient religious, philosophical, literary, artistic, social, and political characteristics, with emphasis on the connections and tensions among them. Lectures by faculty from various departments and sections conducted by the faculty listed.

5 units, Win (E. Brown, Langmuir)
Lectures MTW 10; Sections W 2:15–4:05 or Th 2:15–4:05

170. Chaucer's England—(Same as English 170).

Given 1975–76

182. Christian, Islamic, and Jewish Political Philosophies of the Middle Ages—(Same as Religious Studies 182 and History 209.) A comparative study of major political philosophers with attention to their differing social and religious backgrounds. Prerequisite: Medieval Studies 65 or consent of instructor(s).

5 units, Win (Berman, A. Bernstein)
M 4:15–6:05

RELATED COURSES

Current courses which are suitable for the Medieval Studies major are listed below; more detailed descriptions of the courses are to be found under the various departmental headings.

ART

104B. Byzantine Art
105B. Romanesque Art
107. Medieval Architecture
108A. Late Medieval Art in Northern Europe
206. Seminar in Medieval Art
206A. Colloquia in Medieval Art
208. Seminar in Medieval Architecture

CLASSICS

208. Post-Classical Latin

DRAMA

152. Medieval and Renaissance Drama

ENGLISH

67B. King Arthur in History, Legend, and Literature
100B. Basic Seminar
102. History of the English Language
110. Earliest English Literature
171. Chaucer
205. Introduction to Old English
211. Readings in Middle English Literature
212A,B. Medieval to Renaissance: the Development of Literary Forms
260. History of Literary Theory
270. Beowulf

FRENCH AND ITALIAN

140. Dante, Inferno
141. Dante, Purgatorio
142. Dante, Paradiso

GERMAN STUDIES

204. History of the German Language
228. Middle High German
214. Old High German
227. Medieval Thought and Literature
290. Senior Seminar: Manners, Morals, and Mores in the Middle Ages

HISTORY

33. Urban Cultures from Athens to Florence
107B. 13th Century Europe
108. The Genesis of Antisemitism
140. England to 1460
208. Undergraduate Colloquium: The Christianization of Europe
297. Comparative Feudalism: Japan and Europe
SCHOOL OF HUMANITIES AND SCIENCES

187. The Islamic World, 622–1258
207. Core Colloquium. Medieval History

HUMANITIES SPECIAL PROGRAMS
62. Christian and Secular Europe: Medieval and Renaissance

MUSIC
30. Introduction to Medieval Music
100. Music History: Medieval and Renaissance
140. Studies in Medieval and Renaissance Music
269A. Studies in Performance Practices: Medieval

PHILOSOPHY
101. Early Christian, Medieval, and Renaissance Philosophy

POLITICAL SCIENCE
151. Political Thought: Augustine to Hobbes

RELIGIOUS STUDIES
123. Judaism
124. Christianity
127. Islam
164. Muhammad and the Koran
171. Augustine

SLAVIC LANGUAGES AND LITERATURES
117A. Slavic Civilization
211. Introduction to Old Church Slavonic and Early Russian Texts
212. History of the Russian Literary Language

SPANISH AND PORTUGUESE
(Spanish)
231. Medieval Poetry
232. Medieval Prose
331. The Spanish Epic and Ballad
334. Libro de Buen Amor and the Courtly Love Tradition

INTERNATIONAL RELATIONS,
SPECIAL OFFERINGS FOR UNDERGRADUATES

Committee in Charge: Committee on International Relations, a subcommittee of the President's Commission on International Studies, Robert O. Keohane (Political Science) Chairman; Frederick Bowser (History); Alexander Dallin (History); Alexander L. George (Political Science); David Halliburton (English); Harry Harding (Political Science); David Kennedy (History); Mark Mancall (History); Gerald M. Meier (Graduate School of Business); John H. Merryman (School of Law); Michael Sullivan (Art); Wayne Vucinich (History); Robert Ward (Political Science); Lee Yearley (Religious Studies)

The Committee on International Relations, composed of faculty members from several disciplines, helps to develop innovative courses, seminars, and colloquia to assist undergraduates to understand the origins and implications of contemporary problems that transcend national boundaries. Courses sponsored by the Committee are taught by faculty in several departments, and are designed to supplement related offerings in a wide variety of departments, institutes, and schools, described in other sections of this catalog. Unless stated otherwise, the courses are open to graduate students with the consent of the instructor.

Members of the Committee on International Relations are available to advise students on work in international relations throughout the university. Although there is no formally constituted academic major in international relations, undergraduates may apply for an Interdepartmental Major in which the study of international relations is emphasized. Students planning interdepartmental majors in international relations are strongly encouraged to undertake some study overseas and to integrate that work with their international relations program on the Stanford campus. For further information, see the statement on Interdepartmental Majors and Overseas Studies sections in this catalog.

For the convenience of students considering work in international relations, quite a few courses in the field not sponsored directly by the Committee are included in this section of the catalog, as well as courses taught by Committee members or developed under the Committee's aegis. The principal criteria for inclusion of courses are three: (1) that the course be primarily designed for undergraduates; and (2) that it deal with international, transnational or intercultural interactions, not merely with various societies in a comparative way; and (3) that it not
deal entirely with one society, even in its foreign relations. By the last criterion, courses on the foreign policies of various states are excluded; they may be found under the listings for history and political science in this catalog.

The Committee on International Relations puts special emphasis on developing courses on international relations that are humanities-oriented, as well as those focused on the traditional subject matters of disciplines such as economics, history and political science. Students' attention is therefore called particularly to these offerings.

The introductory course in international relations at Stanford is “How Nations Deal with Each Other” (History / Political Science 135C). In general, students should enroll in this course before taking substantial further work in the field.

Courses Taught by Present or former Committee Members or That Have Been under Committee Sponsorship

The following courses can be considered Committee offerings, since they are either taught by Committee members or have been developed with Committee support.

How Nations Deal with Each Other—(Enroll in History 135C or Political Science 135C.) A general course in international relations, emphasizing the interaction of political, economic, social and cultural factors. Special attention will be given to problems of international conflict and distribution of wealth. A variety of analytical approaches, drawn from economics, history, political science, and moral philosophy, will be used to develop explanations of events and prescriptions for policy.

5 units, Aut (Keohane)

The Diplomatic Revolution of Our Time—(Enroll in History 135 or Political Science 135.) An investigation of the problems raised by the collapse of the traditional system of Western diplomacy as a result of two world wars, the expansion of the diplomatic community, the breakdown of its homogeneity, the emergence of new nations, tensions between great and small powers, negotiations between states with conflicting national and cultural traditions, the functions and limitations of international organizations, and the new dimensions of diplomacy that have emerged since 1945.

4 to 5 units, Spr (George)

Underdevelopment and Foreign Policy — (Enroll in Political Science 137W.) An examination of the problems which the condition of underdevelopment poses for foreign policy and alternative ways of dealing with those problems. Particular attention will be given to the nonaligned movement and its meaning; foreign policies of independence and foreign policies of development; the nature of foreign policy elites and the domestic political determinants of foreign policy; foreign aid, investment, neocolonialism, and dependency relationships; problems of dealing with multinational corporations, and “resource diplomacy,” with emphasis on the experience of OPEC and the politics of oil.

5 units, Aut (Weinstein) MTWThF 1:15

Problems of Arms Control and Disarmament—(Enroll in History 138A,B or Political Science 138A,B.) General international politics; international law and relations; stressing political, legal and technological problems of arms control. 138A is a prerequisite to 138B; the second quarter will provide for individual research.

5 units, Win, Spr (Barton, Brody, Craig, D. Dunn, T. Ehrlich, George, Lederberg, Lewis, Panofsky, Paret, A. Peterson)

Security and Strategy in East Asia—(Enroll in Political Science 139W.) The development of American and Japanese strategic perspectives on Asia and Asian perspectives on the United States; the application of U.S. strategic doctrines in Asia; the nature of conflict in the region; and problems of alliances, commitments, and military aid.

5 units, Spr (Weinstein) MTWThF 11

Seminar on the United States and the Pacific—(Enroll in Political Science 225.) An analysis in political, strategic, economic and cultural terms of recent and contemporary United States relationships with major states and regions bordering the Pacific Ocean. Attention will be focused on the process by which a society and polity that has always been Atlantic and European in its principal orientations has gradually acquired an increasingly important Pacific orientation, as well.

5 units, Spr (Ward)

International Communism—(Enroll in History 123B or Political Science 123B.) A sur-
vey of the development of communism as an international movement, its organizational forms and ideology, with particular emphasis on problems of authority and control, tensions among and within its national components, and varieties of social composition, political strategies, successes and failures.

5 units, Aut (Dallin) MTWTh 10

Undergraduate Seminar: Problems in International Communism—(Enroll in History 218S or Political Science 218S.) This seminar is intended to provide an acquaintance with sources and existing studies, and an opportunity to do research on a limited topic dealing with relations among, or comparisons of, communist parties. Emphasis is placed on differences in perceived national interests, sociopolitical setting, and political culture, and patterns of conflict resolution among the parties.

5 units, Win (Dallin) T 2:15–4:05

International Organizations in World Politics—(Enroll in Political Science 133C.) Analysis of the role of international organizations in contemporary world politics, with particular reference to transnational relations. Attention will be concentrated less on traditional peacekeeping activities of organizations such as the United Nations than on new issues facing international organizations, particularly arising from international and transnational interdependence in a variety of issue-areas. (Graduate students enroll in Political Science 233C.)

5 units, Win (Keohane)

International Aspects of Environmental Disruption—(Enroll in Political Science 137C.) Many environmental problems transcend national borders. Others are at least partially the result of international politics and economic activities. In this seminar, students will explore the environmental crisis as a subset of international relations, with particular emphasis on ocean and waterway problems. Desirable prerequisite: Political Science 135C or History 135C.

5 units, Win (Corning)

Seminar on Nuclear Proliferation — (Enroll in Political Science 142C.) Investigation of the technical, economic, domestic and international political factors leading to the expansion and contraction of nuclear weaponry. Prerequisite: Political Science 138A. (Graduate students enroll in Political Science 243C.)

5 units, Spr (Brody)

Seminar on Force and Diplomacy in the Modern Era — (Enroll in Political Science 145A.) Critical examination of theories of force as an instrument of foreign policy; evaluation of crises and conflicts in the post-World War II era with reference to lessons for theory and practices. (Graduate students enroll in 245A.)

5 units, Spr (George)

International Dependency—(Enroll in Political Science 131C.) What is meant when we say that one state is dependent upon another, more powerful state? What are the implications of a dependency relationship for the domestic political economy of both parties? These questions will be examined through case studies of the United States and a Latin American country, France and an African country, and the Soviet Union and an Eastern European country. Desirable prerequisite: 135C.

5 units, Spr (Abernethy) MWF 10

Slavic Civilizations—(Enroll in History/Slavic 117A and B, and History/Slavic/Political Science 117C). A three-quarter sequence, each quarter of which may be taken separately. The first quarter, led by Professor Vucinich, deals with Slavic Civilization to 1700. The second quarter, led by Professor Todd, covers the period from 1700 to 1914. The third, taught by Professor Dallin, deals with the contemporary period. The approach in this sequence is interdisciplinary, utilizing lecturers from the various disciplines with competence in the field and integrating readings and lectures so as to give the student an understanding of the distinct contributions made by the various Slavic peoples. The course treats the histories and cultures of Bulgaria, Czechoslovakia, Poland, Russia and Yugoslavia.

5 units each quarter, Aut, Win, Spr (Vucinich, Todd, Dallin and Staff)

War and Society—(Enroll in History 128A.)—An analysis of military affairs and of their interaction with intellectual, social, economic, and political history since the Renaissance. The lectures are grouped around major sessions such as the impact of violence on political development, ethical theories of
war, the use of war as an instrument of policy.

5 units, Win (Paret)

Undergraduate Colloquium: Biography and History—(Enroll in History 229A.) The course explores techniques of biography, the strengths and limitations of the genre, and the place of biography in history.

5 units, Spr (Paret)

Politics, Society and Art in Modern European History—(Enroll in History 229.) Topics of the course vary from year to year. In 1974-75 the course will explore “Irony and realism in 19th Century literary and graphic interpretations of European society.”

5 units, Aut (Paret)

Ethics, Morality and International Relations—(Enroll in Philosophy 197.) The purpose of this seminar is to analyze the application of ethical principles to policy decisions involving international relations. This analysis requires acquaintance with ethical principles, practice in applying these principles to situations, and critical evaluation of the application of these principles. To what extent do actual decisions of policy-makers comply with ethical principles; why is this the case? Why might one think that such decisions ought to comply with certain principles? The plan for the seminar is to study ethical theory for two weeks, then analyze a number of cases, e.g. the U.S. intervention in the Dominican Republic and the Cuban missile crisis, in ethical terms.

5 units, Win (Serene) TTh 2:15-4:05

Colloquium on National and International Identity—(Enroll in Comparative Literature 194A, Modern Thought and Literature 194A, or English 194A.) Intensive study of national and international dimensions of literature, drama, and thought, with emphasis on modern problems of identity in Anglo-American and European cultures. Topics will include nationalism and national revivals in the British Isles, the United States, and Europe. Enrollment limited to 15.

5 units, Spr (Halliburton)

The Meeting of Eastern and Western Art—(Enroll in Art 126E.) The interaction between the art of the Far East, Europe, and America from the 16th Century to the present day.

4 units (Sullivan) given 1975-76

Problems in International Political Economy—(Enroll in Economics 168.) This course introduces the student to the complexity and controversy of international economic policy problems through the study of a selected number of specific policy-making situations relating to international development policy. Approximately one-half of the sessions are devoted to small group policy conferences in which students present and discuss “position papers” on specific policy problems. Considerable independent study is encouraged. These problems are studied primarily through sets of specially prepared source materials. Lectures present some international economic principles that can be applied to the problems and place the problems in their wider context. Prerequisite: Economics 1.

5 units, Spr (Meier) given 1975-76

International Economic Conduct—(Enroll in Freshman Seminar.) This seminar will study problems of competition and cooperation in the formation of foreign economic policy. Special attention will be given to how national economic autonomy can be reconciled with forces of international economic integration. Actual behavior in international economic relations is compared with the norms and codes of conduct established by international economic institutions and multilateral agreements. Essays will be written on recent policy problems in the international economy. These problems will provide an introduction to the context and process of policy-making in international economic affairs. Beyond this, some philosophical questions will be raised about non-discrimination, distributive justice, and sanctions.

3 to 5 units, Spr (Meier)

Given 1975-76

North American and Latin American Poetry—(Enroll in Spanish 262 or Comparative Literature 259B.) Selected poets from the Twentieth Century. Reading knowledge of Spanish required. How do poetic practices in North America and Latin America relate? Are there common influences? Can we compare the cultural context and the cultural sanctions inferable from what we read? Where has the poetry reflected, and perhaps conditioned, the felt historical experience of North Americans and Latin Americans?

5 units, Spr (Felstiner, Franco)
RELATED UNDERGRADUATE COURSES

The following courses meet the criteria for inclusion of courses under “international relations,” but have not been sponsored by the Committee:

International Law—(Enroll in Political Science 130C.) A broad overview of theories, development, present state and propensities of international law as a process in various critical arenas of international interaction.

4 to 5 units, Spr (Triska)

The International System and Comparable Systems—(Enroll in Political Science 133.) A comparison, in terms of conflict and integration, of historical and contemporary international systems with selected inter-city systems (in ancient Greece, for example), certain inter-band and inter-tribal systems, and the like, with consideration for some possible future trends.

5 units, Win (North) T 4:15

Seminar on the Political Economy of U.S.-Latin American Relations—(Enroll in Political Science 143A.) Limited to advanced undergraduates, knowledge of Spanish or Portuguese recommended. Consent of the Instructor required.

5 units, Win (Fagen) T 2:15-4:05

Seminar on the Dynamics of Escalation — (Enroll in Political Science 145.) An investigation of the dynamics of escalation in a number of different situations and the methods whereby this research can be undertaken. A major focus upon some of the ways in which political and military escalations are related to changes in domestic and international environments. Such environments include certain demographic, technological and economic dimensions as well as other characteristics of state and international systems—especially Great Power systems.

5 units, Win (North)

Latin America and the African—(Enroll in History 182.) This course examines the economic, political and cultural ties that have existed between Latin America and Africa since the 16th Century. The current prospects for both cooperation and rivalry between the two areas are discussed in some detail.

4-5 units, Win (Bowser)

Imperialism and the International Order in Modern East Asia—(Enroll in History 190.)

5 units, Aut (Duus, Van Slyke) MTWThF 1:15

Undergraduate Seminar: The Cold War—(Enroll in History 269S.) This research seminar, which requires a major paper (18-25 pages) is designed to introduce students to some of the major problems and interpretations in the Cold War, and to give them an opportunity to do research in depth on a problem. Readings will be drawn from, among others, Caddis Smith, Gabriel Kolko, W. A. Williams, Arthur Schlesinger, Adam Ulam, Robert Tucker, Herbert Feis, George Cannon, and Graham Allison.

5 units, Win (Bernstein) W 2:15-4:05

Race and Culture Contact in the Caribbean —(Enroll in Anthropology 104.) Types of social systems and cultural patterns in the West Indies arising from relations between Europeans, West Africans, and Asians, with implications for development and social change.

5 units, Win (Drake) MWF 1:15

The World’s Food Economy—(Enroll in Food Research 103 or Economics 106.) This course will examine the interrelationships between food population and economic progress. The emphasis will be on the role of agriculture in the economic and social development of low-income nations. Attention will also be given to the economic and nutritional characteristics of the major categories of food and changes in food consumption associated with economic development.

3 units, Spr (Timmer) MWF 10

Undergraduate Workshop in World Food Problems—(Enroll in Economics 108A,B or Food Research Institute 150,151.)—A two-quarter workshop to examine the current adequacy of world food supplies on a country and regional basis. Members of the workshop will examine concepts and measurement of the quality of nutrition, problems of measurement of food supplies, the incidence and causes of inadequate nutrition, and projections of nutritional problems over time. Each member of the workshop will investigate the sufficiency of food supplies in a particular less developed country or region and present a report on his findings. Enrollment limited to 12. Prerequisite: Consent of instructor.

5 units each quarter, Win, Spr (Jones)
Trade and Development Problems of Tropical Africa—(Enroll in Economics 160 or Food Research Institute 160.) Analysis of selected international aspects of tropical African economic development. Topics include African/non-African international trade and economic relations (theoretical background, historical perspective, case studies of export-led growth, and the impacts of international capital flows) and intra-African trade and economic integration (customs union theory, historical perspective, case studies of African economic integration).

3 to 5 units, Win (Pearson)

International Economics I—(Enroll in Economics 165.) Comparative advantage in production and trade among nations, the international monetary mechanism; domestic monetary, fiscal and tariff policies and their relationship to foreign trade. Prerequisite: Economics 1.

5 units, Aut (Gonzalez-Vega)

International Economics II—(Enroll in Economics 166.) Selected topics in international economics, with emphasis on individual study, seminar presentations, and discussions. Enrollment limited to 16. Prerequisite: Economics 165.

5 units, Win (Pearson)

Europe and the World—(Enroll in Spanish 182 or Undergraduate Specials 114.) The aim of this seminar is to see how Europe's role in the world is viewed by various European groups, by the United States and by the Soviet Union.

5 units (Hilton)

Students should also consider graduate offerings in which advanced undergraduates are admitted with consent of the instructor.

A student who is majoring in international relations under the Committee on Interdepartmental Majors might very well include in his or her program courses other than those listed above, such as offerings on particular societies and their external relations. Students taking such a major construct their own lists of courses to be approved by their advisors.

ADMINISTRATION

Director and Senior Lecturer in Spanish and Portuguese: Phillip B. Petersen

Assistant Director, Electronics Engineer and Lecturer in Language Laboratory: John Metcalfe

The Language Laboratory with one hundred and fourteen Level III (listen-respond-record) student positions offers varied programs in Amheric, Arabic, Cambodian, Cantonese, Cebuano, Czech, Dutch, English as a foreign language, French, German, Greek, Hausa, Hebrew, Indonesian, Irish, Italian, Japanese, Korean, Latin, Lithuanian, Mandarin Chinese, Norwegian, Persian, Polish, Portuguese, Romanian, Russian, Spanish, Swahili, Swedish, Thai, Twi, Vietnamese, and Yoruba.

Whether engaged in formal language studies or not, students are invited to use the Language Laboratory for listening, repetition, recording and self-evaluation. As an additional aid, departmental monitors in the major languages taught at the University are supplied for individual work. The Language Laboratory is open daily. Current news from world capitals, recorded from short-wave radio, is available for advanced students.

215. Language Laboratory Techniques — (Same as Education 295.) All aspects of such laboratories are covered, from administration and equipment selection to operation of recording and playback equipment. Assumes no prior electronics or instrumentation experience.

2 units, Spr (Metcalfe) TTh 1:15
Sum (Metcalfe) MTWThF 11
(short term)

CENTER FOR LATIN AMERICAN STUDIES

Committee in Charge: The Committee on Latin American Studies, a subcommittee of the Presidential Commission on International Studies.

Chairman of the Committee and Director of the Center: Bernard J. Siegel

The Center for Latin American Studies administers four principal programs. They are the graduate A.M., the Graduate Summer Grant Program, and two undergraduate programs: the A.B., and the Undergraduate Summer Research Program. The Center also cooperates with the Schools of Law and Ed-
ucation in offering two joint-degree programs and with the Overseas Studies Office in offering a Latin American Studies Program in Lima, Peru.

Inquiries concerning all programs should be directed to the Director, Center for Latin American Studies, Bolivar House, Stanford, California 94305.

**MASTER OF ARTS**

The Latin American A.M. program is designed for (1) students who wish to pursue an interdisciplinary approach to the study of Latin America before continuing on to a relevant doctoral program in one of the social sciences or humanities; and (2) individuals who desire to add graduate-level expertise in Latin American Studies to other training necessary for careers in business, journalism, government, or one of the professions. The Departments of Anthropology, Economics, History, Political Science, Sociology, Spanish and Portuguese, and the Food Research Institute participate in the A.M. program.

To qualify for admission to the program, applicants must have the equivalent of an A.B. or a B.S. degree, training in at least one of the social sciences, and a working knowledge of Spanish or Portuguese. Applicants must also take the Aptitude Test of the Graduate Record Examination and have the results sent to the Office of Graduate Admissions. Deadline for submission of applications for admission and financial aid is January 15, 1975.

The student’s program is worked out in consultation with the Director of the Center and with the faculty of the participating departments, within the framework of the following academic requirements:

a) Ten courses with a minimum of 38 units. At least eight of the ten courses must be basically Latin American in content. Students must receive grades of A, B, or plus in at least seven courses in order to complete the degree. Courses are distributed as follows:

1) Core Seminar (LAS 250, 251, 252)—an interdisciplinary course required of all A.M. candidates in Latin American Studies, taught by faculty from the participating disciplines. Fifteen units; 5 units per quarter.

2) Latin American Bibliography (LAS 260) required of all A.M. candidates in Latin American Studies. Two units.

3) Three or four courses that qualify as graduate level in a single base discipline.

4) Two or three courses distributed among other disciplines. (Relevant courses may be found in the listings for the participating departments.)

b) Demonstration of language competency in either Spanish or Portuguese at least equivalent to three years of university training (i.e., Spanish 113 or Portuguese 183). Students with advanced competency in Spanish may take elementary Portuguese for credit; otherwise, first- and second-year language courses may not be counted toward the degree. If Spanish or Portuguese is the student’s base discipline, he or she must show ability in both languages. Courses in linguistics may be counted toward this concentration.

There is no thesis requirement for the A.M. degree in Latin American Studies. Instead, a paper that gives satisfactory evidence of methodological, analytical, research and writing skills is required from each member of the Core Seminar.

Since the University does not offer a Ph.D. in Latin American Studies, students who wish to remain in an academic program at Stanford after completing their A.M. must be accepted by one of the regular departments.

**BACHELOR OF ARTS**

The purpose of the A.B. degree is to allow a small number of undergraduates to design individualized, interdisciplinary programs emphasizing independent study. Students must apply for admission to the major not later than the beginning of the second quarter of their junior year; exceptions will be made only in unusual circumstances.

The student must fulfill the following requirements for the major:

a) Completion of a coherent interdisciplinary program of at least 55 units, based on an individualized plan of study achieved in consultation with, and approved by, a faculty advisory committee. This program will ordinarily include:

1) At least 25 units in a single base discipline.

2) At least 40 units in 100-level courses
or higher, focused directly on Latin America or closely related topics. (Relevant courses may be found in the listings for the participating departments.)

First- or second-year language courses do not count toward the 55 units.

b) Demonstration of language competency in either Spanish or Portuguese at least equivalent to three years of university training (i.e., Spanish 113 or Portuguese 183). An elementary reading knowledge of a second language of the area is recommended but not required.

c) Submission in the senior year of a substantial research paper of acceptable quality relating to Latin America on a topic approved by the student's faculty committee. Up to ten units may be given for preparation of the senior paper.

d) A grade average at least midway between "B" and "C" must be maintained for all letter-graded courses. Only 10 units of pass/no-credit work may be counted toward LAS degree requirements.

Honors in Latin American Studies will be recommended for exceptional students who have maintained a grade average at least midway between "A" and "B" for all area-related courses; completed a strong and well-designed program; and submitted a senior paper judged to be outstanding by the Subcommittee on the Undergraduate Major.

Special Programs

A Latin American Studies program in Peru, administered by the Overseas Studies Office, is available to students autumn and winter quarters.

Each summer the Center sponsors a small number of juniors to conduct individual research projects in Latin America. Students must have demonstrated the ability to work independently and must possess the necessary language competence. A course in research design, LAS 152, is required the spring quarter before departure and an extensive written report the following autumn quarter. Students from all departments are eligible to apply.

Advanced Stanford graduate students having an area concentration may apply to the Committee on Latin American Studies for summer grants for either pre-dissertational research or intensive language training.

Joint-Dual Degree Programs

LAS/Law—The Center for Latin American Studies and the Stanford Law School offer a joint program leading to the J.D. degree in Law and the A.M. degree in Latin American Studies. Students must be independently accepted by both Law and Latin American Studies.

LAS/Education—The degree of Master of Arts in Teaching with an interdisciplinary concentration in Latin American Studies is offered jointly by the Center and the School of Education. For the general requirements, see the section "School of Education" in this bulletin. For additional Latin American Studies requirements, inquiry should be made to the Center. Candidates must have a teaching credential.

Courses

150A. Workshop in Latin American Studies: Peru—Restricted to students accepted for the Overseas Studies program in Peru.

2 to 5 units, Spr (Staff)

152. Undergraduate Seminar in Research—Restricted to students accepted for the Latin American Studies Summer Research Program.

5 units, Spr (Staff) M 4:15–6:05

153. Undergraduate Independent Research—Restricted to students in Latin American Studies Summer Research Program.

5 units, Aut (Staff) by arrangement

169. Directed Individual Study — For students engaged in special interdisciplinary work that cannot be arranged by department. (Graduate students enroll in 269.)

198. Senior Thesis — Restricted to undergraduate majors.

1 to 10 units, Aut, Win, Spr (Staff) by arrangement

250, 251, 252. Core Seminar in Latin American Studies—Introduction to methodologies and the status of research in the social sciences with relation to Latin America.

5 units, Aut, Win, Spr (Staff)

T 2:15–4:05
260. Latin American Bibliography — With emphasis on the contemporary period.
2 units, Aut (Breedlove) Th 12:00–1:15

LINGUISTICS

Chairman: Clara N. Bush
Professors: Charles A. Ferguson, Joseph H. Greenberg.
Associate Professors: Clara N. Bush, Elizabeth C. Traugott.
Visiting: Terry Winograd
Lecturers: Elaine Kaufman, Frieda N. Politzer.
Affiliated Faculty:
Professors: Alphonse Juilland, Robert L. Politzer
Associate Professors: Andrew M. Devine, Dorothy A. Huntington

English for Foreign Students:
Director: Clara N. Bush
Lecturers: Beverley McChesney, Frieda N. Politzer

Special Language Program:
Coordinator: Staff

PROGRAMS OF STUDY

The Committee on Linguistics offers degrees on both the undergraduate and the graduate level. For University regulations governing both undergraduate and graduate degrees, see the section “Degrees” in this bulletin. The student’s program should be prepared in advance in consultation with the student’s adviser.

Candidates for advanced degrees must have completed an equivalent of the training represented by an A.B. or B.S.

BACHELOR OF ARTS IN HUMAN LANGUAGE

The undergraduate program in Human Language emphasizes the role of language in man’s thinking and social behavior. It is an interdisciplinary major sponsored by the Committee on Linguistics which draws not only on the courses specifically created for the major but also on areas of instruction available elsewhere in the university. This major cuts across the Humanities, Social Sciences, and Physical Sciences, and provides a solid general education as a background for advanced studies in such fields as Anthropology, Communications, Computer Science, Education (Language Arts and Language Teaching), Hearing and Speech Sciences, Languages, Linguistics, Philosophy, and Psychology.

Requirements for the B.A. include study of a foreign language, six core courses, and more advanced courses in an area of specialization.

1. Language. Majors are required to have training in one foreign language, equivalent to at least two years of college language courses. Since the language skills acquired will be used primarily to exemplify linguistic concepts, students are encouraged to learn a non-Indo-European language.

2. Courses. The six core courses are Linguistics 1, 10, 30, 45, 50, and 60 (27–30 units). Linguistics 1 (4–5 units) is a prerequisite for all the others, though it may be taken concurrently. At least three of the core courses must be taken for the full five units of credit.

A minimum of three advanced courses is required in one particular area of specialization listed below, to be planned in consultation with the student’s adviser. Courses from allied departments (Anthropology, Education, Psychology, etc.) may also be chosen to fulfill this requirement.

a) Formal aspects of language (e.g., grammar construction; formal grammars; artificial intelligence)
b) Social aspects of language (e.g., language, culture, and society; language variation in space and time; urban language problems; literacy; language in civilization)
c) Cognitive aspects of language (e.g., language and mind; signs and symbols; communication systems)
d) Physical aspects of language (e.g., physiology and acoustics of speech; perception and production; communicative disorders)
e) A particular language or language area over and above the language requirement stated above (e.g., languages of Africa, History of English, Romance linguistics, Chinese, German, etc.)
3. Honors Program. Students majoring in Human Language who plan to apply for graduate studies in Linguistics should without exception seek departmental honors; students who plan to apply for graduate studies in fields related to Human Language are strongly advised to do so. An application to pursue honors work should be presented well before the end of the junior year; approval will be given only to students who have maintained an average of B or better in the courses required for the major.

In addition to fulfilling the requirements for the major, honors students will take at least three additional advanced courses (12–15 units) from any one of the five areas of specialization; students planning to apply for graduate work in Linguistics are advised to take three courses in Area A (the formal aspects of language), if they have not already done so in completion of the requirements for the major.

Every honors major will take Linguistics 198, the Honors Seminar, in the Autumn of the senior year (5 units), in which he or she will prepare a project on a topic approved by the faculty member in charge of the Honors Seminar. The honors project must be submitted in final, acceptable form no later than six weeks before the date of intended graduation.

Master of Arts

The following requirements are in addition to the University residency requirement for the degree.

1. Candidates must demonstrate their proficiency in reading linguistic literature in one foreign language, preferably French, German or Russian. If the candidate’s area of specialization or professional goals make a different kind of proficiency more appropriate or favor a language other than these three, this requirement may be satisfied otherwise through the mechanism of a petition subject to approval by the Graduate Studies subcommittee.

2. Courses. Candidates must complete a minimum of 36 units of graduate work in linguistics and allied fields, including the four core graduate courses (200, 215, 220, 230), which total 16 units, and the option of up to 6 units for a research project or M.A. thesis; see 4 below. Courses to be counted toward the M.A. which are not in general linguistics are to be approved by the adviser. Candidates coming to the program with no previous background in linguistics may expect that the ratio of course work in linguistics to work in allied fields will be greater than for candidates with some previous preparation in linguistics. A grade point average of at least B must be maintained for all degree program course work.

3. Examination. Candidates must successfully pass a general examination, testing for synthesis of the subject matter of general linguistics, and containing, in addition, an essay question on the area of specialization of the candidate, with the choice of substituting an essay question on general linguistics.

4. Thesis. Candidates may elect one of three options:

   a) A formal M.A. thesis, fulfilling the University requirements specified in the “Degrees” section of Courses and Degrees.

   b) A research project producing a paper which integrates the subject matter of linguistics into the candidate’s field of specialization.

   c) No thesis or research project. (The election of this option is subject to the approval of the Subcommittee on Graduate Studies.)

Master of Arts in Teaching

The degree of Master of Arts in Teaching is offered jointly by the Linguistics Program and the School of Education. In addition to completing a minimum of 24 units in linguistics courses, to be selected in consultation with the Chairman of Linguistics, the candidate must pass a comprehensive examination. The general requirements for the degree are outlined by the School of Education in this Bulletin.

Minor in Linguistics for the Degree of Doctor of Philosophy

1. Courses. Candidates must complete a minimum of 30 units of graduate work in linguistics and allied fields, including the four graduate core courses (16 units) and the option of up to 6 units for a research project. Courses to be counted toward the minor which are not in general linguistics
SCHOOL OF HUMANITIES AND SCIENCES

are to be approved by the linguistics adviser.

2. **Research project** (optional). Candidates may elect to present a paper which integrates the subject matter of linguistics into the field of specialization of the candidate.

3. The linguistics adviser will serve on the candidate’s University Oral examination committee and may request that up to one-third of the examination be devoted to the minor subject.

**DOCTOR OF PHILOSOPHY**

1. **Language:** Candidates must demonstrate their ability to read at least one foreign language with sufficient facility to understand and to interpret the linguistic research published in that language. (Particular areas of specialization may require additional research languages.)

   In addition, each candidate must demonstrate an explicit in-depth knowledge of the structure of at least one language (normally neither the candidate’s native language nor the language used for the reading exam).

2. **Courses.** A minimum of 80 units of graduate work beyond the A.B. or B.S. exclusive of dissertation units, at least 32 of which are in general linguistics, or, beyond the A.M., 40 units exclusive of dissertation units, at least 16 of which are in general linguistics.

3. **Examinations.** Successful passing of two examinations:
   a) A qualifying examination on the principles of general linguistics and the theory, methods, and techniques of the main linguistic disciplines. The examination will presuppose at least the kinds of materials available in 200, 215, 220, and 230. It will normally be taken prior to the end of the first year.
   b) A field of specialization such as anthropological linguistics, applied linguistics, computational linguistics, developmental psycholinguistics, grammatical theory, hearing and speech sciences, historical linguistics, a language or language group, sociolinguistics, or some combination of these. The examination will normally be taken prior to the end of the third year.

4. **Research.** Experience in preparing a research project other than the dissertation. May be fulfilled by 398 (up to 6 units), the A.M. thesis, or participation in an established project (see Research below).

5. **Teaching.** A minimum equivalent to one-half of one quarter during the second or third year in residence.

6. **Colloquia.** Three oral presentations which may be given as colloquia or in seminars; at least two should be given during the first three years of study.

7. **Dissertation.**
   a) Approval of dissertation topic and appointment of a dissertation committee by the Chairman.
   b) Successful passing of a University Oral examination on the Dissertation Project and related areas.
   c) Dissertation (up to 15 units).

**SPECIAL LANGUAGE COURSES**

(80, 81A,B,C, 83A)

Students interested in studying a modern foreign language not regularly taught at Stanford, such as Arabic, Bengali, Czech or Modern Hebrew, may propose a Special Language Course. Students will be expected to give a reasonable justification for including the study of the special language in their educational experience at Stanford. If the proposal is approved and suitable arrangements for instruction and evaluation can be made, a course will be set up and students may enroll with or without credit. The proposal should be made at least one month before the quarter in which the course is to be given.

Normally a Special Language Course will be set up for groups of three to ten students at the elementary level, but in special cases a course may be set up at an intermediate level or even for an individual student. The instructor will be a member of the Stanford community who by training or personal knowledge of the language is qualified to teach it as a special course. Special Language Courses will be arranged on a quarter to quarter basis and maximum credit for one quarter will be 5 units. Considerable variation in teaching approaches should be expected but a degree of uniformity will be accomplished by a set of guidelines given to instructors. Regular letter grades with pass/fail option will be given.
Special Language Courses supersede ad hoc language courses set up under SWOPSI, SCIRE, and Undergraduate Specials.

Address all inquiries to Coordinator, Special Language Courses, Committee on Linguistics, 497-3279 (telephone).

RESEARCH

The Committee on Linguistics maintains a program of basic research in linguistics and related fields. The major projects are language universals, study of child language development, and sociolinguistics. A limited number of research assistantships and associateships are available, graduate and post-doctoral.

COURSES

Courses are offered in (1) grammatical theory, i.e., the general goals and history of linguistic analysis and theory (numbers 0-14); (2) phonetics and phonology (numbers 15-29); (3) syntax and semantics (numbers 30-44); (4) language variation and sociolinguistics (numbers 45-59); (5) developmental psycholinguistics (numbers 60-64); (6) computational linguistics (numbers 65-69); (7) applied linguistics (numbers 70-74); (8) methods (numbers 75-79); (9) languages (numbers 80-94).

UNDERGRADUATE


5 units, Aut (Ferguson, Greenberg, Huntington and Staff) MWF 10


5 units, Aut (Fox) MWF 1:15


5 units, Win (Wasow) MWF 10

45. Language, Society and Culture—(Same as Anthropology 166.) The linguistic basis of culture, the relation of language to culture and society and the role of linguistic data in the reconstruction of history. The course will emphasize three general topics: (1) language and cultural theories (evolutionary, functional, and diffusional), (2) language and cultural change (linguistic and non-linguistic factors in change), and (3) language and cultural history (especially linguistic evidence for cultural history). Lecture course. Prerequisite: Linguistics 1 or consent of instructor.

5 units, Win (Greenberg) MWF 2:15

50. Language in Use—The structure of conversation and other forms of discourse. Emphasis on the functions of language in different contexts, rhetorical strategies, and appropriateness conditions of speech acts. Pre-requisites: Linguistics 1 or consent of instructor.

5 units, Spr (Traugott) MTWTh 10

(2 lectures and 2 sections)

60. Language and Mind — Language and the mental processes of individuals. Language behavior as an indicator of thought processes and emotional states, and language as a component and partial determinant of such processes. Abnormal language: aphasia, schizophrenia, altered states of consciousness. Prerequisite: Linguistics 1 or consent of instructor.

5 units, Spr (Staff) by arrangement

80A,B,C. Elementary Special Language Courses. See “Special Language Courses.”

Aut, Win, Spr (Staff) by arrangement

81A,B,C. Intermediate Special Language Courses. See “Special Language Courses.”

Aut, Win, Spr (Staff) by arrangement
83A. Special Language Orientation—Arabic: An introduction to the Arabic language, designed primarily as orientation for students in the Stanford overseas program at the American University of Beirut. Includes a sketch of the structure of Arabic, basic study of the spoken Arabic of the area, and an introduction to the writing system. Special attention to aspects of Middle Eastern culture reflected in the language.
5 units, Spr (Staff) by arrangement

145. Language, Society, and Culture—Content same as 45.
5 units, Win (Greenberg) MWF 2:15

146. Bilingualism in the Chicano Community—(Same as Spanish and Portuguese 216.) An exploration of the general nature of bilingualism, focusing on its use by Chicanos. The course will examine the social and psychological effects of bilingual learning, code-switching, and language maintenance.
3 units, Spr (Hernandez-Ch.) TTh 11:00-12:30

159. Language and Culture—(Same as Anthropology 167.) The relevance of linguistic theory, semantic analysis, and the study of speech as social behavior to problems of anthropology, sociology and psychology. Prerequisite: consent of instructor.
5 units (Frake) given 1975-76

170A. Introduction to Methods of Teaching English as a Foreign Language—A practical approach to problems of teaching English to speakers of other languages, including a survey of those features of English phonology, morphology and syntax which present particular difficulties, presentation of problems, construction of exercises and lesson planning.
3 units, Win (F. Politzer) MWF 10

170B. Practicum in TEFL—Workshop for volunteers currently active in area TEFL programs; discussion of teaching problems and evaluation of effectiveness of classes. Prerequisite: 170A or equivalent.
1 unit, Spr (F. Politzer) by arrangement

170C. Overseas Practicum in TEFL—Available only by prearrangement, and to students who have the prerequisite: 170A and 170B or consent of instructor.
5 units, any quarter student is registered in absentia (F. Politzer) by arrangement

175. Linguistic Field Methods—(Same as Anthropology 161.)

180. Structure of the English Language—(Same as English 101.) Study of what it means to be a "native speaker of English." Emphasis on the semantic, syntactic, and phonological structure of English, with some attention to the application of linguistics to literature.
5 units, Spr (Traugott) MTWTh 3:15

185A,B,C. Beginning Hausa.
5 units, Aut, Win, Spr (Leben) MTWThF 12

186A,B,C. Intermediate Hausa.
5 units, Aut, Win, Spr (Staff) by arrangement

190A,B,C. Beginning Swahili.
5 units, Aut, Win, Spr (Kaufman) by arrangement

5 units, Aut, Win, Spr (Staff) by arrangement

193A,B,C. Beginning Yoruba.
5 units, Aut, Win, Spr (Kaufman) by arrangement

199. Independent Study.
1 or more units, any quarter (Staff) by arrangement

GRADUATE

Theory of Grammar

200. The Goals of Grammar—An introduction to the kinds of assumptions linguists make in defining language and in constructing grammars; emphasis on synchronic vs. diachronic study, on competence vs. performance models, on the innateness hypothesis, and on criteria for evaluating grammars and testing hypotheses.
4 units, Aut (Traugott) MW 10:00-11:50

201. Introduction to Formal Grammars—Mathematical background of transformational grammar. Elementary introduction to formal grammars as models of natural language. Properties of phrase-structure grammars, finite-state, context-free, context-sensitive. Prerequisite: consent of instructor.

Given alternate years

205. Current Issues in Linguistic Theory—In-depth examination of a subject of current controversy, chosen for its far-reaching consequences for linguistic theory. May be re-
peated for credit. Topic for 1974-75: Intersection of Phonology and Syntax.
4 units, Win (Oehrle and Leben)
W 1:15–4:05

206. Grammatical Theories — Selected topics in non-transformational grammatical theory. May be repeated for credit. Prerequisite: 200 or consent of instructor.
4 units (Staff) by arrangement

208. Typology and Universals of Language — (Same as Anthropology 164.) The methodology of structural comparisons of languages; the connection between typological analyses and generalizations about language; universals of language in phonology, grammar, and semantics; problems concerning deductive explanation of universals. Limited enrollment. Prerequisite: elementary linguistics course or consent of instructor. Seminar course.
5 units, Spr (Greenberg) TTh 2:15–4:05

214. History of Linguistics — Survey of Graeco-Roman and Medieval theories of language; the speculative and universal grammarians development of 19th and 20th century linguistic theories. Examinations of specific topics, e.g. case grammars, deep-surface distinctions over time.
4 units, Aut (Clark) T 1:15–3:05; Th 1:15–2:05

215. Foundations of Phonetic and Phonological Analysis — Training in broad transcription; introduction to the articulatory mechanism and to the distinctive features of speech sounds. Beginning practice in phonological analysis (extracting sound patterns from limited bodies of language data).
4 units, Aut (Bush and Hernandez-Ch.)
MW 2:15–4:05 and dhr

216. Phonetic Theory — (Same as Hearing and Speech Sciences 212.) Consideration of the fundamental assumptions implicit in phonetic descriptions and of the evidence available for assessing their validity; the concept of universal phonetics; the relative roles of articulatory, acoustic, and auditory parameters. Prerequisite: 215 or consent of instructor.
4 units, Win (Bush) by arrangement

217. Phonetic Analysis — Training in narrow transcription; application of phonetic analysis to spoken language data in elected fieldwork or laboratory projects. Prerequisite: 215 or consent of instructor.
4 units, Spr (Bush) by arrangement

220. Phonology — The phonological organization of speech sounds in human language. Fundamental issues in phonological theory: the phonemic principle, elements vs. relations, systems and variation. Major theoretical positions 1925 to the present. Prerequisite: 215 or consent of instructor.
4 units, Win (Ferguson) TTh 9:00–10:50

221. Sound Pattern of English — A comprehensive description of the stress and segmental rules of English within the framework of generative phonology. Prerequisite: 220 or consent of instructor.
4 units, Spr (Leben) MTWTh 11

222. Phonological Theory — Coverage of the most recent literature in phonological theory, including work on markedness, rule opacity, rule ordering, abstractness of phonological representations, historical phonology, and recent experimental work. Prerequisite: 220 or consent of instructor.
Given alternate years

223. Problems in Phonology and Morphology — Investigation in some detail of data from a variety of languages with a view to uncovering or resolving problems in current phonological theory.
4 units, Aut (Leben) MW 1:15–3:05

227. Instrumental Phonetics — Techniques of instrumental research in speech perception and production. Theory and instrumentation for analysis and manipulation of speech signals. Laboratory course. Prerequisite: consent of instructor.
4 units, Spr (Huntington) by arrangement

Syntax and Semantics

230. Foundations of Syntactic Theory — Introduction to the transformational theory of syntactic competence. Practical experience in forming and testing linguistic hypotheses, reading and constructing rules, etc.
4 units, Win (Wasow) MWF 1:15

231. Theory of Generative Grammar — Constraints on the form of grammars of natural languages, such as constraints on base rules and transformations, the universal base hypothesis, variables in syntax, and the structure-preserving hypothesis. Prerequisite: 230 or consent of instructor.
4 units, Spr (Wasow) MW 9:00–10:50
232. Advanced Syntax — In-depth study of particular topics, e.g. relativization, complementation. Emphasis on the implications of particular analyses for linguistic theory. Prerequisite: 230 or consent of instructor.

4 units, Aut (Oehrle) TTh 10:00–11:50

235. Syntactic and Semantic Analysis — Treatment of some aspects of language that exhibit an intimate connection between syntax and semantics, such as quantification, negation, pronominalization, reflexivization. Prerequisite: 231 or consent of instructor.

4 units, Win (Oehrle) MWF 11

240. Semantics—Emphasis on lexical representation, compositional analysis, markedness, field meaning at the word vs. sentence levels.

4 units, Spr (Oehrle) MWF 2:15

244. Philosophy of Language — (Same as Philosophy 181.)

Language Variation and Sociolinguistics

245. Sociolinguistics — Selected topics on language and society, including language and social stratification, language standardization, language and national development.

4 units, Spr (Hernandez-Ch.) TTh 9:00–10:50

249. Areal and Social Dialectology—(Same as Spanish and Portuguese 217.) Introduction to the principles and methods of linguistic geography. Special reference to research in Europe and the Americas. Social and linguistic parameters of dialect study.

4 units, Aut (Hernandez-Ch.) TTh 12:15–2:05

251. Language Change — Evidence for change from contemporary languages. Emphasis on acquisitional and sociolinguistic correlates of language change. Prerequisite: elementary linguistics course or consent of instructor.

Given alternate years

252. Historical and Comparative Linguistics — Introduction to the principles and methods of historical linguistics; the development of 20th century trends in historical linguistics. Prerequisite: 215 or consent of instructor.

4 units, Spr (Traugott) MW 12:30–2:05

253. Introduction to Indo-European Linguistics—(Same as Classics 232.)

Developmental Psycholinguistics

260. Child Language I—(Same as Psychology 240.) Review of present knowledge of processes of language acquisition from a linguistic point of view. Survey of recent and past literature. Prerequisite: 10 or 230, or consent of instructor.

4 units, Aut (Clark) TTh 11:00–12:30

261. Child Language II—(Same as Psychology 241.) Variable topics selected from semantics, syntax, or phonology. May be repeated for credit. Topic for 1974–75: Language input to children and the acquisition of speech registers.

4 units, Win (Clark) TTh 1:15–3:05

Computational Linguistics


4 units, Aut (Winograd) TTh 10:30–12:00

266. Computational Models for the Semantics of Natural Language—(Same as Computer Science 266.) Conceptual overview of problems of meaning. Formalisms from logic, psychology, and linguistics, relevance to computer implementations. Survey and critical discussion of current computer systems for natural language.

4 units, Win (Winograd) 9:30–11:00 plus 1 hr. dhr

Applied Linguistics

270. Linguistics and the Teaching of English—(Same as Education 282.) Linguistic aspects of the problems of teaching English to speakers of other languages, and standard English to speakers of other dialects. Prerequisite: introductory course in linguistics or consent of instructor.

3 units, Spr (F. Politzer) MWF 10

271. Topics in Applied Linguistics—May be repeated for credit. Topics for 1974–75 include: choice of medium of instruction in multilingual societies, bilingual education problems of non-standard varieties, and l...
guage standardization. Prerequisite: 10 or equivalent.
4 units, Win (Hernandez-Ch.) TTh 11:00-12:50

Methods

275. Field Research—Methods and research design for the study of language.
Given alternate years.

276. Research Methods in Sociolinguistics
—Introduces the student to social science research methods within the context of sociolinguistic research. Completed or on-going studies in sociolinguistics will be used in illustration. Students will apply some of the methods discussed to individual research projects in sociolinguistics.
Given alternate years

Languages

280. Languages of the Middle East—Structural sketches and sociolinguistic background information on the major contemporary languages of Southwest Asia and North Africa.
Given alternate years

281. Languages of Africa.
Given 1975–76

282. Languages of the Pacific.
Given 1975–76

284. Linguistics and the Analysis of German
—(Same as German 222/322.)

Seminars

Seminars are offered on typology and universals of language, phonological theory, syntax, semantics, sociolinguistics, historical linguistics, developmental psycholinguistics, and computational linguistics. May be repeated for credit. Students are admitted by consent of instructor.

Seminars offered in 1974–75 are:

330. Seminar in Syntax—Topics in the theory of syntax, including the relationship of syntax and semantics. Material from English and other languages. Prerequisite: 231.
5 units, Aut (Wasow and Oehrle) MW 3:15-5:05

340. Seminar in Philosophy of Language—
(Same as Philosophy 241.)

5 units, Win (Ferguson) TTh 1:15–3:05

350. Seminar in Ethnographic Semantics—
(Same as Anthropology 268.)

360. Seminar in Developmental Psycholinguistics—Topics in the acquisition of the first language.
5 units, Spr (Ferguson) TTh 9–11

365. Seminar in Computational Linguistics—
(Same as Computer Science 365.) Examination of unsolved problems in computational linguistics.
5 units, Spr (Staff) by arrangement

380. Seminar in German Linguistics—
(Same as German 325.)

Colloquia, Directed Reading

390. Proseminar—Orientation for first-year graduate students and an introduction to different types of linguistic research ongoing at Stanford.
1 unit, Aut (Bush) Th 2:15

391. Colloquium.
1 unit, Win (Staff) Th 4:15

392. Colloquium.
1 unit, Spr (Staff) Th 4:15

1 to 6 units, any quarter (Staff)
by arrangement

397. Directed Reading.
1 to 5 units, any quarter (Staff)
by arrangement

1 to 6 units, any quarter (Staff)
by arrangement

399. Dissertation Research.
1 to 15 units, any quarter (Staff)
by arrangement

ENGLISH FOR FOREIGN STUDENTS

The courses below represent the basic offerings in English for Foreign Students. Each quarter, additional sections of these courses are scheduled at other hours and days as needed. Those students whose English proficiency is so limited that they are required to take 85, 86, or 96 should normally expect to follow subsequent courses in the sequence during succeeding quarters.
During the summer, courses in spoken and written English up to a maximum of 11 units will be offered during the 8-week summer session. These are open to all regularly enrolled Stanford students. For details, see Summer Session Bulletin.

A 10-week program in Intensive English and Academic Orientation for Foreign Graduate Students is also offered in the summer. The latter program is open to qualified graduate students who have been admitted to degree programs at other U.S. institutions as well as those who have been admitted to Stanford for the following autumn quarter. Academic Orientation sections will focus on the fields of engineering and science, education, business, and social sciences.

86. Spoken English I—Intermediate review and practice of grammatical patterns of spoken English with emphasis on comprehension and intelligibility. One additional hour per week required in language laboratory. Prerequisite: consent of instructor.

3 units, Aut, Win (Staff) MWF by arrangement

87. Spoken English II—For students with some facility in spoken English. Emphasis on fluency, idiom and current usage, with the opportunity to make informal oral presentations. May be repeated for credit. Prerequisite: consent of instructor.

2 units, Aut, Win, Spr (Staff) TTh by arrangement

90A,B,C. Pronunciation—Review and practice of pronunciation patterns of spoken English with special attention to stress, rhythm, and intonation. Prerequisite: consent of instructor.

2 units, Aut, Win, Spr (Politzer) three hours per week by arrangement

92A,B,C. Aural Comprehension—Graded exercises in listening to lectures, dialogs, and discussions with evaluation of comprehension. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr (McChesney) by arrangement

94. Academic Orientation for Foreign Students—An introduction to the system of graduate education in the U.S. and at Stanford, with emphasis on the development of effective graduate study techniques. Particular attention will be given to the skills of note-taking, preparing for and taking examinations, using special vocabularies, the reading and writing of scholarly and scientific papers, and the presentation of term papers and reports.

3 units, Aut (Staff) to be arranged

95A,B,C. Special Problems in English—Topics (such as Problems in Vocabulary, Problems in Reading Comprehension, etc.) to be determined each quarter according to need and enrollment.

2 units, Aut, Win, Spr (Staff) by arrangement

96. Written English I—Intermediate work in expository writing with special attention to correct grammatical usage. Prerequisite: consent of instructor.

2 units, Aut, Win (Staff) by arrangement

97. Written English II—For students with some facility in written English. Emphasis on fluency, idiomatic usage, and style. Special attention given to mechanics and form appropriate to academic papers. May be repeated for credit. Prerequisite: consent of instructor.

3 units, Aut, Win, Spr (Staff) by arrangement

OTHER COURSES

CLASSICS


EDUCATION

383. Recent Developments in Foreign Language Education.

385. Role of Non-Standard Dialects in Education.

388. Foreign Language Education and Bilingual Education in the Elementary School.

482. Research Problems in Teaching and Learning a Second Language.

ENGLISH

102. The History of the English Language

200A. Introduction to Old Norse.

200B. Old Icelandic Sagas.

205. Old English.

206. Middle English.

FRENCH AND ITALIAN

211. Phonétique et Orthoépie.

212. Histoire de la langue française depuis le Moyen Age.

GERMAN STUDIES

204. History of the German Language.

205. Syntax of Modern German.
225. Linguistics Colloquium: Topics in German Linguistics.
228. Middle High German.
314. Old High German.
319. Early New High German.

HEARING AND SPEECH SCIENCES
230. Physiology of Speech Production.
231. Speech Perception.
281. Seminar in Animal Communication.
310. Experimental Phonetics.

PHILOSOPHY
163B. Intentional Modal Logic.
201. Mathematical Linguistics.

PSYCHOLOGY
146. Language and Thought.
214. Psycholinguistics.
272. Seminar on Topics in Psycholinguistics.

RELIGIOUS STUDIES
69A,B. Hebrew.

SLAVICS
194. Stylistics.
211. Introduction to Old Church Slavonic and Early Russian Texts.
212. History of the Russian Literary Language.

MATHEMATICS
Emeriti: Harold M. Bacon, Stefan Bergman, George Folya, Gabor Szegö (Professors)
Chairman: Robert Osserman
Vice Chairman: Paul W. Berg
Associate Professors: Gregory Brumfiel, John Coates, Fer Enflo, Mary V. Sunseri, Shing-Tung Yau. Visiting: Pierre van Moerbeke
Assistant Professors: Garo K. Kiremidjian, Marvin E. Ortel, Leon M. Simon, Jonathan Stavi, Lawrence Washington, Misha Zafran

OFFERINGS AND FACILITIES
The Department of Mathematics offers programs leading to the degrees Bachelor of Science, Master of Science, and Doctor of Philosophy in Mathematics, and participates in the program leading to the degree B.S. in Mathematical Sciences.

INTRODUCTORY COURSES
The Department of Mathematics offers two main sequences of courses in the calculus. Analytic Geometry and Calculus (41, 42, 43) is designed for students in mathematics, physics, chemistry, engineering and for other students who wish an extensive treatment of the calculus. Calculus and Probability (5, 6, 7) is designed for students in the biological or social sciences and other students who may wish a less extensive treatment of the calculus than is offered in the (41, 42, 43) courses.

In addition to these two main sequences, the Department offers the sequence (41A, 42A, 43A) which covers all of the material of (41, 42, 43) except analytic geometry, and the sequence (10, 11, 21, 22, 23) which covers the material of (41, 42, 43) in five quarters instead of three.

Algebra and Trigonometry (1) is offered for those who need or desire a better preparation in these subjects before entering one of the calculus sequences. Mathematics Workshop (2) also presents a treatment of pre-calculus mathematics, but in a format in which students work at their own pace with individual consultation.

The introductory course in modern algebra is Linear Algebra and Matrix Theory (113). There are no formal prerequisites for this course, but appropriate mathematical maturity is expected.

ADVANCED PLACEMENT FOR FRESHMEN
Secondary school students of unusual ability in mathematics often pursue one or more semesters of college-equivalent courses in mathematics while they are still in high school. Under certain circumstances it is possible for such students to secure both advanced placement and credit toward the Bachelor's degree on the basis of these courses. A decision as to placement and
credit will be made by the Department after consideration of the student's performance on the Advanced Placement Examination in Mathematics (either forms AB or BC) of the College Entrance Examination Board. This examination is the only one used for this purpose. The Department does not give its own Advanced Placement examination. Arrangements for such advanced placement and credit must be made during the first two weeks of the student's first quarter of attendance at Stanford University, or earlier, or the privilege will lapse. For referral to an adviser on advanced placement, communicate with the Academic Secretary of the Department.

PROGRAMS OF STUDY

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, 44, or 41, 42, 43, 44, or 41A, 42A, 43A, 44.) These courses should be started during the first year.

There is no language requirement, but students intending to go on to graduate work in mathematics are strongly urged to study at least one foreign language chosen from French, German, and Russian. They are advised to begin or continue this language study in the first year.

2. Nine courses, each carrying at least three units credit, numbered 100 or above, distributed as follows: three courses in algebra or number theory, four courses in analysis, and two courses in geometry or topology. These will typically be chosen among the following: algebra—113, 114, 120, 121, 152; analysis—106, 115, 116, 117, 130, 131, 132; geometry—142, 143, 159, 217A. Graduate courses in the same subject may be substituted for the preceding courses—for example, 206A for 106.

3. Five additional courses, each carrying at least three credits, chosen from 45, 46 and courses numbered 100 or above. Although not required, 45 is generally recommended.

Students completing the honors sequence 54, 55, 56 may take two elective courses in place of two required analysis courses.

Students planning graduate study in mathematics are advised to include one or more 200 level courses in their programs and, to facilitate this, to complete 113, 114, 115 and 116 as early as possible.

4. One of the following options. The choice of (a) or (b) is recommended.

a. Physics 51, 53, 55, 57 (total, 15 units).

b. Any four quarters of Physics lecture courses, chosen from those numbered 51 or above.

c. A series of courses, within which mathematics is applied in a significant manner. Students choosing this option must have their plans approved by the Undergraduate Affairs Committee of the Department of Mathematics.

Variations in the basic program described above are possible. In particular, students interested in applied mathematics may obtain the B.S. in Mathematics by taking a suitable program of courses in a field of application of mathematics in place of some of the courses prescribed above. Individual programs in such cases must be approved by the Departmental Committee on Undergraduate Affairs.

To receive the Departmental recommendation for graduation a student must have been enrolled as a major in the Department for at least two full quarters, including the last full quarter before graduation, and must complete at least 15 units of 100 (or higher) level courses in the Department.

More detailed information about the preceding and other aspects of the B.S. program is contained in the publication Handbook for Mathematics Majors, available on request from the Academic Secretary of the Department.

HONORS PROGRAM IN MATHEMATICS

Students who complete this program will be awarded the degree Bachelor of Science in Mathematics with Honors.

Admission to the Program — A student may apply for admission to the Honors Program not earlier than the last quarter of the sophomore year, and not later than the first two weeks of the first quarter of the senior year. Application must be made to the Committee on Undergraduate Affairs of the Department of Mathematics. Minimum requirements for consideration of an applica-
tion are (1) a 3.5 average in Mathematics courses taken at Stanford; (2) completion of at least two quarters of Advanced Calculus (44 or 54, and either 45 or 55 or 115) and one quarter of Linear Algebra (113); (3) some evidence of the candidate's interest in and aptitude for advanced work in mathematics; (4) submission of a detailed program of course work for the remaining quarters of the applicant's undergraduate career (see "Program" below for suggestions). This program will be regarded not as strictly binding, but as indicating an intended plan of study; appropriate substitutions can be made later with the approval of the student's adviser and of the Committee. In reaching a decision on the admission of an applicant, the Committee will pay special attention to items (3) and (4).

Each student enrolled in the Honors Program in Mathematics will

1. Satisfy the requirements for the B.S. in Mathematics, maintaining at least a 3.5 grade average in all mathematics courses.

2. Enroll in the Honors sections of mathematics courses whenever possible.

3. Complete, in addition to the requirements for the B.S. in Mathematics, at least 4 units of Mathematics 199. Independent work (199) requires that the student obtain the consent of a member of the Department faculty to supervise and evaluate the student's work. This work may be spread over a period of two or more quarters as the student and the faculty member may agree.

4. Complete, in addition to the requirements for the B.S. in Mathematics, at least 6 units of work as approved by the Committee. This may consist of one of the following options, or of a combination of them:
   a) Additional independent work or seminar work;
   b) Additional undergraduate course work in mathematics or other subjects having high mathematical content and contributing to a broad mathematical and/or scientific knowledge;
   c) Completion of one or more of the basic graduate courses in mathematics such as courses 205, 206, 210, 217. (This is especially recommended for students who plan to enter graduate work in mathematics.)

**Bachelor of Science in Mathematical Sciences**

The Mathematics Department participates with the Departments of Computer Science, Operations Research, and Statistics in a program leading to the degree of Bachelor of Science in Mathematical Sciences. See Program in Mathematical Sciences on page 604 of this bulletin.

**Master of Science**

The University's basic requirements for the Master's degree (residence, etc.) are discussed in the section "Degrees" in this bulletin. The following are Departmental requirements:

Candidates must complete an approved course program of 36 units beyond the departmental requirement for the B.S. degree. The candidate's program must include 18 units of courses numbered 200 or above. The candidate must have a B average over all course work taken in Mathematics, and a B average in the 200 level courses considered separately.

For the degree of Master of Science in Computer Science, see Computer Science Department material 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:

To be admitted to candidacy for the Ph.D. degree, a student must have successfully completed 45 units of graduate courses (i.e., courses numbered 200 and above). In addition the student must pass Qualifying Examinations 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 and submit an acceptable dissertation. The course program should display sufficient breadth in mathematics outside the student's field of specialization and may include work in a field of application of mathematics. In addition, the student must pass reading examinations in two of the languages French, German, and Russian, and pass the University oral examination. A student must receive a grade of B or better in a course to satisfy the Ph.D. requirement.
For the degree of Doctor of Philosophy in Computer Science, see the Computer Science Department material in this bulletin.

For further information concerning degree programs, requirements for a Ph.D. minor in mathematics, fellowships, and assistantships, inquire of the Academic Secretary of the Department.

**Teachers’ Credentials**

The requirements for a teaching major in Mathematics for the Standard Teaching Credential (Secondary) are the B.S. degree with major in Mathematics (see above) or, if the candidate has a Bachelor's degree with a major in another subject, the following: Courses 10, 11, 21, 22, 23, 44 (or 41, 42, 43, 44, or 41A, 42A, 43A, 44), 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. Thirty-six quarter units must be in upper division or graduate standing. Candidates for the General Secondary Credential may count courses 45, 46 and 55, 56 as equivalent to “courses numbered 100 or higher” for the purpose of meeting requirements listed in this paragraph. The requirements for a teaching minor in Mathematics are Courses 10, 11, 21, 22, 23, 44 (or 41, 42, 43, 44) 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 106, 113, 114, 120, 142, 143, 152, and 159, as particularly appropriate to these programs.

**Master of Arts in Teaching (Mathematics)**

In cooperation with the School of Education, the Department offers a program leading to a degree, Master of Arts in Teaching (Mathematics). This degree is intended for candidates who have a teaching credential and wish further to strengthen their academic preparation. Detailed requirements are outlined in this bulletin under “School of Education, Master of Arts in Teaching.”

**Courses**

**INTRODUCTORY AND UNDERGRADUATE COURSES**

Introductory courses will be offered only if twenty or more students enroll.

1. Algebra and Trigonometry—Fundamental laws; linear and quadratic equations; inequalities; logarithms; binomial theorem; trigonometric functions, identities, and equations; solution of right and oblique triangles; complex numbers; De Moivre’s theorem. (Attention is called to the fact that this course cannot be taken in partial fulfillment of the distribution requirement in Natural Science, Mathematics, and Technology.)

   4 units, Aut (----) MTWThF 8, 12, and 2:15

   Win (----) MTWThF 12

2A,B. Mathematics Workshop — The main aim of the workshop is to have students learn that they can do mathematics, regardless of their previous experience. This course uses materials and techniques designed especially to help students master the art of solving problems. Its flexible format allows each student to build conceptual understanding in an atmosphere free of anxiety, and with as much personal attention as desired. Visualization, pattern recognition, diagramming, and systematic analysis are among the techniques emphasized to foster self-confidence in doing mathematics. The course also reviews fundamental algebra and then moves on to pre-calculus mathematics, investigating polynomials, rational, exponential, logarithmic and trigonometric functions in a highly visual treatment to develop basic mathematical intuitions.

   2A. 4 units, Aut (deLeeuw) MWF 3:15 and sections

   Win (deLeeuw) MWF 3:15 and sections

   2B. 4 units, Win (deLeeuw) MWF 2:15 and sections

   Spr (deLeeuw) MWF 2:15 and sections
5. Calculus and Probability—The sequence (5, 6, 7) is designed primarily for the general student and students in the biological and social sciences. The courses will provide the student with the basic ideas of calculus and of probability theory. Applications will be chosen mainly from biology, economics and other social sciences. Topics will include the following: Algebra of sets, sample spaces, counting problems. Probability. Random variables, expectation, variance. Real number system. Functions and graphs. Tangent lines, derivatives, rules of differentiation. Derivatives of the elementary functions. Maximum-minimum problems, rates of change. Anti-derivatives, integrals, area and other applications. Special probability distributions and applications. Law of large numbers. Prerequisites: algebra and trigonometry.

3 units, Aut (—) MWF 8, 9, 10, 12, and 1:15
Win (—) MWF 8, 10, and 2:15

6. Calculus and Probability—Continuation of 5. Prerequisite: 5.

3 units, Win (—) MWF 8, 9, 10, 12, and 2:15
Spr (—) MWF 8 and 2:15


3 units, Aut (—) MWF 2:15
Spr (—) MWF 8, 9, 12, and 2:15
Sum (—)

10. Analytic Geometry and Calculus—The sequence (10, 11, 21, 22, 23) covers the same subjects as the sequence (41, 42, 43) described below. Prerequisites same as for 41.

3 units, Aut (—) MWF 8, 9, 10, 12, 1:15, and 2:15
Win (—) MWF 10, 12, and 2:15


3 units, Win (—) MWF 8, 9, 10, 1:15, and 2:15
Spr (—) MWF 10, 12, and 2:15


3 units, Aut (—) MWF 8 and 2:15
Spr (—) MWF 8, 9, 10, 1:15, and 2:15


3 units, Aut (——) MWF 8 and 2:15
Win (——) MWF 2:15

23. Analytic Geometry and Calculus—Continuation of 22. Prerequisite: 22.

3 units, Aut (——) MWF 2:15
Win (——) MWF 2:15
Spr (——) MWF 2:15

41. Analytic Geometry and Calculus — The sequence (41, 42, 43) is intended for students whose major area of specialization is in mathematics, the physical sciences, or engineering, or who need a more extensive and detailed study of analytic geometry and calculus than that provided in the sequence (5, 6, 7). Principal topics included in the three courses are functions and graphs, limit, continuity, derivative, plane analytic geometry of the straight line, conics, geometrical and physical applications of the derivative, mean value theorem, antiderivative, integral, fundamental theorem, technique of integration, geometrical and physical applications of the integral, polar coordinates, parametric equations, vectors in the plane and in space, analytic geometry of space of three dimensions, planes, surfaces, lines, curves, brief introduction to calculus of functions of two or more variables. Prerequisites: algebra and trigonometry.

5 units, Aut (Sunseri) MTWThF 8
(Berg) MTWThF 9
(Hawley) MTWThF 10
Win (Hawley) MTWThF 1:15

41A. Calculus — 41A, 42A, 43A together cover the same topics in the calculus as 41, 42, 43, but topics in plane analytic geometry are omitted. Requirements for admission to 41A are the same as for 10, but in addition the student must have had substantial course work in analytic geometry in high school or college. Admission to 41A will be restricted to students who pass a qualifying examination in analytic geometry to be given during the first week of the quarter. Details of this examination will be explained at the first meeting of the class. This examination will be waived only for those who present transfer college credit in analytic geometry.

5 units, Aut (Sunseri) MTWThF 9

42. Analytic Geometry and Calculus—Continuation of 41. Prerequisite: 41.

5 units, Win (Sunseri) MTWThF 8
(Berg) MTWThF 9
Spr (Ortel) MTWThF 1:15
42A. Calculus—Continuation of 41A.  
5 units, Win (Sunseri) MTWThF 9

43. Analytic Geometry and Calculus—Continuation of 42. Prerequisite: 42.  
5 units, Aut (Phillips) MTWThF 1:15  
Spr (Sunseri) MTWThF 8  
(Berg) MTWThF 9

43A. Calculus—Continuation of 42A. Concurrent registration in 44 is permissible.  
3 units, Spr (Sunseri) TTh 9

44. Advanced Calculus I — Infinite series, convergence tests, parallel topics on improper integrals. Uniform convergence. Power series. Complex numbers. Prerequisite: 7, 23, 43, or 43A, or concurrent registration in 23, 43, or 43A and instructor’s consent.  
3 units, Aut (——) MWF 8, 10, 12, 1:15, and 2:15  
Win (——) MWF 10 and 1:15  
Spr (Feferman) MWF 9

45. Advanced Calculus II — Vectors and curves in the plane. Functions of two variables, directional derivatives, gradient, line integrals, double integrals. Plane mappings, vector fields, Green’s theorem. Prerequisite: 43.  
3 units, Win (——) MWF 10, 12, and 2:15  
Spr (——) MWF 10 and 1:15

46. Advanced Calculus III—Vectors, curves and surfaces in space. Functions of several variables, vector calculus, multiple integrals, surface integrals, Stokes’ theorem, divergence theorem, differential forms. Prerequisite: 45.  
3 units, Spr (Gilbarg) MWF 10

54. Honors Calculus — 54, 55, and 56 constitute an honors sequence in advanced calculus. The material covered is a more general version of 44, 45, 46, together with some of the topics of 115, 116, and 117. Prerequisites: 43 and 113 (or concurrent registration in 113), and consent of instructor.  
4 units, Aut (Cohen) MWF 2:15

55. Honors Calculus—Continuation of 54.  
4 units, Win (Cohen) MWF 2:15

56. Honors Calculus—Continuation of 55.  
4 units, Spr (Cohen) MWF 2:15

97. Introductory Seminar in Mathematics—These seminars are intended to provide the general student with an opportunity for active involvement in learning mathematics. The subjects are topics not included in the standard curriculum. The seminars will be designed and conducted by graduate students under supervision of a faculty committee. A list of seminar offerings each quarter will be available from the Academic Secretary of the Department.  
1 to 2 units, Aut, Win, Spr (——)  
by arrangement

COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

Unless explicitly stated there are no prerequisites for the courses listed below. Where a prerequisite is stated it may be waived with the consent of the instructor.

106. Introduction to Theory of Functions of a Complex Variable — Complex numbers, analytic functions, Cauchy-Riemann equations, complex integration, Cauchy formula; elementary conformal mappings. Prerequisite: 45.  
3 units, Aut (Finn) MWF 1:15  
Spr (Levine) MWF 11

113. Linear Algebra and Matrix Theory—The study of the algebraic properties of matrices and their interpretation in geometric terms. The relationship between the algebraic and geometric points of view and matters that are fundamental to the study and solution of linear equations are dealt with. Topics include: linear equations, vector spaces, linear dependence, bases and coordinate systems; linear transformations and matrices; similarity and eigenvalues; reduction of quadratic forms.  
3 units, Aut (——) MWF 9, 11, 1:15, and 2:15  
Win (Ortel) MWF 9  
Spr (——) MWF 9 and 1:15  
Sum (——)

114. Linear Algebra and Matrix Theory—Continuation of 113: A deeper study of certain of the topics indicated as well as additional topics chosen among the following: invariant subspaces, canonical forms of matrices, minimal polynomials and elementary divisors; vector spaces over arbitrary fields; inner products; Hermitian and unitary matrices; multilinear algebra.
115. Fundamental Concepts of Analysis—A rigorous development of real analysis in Euclidean space: basic point set topology, limits, continuous functions. Especially recommended for students who intend to take graduate work in mathematics. Prerequisite: 44. Recommended: 45.

3 units, Aut (Milgram) MWF 1:15
Win (McGregor) MWF 11
Spr (Ortel) MWF 9


3 units, Win (Kiremidjian) MWF 1:15
Spr (Stavi) MWF 10


3 units, Spr (Kiremidjian) MWF 1:15

120. Modern Algebra — Integral domains, fields, polynomials, divisibility theory, groups. Prerequisite: 113.

3 units, Win (Washington) MWF 2:15
Spr (Brumfiel) MWF 3:15

121. Modern Algebra—Continuation of 120.

3 units, Spr (Washington) MWF 2:15

123. Theory of Probability—This is an introductory course to the theory of probability and some of its applications. The basic concepts of probability, random variables and their distribution functions are treated in the modern manner. Classical limit theorems for sequences of independent random variables are discussed in some detail. Prerequisite: 44.

3 units, Win (Karlin) MWF 9

124. Introduction to Stochastic Processes—The discussion will include types of Markov chains, branching and queuing processes, applications to order statistics, and an introduction to Brownian motion. Prerequisite: 123.

3 units, Spr (Karlin) MWF 9

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. Prerequisite: 44 or concurrent registration in 44.

3 units, Aut — MWF 8, 11, and 2:15
Win — MWF 12 and 2:15
Sum —


3 units, Win — MWF 11 and 2:15
Spr (Simon) MWF 2:15


3 units, Spr (Levine) MWF 2:15

134. Difference and Integral Equations — An introduction to the theory of linear functional equations of the difference and integral types, with analytical techniques for their resolution and numerous illustrative examples of historical or technical interest.

3 units, Aut (Levine) MWF 2:15

136. Introduction to Computing — (Enroll in Computer Science 106.)

137A,B. Numerical Analysis — (Enroll in Computer Science 137A,B.)

142. Higher Geometry—A study of various geometries, including projective, affine and non-euclidean geometry, from the unifying viewpoint of transformation groups. Prerequisite: 113.

3 units, Aut (Hawley) MWF 2:15

143. Topics in Geometry — Selected topics. Possible choices include algebraic geometry, differential geometry, and foundations of geometry.

3 units, Spr (Hawley) MWF 1:15

150. Introduction to Combinatorial Theory—(Enroll in Computer Science 150.)

152. Elementary Theory of Numbers — Euclid's algorithm, fundamental theorems on divisibility; prime numbers; congruence of numbers; theorems of Fermat, Euler, Wil-
son; 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, Aut (Feferman) MWF 2:15

159. Introduction to Topology—This course will cover some of the basic properties of metric and topological spaces; compactness, connectedness, and continuity. Special attention will be paid to the Euclidean spaces; and the fixed-point and degree of mapping theorems will be developed. Enrollment is limited to undergraduates.

3 units, Win (Milgram) MWF 11


161. Introduction to Set Theory—(Enroll in Philosophy 161.) Intuitive justification of the axioms. Operations on sets, relations and functions. Equivalence and ordering relations. Equivalence of sets and cardinal arithmetic. Topics on ordinal numbers and axiom of choice as time permits. Prerequisite: 160A or equivalent.

162. Theory of Automata — (Enroll in Philosophy 162.) An introduction to finite automata. Comparison of different notions of computability. Relationship to programming languages and theories of grammars.

190A,B. Perspectives in Mathematics — Some of the most impressive progress in many fields of mathematics has resulted from utilization of ideas and methods from other fields, both within and outside of mathematics. One can gain a deeper understanding even of special subjects in mathematics by learning something of such interrelationships, both historically and conceptually. It is not possible to provide this within the separate confines of the standard course. The aim of this course is in partial compensation. Each year, several topics which reveal significant interconnections will be treated in detail. Intended for seniors and well prepared juniors; admission by consent of instructor.

Alternate years, given 1975–76

195. Mathematics Workshop Consulting—This course, together with Mathematics 2, Mathematics Workshop, form part of a continuing experiment whose aim is to create an optimal learning environment for those students having weak backgrounds in mathematics. Students enrolled in Mathematics 195 will study recent literature on mathematics education and will work together in pairs leading small groups of Mathematics 2 students.

3 units, Aut (deLeeuw) MWF 1:15 and by arrangement
Win (deLeeuw) MWF 1:15 and by arrangement
Spr (deLeeuw) MWF 1:15 and by arrangement

196. Undergraduate Colloquium—Based on reading and discussion of topics in history and philosophy of mathematics. Prerequisite: consent of instructor.

3 units, Spr (Hawley) by arrangement

197. Undergraduate Seminars—These seminars are intended to supplement the standard curriculum, and especially to provide an opportunity for students with appropriate mathematical backgrounds, through active involvement, to share in the excitement of discovery in Mathematics. The seminars will be designed for the average student, rather than for the honors mathematics major.

The seminars will be designed and conducted by graduate students under supervision of a faculty committee. A list of seminar offerings each quarter will be available from the Academic Secretary of the Department.

1 to 3 units, Aut, Win, Spr, by arrangement

199. Independent Work—This course provides an opportunity for any undergraduate to pursue a reading program on a topic of his choice under the direction of a faculty member of the Department of Mathematics. Credit for the course may be used toward the fulfillment of the elective requirement for the degree in mathematics. Students wishing to use credit for the course toward the fulfillment of the department's area requirements must receive the approval of the Undergraduate Affairs Committee of the Department.

Students having a topic they wish to investigate but who need help in finding a faculty member to direct their reading should see Professor deLeeuw.

(Staff) by arrangement
COURSES INTENDED PRIMARILY FOR GRADUATE STUDENTS


205A. 3 units, Aut (Zafran) MWF 10
205B. 3 units, Win (Zafran) MWF 10
205C. 3 units, Spr (Zafran) MWF 10

206A,B,C. Theory of Functions of a Complex Variable — Complex integration. Cauchy's theorem, calculus of residues; power series, infinite products, entire functions, Picard's theorem; Riemann mapping theorem. Prerequisite: 116 or equivalent.

206A. 3 units, Aut (Kiremidjian) MWF 11
206B. 3 units, Win (Kiremidjian) MWF 11
206C. 3 units, Spr (Kiremidjian) MWF 11

210A,B,C. Modern Algebra — Groups, rings and fields; Galois theory, ideal theory, introduction to algebraic geometry; representations of groups and algebras; multilinear algebra. Prerequisite: 120 or equivalent.

210A. 3 units, Aut (Brumfiel) MWF 1:15
210B. 3 units, Win (Washington) MWF 1:15
210C. 3 units, Spr (Coates) MWF 1:15

217A,B. Differential Geometry — Classical differential geometry of curves and surfaces; surfaces of constant curvature, connections with non-euclidean geometry; minimal surfaces. Intrinsic geometry, parallel transport, geodesics; geometry on a surface. Prerequisite: 130 or equivalent.

217A. 3 units, Win (Yau) MWF 2:15
217B. 3 units, Spr (Yau) MWF 2:15

220A,B. Methods of Mathematical Physics — Potential theory, Green's function, integral equations; Hilbert space approach to problems of mathematical physics; elementary spectral theory; variational methods.

220A. 3 units, Aut (Gilbarg) TTh 1:15 to 2:30
220B. 3 units, Win (Gilbarg) TTh 1:15 to 2:30

221A. Calculus of Variations — Euler-Lagrange equations, sufficient conditions; applications to eigenvalue and scattering problems; direct methods, Dirichlet's principle.

230A,B. Advanced Probability — Fundamental concepts, weak and strong laws of large numbers, convergence of distributions and the central limit theorem, infinitely divisible distributions and stable laws. Prerequisite: 205A.

230A. 3 units, Win (van Moerbecke) MWF 3:15
230B. 3 units, Spr (van Moerbecke) MWF 3:15

232A,B,C. Topics in Stochastic Processes — An introduction to the modern theory of stochastic processes with emphasis on concrete cases such as Brownian motion and Levy increasing processes. General discussion of aspects of Markov processes and potential theory. Prerequisites: 230A,B.

232A. 3 units, Aut (Chung) MWF 3:15
232B. 3 units, Win (Chung) MWF 3:15
232C. 3 units, Spr (Chung) MWF 3:15

235A,B,C. Selected Topics in Ergodic Theory — Topics from: The Kolmogorow-Sinai theory of entropy; the isomorphism theorem for Bernoulli shifts and Bernoulli flow; K-automorphisms applications to mechanical systems, and automorphisms of compact groups.

235A. 3 units, Aut (Ornstein) by arrangement
235B. 3 units, Win (Ornstein) by arrangement
235C. 3 units, Spr (Ornstein) by arrangement

237A,B,C. Advanced Numerical Analysis — (Enroll in Computer Science 237A,B,C.)


243A. 3 units, Aut (Schiffer) MWF 11
243B. 3 units, Win (Schiffer) MWF 11

244A,B. Riemann Surfaces — The construction of harmonic and analytic functions on compact and non-compact Riemann surfaces. The Riemann-Roch and Runge theor-

Alternate years, given 1975–76


Alternate years, given 1975–76

253A,B,C. Total Positivity and Applications to Analysis—Classifications of totally positive kernels, Polya frequency functions, Tchebycheff systems, connections with Sturm-Liouville eigenvalue problems and integral equations. Some applications in probability theory will also be given. Prerequisites: 205 and 206.

253A. 3 units, Aut (Karlin) TTh 9-10:15
253B. 3 units, Win (Karlin) TTh 9-10:15
253C. 3 units, Spr (Karlin) TTh 9-10:15

254A,B. Ordinary Differential Equations—Fundamental existence theorems, stability and asymptotic behavior of nonlinear systems, Poincaré-Bendixson systems, connection with Sturm-Liouville eigenvalue problems and integral equations. Some applications in probability theory will also be given. Prerequisites: 205 and 206.

Alternate years, given 1975–76


256A. 3 units, Aut (Simon) 11:00–12:15
256B. 3 units, Win (Simon) TTh 11:00–12:15
256C. 3 units, Spr (Simon) TTh 11:00–12:15


Alternate years, given 1975–76


261A. 3 units, Aut (de Leeuw) MWF 10
261B. 3 units, Win (Enflo) MWF 10
261C. 3 units, Spr (Enflo) MWF 10


3 units, Aut (Samelson) MWF 9


265A. 3 units, Aut (Phillips) MWF 10
265B. 3 units, Win (Phillips) MWF 10

266A,B. Harmonic Analysis.

Alternate years, given 1975–76

271A,B. Mathematics of Wave Motion—Analytical techniques for the calculation of varied wave phenomena, with emphasis on
the use of fundamental solutions (localized source functions), asymptotic integration and integral equations. Illustrative problems obtained from the subjects of elasticity, electromagnetic theory and magnetohydrodynamics.

Alternate years, given 1975–76

273. Electromagnetic Theory — A systematic characterization of field equations, conservation laws and interfacial (or boundary) conditions by means of variational principles. Representation theorems for the fields due to prescribed or equivalent sources in finite and infinite domains.

3 units, Win (Levine) MWF 1:15

274. Topics in the Mathematical Theory of Surface Tension — The course will deal principally with the qualitative properties of the interface between two fluids as determined by the fluid and boundary materials and the boundary geometry. Conditions for existence and for non-existence of solution surfaces will be given. Some experimental demonstrations may be included.

2 units, Win (Finn) MW 2:15

277A,B. Mathematical Theory of Relativity — Ricci calculus; variational principles and covariance properties; differential geometry of space-time; Cauchy's problem for the differential equations of gravitation and electromagnetism; relativistic hydrodynamics; unified field theories.

277A. 3 units, Win (Schiffer) TTh 11:00–12:15
277B. 3 units, Spr (Schiffer) TTh 11:00–12:15


281A. 3 units, Aut (Brumfiel) MWF 9
281B. 3 units, Win (Brumfiel) MWF 9
281C. 3 units, Spr (Brumfiel) MWF 9


283A. 3 units, Aut (Milgram) MWF 2:15
283B. 3 units, Win (Milgram) MWF 2:15

284A. Differentiable Manifolds — An introduction to the theory of differentiable manifolds, including tensors, differentiable forms, integration on manifolds, and deRham cohomology. Also elements of the theory of sheaves and Lie groups. Prerequisites: 113, 116, and 120 or the equivalent.

3 units, Aut (Osserman) TTh 11:00–12:15

290A,B,C. Mathematical Logic — Model theory: formal languages and their models; validity and definability; complete and decidable theories. Theory of recursive functions and formal systems: recursively enumerable sets; recursively unsolvable problems in mathematics and logic; Gödel's theorems. Set theory: the cumulative hierarchy; axiomatic set theory and its models, in particular the constructible sets. Prerequisites: 160 and 161 or equivalent.

290A. 3 units, Aut (Stavi) MWF 11
290B. 3 units, Win (Feferman) TTh 1:15–2:30
290C. 3 units, Spr (Feferman) TTh 1:15–2:30

291A,B. Topics in Model Theory — Selected principally from: model constructions, including ultraproducts, and their properties; applications of model theory to mathematics; infinitary languages; functorial semantics. Prerequisite: 290 or equivalent.

291A. 3 units, Win (Stavi) MWF 11
291B. 3 units, Spr (Stavi) MWF 11

292A. Topics in Recursion Theory — Selected principally from: recursive ordinals, hierarchies, hyperarithmetic sets, and other generalizations of recursion theory; advanced theory of recursively enumerable sets and their degrees of undecidability. Prerequisite: 290 or equivalent.

3 units, Aut (Feferman) TTh 1:15–2:30

293A,B. Topics in Proof Theory — Selected principally from: Gentzen's theory of formal rules for finite and infinitary languages; analysis of formal proof trees by use of ordinal functions, constructive functionals of higher type. Prerequisite: 290 or equivalent.

Alternate years, given 1975–76

294A,B. Topics in Set Theory — Selected principally from: Forcing and generic sets, Boolean valued models and independence results; mathematical consequences of large cardinal assumptions. Prerequisite: 290 or equivalent.

Alternate years, given 1975–76
MODERN
THOUGHT AND
LITERATURE

Committee in Charge: Lucio Ruotolo (English), Acting Chairman, Ellen H. Rogat, Post-doctoral Fellow in Teaching/Research in Modern Thought and Literature (English) and Assistant Director, Martin Bresnick (Music), Albert Elsen (Art), John Foster (English), Jean Franco (Spanish and Comparative Literature), René Girard (Modern Thought and Literature and French, on leave 1974–75), Albert Guerard (English, on leave), David Halliburton (English), Kurt Mueller-Vollmer (German Studies), Bridget O’Laughlin (Anthropology), autumn quarter, Michelle Rosaldo (Anthropology), winter and spring quarters, Peter Stansky (History)

The Committee sponsors a program leading to the Ph.D. in Modern Thought and Literature. This degree is designed for students intending to teach modern literature in interdisciplinary programs or in English departments. It assumes serious interest in one or more areas of modern thought: history, psychology, philosophy, anthropology, linguistics, political and social thought, religious studies, the several arts, contemporary culture generally. The term modern is construed to mean, roughly, from the Enlightenment to the present. Thus a student would specialize in modern English and American literature from the Enlightenment to the present, and in addition would pursue an individual program of interdisciplinary studies involving part of the same period. The student would, that is, acquire an extensive knowledge of the literature in one language for approximately the last two hundred years. But no attempt would necessarily be made to cover aspects of non-literary thought for the full modern period.

The Committee also offers several interdisciplinary courses open to qualified undergraduates and graduates in other programs.

PROGRAMS OF STUDY

MASTER OF ARTS

Only candidates for the Ph.D. will be admitted. But students in the Ph.D. program
who satisfy the committee of their progress, and who complete satisfactorily 45 units of work, may apply for an A.M. in Modern Thought and Literature.

**Doctor of Philosophy**

University regulations regarding this degree are discussed in the section "Degrees" in this bulletin. The following Committee requirements are in addition to the basic ones established by the University.

A candidate for the Ph.D. degree in Modern Thought and Literature must complete three years (nine quarters) of full-time work, or their equivalent, in graduate study beyond the A.B. He or she will be expected to offer at least 90 units of graduate work in addition to his dissertation. At least three consecutive quarters of graduate work must be taken at Stanford. Students may spend one year of graduate study abroad.

Each student will plan his or her program with specified advisers. The exact distribution of time, between the literature of specialization and the interdisciplinary work in modern thought and literature, will depend on the nature of the undergraduate preparation. Candidates with an inadequate preparation in earlier literature may be asked to take appropriate courses.

The Committee believes that creative writing or other artistic activity contributes to the development of the teacher of modern literature. A reasonable amount of creative work (the amount to be approved by each student's advisers) may be counted among the 90 units required.

Normally, the requirements for the Ph.D. in Modern Thought and Literature would be distributed as follows:

1. An introductory seminar, Modern Thought and Literature 361 (5 units).
2. Approximately 45 units of advanced work in "modern" literature of one language, including at least two seminars in the appropriate department.
3. Approximately 40 units of advanced work in a coherent and individually arranged interdisciplinary program, including at least one further seminar. The program may include courses and reading in various areas of modern thought and culture, and individual creative work.
4. Teaching is considered an essential part of the program. During the first year a candidate is expected to act as a reader for one course, in the second year to teach two quarters of Freshman English, and in the third or fourth year to assist a faculty member as a section leader in a large survey course.

5. **First-Year and Second-Year Qualifying Procedures.** No later than the third quarter of the first year the student will meet with faculty members designated by the Chairman in order to discuss the student's academic performance. The faculty will recommend what further courses, if any, should be taken to correct deficiencies. The student will indicate which of the optional plans for qualification he or she has elected to pursue. These are:

   a) a written or oral examination;
   b) a monograph covering the work done;
   c) either one or both of the above combined with (for certain areas) public lectures or discussions.

Before the end of the third quarter of the first year a student electing (a) will arrange with his or her adviser a program of preparation (including, for example, the establishment of a reading list) for the examination. A student electing (b) or (c) will submit a suitable prospectus.

Students must complete their qualifying plans early in the first quarter of the second year; i.e. this is the deadline for taking the examination, for turning in the complete monograph, as in options (a) or (b), or for completing the combined activities of option (c).

6. **Language Requirement.** Students must demonstrate by the end of the third quarter of the first year a reading knowledge of one foreign language comparable to that required by the Department of English; and by the beginning of the first quarter of the third year, an advanced reading knowledge of one other foreign language. An "advanced" reading knowledge means the ability to make a genuine scholarly use of the language: that is, to read prose of ordinary difficulty.

7. **Summary Requirement.** At the termination of his or her course work, and prior to the university orals examination, each student will prepare a detailed statement of the advanced work he or she has done outside the area of his or her specialization. This statement must be approved by the student's
advisers and certified by the Committee on Modern Thought and Literature.

8. University Oral Examination. This examination, covering the student’s areas of concentration and dissertation proposal, will normally be taken in the third year of graduate study.

9. Dissertation. The fourth year will be devoted to the dissertation, which shall be a substantial and original contribution acceptable to the Committee on Modern Thought and Literature. The subject may be drawn from the literature of specialization, from the area of non-literary studies, or from a combination of the two.

GRADUATE PROGRAM IN HUMANITIES

The Committee participates in the Graduate Program in Humanities leading to a joint Ph.D. degree in Modern Thought and Literature and Humanities. For a description of the Humanities program, see the section “Humanities Special Programs.”

UNDERGRADUATE PROGRAM

The Committee sponsors several courses open to qualified undergraduates, but does not at present offer a major in Modern Thought and Literature. Students wishing to design their own interdisciplinary major should consult the Academic Information Office, on the third floor of the Old Union, and the Chairman of the Committee.

COURSES

Courses are open to qualified students from any department.

63B/163B. Studies in Women’s Consciousness—An interdisciplinary approach to the relationship between women novelists’ positions as women and their ways of interpreting and expressing reality. Concentration on George Eliot and Virginia Woolf, but including Jane Austen, Charlotte Brontë and Doris Lessing as well.

5 units, Spr (E. Rogat) MWF 11

128. The American Condition: Literature and History in the 20th Century—(Same as English 128.)

5 units, Aut (Chace, Kennedy) MWF 9

147. Twentieth Century Theater—(Same as English 147.) Major dramatic works and innovations in staging, design, and acting. We will also discuss influential theorists such as Stanislavski, Artaud, and Grotowski. Dramatists include: Chekhov, Shaw, Strindberg, Brecht, Pirandello, Coward, Beckett, Pinter, Bond, Durrenmatt, Genet.

5 units, Win (Friedlander)

167. The Literature of Fantasy—(Same as English 167.) Major forms of fantasy in literature and other arts. Examining science fiction, pornography, gothicism, and religious and romantic adventure, we will attempt to formulate a theory of the nature and uses of fantasy.

5 units, Aut (Friedlander)

186. Turgenev—(Same as Slavic Languages and Literatures 186.) The significance of his work in 19th century literature and intellectual history. The course will treat Turgenev’s work as a conscious effort to articulate in fictional form the dominant intellectual currents of his time.

4 units, Spr (Brown)

194A. Colloquium on National and International Identity—(Same as Comparative Literature 194A and English 165.) Intensive study of national and international dimensions of literature, drama and thought with emphasis on problems of identity in Anglo-American and European cultures. Topics will include nationalism and national revivals in the British Isles, the United States and Europe. Enrollment limited to 15.

5 units, Spr (Halliburton)

195. Ad Hoc Undergraduate Seminars—In a given quarter a group of undergraduates (at least 3 but preferably more) who wish in the following quarter to study a subject or an area not covered by regular courses may plan an informal seminar and approach a faculty member to supervise it. A syllabus for the course should be submitted to the Chairman of the Committee at least 2 weeks before the end of the previous quarter. No more than 5 units of credit will be given for Modern Thought and Literature 195 and/or 198 in any one quarter.

Any quarter, by arrangement

198. Individual Work—Advanced undergraduates who wish to study a subject or an area not covered by regular courses may,
with permission, enroll for individual work under the supervision of some member of
the faculty. No more than five units of credit
will be given for Modern Thought and Lit-
erature 198 and/or 195 in any one quarter.

Any quarter, by arrangement

201. Philosophy and Literature—(Same as
Philosophy 11.)
4 units, Win (Howell) MWF 11

213. Contemporary Critical Approaches—
(Same as English 302.)
4 units, Spr (Lyons) MW 2:15-4:05

217. Representation—(Same as Compara-
tive Literature 220 and English 200.) Broad
study of the mimetic mode in the several
arts, including poetry, drama, and painting,
with emphasis on theory.
5 units, Aut (Dufrenne) MWF 11

220. Film Aesthetics—(Same as Communi-
cation 101.) A systematic examination of the
nature of the film medium, and of attempts
to construct theories of film. Attention is
given to the problems of aesthetics and commu-
nication from the viewpoints of practi-
tioner, critic, and audience.
4 units, Aut (Kovdcs) MWF 10,
with evening screening

221. History of Film—(Same as Communi-
cation 141.) Studies in the development of the
motion picture as an art form and a
means of communication. Lab.: screenings
of films announced in class.
4 units, Win (Mayer) MWF 9

222A. Modern Art IV: Twentieth Century
Painting I, 1900–1920—(Same as Art 121A.)
Fauvism, Matisse, German and Austrian Ex-
pressionism, Picasso and Cubism, Orphism,
Futurism.
4 units, Win (Elsen), to be arranged

222B. Modern Art V: Twentieth Century
Painting II, 1920–1960—(Same as Art 121B.)
Abstraction, Constructivism, Dada, Surreal-
ism, Abstract Expressionism.
4 units, Spr (Elsen), to be arranged

229. Art, Politics and Society—(Same as
History 229/328A.)

5 units, Aut (Paret) M 2:15–4:05

230. Biography and History—(Same as His-
tory 229A/303.)

5 units, Spr (Paret) T 2:15–4:05

231A, B. Russian Intellectual History —
(Same as History 118A, B, Slavic Languages
and Literature 118A, B, and Comparative
Literature 118A, B.)
(Brown, Emmons) given 1975–76

232A. The World of William Morris—
(Same as History 243A/343A.)
5 units, Aut (Stansky) T 2:15–4:05

232B. Into the World of William Morris—
(Same as History 243B/343B.)
5 units, Win (Stansky) T 2:15–4:05

240. Theory of the Novel—(Same as English
230 and Comparative Literature 228.)
5 units, Win (Levine) MWTh 2:15–3:05

247. Selected Problems of Anthropological
Theory—(Same as Anthropology 183.) Under-
graduate lecture course in the history of
anthropological theory; introduction to sem-
inal controversies and opposed traditions in
the analysis of society and culture.
5 units, Spr (O’Laughlin)
TTh 4:15–6:05

248. Women in Cross-Cultural Perspective
—(Same as Anthropology 138.) A lecture
course on various traditional anthropological
concerns, as these are illuminated by a study
of the position and behavior of women. Top-
ics will include the place of women in kin-
ship, political, economic, and ritual systems.
5 units, Win (J. Collier, M. Rosaldo)
TTh 1:15–3:05

249. Anthropological Approaches to Reli-
gion—(Same as Anthropology 143.) An ex-
amination of various approaches to the inter-
pretation of non-Western religious beliefs
and practices, with an emphasis on recent
developments in structural anthropology.
5 units, Win (R. Rosaldo) MWF 2:15

251. Masks of Violence in Myth, Literature
and Contemporary Culture—(Same as Com-
parative Literature 251.) Themes and struc-
tures common to primitive and modern
modes of expression. The plague, for in-
stance, will be traced and interpreted from
its mythical origins to its contemporary for-
mulations. Enrollment limited to 15.
5 units (Girard), given 1975–76

252. Political Thought: The Modern Pe-
riod—(Same as Political Science 153.) The
development of democratic theory, liberalism, socialism, communism and anarchism since 1785. The course will undertake critical analysis of attempts to adapt the ideals of democracy and social justice to the large modern state. The Federalist papers, Tocqueville, J. S. Mill, Marx and Lenin will be considered.

5 units, Spr (N. Keohane) MWTh 10

254. Seminar in Political Theory and Method: Thought and Action—(Same as Political Science 254.)

5 units, Aut (Drekmeier) T 7:30-9:30 p.m.

255A. Nineteenth Century Poetry as Myth-Making—(Same as English 255A and Comparative Literature 261.)

5 units, Win (Mellor) MTWTh 11

260A,B. "Modernisms"—(Same as Political Science 160A,B/260A,B.)

5 units each, Win and Spr (Y. Rogat)

M 2:15-4:05

262. Nietzsche and the Literary Imagination—(Same as English 262 and Comparative Literature 262.) A basic introduction to Nietzsche's philosophy with additional attention given to his experiments with literary form. His impact upon Gide, Shaw, Mann, Belyj, Yeats, Rilke, D. H. Lawrence, Malraux, and Sartre. Reading knowledge of French or German desirable but not required.

5 units, Aut (Foster) MWF 9

269A. Toward an Understanding of Romanticism—(Same as English 269A and Comparative Literature 269A.)

5 units, given alternate years

270. Modern Critical Thought: The Symbolist Heritage—(Same as French 270 and Comparative Literature 270.)

3 to 5 units (Cohn) given 1975-76


3 units, Win (Bertrand)

273. Individu et société dans le roman français contemporain—(Same as French 283.) De La Peste de Camus au "roman de contestation" actuel.

4 units, Spr (Bertrand)

274. Latin-American Literature in a Social Context I—(Same as Spanish 274.) The Elites and Culture in a Dependent Society. Romantics, Positivists, and Arielists.

4 units, Aut (Franco) MWF 1:15


4 units, Win (Franco) MWF 1:15


4 units, Spr (Franco) MWF 1:15

280. Broadcasting and Film Criticism—(Same as Communication 180.) An attempt to develop a critical view of film. Readings and discussion will consider models of artistic and literary criticism as points of comparison. The student will be introduced to journalistic, psychoanalytical, Marxist, structuralist and semiological approaches. Weekly reviews will stress the meaning of the films and a lucid writing style. Prerequisites: 101, 141, or 142.

4 units, Spr (Kovács) MWF 9

281. Classics of Modern European Cinema—(Same as Communication 210B and Comparative Literature 210B.) A consideration of key works by the most influential auteur directors. Through the specific movies the director's gestalt, aims, and style will be discussed. Selected criticism will be examined for its ability to interpret the meaning of the films and to place them in a larger cultural context. Special attention will be given to structuralist and semiological methods of interpretation. Bunuel, Bergman, Fellini, Godard, Resnais, Pasolini, and Renoir will be the focus of the course.

3 to 5 units, Win (Kovács) by arrangement

286. Structuralism and After—(Same as French 286 and Comparative Literature 286.) The notion of structuralism in the sciences, linguistics, literary criticism. Its pre-20th century antecedents. Lévi-Strauss and struc-
tural anthropology. Jacques Derrida’s “de-
construction.”

5 units (Girard) given 1975–76

302. Poetics and the Poetic—(Same as Com-
parative Literature 302 and English 366.) Int-
tensive study of poetics as theory, and of
various poetic manifestations. May include
study of relation of poetry to other types of
language, poetry and music, the being of the
poet, the poetic in nature, and the poetic as
an aesthetic category.

5 units, Aut (Dufrenne) TTh 4:15–6:05

315F. Seminar: The Enlightenment and its
Literary Traditions—(Same as English 315F
and Comparative Literature 315F.)

5 units, Aut (Watt) TTh 2:15–4:05

337. European Intellectual History Since
the Enlightenment—(Same as History 337.)

Graduate Colloquium.

5 units, Aut (Robinson) W 2:15–4:05

361. The Modern Tradition—(Same as En-
GLISH 361 and Comparative Literature 361.)
Introduction to the interdisciplinary study
of modern thought and literature with em-
phasis on such modern developments as
structuralism, phenomenology, and Marx-
ism.

5 units, Win (Halliburton) TTh
2:15–4:05

362. Death in Literature and Psychology—
(Same as English 362.) Seminar; open by
permission to graduate students and to a few
exceptionally well-prepared undergraduates.

5 units, Spr (I. Yalom, M. Yalom)
to be arranged

365A. Seminar: The Landscape in Amer-
ican Literature—(Same as English 365A.)

5 units, Win (Momaday)

366. Mimesis—(Same as Comparative Lit-
erature 366.) The Aristotelian interpreta-
tion of Platonic mimesis as desire, and its re-
lation to the modern idea as “realist” or
“cooper of reality”; its effects on the avant-
garde as well as on traditional aesthetic dog-
ma.

5 units (Girard) given 1975–76

369. Seminar: Major Modern Critics —
(Same as English 369 and Comparative Lit-
erature 369.) Reading and discussion of crit-
ical writings and theories of influential
modern figures such as Auerbach, Kenneth
Burke, Spitzer and Lukács. Emphasis on
twentieth century (e.g. existentialism, struc-
turalism, Marxism), but the course will also
place modern critics in tradition beginning
with Aristotle.

5 units, Aut (Halliburton) MW
2:15–4:05

373. Religionskritik im 19. Jahrhundert—
(Same as German Studies 360.)
3 to 5 units (Bark) given 1975–76

376. Methodenlehre der Literaturwissen-
schaft—(Same as German Studies 400.)

4 units, Spr (Mueller-Vollmer)

388B. Seminar: Virginia Woolf and her Cir-
cle—(Same as English 388B.)

5 units, Win (Ruotolo) TTh 2:15–4:05

395. Ad Hoc Graduate Seminars—In a given
quarter, a group of graduate students (at
least three but preferably more) who wish in
the following quarter to study a subject or
an area not covered by regular courses and
seminars may plan an informal seminar and
approach a suitable member of the faculty
to supervise it, either on a graded or pass/no
credit basis.

Any quarter, by arrangement

398. Research Course—The student pursues
a special subject of investigation under su-
pervision of some member of the Committee
or another faculty member. Thesis work not
to be registered under this course.

Any quarter, by arrangement

399. Thesis.

Any quarter, by arrangement

RELATED COURSES

Students of Modern Thought and Literature
are referred to the offerings of the sev-
eral literature departments and of Compar-
ative Literature. A few courses of special
interdisciplinary interest are listed below.
Consent of the instructor is required for most
of these.

ANTHROPOLOGY

1. Cultural Anthropology
126. Culture Change
145. Political Anthropology
166. Language, Society and Culture
168. Introduction to General Linguistics
245. Political Anthropology
251. Economic Anthropology
290B. History of Anthropological Theory

ART
175A,B. Modern Architecture (European)
176. American Architecture and Urbanism

ASIAN LANGUAGES
255A. The Nature of Literature: Japanese and Western Views
255B. Chinese and Western Theories of Literature

COMMUNICATION
210A. American Experimental Film
210C. The Movies of Hollywood: Their Making and Meaning

DRAMA
156/256. Modern Drama from 1818
157/257. American Drama from 1920
353. Seminar in Contemporary Critical Approaches

ENGLISH
60/160. American Jewish Writing
69/169. Post-Modernism: The Literature of the Last Decade
168. American Indian Mythology and Lore
265. Ideas of Experience in American Prose.

GERMAN STUDIES
241. Deutsche Geistesgeschichte I—Von der Aufklärung zur Romantik
242. Deutsche Geistesgeschichte II—Von der Romantik bis Nietzsche
243. Deutsche Geistesgeschichte III—Von Nietzsche zur Gegenwart

HISTORY
134. The Age of Reason and Enlightenment: European Intellectual History in the 17th and 18th Centuries
138A. European Intellectual History in the 19th Century
138B. European Intellectual History in the 20th Century
235/335. Studies in the Enlightenment

HUMANITIES SPECIAL PROGRAMS
305. The Early Modern Period
306. Modernism and the Consciousness of the Humanities
353. The Humanities in the University

LINGUISTICS
245. Sociolinguistics

PHILOSOPHY
103. Philosophy in the 19th and Early 20th Centuries
181. Philosophy of Language
199. Seminar in Recent Philosophical Literature

POLITICAL SCIENCE
157. Theory of Revolution

PSYCHOLOGY
121. Social Psychology
132. Theories of Personality
136. Abnormal Psychology
146. Language and Thought
172. Psychology of Perceptual Experience

SOCIOPY
316. The Social Psychology of Organizational Settings
371. Basic Problems in Sociological Theory
380. Introduction to Sociological Research

SLAVIC LANGUAGES AND LITERATURES
117A,B,C. Slavic Civilization

MUSIC
Emeritus: Putnam C. Aldrich, William L. Crosten, Sandor Salgo (Professors)
Chairman: Albert Cohen
Associate Professors: Imogene Horsley (on leave spring quarter 1975)
Senior Lecturers: Arthur P. Barnes (Director of Bands) (on leave spring quarter 1975), Marie Gibson (Voice)
Assistant Professors: William H. Mahrt, Mark F. Starr
Lecturers: Michael J. Andrews, Martin Breznick (Theory); Meredith Ellis Little (Early Music Performance); Adolph Balzer, Earle Blew, Nathan Schwartz, Naomi Sparrow (Piano); David Abel, Anne W. P. Crowden (Violin); Rolf Persinger (Viola); Bonnie Hampton (Violoncello);

* Members of the Francesco Chamber Trio.
Charles Siani (Double Bass); Frances Blaisdell, Lupe Duran, Alexandra W. Hawley (Flute); Raymond H. Duste (Oboe); David B. Breeden (Clarinet); Susan Willoughby (Bassoon); Charles R. Bubb (Trumpet); Robert Szabo (Trombone); Earl Saxton (French Horn); Floyd O. Cooley (Tuba); Marjorie Chauvel (Harp); Charles A. Ferguson (Guitar); Stanley Buetens (Lute); Martha Blackman (Viola da Gamba); Margaret Fabrizio (Harpsichord and Early Piano); Joan Ben- son (Clavichord and Early Piano); Robert Bernard (Voice); Herbert Myers (Early Winds). Visiting: Lou Harrison (Composition)

Music Librarian: Edward E. Colby
Director of Glee Club: Robert R. MacKinnon

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 composers, performers, teachers, or research scholars.

Practice facilities are available in the Knoll, the Music Annex, and the Dinkelspiel Auditorium Building, which also includes a theater for concert and operatic productions. In addition to pianos, organs, harpsichords, and a variety of early stringed and wind instruments, students may use rare instruments from the Harry R. Lange Historical Collection.

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.

The Music Department has access to large digital computers on which work is being done in sound synthesis, acoustical analysis, and composition. Advanced composition students interested in electronic music and use of the computer in composition, and students with a particular interest in acoustics are encouraged to make use of this facility.

PROGRAMS OF STUDY

Bachelor of Arts

Undergraduate major — May be planned in one of three ways depending on whether the student wishes:

1) A concentration in composition, performance, or music history.
2) Preparation for secondary school teaching by way of the Stanford Internship Program.
3) A general program of studies without special emphasis on any particular branch of music.

The plan in each case will be drafted by the student and his or her adviser to include certain required work as outlined below plus electives which take into account the individual's particular talent and interest.

To insure a strong foundation for the individual concentrations, all students are required:

A. To include the following courses in their programs:
   1. Music 21–22 (Elements of Music)
   2. Music 23 (Functional Harmony)
   3. Music 100, 101, 102 A–B, 103 A–B, 104 A–B (Music History and Theory)
   4. Individual studies in performance: six quarters
   5. Ensemble: six quarters of work in one or more departmental organizations or in chamber music, excluding Music 161C (Sports Activity Band) and Music 167 (Glee Club)

B. To demonstrate a minimum proficiency in piano, which will include sight-reading of works at the level of Clementi sonatinas as well as playing two prepared pieces comparable in difficulty to Bartok's Mikrokosmos, Book 4. This requirement should be fulfilled as early as possible and not later than the beginning of the junior year.

C. To demonstrate ability to hear music accurately and to perform it at sight. These skills will be checked by two examinations, the first to be taken upon completing Music 22, the second to be taken in the first quarter of the senior year.

Independent work by advanced students is encouraged as indicated under Music 199.

Students who have completed the major and have demonstrated marked ability in composition, performance, or music history are invited to apply for admission to the departmental Honors Program. The latter involves working out a substantial project in the individual's main field of interest.
Prospective music majors should consult one of the advisers in the Music Department as early as possible in order to plan a program that allows sufficient time for practice as well as for other study. This applies especially to freshmen and to those who wish to concentrate in performance.

The sample schedule given below shows how the University Distribution Requirements may be fulfilled so as to permit substantial work in music during the Freshman and Sophomore years. Note the inclusion of foreign language study which is strongly recommended for all music majors and especially for those expecting to continue into graduate work.

**Recommended Schedule for Completing the Music Major Program**

**First Year**

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>English* (2 quarters writing)</td>
<td>3</td>
<td>3</td>
<td>—</td>
</tr>
<tr>
<td>Music 21, 22, 23</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Music 100</td>
<td>—</td>
<td>—</td>
<td>4</td>
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<tr>
<td>Individual Instruction and/or Ensemble</td>
<td>1-4</td>
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<tr>
<td>Choice of Foreign Language, Freshman Seminar, or University Distribution requirement</td>
<td>3-5</td>
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</tbody>
</table>

* (English or Music 21 may begin winter quarter. If Music 21 and 22 are taken in winter and spring quarters of first year, Music 23 must be taken in autumn quarter of second year.)

**Second Year**

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
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</thead>
<tbody>
<tr>
<td>Music 101, 102 A-B, 103 A-B</td>
<td>4</td>
<td>6</td>
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<tr>
<td>Individual Instruction and/or Ensemble</td>
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<tr>
<td>University Distribution Requirement in Science or Social Science</td>
<td>3-5</td>
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<tr>
<td>Elective (or Music 23 in autumn if not taken previously)</td>
<td>3-5</td>
<td>(3)*</td>
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* (Optional)

**Third Year**

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<th>Courses</th>
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<th>Sp</th>
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<tr>
<td>Music 104 A-B</td>
<td>6</td>
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**TEACHING CREDENTIAL (SECONDARY) — INTERNSHIP PROGRAM IN MUSIC**

Students in the Department may prepare themselves for work toward the Standard Teaching Credential (Secondary) in music. This work at Stanford is organized in an Internship Program consisting of four quarters of graduate study at the University combined with half-time teaching on salary from September to June as an intern in secondary schools near Stanford.

The program begins only in the Summer quarter of each year. Students are admitted to it on recommendation of the Music Department and the School of Education. Applicants must have a bachelor's degree with a major in music. Undergraduate preparation should include foundation courses comparable to those listed above under A.B. major, plus the following:

- Music 127. Orchestration
- Music 130, 131. Conducting (9 units)
- Music 65A,B,C. Vocal and instrumental classes (3 to 5 units)

**GRADUATE DEGREES IN MUSIC**

The following statements apply to all the graduate degrees described below, unless otherwise indicated.

Applicants for admission to graduate study should arrange to take the Graduate Record Examination, including the Advanced.Music sections. Prior to initial registration, the student should be prepared:

(a) to demonstrate proficiency in piano equal to that specified in the A.B. program; (b) to demonstrate a reading knowledge of one foreign language chosen from French, German, or Italian, and a knowledge of the common musical terms in all three of the above languages; (c) to take placement tests in theory and music history.

Students whose previous preparation proves insufficient must expect to spend more than the minimum time in residence. None of Stanford’s required undergraduate courses in music may be credited toward an advanced degree.

Only work that receives a grade of A, B, or plus will be recognized as fulfilling the advanced degree requirements in music.

Doctoral candidates working in absentia on Ph.D. dissertations or D.M.A. final projects which require consultation with faculty members must continue enrollment in the University under the heading of Terminal Graduate Registration.

**Teaching assistantships** — It is the policy of the Department to appoint each Doctoral candidate to a teaching assistantship for at least one quarter.

**MASTER OF ARTS**

**Residence** — A minimum of three quarters of full-time study in residence is required.
Study program — Students may concentrate in composition, performance (including conducting), or music education. To be recommended for the A.M. degree, a candidate must complete a program of 36 units of graduate course work, including Music 200 and 299 plus three quarters of ensemble performance. Depending on the concentration, the Master of Arts Project will be an investigative essay, a composition, or a demonstration of performance supported by a written commentary on the performance practices that are involved.

Doctor of Musical Arts

The purpose of the Doctor of Musical Arts program is to offer advanced training in the practice and pedagogy of music. Students may concentrate in composition, music education, or performance (including conducting)—the latter concentration to be centered on the investigation of performance practices from medieval to modern times. Each concentration will be given breadth through collateral studies in other branches of music and in relevant fields outside music as seems desirable.

Admission — In addition to completing entrance tests, an applicant will be asked to submit evidence of accomplishment in the proposed field of concentration. Applicants in music education must have had at least two years of successful teaching experience.

Residence — If there are no deficiencies to be made up, this program may be completed in a minimum of two years of full-time study following the Master’s degree. The candidate must spend at least three consecutive quarters in residence and must devote at least one quarter in residence to work on his or her final project.

Study program — The candidate must complete, beyond the Master’s degree, a minimum of two years of full-time work which will be planned individually for each concentration. It must be emphasized, however, that the degree will be awarded on the basis of demonstrated achievement rather than on the accumulation of units.

In addition to such independent study and formal course work as may be done, each program will include: (a) four term projects; (b) a final project; and (c) a public lecture-demonstration.

Candidates in performance will make an extensive study of repertoire, leading to four demonstrations of their ability to give stylistically acceptable performances of music from different historical periods. Each demonstration is to be supported by a written report containing analysis of the music in question, discussion of the special performance problems that are involved, and detailed proposals for the solution of those problems.

Candidates in music education will do extensive reading and research in both the philosophy and practice of their field, each candidate ultimately focusing on a special branch according to his or her particular interest. The students in this area will also complete a minor of at least 12 units in composition, music history, or performance.

Candidates in composition will be expected to produce a number of original works demonstrating their ability to compose in a variety of forms and for the common media of vocal and instrumental music. Insofar as possible, the works submitted will be presented in public performance prepared by the composer.

Final project — (1) composition: an extended work for instruments, voices, or electronic media; (2) music education: a dissertation based on independent research in the candidate’s field of specialization; (3) performance: possibilities open to the candidate include (a) preparing a modern performing edition of an early score; and (b) writing an extended critical or historical essay on a selected problem or phase of performance practice.

Public lecture-demonstration — This is to be given during the last quarter of residence. It should be about one hour in length, dealing with some aspect(s) of the candidate’s final work.

Foreign language requirements — All students are required to demonstrate knowledge of the common musical terms in French, German, and Italian, and, with possible exception at discretion of the adviser for concentrators in music education, a reading knowledge of one of the above languages. Concentrators in performance are further required by the end of their first year of doctoral study to demonstrate reading ability in a second language chosen from the three listed above.

Departmental examinations — (1) a qualifying examination consisting of written and
oral tests in the general field of music history, no later than the fifth quarter of full time study; (2) a written examination in the candidate's special area of concentration, no later than the third quarter after passing the qualifying examination.

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.

Admission—In addition to completing entrance tests, an applicant is asked to submit some evidence of his or her work in the field of music history such as a term paper or a Master’s thesis.

Basic requirements—Each candidate must complete a minimum of three years of full-time work. The student may proceed directly to the Ph.D. without taking the A.M. en route. The program will normally include: (1) seminars in musical notation, analysis and performance practice; (2) readings in music theory; (3) independent research culminating in a dissertation; (4) dissertation research to be taken in the third year of residence.

Foreign language requirements—A reading knowledge of French or Italian, and German, plus any other language necessary to research in the candidate’s field of specialization. The examination will consist of the translation into idiomatic English of excerpts in prose and poetry. The examination in one language must be taken prior to the student's first registration. The second language must be certified before the beginning of the second year of residence.

Departmental examinations—(1) a qualifying examination consisting of written and oral tests in the general field of music history, no later than the fifth quarter of full-time residence; (2) a written examination in the candidate's special area of concentration, no later than the third quarter after passing the qualifying examination; (3) the University Oral Examination, to be taken prior to the actual writing of the dissertation at the beginning of the fourth year of residence.
organization into musical forms. Development of notation as a means of representing and controlling sound in various media. Ear-training, beginning with acoustical phenomena, will underlie all written work. Lectures and laboratory sections. Open to all students desiring basic technical knowledge of musical composition. No prerequisite for 21 except ability to read music.

21. **MUSIC**
   4 units, Aut (Staff)
   Win (Staff)

22. 4 units, Win (Staff)

23. **Functional Harmony**—Prerequisite: 21, 22.
   4 units, Aut (Staff)
   Spr (Staff)

27. Solfège and Ear Training.
   3 units, Aut, Win, Spr (Staff)

100. **Music History:** Medieval and Renaissance—Prerequisites: 21, 22.
   4 units, Spr (Mahrt)

101. **Music History:** Baroque—Prerequisites: 21, 22, 100.
   4 units, Aut (Horsley)

102A. **Music History:** Classic—Prerequisites: 23.
   3 units, Win (Ratner)

102B. Eighteenth Century Harmonic Practice.
   3 units, Win (Ratner, Staff)

103A. **Music History:** Romantic—Prerequisites: 102 A-B.
   3 units, Spr (Ratner)

103B. Nineteenth Century Harmonic Practice.
   3 units, Spr (Staff)

104A. **Music History:** Modern—Prerequisites: 103 A-B.
   3 units, Aut (Bresnick)

104B. Twentieth Century Techniques.
   3 units, Aut (Staff)

Note: 102 A-B must be taken concurrently—the same applies to 103 A-B and 104 A-B.

**MUSIC THEORY AND COMPOSITION**

123. Composition—Individual projects in creative work. May be repeated for credit.

Prerequisite: consent of instructor.
   3 units, Aut (Harrison)
   Win, Spr (Smith)

125. **Modal Counterpoint.**
   3 units, Spr (Houle)

126. **Tonal Counterpoint**—Prerequisite: 103B.
   3 units (Ratner)

127. **Orchestration**—Prerequisite: 23.
   3 units, Aut (Barnes)

223. Seminar in Composition—May be repeated for credit.
   4 units, Aut (Harrison)
   Win, Spr (Smith)

224, 225. Solfège and Score Reading.
   224. 4 units, Aut (Barnes)
   225. 4 units, Win (Barnes)

228. **Studies in Thorough-Bass**—Prerequisite: 102A-B.
   228A. 4 units (Horsley) given 1975–76
   228B. 4 units (Horsley) given 1975–76

229. **Tonality and Structure**—Graduate review of harmonic functions; relation between details of progression and total structure.
   4 units (Smith)

**HISTORY AND LITERATURE OF MUSIC**

Unless otherwise stated, prerequisites for any course in this section are 103A,B.

140. **Studies in Medieval and Renaissance Music**—Prerequisite: 100.
   140A. The Italian Madrigal.
   4 units (Horsley)

141. **Studies in Baroque Music.**
   141A. The Music of Handel.
   4 units (Horsley)

142. **Studies in Classic Music**—Prerequisites: 102A,B.
   142A. String Quartets of Beethoven.
   4 units (Ratner)

142C. Chamber Music of the Classic Period.
   4 units (Ratner)

142D. The Piano Sonatas of Beethoven.
   4 units, Aut (Schwartz)
142E. The Symphonies of Beethoven.
   4 units, Win (Starr)

   4 units (—)

144. Studies in Modern Music — Prerequisites: 104A, B.
   144A. Twelve-Tone and Serial Music.
   4 units (Smith)
   144B. Innovations in Contemporary Music.
   4 units, Win (Smith)

150. History of Musical Instruments.
   4 units, Win (Houle)

153. Organ Literature.
   153A. Organ Music (Cabezón to Bach).
   4 units, Win (Nanney)
   153B. Organ Music (Bach to Ligeti).
   4 units (Nanney) given 1975–76

198. Senior Honors Project.
   4 units (Staff)

199. Independent Study — For advanced undergraduates who wish to do work outside
   the regular curriculum. Before registering for this, a student must present a specific
   project and must enlist a faculty sponsor. Credit up to 4 units per quarter.

PERFORMANCE

12. Introductory Piano — Class for music majors only.
   1 unit, Aut, Win, Spr (Blew)

65A. Stringed Instruments Class — For Credential candidates.
   1 unit, Aut, Win, Spr (Kuhn)

65B. Wind Instruments Class — For Credential candidates.
   1 unit, Aut, Win (Barnes)

65C. Voice Class — For Credential candidates, music majors, and non-majors who
   are members of departmental performing organizations.
   1 unit, Aut, Win, Spr (Gibson, Bernard)

73, 74, 75, 76, 77. Small Group Instruction —
   A special fee of $30 per quarter is charged for enrollment in any of these groups.
   1 unit, Aut, Win, Spr (Staff)

73. Voice Class.
   (Gibson, Bernard)

74A. Stringed Instruments Classes.
   (Staff)

74B. Viola da Gamba Class.
   (Blackman)

74C. Lute and Classical Guitar Class.
   (Ferguson)

74D. Baroque String Performance Class.
   (Blackman)

75A. Wind Instruments Classes.
   (Staff)

75B. Renaissance Wind Instruments Class.
   (Staff)

76. Brass Instruments Classes.
   (Staff)

77. Percussion Class.
   (—)

172, 173, 174, 175, 176, 177, 272, 273, 274, 275, 276, 277. Individual Vocal and Instrumental Instruction—A special fee of $60 per
   quarter for majors and $120 for non-majors is charged for enrollment in these courses.
   Students who wish to enroll in individual instruction must demonstrate, by audition
   with the appropriate teacher, a minimum proficiency on his instrument. Minimum
   repertory lists for each instrument are available at the Music Department office.
   3 units, Aut, Win, Spr

   172A, 272A. Piano.
      (Baller, Blew, Schwartz, Sparrow)

   172B, 272B. Organ.
      (Nanney)

   172C, 272C. Harpsichord.
      (Fabrizio)

   172D, 272D. Clavichord.
      (Benson)

   172E, 272E. Early Piano.
      (Benson, Fabrizio)

      (Gibson, Bernard)

174, 274. Stringed Instruments.
   174A, 274A. Violin.
      (Abel, Crowden)

   174B, 274B. Viola.
      (Persinger)

   174C, 274C. Violoncello.
      (Hampton)

   174D, 274D. Contrabass.
      (Siani)
174E, 274E. Viola da Gamba.  
(Blackman)
(Buetens, Ferguson)
(Chauvel)
175, 275. Woodwind Instruments.  
175A, 275A. Flute.  
(Blaidsell, Duran, Hawley)
175B, 275B. Oboe.  
(Duste)
175C, 275C. Clarinet.  
(Breeden)
175D, 275D. Bassoon.  
(Willoughby)
175E, 275E. Renaissance Wind Instruments.  
(Myers)
176, 276. Brass Instruments.  
176A, 276A. French Horn.  
(Saxton)
176B, 276B. Trumpet.  
(Bubb)
176C, 276C. Trombone.  
(Szabo)
176D, 276D. Tuba.  
(Cooley)
177, 277. Percussion.  
(—)
130. Orchestral Conducting—Prerequisite: 127.
130A. 3 units, Win (Starr) given 1975–76
130B. 3 units, Spr (Starr) given 1975–76
131. Choral Conducting.  
4 units, Win (Schmidt)
4 units, Aut (Houle)
230. Advanced Orchestral Conducting.  
230A. 4 units, Win (Starr) given 1975–76
230B. 4 units, Spr (Starr) given 1975–76
231. Advanced Choral Conducting.  
231A. 4 units, Aut (Schmidt)
231B. 4 units, Win (Schmidt)
4 units, Aut (Schmidt)
52. Choral Repertory (1750 to Present).  
4 units, Aut (Schmidt) given 1975–76
268. Thorough-Bass Realization.  
1 unit, Aut, Win, Spr (Fabrizio)
269. Studies in Performance Practices — Performance studied in the light of musical resources, aesthetic attitudes, and theoretical principles of the various historical periods. Lectures, individual research, and practice sessions leading to concert performances. May be repeated for credit. Prerequisite: 169.
269A. Medieval.  
4 units, Aut (Mahrt)
269B. Renaissance.  
4 units, Win (Houle)
269C. Baroque.  
4 units, Spr (Houle)
269D. Classic.  
4 units, Aut (Ratner)
1 to 4 units, Aut, Win, Spr (Starr, Gibson, Staff)
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 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.
158. Renaissance Wind Band.  
1 unit, Aut, Win, Spr (Houle, Mahrt)  
M 2:15–5:05
159. Contemporary Performance Ensemble.  
1 unit, Aut, Win, Spr (Bresnick, Chowning) T 4:15–6:05
160. University Orchestra.  
1 unit, Aut, Win, Spr (Starr) M 7:30 p.m. and Th 7:15 p.m.
161. University Bands.  
161A. Concert Band.  
1 unit, Aut (Barnes) T 7:15 p.m.  
Win (Barnes) MWF 4:15–5:30 p.m.
Spr (Barnes) MWF 4:15–5:30 p.m.
161B. Studio Band.
1 unit, Aut, Win, Spr (Barnes) by arrangement

161C. Sports Activity Bands.
1 unit, Aut (Barnes) MWF 4:15-5:30
1 unit, Win, Spr (Barnes) by arrangement

162. University Chorus.
1 unit, Aut, Win, Spr (Schmidt)
M 7:30-9:30 p.m. and W 4:00-5:30

163. University Choir — Official choir of Memorial Church, which furnishes music for Sunday services and special occasions in the Church calendar. Eight members chosen by audition may receive an honorarium for performing duties other than those required of the regular Choir.

2 units, any quarter (Schmidt) T 4:15-5:30 and Th 7:00-8:30 p.m. and Sunday 10-12


1 unit, Aut, Win, Spr (Schmidt) MTh 12

166. Chamber Orchestra — Open to advanced players who have had orchestral experience.

1 unit, Aut, Win, Spr (Starr) TF 12

1 unit, Aut, Win, Spr (MacKinnon)
T 7:15-8:45 p.m. and Th 4:15-5:45

168A. University Wind Ensemble.
1 unit, Aut, Win, Spr (Barnes)
M 12 and W 7:30

168B. Brass Choir.
1 unit, Aut, Win, Spr (Barnes)
T 4:15 and Th 12

170. Piano Accompanying.
2 units, Spr (Schwartz)

171. Chamber Music — Open to any student with sufficient technical ability to play in small combinations for strings, winds, and keyboard instruments.

1 unit, Aut, Win, Spr (Hampton, Staff)

271. Performance Special — For students who take part in performances organized in Music 269 or 279 while not enrolled in either of those classes.

1 unit, Aut, Win, Spr (Staff)

MUSIC EDUCATION


265A. 3 units, Sum (Kuhn) MTWTh 3:15
265B. 2 units, Aut (Kuhn) T 4:15-6:05
265C. 2 units, Win (Kuhn) T 4:15-6:05
265D. 1 unit, Spr (Kuhn) T 4:15-6:05

280. Seminar in Music Education.
4 units, Aut (Kuhn)

281. Administration and Supervision of Public School Music.
4 units, Spr (Kuhn)

282. Teaching Music in the Elementary School—(Same as Education 165.) Teaching methods and techniques. Examination and evaluation of new curricular trends such as the Kodaly Singing School, the Orff Music for Children, and Suzuki Talent Education.

3 units, Spr (Kuhn) by arrangement

283. Practice Teaching in Elementary School Music. Prerequisite: 282.

1 to 2 units, any quarter (Kuhn)

GRADUATE RESEARCH AND SPECIAL STUDIES

200. Music Bibliography — Use of bibliographical materials in graduate study; introduction to methods of research.

3 units, Aut (Colby)

201. Graduate Review in Musical Analysis.
4 units, Aut (Cohen)

221. History of Music Theory.

221A. Ancient through Renaissance
4 units, Win (Cohen)

221B. Baroque through Modern
4 units, Spr (Cohen)

299. Master of Arts Project.
4 units, any quarter (Staff)

300. Seminar in Musical Notation.

300A. 4 units, Aut (Horsley)
300B. 4 units, Win (Horsley)
300C. 4 units, Spr (Mahrt)

301. Seminar in Music History and Analysis.
4 units, Aut, Win, Spr (Smith, Horsley, Ratner)
PHILOSOPHY

Emeriti: John D. Goheen, John L. Mothershead, Jeffrey Smith (Professors)
Chairman: Julius Moravcsik
Director of Graduate Study: To be named
Director of Undergraduate Study: Robert Howell

Professors: Solomon Feferman, Dagfinn Føllesdal (Summer), K. Jaakko Hintikka (Winter), Georg Kreisel, Julius Moravcsik, David S. Nivison, Patrick Suppes
Associate Professors: Dov M. Gabbay, John Perry. Visiting: Jon Elster (Spring, Summer); Bengt Hanssen (Fall, Winter).
Assistant Professors: Michael Bratman, Nancy Cartwright, Robert Howell, Eilene Serene, Thomas Wasow

Offerings and Facilities

Philosophy attempts to explain the grounds of knowledge, the limits of reality and the nature of value, justice, and morality. It asks fundamental questions about how we reason and how we ought to reason. Its subject matter encompasses all the other academic disciplines, indeed all areas of human experience—society, values, mind, language, art, science.

Philosophy seeks clarity and depth of understanding. Philosophic thinking is rigorous, systematic, abstract thinking. Though one of the humanities, philosophy is as relevant to the natural and social sciences and mathematics as it is to literature and history. And though philosophy puts a premium on verbal skills, it puts no less a premium on the kinds of intellectual skill needed for good work in the sciences.

The Tanner Memorial Library of Philosophy, situated in the Philosophy Building, contains an excellent working library and ideal conditions for study.

Both the graduate students and the undergraduate majors in philosophy have associations for discussion of philosophical issues and reading of papers by students, faculty, and visitors. These associations nominate the Directors of Graduate and Undergraduate Study and elect student representatives to Department meetings.

A number of scholarships are available preferentially for undergraduate majors in Philosophy. Students in the Department seeking University support should identify their major field when making application.

Programs of Study

Bachelor of Arts

The following Departmental requirements are in addition to the University's basic requirements for the Bachelor's degree:

At least 48 units of Philosophy courses that have been accepted by the Department and the instructor as meeting the student's A.B. requirements, including:

1. At least one course approved by the student's departmental adviser from each of these four areas:
   a) Logic, philosophy of science, philosophy of language
   b) Ethics, aesthetics, social philosophy, value theory
   c) Epistemology, metaphysics
   d) History of philosophy
Normally these are to be lecture courses of at least 3 units each. 

2. At least six courses in which the student receives a grade of B or better. Units of Directed Reading (Phil. 197) may not be counted in the 48 unit requirement. No more than 10 units completed with grades of Pass may be counted in the 48 unit requirement.

**Honors Program in Philosophy**

The Honors Program in Philosophy is an integral part of a Tutorial Program. Both juniors and seniors may apply for individual tutorial with a member of the Department. Junior Tutorial will occupy 12 units (4 units each quarter) of the student's academic program and will be devoted to a course of study and research designed in consultation with his instructor. Juniors may, if this is a preferred type of instruction, apply for group tutorial to be conducted by a member of the Department. To be accepted for Senior Tutorial, normally a student must have demonstrated superior ability in Junior Tutorial. 

Tutorial in the senior year will occupy 15 units (5 units each quarter) of the student's academic program, and will be devoted to research on a topic resulting in a Senior Tutorial Essay. All students accepted for Senior Tutorial automatically become candidates for Departmental Honors. To achieve Departmental Honors, the Senior Essay must be distinguished. Failing to attain Departmental Honors, a student may nevertheless qualify for Senior Tutorial credit.

Group tutorials or colloquia may be proposed by the undergraduate students organization. The Department will assist the students in the design of these courses and seek to secure instructors for them.

**Combined Major in Classics and Philosophy**

Students may, with the consent of the Chairmen of departments concerned, offer for the degree of Bachelor of Arts a combined major in Classics (Latin and/or Greek) and Philosophy. Students interested in such a major should consult the Chairman of each of the departments concerned.

**Honors Program in Humanities**

The Department of Philosophy participates in the Graduate Program in Humanities leading to the joint Ph.D. degree in Philosophy and Humanities. For description of that program, see the section "Humanities Special Programs" in this Bulletin.

**Advanced Degrees**

The members of the Department are prepared to direct and supervise individual study and research to supplement instruction offered in courses listed below. In addition, advanced seminars, unlisted in the catalog, are frequently organized in response to student interest. Candidates for advanced degrees are urged to discuss their entire program of study with their Departmental adviser as early as possible.

Applicants for admission to graduate standing in the Department of Philosophy should apply to the Director of Admissions. Applicants are required to take, in their senior year or later, the Graduate Record Aptitude Test.

The Department will not ordinarily admit students who wish to become candidates for the Master's degree only. A student will, however, be welcomed as a candidate for the Master's degree if he or she has been admitted as a candidate for a higher degree in some other appropriate department or school of the University.

**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:

1. Normally a student will be admitted to and allowed to continue in the A.M. program only if he or she is a matriculated Stanford graduate student working for some other Stanford degree. The student must petition the department.

2. Each A.M. candidacy is subject to the five-year time limit established by the University.

3. Unit requirements: at least 36 philosophy units taken as a graduate student at Stanford.

4. Up to 9 units taken as a graduate at Stanford may be taken as directed reading. Normally at least six Stanford graduate units should be taken in each of the four fields in which the Department sets "pro-
ficiency requirements" in the General Program for the Ph.D.
5. The student must satisfy three of the proficiency requirements for the General Program for the Ph.D. in Philosophy, at least one of which should be by examination or the writing of a research paper.
6. A thesis is not required. The student is expected to complete the M.A. within three years.

MINOR IN PHILOSOPHY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Each student shall take 30 units of course work within the Philosophy Department, no more than six of which may be directed reading and shall satisfy one proficiency requirement, not necessarily by taking an examination. (See item two under Proficiency Requirements). The choice of courses and satisfaction of a proficiency requirement must be recommended by a faculty member who agrees to serve as the student's adviser with the general restriction that at least one course must be taken in three of the areas in which the Ph.D. candidates are expected to satisfy the proficiency requirements. All programs must be approved by the Department Committee on Graduate Study. A faculty member from the Philosophy Department (usually the student's adviser) will serve on the student's doctoral oral examination committee and may request that up to one-third of this examination be devoted to the minor subject.

DOCTOR OF PHILOSOPHY

The University's basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the section “Degrees” of this bulletin. The following are Departmental requirements:

Courses—There are no fixed course requirements, but the Department reserves the right to prescribe the courses a student takes in preparation for the preliminary examinations. The program of courses for this purpose will depend on the preparation of the individual student and is decided in consultation with his or her Departmental adviser.

GENERAL GRADUATE PROGRAM

Proficiency Requirements
1. Every student is expected to satisfy a proficiency requirement in each of the following areas:

   a) History of Philosophy
   b) Logic and Philosophy of Science
   c) Epistemology and Metaphysics
   d) Value Theory

2. Written preliminary examinations, four hours in duration, will be given in each of these areas during the first week of the spring quarter. The scope of each examination is described below.

   a) Four sections:
      1) Greek Philosophy
         Pre-Socratics, Plato, Aristotle
      2) The Rationalists
         Descartes, Spinoza, Leibniz
      3) The Empiricists
         Locke, Berkeley, Hume
      4) 19th and 20th Century Philosophy
         Kant and two major 19th and 20th century philosophers such as Hegel, Nietzsche, Mill, Bradley, Bergson, and Husserl. (Some comparative questions will be asked.)

      Those examined will answer questions on one philosopher from each section.

   b) Four sections:
      1) elementary logic (157A,B level)
      2) advanced logic
      3) philosophy of science
      4) formal theories of language

      Those examined must answer questions in section (1) and in at least one other section.

   c) Four sections:
      1) epistemology
      2) metaphysics
      3) philosophy of language
      4) philosophy of mind

      Those examined must answer questions in section (1) or section (2) and in at least one other section.

   d) Five sections:
      1) ethics and value theory
      2) social and political philosophy
      3) aesthetics
      4) philosophy of law
      5) philosophy of education

      Those examined must answer questions in section (1) and in at least one other section.

3. Every student must take at least one preliminary examination during the first year of graduate study.

4. Every student must have passed at least
two preliminary examinations by the end of the second year of graduate study.

5. Students may satisfy the remainder of the proficiency requirements in any one of the following ways:
   a) passing two additional preliminary examinations before the end of the second year;
   b) passing one additional preliminary examination before the end of the second year and fulfilling the general course requirement in the area in which an examination has not been taken (see 7 below for a description of course requirements);
   c) passing one additional preliminary examination before the end of the second year, passing a specialized examination (see 8 below) in some area in which he or she has previously passed a preliminary examination, and fulfilling a special course requirement in the remaining area.
   d) fulfilling the course requirement in one of the two areas in which an examination has not been taken, passing a specialized examination in some area in which he or she has previously passed a preliminary examination, and fulfilling a special course requirement in the remaining area.

6. In addition to these programs a student may substitute a research paper for no more than one preliminary examination (excluding specialized examinations) or course requirement in any of the above options subject to the following conditions:
   a) the student submits a written request for this substitution, including a detailed sketch of the proposed paper, to the faculty committee responsible for the preliminary examination in the relevant area no later than the second week of the autumn quarter of the student’s second year of graduate study;
   b) the faculty committee unanimously approves the request;
   c) the final draft of the paper is submitted to the faculty committee no later than Friday of the second week in March of the student’s second year of graduate study;
   d) the faculty committee passes the paper.

7. Course requirements, general and special, in the areas are as follows:
   a) History of Philosophy
      1) general: four courses from the following: 100–104, 120, 122, 136, 137, 145, 147, 178, 232, 236, 237 (at most one course in the group 100–104, 120, 122 may be included);
      2) special: two courses from the above list (neither survey courses nor seminar courses may be chosen to satisfy this requirement).
   b) Logic and Philosophy of Science
      1) general: at least one of the following courses: 157A, 157B, 160A, 160B, and three additional courses chosen from the following: 157A, 157B, 160A, 161, 162, 163A, 163B, 164, 166, 193, 201, 205, 242A, 242B, 242C. An advanced course in theoretical science or mathematics may be substituted for at most one of these three additional courses, subject to approval by the Director of Graduate Study;
      2) special: 157A and 157B.
   c) Epistemology and Metaphysics
      1) general: 184 plus three additional courses from the following: 169, 178, 181, 182, 185, 189, 201, 202, 220, 244, 245, 246;
      2) special: 184 plus one additional course from the above list.
   d) Value Theory
      1) general: 170 or three additional courses from the following list: 170, 174, 175, 179, 193, 203, 215;
      2) special: 170, or one additional course from the above list.

A grade of B, or better, must be obtained in a course if it is to count toward fulfilling a course requirement. Course requirements need not be completed during the second year of graduate study. Under no circumstances will courses taken at another university count toward fulfilling a course requirement.

8. At the request of individual students pursuing a program under 5.c or 5.d above, the faculty committee preparing the preliminary examination in a given area will administer a specialized examination in
This specialized examination will focus intensively on one or more of the sections of the regular examination and may be tailored to the student's special interests. The examination may be written, oral, or both written and oral, at the discretion of the committee.

9. First-year students should inform the department secretary, no later than the first Monday in February, of the preliminary examinations they propose to take during that year. Second-year students should inform the secretary, by this same date, of the program (see 5 and 6 above) they have chosen to satisfy the proficiency requirements.

10. Normally (to continue as a student in the Department) one is expected to have passed all examinations (preliminary and special) and research paper requirements in his chosen program by the end of the second year. Exceptions to this rule are the following:

a) Students in interdepartmental degree programs may be permitted to postpone attempting to satisfy these requirements until the third year. Students must submit to the Director of Graduate Study a written request for such permission. In no case will permission be granted to postpone the preliminary examination taken during the first year.

b) In special circumstances, determined by the Department, students who attempt and fail to satisfy these requirements by the end of the second year may be allowed an additional year in which to satisfy them.

Language Requirements—There is no departmental language requirement, but a student's dissertation committee may require him or her to demonstrate competence in one or more languages if his or her dissertation research makes this requirement appropriate.

Dissertation—Upon passing the preliminary examinations the candidate will submit a brief written statement of the dissertation plans to the Department, and a committee will be appointed to direct the research for and writing of the dissertation. Departmental approval of the dissertation proposal is required for formal admission to candidacy for the doctoral degree.

The dissertation requirement may be fulfilled either by one work of monographic character or by two or more separate articles whose appropriate length, number, and topical and methodological unity or diversity are to be decided in consultation with the dissertation committee.

The dissertation must be submitted to the committee in substantially final form at least four weeks before the University deadline in the quarter during which the candidate expects to receive his or her degree.

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 candidacy by repassing the preliminary examinations.

Oral Examination—The University oral examination is taken after completion of an acceptable first draft of the dissertation, and is primarily a dissertation defense.

Special Graduate Programs in Logic, Philosophy of Language, and Philosophy of Science

Recognizing the interests of students in more technical areas of Philosophy, the Department offers programs allowing the student to concentrate in one of three fields. The difference between these special programs and the general graduate program in Philosophy lies in the course requirements and the written preliminary examination. The student need not declare his or her intention to participate in a specialized program until February 1 of the second year.

Courses—All students in these programs are required to take 160A,B (Symbolic Logic), 161 (Introduction to Set Theory), 164A, B (Philosophy of Science), 181 (Philosophy of Language), 184 (Theory of Knowledge). In addition a student is required to take one course or seminar in the general area of history of philosophy and one course or seminar in the general area of ethics, value theory, and social philosophy (the courses are to be chosen in consultation with the student's adviser). These course requirements must be completed by the end of the third year of the student's residence in graduate school. In lieu of these courses equivalent or more advanced course work may be offered subject to Departmental approval. A pro-
gram of advanced courses in the student's specialty will depend on the preparation of the individual student and is decided in consultation with his or her Departmental adviser.

Preliminary Examinations

1. All first-year students must pass the preliminary examination in logic and philosophy of science given to students in the general graduate program (see above).

2. All second-year students must pass a special written examination, four hours in duration, containing three sections, given during the second week in March:
   1) logic
   2) philosophy of science
   3) philosophy of language

   Questions from at least two sections must be answered.

3. All third-year students must pass an examination in the area in which they propose to write a dissertation. This examination will be tailored to the student's special interests. It may be written, oral, or a combination of both, at the discretion of the examining committee. This examination will be given no later than the third week in March.

   It is expected that the student will pass these examinations in order to continue as a graduate student. When circumstances warrant, however, a student may be permitted to take an examination a second time.

Graduate Program in Humanities

The Department of Philosophy also participates in the Graduate Program in Humanities leading to the joint Ph.D. degree in Philosophy and Humanities. For a description of that program, see the section "Humanities Special Programs."

Graduate Fellowships and Assistantships

The Department endeavors to provide financial support, when needed, to anyone admitted as a graduate student and maintaining a satisfactory level of graduate work, provided that need, or the possibility of it, is made known to the Department before admission. Fellowships provided by the Locke and Weiss funds are reserved for students in philosophy. Application forms for fellowships may be secured by writing the office of Financial Aids.

The Department of Philosophy no longer offers separate teaching assistantships as part of its support program. Each graduate student, whether receiving financial support of some kind or not, is considered a member of the Philosophy Fellows program, in which he or she will have certain teaching duties. Details of this program may be obtained from the Department. In any term in which he or she is teaching a section, the student may register for 239, "Teaching Methods in Philosophy." Members of the Philosophy faculty will provide the student with individual guidance during this teaching experience. Whenever possible, the student's teaching experience will be in courses he or she chooses.

Introductory Courses

These courses will acquaint the student with some of the most important problems, positions and methods in Philosophy. Some are designed to give the student general preparation for further work in Philosophy. Some apply the philosopher's approach to particular problems and subjects the student may encounter in other areas of study. Each course covers a wide variety of subject matter. The student's choices among introductory courses should be determined by interest in the topics covered. All of these courses are recommended for freshmen and other students without prior work in Philosophy.

1. Introduction to Philosophical Concepts — This course introduces the student to the critical and rational examination of such questions as: (a) what should be the over-all program of one's life? (b) what is our relationship to Nature? (c) what are the limits of human knowledge? and (d) what are viable conceptions of the human self? The course will present samples of what historically important philosophers as well as contemporary philosophers have to contribute toward the answering of these questions. Recommended for freshmen.

   5 units, Spr (Perry) MTWTh 10; section by arrangement

2. Introduction to Ethics — This is a systematic treatment of the major problems of
ethics as these problems arise in the works of classical and contemporary moralists. Several ethical positions are surveyed critically, including intuitionism, utilitarianism, the emotive theory, and various forms of relativism, subjectivism, and absolutism. Among the topics discussed are: How are moral judgments related to scientific judgments? How are moral judgments justified? Are all human acts fundamentally selfish? Can morality be based on some conception of what is natural? What is the relation between value in general, the highest good, and obligation? Are the notions of freedom and responsibility meaningful if human actions are determined? What is the relation between personal value and social value? There are four lectures a week; a fifth hour is given to discussion sections.

5 units, Aut (Bratman) MTWTh 9

4. Ancient Chinese Philosophy — Examination of the major Chinese philosophers and the conflict of social and individual values from the Sixth Century through the Third Century B.C., against the background of interstate struggle, social evolution and the emergence of a universal empire.

4 units, Spr (Nivison) MTWTh 9

5. Introduction to Philosophy — This is a general introduction to the problems with which philosophers are and always have been concerned, the conflicts in point of view that have arisen in the attempts that have been made to solve these problems, and the practical consequences of adopting any of these points of view. The course also strives to enlarge the intellectual horizon of students by making them familiar with concepts which everyone needs if he is to deal adequately with fundamental beliefs, and to clarify the often highly ambiguous terminology that is associated with these concepts. The course meets five times a week.

5 units, Aut (Mothershead) MTWThF 10

7. Freedom and Authority: An Introduction to Social and Political Philosophy—The course is organized around the problem of institutional justification: By what standard or principle are social institutions—especially political and legal ones—properly justified and criticized? How can political authority be justified and individual liberty justifiably limited? Further topics include the concept of human welfare, distributive justice, the justification of disobedience from “trashing” to tyrannicide, game theory and the analysis of political processes, law and morality, natural law, the appeal to tradition, and others. Attention will also be given to philosophic aspects of certain topics of current social concern, like pollution and population control, sexual perversion and privacy, academic freedom, and peace. This is a two-quarter course, but the student may register for only one quarter if he or she so wishes. Discussion sections are conducted as seminars. Recommended for freshmen.

4 units, Spr (Elster) MTWTh 9


4 units, Aut (Cartwright) MTWTh 11

11. Philosophy and Literature—This course will examine some of the principal modern literary works expressing philosophical ideas (selection of reading will be announced later).

4 units, Win (Howell) MWF 11

16. Philosophical Problems in Machine Intelligence—This course will consider past and current work in the field of artificial intelligence from the view of the philosophical problems that this research raises. We will concentrate on the natural language, but other aspects of intelligence, such as perception, problem solving, theorem proving, and planning will also be considered. (Graduate students should enroll in Philosophy 116.)

3 units, Win (Smith) MWF 9

57A. Introduction to Logic—(Graduate students enroll in 157A.) Discussions of axioms and rules of inference of first order predicate logic. Natural deduction rules. Interpretation and validity, theory of description, theory of definition; axiomatic theories. Basic definitions and operation with sets. The first class meeting is an organizational meeting only.

5 units, Aut, Win, Spr (Suppes) T 1:15

UNDERGRADUATE SEMINARS

27. Undergraduate Seminar in Philosophy of Religion—A critical examination of the fundamental issues involved in the decision whether or not to believe in God. Attention will center upon: (1) traditional arguments in support of religious belief; (2) the problem of evil as an argument for atheism; (3)
the relation between science and religion; (4) the relation between morality and religion; (5) contemporary criticisms of Christian belief. There will be two separate sections: enrollment in each will be limited to 20.

4 units, Aut (——) given 1975–76

28. Undergraduate Seminar in Philosophy of History—Does the course of human events have a pattern, goal or “meaning”? Can future events be predicted? Does historical knowledge differ from scientific knowledge? Why do we expect a good historian to have imagination and literary ability? Can we, as historians, be “objective”? Should we be? What is the point of studying history? Are there some things that are eternal—that have no history at all? The seminar will assess various answers to these questions and will search for new ones.

3 units, Spr (——) given 1975–76

29. Undergraduate Seminar in Theories of Language.

3 units, Spr (Wasow) evenings to be arranged

30. Undergraduate Seminar in the Philosophy of Education.

3 units, Spr (Bratman) MWF 1:15

57B. Introduction to Logic—Continuation of 57A. (Graduate students enroll in 157B.) Completeness proof, decidability, compactness and basic model theory; the axiomatic method. 57B bridges the gap between 57A and other courses in mathematical logic.

3 units (Gabbay) given 1975–76

70. Fact and Value—A discussion of some of the main problems connected with the nature of values and value judgments, especially as they arise in the twentieth century literature of value theory and “metaethics.” Specific topics include the Naturalistic Fallacy, non-cognitivism, intrinsic and extrinsic value, the derivability of an “ought” from an “is,” and the nature of ethical disagreement. (Graduate students enroll in 170.)

4 units, Win (Bratman) MWF 3:15

73. Philosophy of Human Life—(Same as Human Biology 173.) This course in bioethics and philosophy of medicine is designed to relate moral philosophy (including ethics, value theory, and social philosophy) to the interests of the Human Biology Program. Its goals are to help students acquire the intellectual skills of the philosopher and to increase students’ sensitivity to certain normative and conceptual issues. Topics include: (1) health, welfare, and the Good of Man; (2) moral obligation and its relation to social and individual welfare; (3) human life (including the meaning of life, the point of death, abortion, and personal identity; (4) human and social engineering; and (5) the distribution of medical and other welfare services. (Graduate students enroll in Philosophy 173.)

3 units, Aut (Staff) given 1975–76

79. Philosophy of Law—The nature and function of law, the relation of law to ethics, and the judicial process. (Graduate students enroll in Philosophy 179.)

4 units, Win (Serene) MWF 10

HISTORY OF PHILOSOPHY

100. Greek Philosophy — Characterization of historical situation in which Western science and philosophy began. Rise of critical thought. Early metaphysical speculation. Sophists and Socrates. Post-Socratic ethical schools. Philosophies of Plato, Aristotle, the Epicureans, the Stoics, the Skeptics, and Neo-Platonism. Prerequisite: some general course in philosophy, such as 2, 5, or 7.

4 to 5 units, Spr (Lewis) MTWTh 10

101. Early Christian, Medieval, and Renaissance Philosophy—This course examines medieval developments in philosophy of language, philosophy of religion, philosophy of science, theory of knowledge, and ethics. The readings are arranged by topic; they focus on the work of Augustine, Aquinas, Abelard, Aquinas, Scotus, and Occam. Prerequisite: one course in philosophy or permission of instructor.

4 or 5 units, Spr (Serene) MTWTh 11


4 or 5 units, Win (Perry) MTWTh 11
103. Philosophy in the Nineteenth and Early Twentieth Centuries—Trends in philosophy during the period considered as a background for understanding 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. Recommended: 102.

4 or 5 units, Spr (Howell) given 1975–76

104. Contemporary Philosophy—Some principal developments in contemporary philosophical thinking. Prerequisites: a total of two philosophy courses.

4 units, given 1975–76

106. Introduction to Philosophy—For graduate students. Lectures same as 5.

5 units, Aut (Moravcsik) MTWTh 10; Th or F section

120. Ancient Chinese Philosophy—For advanced students. Lectures same as Philosophy 4, with special section.

4 units, Spr (Nivison) MTWTh 9; F section

122. Chinese Philosophy Since Classical Times — The major philosophers since the third century B.C. with emphasis on the period from Sung through middle Ch'ing. Buddhism will be reviewed but not treated in depth in this course. Prerequisite: 120 or equivalent.

Aut (Nivison) MWF 1:15
Units to be arranged


3 units, Win (Nivison) MWF 1:15

136. Philosophy of Plato.

4 units, Win (Moravcsik) MTWTh 9:00

137. Philosophy of Aristotle—Prerequisite: 100 or equivalent.

4 units, Win, given 1975–76

145. Seminar in the Philosophy of David Hume—Prerequisite: 102 or equivalent.

3 units, Aut (Perry) T 4:15–6:05

147. The Philosophy of Kant—An introduction to the most important themes of the Critique of Pure Reason. Other works by Kant may also be discussed.

4 units, Spr (Howell) MTWTh 1:15

152A. The Philosophy of Heidegger—Study and discussion of selected works by Heidegger in English translation including Being and Time. Students who want to take this course, should preferably have taken course 178 or have comparable background in phenomenology.

3 units (Føllesdal) alternate summers given 1975–76

152B. The Philosophy of Sartre—Study and discussion of selected works by Sartre in English translation, including Being and Nothingness, and several of Sartre's novels and plays.

3 units, Sum (Føllesdal)

SYSTEMATIC PHILOSOPHY

116. Philosophical Problems in Machine Intelligence—For graduate students. Lectures same as 16.

3 units, Win (Smith) MWF 9

156. Introduction to Ethics—For graduate students. Lectures same as Philosophy 2. Special section for graduate students.

4 units, Aut (Bratman) MTWTh 9

157A. Introduction to Logic—For graduate students. Lectures same as Philosophy 57A.

157B. Introduction to Logic—For graduate students. Lectures same as 57B.

3 units (Gabbay) given 1975–76

160A,B. Symbolic Logic—Thorough treatment of validity, provability, consistency, completeness, definability and decision problems for logical calculi, and axiomatic theories.

160A. 3 units, Aut (Jech) MWF 3:15
160B. 3 units, Win (Hanssen) MWF 3:15

161. Introduction to Set Theory—Intuitive justification of the axioms. Operations on sets, relations and functions. Equivalence and ordering relations. Equipollence of sets and cardinal arithmetic. Topics on ordinal numbers and axiom of choice as time permits. Prerequisite: 157B or 160A or equivalent. First meeting is organizational only.

3 units, Aut, Win, Spr (Suppes) T 2:15

162. Theory of Automata—An introduction to finite automata. Comparison of different notions of computability. Relationship to programming languages and theories of grammars.

3 units, Aut (Suppes) given 1975–76
163A. **Fundamental Concepts of Intuitionistic Logic** — Constructive operations applied to concrete and abstract objects, examples of intensional and extensional constructions, notion of free choice sequence, the concept of idealized mathematician. Role of Church's thesis. Derivation of formal laws from analysis of basic notions. Prerequisite: 157B or 160A or equivalent.

3 units, given 1975–76


163B. 3 units, Aut (Gabbay) MTWTh 12
163C. 3 units, given 1975–76

164. **Philosophy of Science** — Detailed analysis of the structure and methods of empirical science. Application of set-theoretical models in particular sciences. Students are expected to write a paper on applying set-theoretical methods to a scientific or philosophical topic within their domain of interest. Examples in the course range from physics to psychology and linguistics.

3 units, Aut (Cartwright) TTh 1:15

166A. **Wittgenstein’s Philosophy of Logic**—An examination of Wittgenstein’s views on the nature of mathematics and mathematical reasoning.

3 units, Spr (Kreisel) given 1975–76

166B. **Russell’s Philosophy of Logic** — An examination of Russell’s views on the nature of mathematics and mathematical reasoning.

3 units, Aut (Kreisel) MW 2:15

167. **Elementary Proof Theory.**

4 units, Win (Kreisel) given 1975–76

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, Aut (Nivison) given 1975–76

169. **Philosophy of Religion: A Critical Survey**—An examination of a number of central problems in the philosophy of religion with emphasis upon their relations to the issue of belief versus unbelief. Among the topics considered will be: (1) traditional arguments in support of religious belief; (2) arguments for atheism, with emphasis upon the problem of evil; (3) the relation between science and religion; (4) the relation between morality and religion; (5) the nature of religious experience; (6) philosophical criticisms of theological method; (7) contemporary criticisms of Christian belief.

4 units, Win, given 1975–76

170. **Fact and Value**—For graduate students. Lectures same as 70.

4 units, Win (Bratman) MWF 3:15

172. **Psychology of Perceptual Experience**—(Enroll in Psychology 172.)

173. **Philosophy of Human Life**—For graduate students. Lectures same as 73.

3 units, Aut (Staff) given 1975–76

174. **Aesthetics**—Some central problems in philosophy of art: the nature of a work of art, modern and traditional definitions and theories of art, aesthetic experience, objectivity and non-relativity in criticism, possibility of standards of taste or of evaluation, special topics concerning aesthetic perception and the notion of aesthetic sensibility.

4 units, Spr (Howell) TTh 2:15

175. **Freedom and Authority: An Introduction to Social and Political Philosophy**—Lectures same as Philosophy 7. For graduate students and advanced undergraduates. Special section. Units negotiable.

4 units, Spr (Elster) MTWTh 9

178. **Phenomenology and Its Background**—A survey of the development of phenomenology and its contemporary philosophical significance. An analysis of the writings of Husserl and others.

3 units, alternate Sum (Føllesdal)

179. **Philosophy of Law**—For graduate students. Lectures same as 79.

4 units, Win (Serene) MWF 10

181. **Philosophy of Language**—A study of the concepts and techniques required for the syntactic and semantic analysis of natural languages, including elements of formal semantics and transformational grammar. Prerequisites: two courses in philosophy or linguistics.

4 units, Aut (Moravcsik) MTWTh 11
   4 units, Win (Howell) TTh 2:15

184. Theory of Knowledge — A survey of classical problems in epistemology. Attention will center upon: (1) nature of perceptual experience; (2) knowledge of the physical world; (3) knowledge of other minds; (4) knowledge of the past; (5) the problem of induction.
   4 units, Win, given 1975–76

   4 units, Win (Bratman) MWF 2:15

186. Causal Models in the Behavioral and Natural Sciences—Historical problems about causation and determinism; recent models of causation, especially in the behavioral sciences.
   4 units, Spr (Cartwright) MTWTh 11

189. The Concept of Mind—A discussion of the concepts of action and behavior, belief, desire, sensation, and perception, and of their logical interrelations.
   4 units, Win (Perry) MTWTh 10

   4 units, Aut (Bratman) by arrangement

192. Undergraduate Colloquium — Group tutorial for undergraduates on topics chosen by the undergraduate student association.
   4 units, Spr (Elster) Th 4:15

193. Theory of Social Decision Making—An in-depth survey of social choice theory. An interdisciplinary subject belonging to social welfare economics, political science, political philosophy, and other disciplines concerned with decision making or public policy analysis. A systematic (formal models) approach will be taken to such topics as majoritarianism, Arrow’s paradox, “rationality” and the foundations of pure choice theory, the nature and measurement of human welfare, distributive justice, the nature and rationale of democratic political processes, act- vs. rule-utilitarianism, and fair solutions to conflicts of interest. Prerequisite: some acquaintance with naive set theory and axiomatic method. Consult instructor for details.
   3 units, Spr (Hanssen) MWF 2:15

196. Tutorial—Senior year.
   5 units, any quarter (Staff) by arrangement

197. Individual Work for Undergraduates.
   Any quarter (Staff) by arrangement

199A, B, C. Seminar in Recent Philosophical Literature—Open to junior and senior students with consent of instructor.

199A. Topic: Pictorial Representation.
   3 units (Howell) given 1975–76

199B. Topic: Choice Theory.
   3 units, Win (Hanssen, Suppes) T 4:15

199C. Topic: Philosophy of Religion.
   Given 1975–76

COURSES INTENDED PRIMARILY FOR GRADUATE STUDENTS

201. Mathematical Linguistics — Construction of categorical grammars as well as phrase-structure grammars. Introduction to probabilistic grammars. Main emphasis, however, on model-theoretic semantics of natural languages. Extension of model-theoretic semantics to procedural semantics. Recommended: 162.
   3 units, Win (Suppes) given 1975–76

   3 units, Spr (Wasow, Moravcsik) W 4:15–6:05

203. Seminar in Ethical Theory—Analyses of texts by Moore, Ross, Stevenson, Hare, Dewey, and a selection of recent papers in ethical theory will serve as the basis for discussion. One term paper or several short papers. Prerequisite: 2 or consent of the instructor.
   3 units, Spr, given 1975–76

205. Philosophical Foundations of Quantum Mechanics — The course will center around problems in the foundations of quantum mechanics which have been considered philosophically important, such as the uncertainty principle, the status of causality, complementarity principle, the role of probability concepts and the need for a multi-valued logic. Various axiomatic formula-
tions of classical quantum mechanics will also be discussed.

3 units, Win (Cartwright) given 1975–76

215. Philosophy, Education, and Society—
An advanced seminar which focuses on philosophy of social science, including an examination of the philosophical bases for social science in the works of Marx, Weber, and Durkheim, as well as an examination of the current relationship of analytic philosophy and phenomenology to modern sociological theory. The latter half of the seminar will focus on comparative theoretical approaches to educational research in the light of modern philosophy and sociological theory. Enrollment limited to students with substantial background in philosophy and/ or sociological theory. Prerequisite: consent of instructor.

4 units, Spr (Pacheco) T 7–10 p.m.

220. Epistemology—A survey of the central problems of epistemology emphasizing the uses of modern techniques in clarifying classical epistemological issues.

4 units, Win (Hintikka) MTWTh 1:15

232. Seminar in the Philosophy of Kant —
Detailed analysis of the Critique of Pure Reason.

3 units (Hintikka) given 1975–76

236. Seminar in the Philosophy of Plato—A study of metaphysical and epistemological themes in the later Platonic dialogues.

3 units, Spr (Lewis) T 4:15


3 units, Win (Hintikka) Th 4:15–6:05

239. Teaching Methods in Philosophy.
1 to 3 units, any quarter (Staff) by arrangement

240. Individual Work for Graduates.
Any quarter (Staff) by arrangement

241. Seminar in the Philosophy of Language —This is a seminar that is organized to cover the most important contemporary literature in the philosophy of language. It is understood that students involved will play an important role in organizing the work of the seminar.

1 to 6 units, Win (Hintikka) W 4:15–6:05

242A,B,C. Seminar in the Philosophy of Science.

242A. Topic: Quantum Mechanics.
3 units, Aut (Cartwright, Suppes) M 4:15–6:05

242B. Topic: (to be announced.)
3 units, Win (Suppes) M 4:15–6:05

242C. Topic: (to be announced.)
3 units, Spr (Suppes) M 4:15–6:05

244. Seminar in Metaphysics.
3 units, Aut (Howell) given 1975–76

245. Seminar in the Philosophy of Mind.
3 units, Spr (Perry) M 4:15

246. Seminar in the Philosophy of Action.
3 units, Spr (Bratman) Th 4:15

Any quarter (Staff) by arrangement

276. Seminar on the Psychoanalytic Theory of Defense Mechanisms—(Enroll in Psychology 276.) This seminar will examine selected literature on the defense mechanisms. It will critically explore the theoretical ideas and examine attempts to objectify the concepts empirically from cognitive, behavioral, and motivational standpoints.

3 units, Spr (Horowitz, Suppes) M 2:15–4:05

280. Chinese Religious Thought—(Enroll in Religious Studies 215.)

5 units, Spr (Nivison, Yearly) TTh 2:15–4:15

3 units, Spr (Kreisel) MW 2:15


3 units, Aut (Kreisel) T 4:15

290A,B,C. Mathematical Logic—(Enroll in Mathematics 290A,B,C.)

291A,B. Topics in Model Theory—(Enroll in Mathematics 291A, B.)

292A,B. Topics in Recursion Theory—(Enroll in Mathematics 292A,B.)

293A,B. Topics in Proof Theory—(Enroll in Mathematics 293A,B.)

294A,B. Topics in Set Theory — (Enroll in Mathematics 294A,B.)
295. Advanced Automata Theory—(Enroll in Electrical Engineering 484.)

299A,B,C. Advanced Seminar in Recent Philosophical Literature—See 199A,B,C.

299D. Seminar in Modal Logic.
   3 units, Aut (Gabbay) by arrangement

   391A. Units by arrangement, Aut (Jech) W 4:15–6:05
   391B. Units by arrangement, Win (Kreisel) W 4:15–6:05
   391C. Units by arrangement, Spr given 1975–76

PHYSICS

Emeriti: Felix Bloch, Paul H. Kirkpatrick, David L. Webster (Professors)


Associate Professors: William A. Bardeen (on leave autumn quarter 1974), Theodor W. Hansch (on leave autumn quarter 1974), Robert V. Wagoner


Offerings and Facilities

The Russell H. Varian Laboratory of Physics, the adjacent Physics Lecture Hall, and the nearby W. W. Hansen Laboratories of Physics (High Energy Physics Laboratory, Microwave Laboratory, and Biophysics Laboratory) form a closely related complex housing a range of physics activities from general courses through advanced research. The facilities include an 18 MeV Tandem Van de Graaff accelerator and a 1.2 BeV electron linear accelerator. A superconducting electron linear accelerator is under construction. Separated from this group is the Stanford Linear Accelerator Center (SLAC), a separate very high-energy physics laboratory which has as its principal tool a two-mile-long, 20-BeV electron accelerator and a 1.5-BeV electron-positron storage ring.

Professor Robert Hofstadter is the Director of the High Energy Physics Laboratory; Professors Fairbank, Schwartz, Schwettman, Wojcicki, and Yearian are on the staff of the Laboratory. The staffs of the other branches of the W. W. Hansen Laboratories of Physics and of the Stanford Linear Accelerator Center are mentioned elsewhere in this catalog (see Applied Physics Department, Biophysics Program, Stanford Linear Accelerator Center).

One of the most important facilities is the Physics Library, which includes current subscriptions and back sets of important journals, together with textbooks, scholarly treatises in English, French, German, and Russian and the collected works of the most eminent physicists. It is a center for reading and study of physics at all levels.

In addition to course work providing a sound foundation in classical and modern physics, undergraduates are offered laboratory work at several levels. Both series of introductory courses include laboratories in which students carry out individual experiments. The Intermediate and Advanced Physics Laboratories offer facilities for increasingly complex individual work, including independent investigations.

The Department now offers courses in gravitation. Students who wish to specialize in this field or in astronomy, astrophysics, or space science should consult the Astronomy Course Program in this bulletin.

Graduate students find opportunities for research in the fields of astrophysics, theoretical physics, low temperature physics, molecular physics, nuclear physics including the Mossbauer effect, high energy physics, coherent optical radiation, and solid state physics. The fields of astrophysics, microwave physics, plasma physics, ferrites, biophysics, and others of a similar nature are offered in the Applied Physics Department and in the Biophysics Program. The number of graduate students admitted to the Physics Department is strictly limited. Students should complete application by January 15, 1975, for the following autumn. Graduate students may normally enter the Depart-
ment only at the beginning of autumn quarter.

**Programs of Study**

The study of physics is undertaken by three principal classes of undergraduates: those including physics as part of a general education, those preparing for careers in professional fields that require a knowledge of physics, such as medicine or engineering, and those preparing for teaching or research careers in physics itself. In this Department the courses numbered below 200 are planned to serve all three of these groups. The courses numbered above 200 meet the needs mainly of the third group, but also of some students majoring in other branches of science and in engineering.

**Bachelor of Science**

Department requirements for the degree of Bachelor of Science are as follows: Physics 51, 53, 54, 100, 101, 110, 111, 120, 121, 122, 130, 131, 132, 161, 170, 171, 200, 201. The Department strongly advises the study of Chemistry 4 and 5 and also the study of a modern language.

Students may reach the level of the 200-series courses via a normal or an advanced sequence. Exceptionally able students with an especially good preparation in physics will find the advanced sequence advantageous. It requires fewer courses and provides more opportunity for electives in either physics or other fields. Admission to the advanced sequence from the normal sequence requires A grades in 51 and 53 and permission of the Physics Department Undergraduate Study Committee; students must previously have taken Mathematics 41, 42, and 43.

The advanced sequence, Physics 59 and 60, is available to students with at least a year of high school physics and some calculus. Incoming students should apply directly to the Department before entering Stanford for permission to take 59 and 60. For these students the first year would be Physics 59, and 60, and perhaps 55, 56. Students who decide to enter the physics program after the freshman year can do so by taking Physics 55, 56, 59, and 60, provided they had previously taken Mathematics 41, 42, and 43.

Sample programs in physics and mathematics under the two sequences are shown below. Students should consult their advisers about the course distribution requirements in other areas. The sequence of courses during the first two years is relatively inflexible, but considerable freedom exists during the upper-class years. Students are urged to work out, in consultation with their advisers, a program which will best fulfill their individual aims. The Undergraduate Office of the Physics Department has more detailed information on how to obtain a Bachelor's degree in Physics. This should be carefully studied by prospective majors, especially if they intend to make use of Stanford's programs abroad. Under some circumstances the Department will permit, by petition, flexibility in the requirements so that the student may fit a period abroad into the program.

**Normal Sequence**

**First Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 51, 53. Mechanics, Electricity</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 54. Electricity Laboratory</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Math. 41, 42, 43. Analytic Geometry and Calculus</td>
<td>5</td>
<td>5</td>
<td>5</td>
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</table>

**Second Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Physics 55, 57. Light and Heat, Atomic Physics</td>
<td>4</td>
</tr>
<tr>
<td>Physics 56, 58. Light and Heat, and Atomic Physics Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>Physics 110, 111. Int. Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Math. 44, 45, 46. Advanced Calculus</td>
<td>3</td>
</tr>
<tr>
<td>Math. 130, 131, 132. Ordinary Differential Equations, Partial Differential Equations</td>
<td>3</td>
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</table>

**Third Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Physics 100. Int. Physics Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>Physics 120, 121, 122. Int. Electricity and Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>Physics 130, 131, 132. Atomic and Nuclear Structure</td>
<td>3</td>
</tr>
<tr>
<td>Physics 161. Int. Optics</td>
<td>3</td>
</tr>
<tr>
<td>Math. 106. Complex Variables</td>
<td>(3)</td>
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</tbody>
</table>

**Fourth Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Physics 170, 171, 172. Thermodynamics, Kinetic Theory and Introduction to</td>
<td>A</td>
</tr>
</tbody>
</table>

* Additional elective units must be added to bring the total number of units to 180 as required by the University. Students should consult their advisers about the course distribution requirements in areas outside of the sciences.

† Not required for degree in physics.

‡ Students who have not taken Physics 58 must also take Physics 101.
<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 55, 59, 60</td>
<td>Light and Heat, Advanced Fresh. Physics</td>
<td>8×</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Math. 113, 114, or 120</td>
<td>Linear Algebra and Matrix Theory or Modern Algebra</td>
<td>(3)</td>
<td>(3)</td>
<td>(3)</td>
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</tbody>
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**ADVANCED SEQUENCE**

**First Year**

**Second Year**

**Third Year**

**Fourth Year**

**Master of Science**

The Physics Department does not offer a separate program for the Master of Science degree, but this degree may be awarded for a portion of the Doctor's degree work. University requirements for the Master's degree are discussed in the section "Degrees" in this bulletin. Among the Departmental requirements are a B average in courses 130, 131, 132, 170, 171, 172, 202, 210, 211, and, if no thesis is submitted, at least 9 additional units of course work above the 200 level (not including 260, 261, 262, 290, 389, or 390).

**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:

Minimum subject matter requirements for the Ph.D. degree in Physics consist of 130, 131, 132, 170, 171, 172, one quarter of Advanced Laboratory (200, 201), 210, 211, 220, 221, 230, 231, 232, 260, 261, 262, 270, 330, and at least two quarters of any of the following courses: 240, 241, 250, 251, 331, 332, 334, 370, 371. All Ph.D. candidates must also take the following mathematics courses or have taken their equivalent previously: 106, 113, 114, 130, 131, 132. A minimum grade average of B during the last five quarters is required in the courses taken toward the Ph.D. degree.

Prior to making an application for Ph.D. candidacy, each candidate for the Ph.D. is required to pass a written comprehensive examination on undergraduate, graduate, and first year physics, given annually on the Thursday and Friday preceding the start of the autumn quarter. The examination should be taken in the summer after the first year graduate courses have been taken. After completion of the thesis he or she must take the University oral examination (defense of thesis). The Physics faculty believes that it is valuable for a scientist to have facility with a foreign language for cultural reasons and in order to establish better contact at meetings in foreign countries.

The Physics Department does not require a minor, but students are advised that the following mathematics courses have been found useful for graduate study in physics, especially for theoretical work: 206, 210, 220, 254, 256.

All prospective Ph.D. candidates in physics, regardless of their source of financial support, are urged to gain teaching experience as an integral part of their graduate training.

The student interested in applied physics and biophysics research should also be aware of the Ph.D. granted independently.
by the Applied Physics Department and by the Biophysics Program. Students interested in astronomy, astrophysics, or space science should also consult the Astronomy Course Program. See elsewhere in this bulletin.

**Minors in physics** must take either Physics 210, 211, and one other course above 100, or Physics 130, 131, and 132, or Physics 170, 171, and 172, with the appropriate prerequisites. All prospective physics minors must receive approval of their physics course program (at least one year before the award of the Ph.D.) from the Physics Graduate Study Committee.

The office of the Physics Department has more detailed information on how to obtain an advanced degree in Physics. This should be consulted by prospective candidates for advanced degrees.

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**TEACHING CREDENTIALS AND MASTER OF ARTS IN TEACHING**

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.

The degree of Master of Arts in Teaching is offered jointly by this Department and the School of Education. The degree is intended for candidates who have a teaching credential and wish further to strengthen their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. A suggested minimum program in the teaching field of physics would be Physics 57, 100, 101, 110, 111, 120, 121, and Mathematics 130, 131. Up to 6 units of equivalent course work, taken elsewhere as a graduate student, can be transferred. Detailed requirements for the degree are outlined in the "School of Education" section.

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**FELLOWSHIPS AND ASSISTANTSHIPS**

The Physics Department makes an effort to support all its graduate students requiring financial aid. The support is through fellowships, teaching assistantships, research assistantships, or a combination of some of these. Applications for financial aid should be made to the Graduate Awards Office before January 15, 1975.

**COURSES**

There are four series of beginning courses. The Ten Series (10, 11, 19) is recommended for the humanities or social science student who wishes to familiarize himself with the methodology and content of modern physics. The different quarters are independent. 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, 54, 55, 56, 57, 58) includes courses for students of engineering, chemistry, geology, mathematics, and physics. The Advanced Freshman Series (55, 56, 59, 60) is for the exceptionally well-prepared student who wishes to advance rapidly in physics.

All undergraduates are offered help with physics problems in the departmental counseling and tutoring center called The Reference Frame. The center is staffed Mondays through Fridays, 9 a.m. to 8 p.m.

The Twenty and Fifty 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.

Courses beyond 60 are numbered in accordance with the following three-digit code. The first digit indicates the approximate level of the course: undergraduate courses (1), first- and second-year graduate courses (2), more advanced courses (3). The second digit indicates the general subject matter: laboratory (0) mathematical physics and mechanics (1), electricity (2), atomic and quantum physics (3), nuclear physics (4), high energy physics (5), structure of matter (7), independent study and research (9).

**10. Special Topics in Physics**—This course proposes to familiarize the humanities or social science student with part of modern physics. In 1974–75, the subject will be Cosmic Evolution. After discussing the physical
laws that govern the universe, its evolution will be traced from the initial primeval fireball, through the formation of galaxies, stars, and planets to the development of life. A feeling for astronomical distances and times will be developed, and exotic astronomical objects, such as quasars, pulsars, and black holes, will also be discussed. No prerequisites.

3 units, Win (Wagoner) TTh 2:15; discussion T 3:15

11. The World of Physics: Nuclei and Particles — This course proposes to familiarize the humanities or social science student with part of modern physics. Starting with the discovery of X-rays, of radioactivity, and of the neutron, the concept of the atom and the nucleus will be considered. A general discussion of nuclear structure and nuclear reactions leads into a review of stellar processes, fission and applications of nuclear physics. Properties of elementary particles will be discussed. The course is open only to students not majoring in the physical sciences or engineering. No prerequisite. One term paper will be required.

3 units, Spr (Hanna) M 2:15-4:05; discussion W 2:15

19. An Introduction to Physics ("Physics for Poets") — A presentation from non-technical, non-mathematical viewpoints of the aims, methods (experimental and theoretical) and achievements in the attempts to understand the basic principles governing the physical world. Each topic is usually introduced through the historical background, but the emphasis is on present knowledge and current problems. Likely topics: classical mechanics, relativity, and quantum mechanics. No prerequisites.

3 units, Aut (Yearian) MW 2:15, one hour discussion by arrangement

21. Mechanics and Heat — Equilibrium, uniform and accelerated motion, force, work, momentum and energy; heat, temperature, properties of matter; pressure, behavior of fluids, elementary kinetic theory of gases. Prerequisite: working knowledge of elementary algebra, geometry.

4 units, Aut (Fairbank) lec. MWF 10 or 11 and lab.

Sum (——) lec. MTWTh 10; lab. T or Th 2:15-5:05

23. Electricity and Optics — Electric charges and currents, magnetism, induced currents; wave motion, interference, diffraction, geometrical optics. Prerequisite: 21.

4 units, Win (Wojcicki) lec. MWF 10 or 11 and lab.

29. Modern Physics — Basis of modern atomic theory, structure and properties of atoms, the nucleus, radioactivity. Prerequisite: 23.

4 units, Spr (Little) lec. MWF 9 or 10; discussions (——)

51. Mechanics — Vectors, particle kinematics and dynamics, work, energy, momentum, angular momentum; conservation laws; rigid bodies; oscillations. Discussions based on use of calculus. Prerequisites: Mathematics 41 or 11 and continuation in Mathematics 42, or consent of instructor.

4 units, Win (Schwettman) lec. MWF 9 or 10; discussions (——)

53. Electricity — Electric charges and currents, magnetism, induced currents, electric oscillations, electromagnetic waves. Prerequisites: 51 and Mathematics 42 or 21, or consent of instructor.

4 units, Spr (Meyerhof) lec. MWF 9 or 10; discussions (Glavish)

54. Electricity Laboratory — Concurrent registration in 53 is required.

1 unit, Spr (Glavish)

55. Light and Heat — Reflection and refraction of light, lens systems; light and electromagnetic waves; temperature, properties of matter, introduction to kinetic theory of matter. Prerequisites: 53 and Mathematics 43 or 23, or consent of instructor.

4 units, Aut (Ritson) lec. MWF 9 or 10; discussions (Schwettman)

56. Light and Heat Laboratory — Concurrent registration in 55 is required.

1 unit, Aut (Schwettman)

57. Atomic Physics — Relativity, experimental basis of quantum theory, Schrödinger equation, atomic structure, nuclear structure, high energy physics, elementary particles. Prerequisite: 55.

3 units, Win (Hansch) TTh 11:00-12:15

58. Atomic Physics Laboratory — Concurrent or prior registration in 57 is required.

1 unit, Win (Schawlow)

59, 60. Advanced Freshman Physics — An introduction to Newtonian mechanics, special relativity and electricity and magnetism
from an advanced viewpoint. The format will be lectures and small discussion sections, which will require a considerable amount of outside reading and homework. Successful completion of the course entitles the student to enter the Advanced Sequence. Prerequisites: advanced placement in mathematics and in the Physics 50 series, prior or concurrent registration in Math. 43, and consent of the instructor.

59. 4 units, Aut (Hitlin) TTh 9:00-10:50
60. 4 units, Win (Hitlin) TTh 9:00-10:50

100, 101. Intermediate Physics Laboratory — Fundamental experiments in mechanics, heat, electricity and magnetism, optics, and atomic physics. One set of apparatus for each experiment is available so that one or two students will perform a given experiment during a particular laboratory session. Students will work one or two weeks per experiment, completing ten to fifteen experiments during two quarters. Prerequisites: 111 and concurrent or prior registration in 121 and 122.

100. 2 units, Aut, Win, Spr (Wojcicki) by arrangement
101. 2 units, Aut, Win, Spr (——) by arrangement

110, 111. Intermediate Mechanics — Mechanics of systems of particles and rigid bodies. Coordinate transformation and vectors; Newtonian mechanics; linear and nonlinear oscillations; Hamilton’s principle, Lagrangian and Hamiltonian dynamics; central forces, planetary motion; collisions; non-inertial reference systems; rigid body dynamics; coupled oscillations. Prerequisites: 51 and Mathematics 130.

110. 3 units, Win (Bardeen) MWF 9
111. 3 units, Spr (Bardeen) MWF 9

120, 121, 122. Intermediate Electricity and Magnetism — Vector analysis, electrostatic fields, including multipole expansion; dielectrics. Special relativity and transformation between electric and magnetic fields. Maxwell’s equations. Static magnetic fields, magnetic materials. Electromagnetic radiation, plane wave problems (free space, conductors and dielectric materials, boundaries). Dipole and quadrupole radiation. Wave guides and cavities. Prerequisites: 53 and prior or concurrent registration in 110. Concurrent or prior registration in Mathematics 130 and 131 with Physics 120 and 121, respectively, is required.

120. 3 units, Aut (Giffard) MWF 10
121. 3 units, Win (Giffard) MWF 10
122. 3 units, Spr (Staff) MWF 10

130, 131. Atomic Structure — Origin of quantum theory, Bohr theory of H atom, including elliptic orbits, Schrödinger equation, one electron atom. First order perturbation theory (time independent and time dependent), magnetic moment and spin, Helium atom, many-electron atom, molecular spectra, X-ray spectra. Prerequisites: 57 or admission to Accelerated Sequence and 111. Concurrent or prior registration in 120, 121, 122, or equivalent, and in Mathematics 130 and 131 is required.

130. 3 units, Aut (Hofstadter) MWF 9
131. 3 units, Win (Hofstadter) MWF 9


3 units, Spr (Hitlin) MWF 11

161. Intermediate Optics — Interference, Fresnel and Fraunhofer diffraction, wave aspects of image formation, Fourier optics and holography, crystal optics, lasers and their modes, optical waveguides.

3 units, Spr (Hansch) MWF 8


170. 3 units, Aut (Lipa) TTh 11:00-12:15
171. 3 units, Win (Fairbank) TTh 11:00-12:15

172. Physics of Solids — Introduction to the principal types of solids, with emphasis on their thermal, electrical and magnetic properties. Elementary treatment of phonons in
solids, electrons in metals, energy bands. Applications to semiconductors, rectification, superconductors, para- and ferromagnetism, magnetic resonance. Prerequisite: 171.

3 units, Spr (Giffard) TTh 11:00–12:15

190. Independent Study and Senior Thesis—Experimental or theoretical physics under supervision of a faculty member. Prerequisites: superior work as an undergraduate physics major, approval of the instructor, and of the Undergraduate Study Committee of the Department of Physics.

Any quarter (Staff) by arrangement

191. Senior Seminar: Basic Gravitation—An introduction to the structure of relativistic theories of gravitation, with applications to problems in astrophysics. Prerequisites: 120, 121, 122 or equivalent.

3 units, Aut (Waggoner) TTh 2:15; one hour discussion by arrangement

200, 201. Advanced Physics Laboratory—Experiments in atomic physics, nuclear physics, solid state physics, low temperature physics, and particle physics. Zeeman effect, isotope shift, gyromagnetic ratio of the electron, β spectra, Compton effect, π-μ decay, X-rays, nuclear magnetic resonance, lasers, Mössbauer effect, and superconductivity. Experiments with transistors, electronic circuits, including amplifiers, oscillators, transmission lines, etc. Physics 200 and 201 consist of a selection of the more fundamental experiments. Prerequisites: 100, 101, 121, and 131. (Note—These courses may be taken in any of the three quarters. Furthermore, a student may take 200 alone or simultaneously with 201.)

200. 3 units, Aut, Win, Spr (Calarco, Hanna, Little, Ritson) by arrangement

201. 3 units, Aut, Win, Spr (——) by arrangement


3 units, Aut (Will) MWF 10

211. Mathematical Physics—Complex variables, complex integration, special functions (Legendre, Bessel, Hypergeometric) and their occurrence in the partial differential equations of physics, Fourier and Laplace transforms, and other topics of interest. Prerequisites: 210 and preferably Mathematics 106 and 132.

3 units, Win (Will) MWF 10

212. Mathematical Physics — Selected topics. Prerequisite: 211.

3 units, Spr (Will) MWF 10


220. 3 units, Aut (Fetter) MWF 9

221. 3 units, Win (Fetter) MWF 9

222. 3 units, Spr (Fetter) MWF 9

230, 231, 232. Quantum Mechanics — The first quarter develops the Schrödinger equation: the formalism of state vectors is employed. The eigenvalues and eigenfunctions are found for simple systems such as the harmonic oscillator and the hydrogen atom. The properties of angular momentum are presented from a group theoretical point of view. In the second quarter variational techniques and perturbation theory are introduced to treat the more complicated systems of many-electron atoms and molecules. The interaction of such systems with radiation is also analyzed using time-dependent perturbation theory. The third quarter deals with scattering theory. The concepts of the scattering matrix, phase shifts, complex potentials, and dispersion relations are developed. The technique of second quantization is also introduced. Prerequisites: 132 and 211 and Mathematics 106 and 132, and preferably Physics 222.

230. 3 units, Aut (Walecka) MWF 11:00
231. 3 units, Win (Walecka) MWF 11:00
232. 3 units, Spr (Walecka) MWF 11:00


3 units, Win (——) MWF 2:15
alternate years, given 1975-76

240, 241. Nuclear Physics—Nuclear force; properties of nuclei; nuclear models, nuclear structure; alpha, beta and gamma decays; nuclear reactions. Prerequisites: 132 and 231, or equivalent.

240. 3 units, Aut (Glavish) TTh 11-12:30
241. 3 units, Win (Glavish) TTh 11-12:30

250, 251. High Energy Physics—Transition probabilities; relativistic treatment of kinematics, spin, phase space; particles and conservation laws (parity, isospin, hypercharge, etc.); quantum numbers of the baryons and mesons; scattering of strongly interacting particles. Unitary symmetry, weak interactions (muon decay and properties), Regge poles, dispersion relations, nuclear-nucleon interactions. Prerequisites: 240 and 330; concurrent registration in 331, 332 recommended.

250. 3 units, Win (Ritson) MWF 10
251. 3 units, Spr (——) MWF 11

260, 261, 262. Research Activities at Stanford—Review of research activities in the Department of Physics at a level suitable for entering graduate students. Each research group will give a presentation of its work for approximately one-half quarter. The research groups have been divided as follows: Nuclear physics, High energy and elementary particle physics, Elementary particle physics, Low temperature physics, Quantum electronics, Theoretical physics.

260. 3 units, Aut (Fairbank, Schwartz, Schwettman, Yearian, Staff) TTh 1:15
261. 3 units, Win (Hansch, Schwablow, Little, Hanna, Staff) TTh 1:15

262. 3 units, Spr (Bardeen, Fetter, Wagoner, Walecka, Staff) TTh 1:15


3 units, Spr (Bloch) MWF 10

290. 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 consent of instructor. If taken under the supervision of a faculty member outside the Department, approval of the Physics Department Chairman is required.

Any quarter (Staff) by arrangement

299G. Teaching of Physics—Techniques of teaching Physics by means of lectures and laboratories. All teaching assistants in Physics are required to register for this course. Prerequisite: graduate standing.

0 or 1 units, Aut, Win, Spr (Hitlin, Yearian) by arrangement

299U. For Undergraduates.

3 units

330, 331, 332. Advanced Quantum Mechanics—Review of quantum mechanics and relativity, relativistic single particle equations (Klein-Gordon and Dirac), second quantization, canonical field theory, relativistic scattering theory. Quantum electrodynamics: applications, radiative corrections, renormalization theory, the Lamb shift. Symmetry principles, phenomenological field theories, special topics in field theory. Prerequisites: 221 and 232.

330. 3 units, Aut (Peccei) TTh 9:00-10:50
331. 3 units, Win (Peccei) TTh 9:00-10:50
332. 3 units, Spr (Peccei) TTh 9:00-10:50

336. Advanced Topics in Theoretical Physics—Discussion of selected topics of current interest in theoretical physics.

3 units, Aut, Win, to be arranged.

3 units, Aut (Donnelly) TTh 1:15–3:05

341, 342. Nuclear Theory — Nuclear matter, theory of angular momentum, group theory and nuclear spectroscopy. Nuclear models. Weak interactions, nuclear reactions, and special topics in intermediate energy physics. Prerequisites: 221, 241, 251, 340, concurrent or prior registration in 331, 332 is recommended.

341. 3 units, Win (Donnelly) TTh 1:15–3:05; alternate years, given 1975–76
342. 3 units, Spr (Donnelly) TTh 1:15–3:05; alternate years, given 1975–76

350, 351. Elementary Particle Theory — S-matrix analysis, helicity and partial wave analysis, dispersion relations, symmetries and applications. Theories of strong interactions, hadron models, reaction mechanisms (Regge Theory, duality, absorption), many-particle processes (statistical models, inclusive reactions, scaling). Theories of weak interactions, current algebras. Prerequisite: 332.

350. 3 units, Aut (Brodsky) MWF 11
351. 3 units, Win (Donnelly) MWF 11

352. Symmetries and Lagrangians — Internal symmetries in Lagrangian models with an emphasis on gauge symmetries and spontaneous breakdown. Some of the models to be discussed are: the Higgs model, the Sigma model, the Yang-Mills model, and the renormalizable gauge models of weak, electromagnetic and strong interactions, with applications.

3 units, Spr (Bars) MWF 11


368. 3 units (Wagoner) given 1975–76
369. 3 units (Wagoner) given 1975–76


370. 3 units, Win, alternate years, (Little) TTh 9–10:50
371. 3 units, Spr, alternate years, (Fetter, Walecka) TTh 9–10:50

389. Research Orientation — The purpose of this course is to allow students to become familiar with the activities of one or more research groups, within the Department or outside. Registration is limited to one quarter per research group with an overall limitation of two quarters. Consent of the student's advisor is required for registration.

Any quarter (Staff) by arrangement

390. Research — All work in experimental or theoretical problems in research, as distinguished from independent study of non-research character listed as Physics 190 and 290. Open only to graduate physics major students, with consent of instructor. If taken under the supervision of a faculty member outside the Department, approval of the Physics Graduate Study Committee is required.

Any quarter (Staff) by arrangement

POLITICAL SCIENCE

Emeriti: Thomas S. Barclay, Philip W. Buck, Anthony E. Sokol, Graham H. Stuart, James T. Watkins IV (Professors)

Chairman: Richard A. Brody


Associate Professors: David B. Abernethy, Robert O. Keohane, John F. Manley (on leave Autumn and Spring quarters), Rob-
Assistant Professors: Jonathan D. Casper, Harry Harding, Jolene Larson, Nannerl O. Keohane, John H. Mollenkopf, Paul M. Sniderman

Lecturers: Paul M. Cocks, Robert M. Rosenzweig, Eric Voegelin, Michael S. Weatherford, Lawrence D. Weiler, Franklin B. Weinstein. By courtesy: Peter A. Corning, Inga Markovits

PROGRAMS OF STUDY

Bachelor of Arts

Major in Political Science

The minimum requirements for recommendation for the degree of Bachelor of Arts with political science as the major are:
1. Registration as a major student in the Department for at least one quarter, and a minimum of 15 units of work offered by this Department.
2. The completion of 45 units of political science, including:
   a) An advanced course or seminar (numbered 100 or above) in at least three of the following fields: public administration, comparative politics, international relations, political theory, American politics, public law.
   b) At least one seminar, which may be counted toward fulfillment of a), above.

No more than 10 units of directed reading may be counted as credit toward the major. Courses used to fulfill the major requirement must be taken for standard letter grades, although courses in excess of the required 45 units may be taken on a pass/no credit basis.

Major in Social Sciences (Political Science)

The student who wishes to pursue a program of interdisciplinary study in social sciences with an emphasis on Political Science may enroll as a major in Social Sciences (Political Science). The major must be declared no later than the winter quarter of the junior year. For the Bachelor's degree, a total of 50 units is required; 30 units must be in Political Science and the remaining 20 must be selected (in consultation with the adviser) from the course offerings of the departments of Anthropology, Communication, Economics, History, Psychology, and Sociology.

HONORS PROGRAM IN POLITICAL SCIENCE

The Honors Program provides qualified majors with an opportunity to write a thesis on a subject of individual interest, for which up to 15 units of credit will be given in the honors candidate's senior year.

Application for admission to the Honors Program should be made in the third quarter of the junior year. Applicants must have at least a 3.0 grade point average in all University work and at least a 3.3 average in political science courses; and must secure the agreement of a regular faculty member to be their thesis adviser.

Graduation with Honors in Political Science will require: (1) completion of all requirements for a major in political science; (2) at least a 3.0 average in all University work; (3) at least a 3.3 average in political science; (4) 55 units of political science, including up to 15 units of Political Science 199 (honors thesis); (5) submission of an acceptable honors thesis. Students who successfully complete the program will graduate "with Honors in Political Science." Interested students should consult the adviser of the Honors Program in their junior year.

Graduate Study

Admission to Graduate Standing

All applicants for admission to graduate work are required to take the Aptitude Test of the Graduate Record Examination. This examination may be taken at most American colleges and by arrangement may be taken in nearly all foreign countries. For details concerning this test see the Information Bulletin. Overseas applicants, who may not receive the Information Bulletin promptly, should write directly to the Educational Testing Service, Box 955, Princeton, New Jersey 08540. The normal quota of students to be admitted is filled from those who have completed their applications by January 1. Only in the most exceptional circumstances will students applying after that date be admitted. Applications completed after June 1 will not be considered. Graduate students enter the Department at the beginning of the academic year.
Except in unusual circumstances, the Department will not admit graduate students who will not be able to take a full-time program. That is, students will be expected to carry a full course load except for time devoted to teaching or research assistantships.

Graduate applicants aged 40 and over will not be considered.

**Master of Arts**

The Department offers a terminal Master of Arts program for a limited number of students. Applicants for the A.M. program are selected on the basis of the same criteria as Ph.D. candidates. Should a student upon successful completion of the Master of Arts program wish to enter the Ph.D. program, he or she will be subject to the same selection process as all other applicants who have received an A.M. degree from other universities. Applicants for the A.M. program are not eligible for University scholarships, fellowships, or teaching assistantships, and they should not apply unless they can pay their own tuition, fees, and maintenance.

The Department also offers the A.M. degree in joint degree programs with professional schools within the University. The normal procedure in these instances is for the student to apply sometime during the first year in the professional school within the University.

The A.M. degree will be awarded to terminal A.M. students as well as to Doctoral candidates if they have completed the following requirements:

- The faculty of the Department recommends a candidate for the Master's degree if he or she has satisfactorily completed, in the judgment of the Department, at least one full academic year as a graduate student, with 45 units of work in political science of which at least 25 units must be taken in graduate seminars (i.e., seminars numbered 200 or above). Not more than 25 units of 45 unit requirement may be taken in a single field. The student shall take at least one course or seminar in three fields and at least two seminars in each of two fields. By special permission, a maximum of ten units of work done in related departments may be accepted in lieu of a portion of the work in political science. Courses numbered below 100 and grades below the level of B will not be considered acceptable for the A.M.

- The University's basic requirements for the Master's degree are discussed in the section “Degrees” in this bulletin.

- The Department does not offer a coterminous Bachelor's and Master's Degree program.

**Master of Arts in the Teaching of Political Science**

The degree of Master of Arts in Teaching is offered jointly by this Department and the School of Education. The degree is intended for candidates who have a teaching credential and wish further to strengthen their academic preparation. The program consists of a minimum of 25 units in political science courses and 12 units in the School of Education. Detailed requirements for the course are outlined in the section “School of Education” in this bulletin.

**Doctor of Philosophy**

- The candidate for the Ph.D. degree will offer three of the following fields of political science: American politics, comparative politics, international relations, political theory, public administration, and public law. The student will prepare and submit himself or herself to written examinations in two of these six fields of political science. The requirement for the third field may be satisfied either by taking a written examination in that field or by offering a minimum of ten units with a grade of B or better in the third field from among the formal graduate level courses in the Department.

- The Ph.D. candidate is required to demonstrate the following:
  1. competence in a foreign language; and/or
  2. competence in statistics and/or related skills such as scale analysis, content analysis, mathematics for social science, or computer science.

The language and/or skill alternatives shall be those most likely to be useful in connection with the student's dissertation research. Level of competence needed for successful completion of the research shall be determined by the student's adviser and program committee. In consultation with his or her adviser and program committee, the student shall propose a relevant program of preparation in a language and/or statistics. This program shall be mandatory unless the student can demonstrate, through an exami-
nation in a language or statistics, that he or she has mastered the necessary skills. In many cases, it may be necessary for the student to show competence in both a language and statistics.

c. If the candidate has not completed at least one year of previous undergraduate instruction, or 5 quarter units of previous graduate instruction, in political theory, he or she will take 5 quarter units of graduate instruction in political theory.

d. Early in the third quarter in residence, each first-year graduate student will submit to the student’s adviser a statement of purpose. This statement will indicate the student’s proposed major fields of study, the courses already taken and those planned to be taken in order to cover the fields, the student’s plans for meeting language and/or skill field requirements, and, where possible, dissertation ideas or plans. This statement will be discussed with, and must be approved by, the student’s adviser not later than May 15. It will then be reviewed by the Director of Graduate Study and, if approved, kept in the student’s file. The main purposes of this procedure are, in order of importance: to advise and assist the student to realize his or her educational goals; to provide an incentive for clarifying goals and for identifying ways to achieve them; to facilitate assessment of progress toward the degree.

e. When both a student and the adviser feel that he or she is ready, the student may take one or more written comprehensive examinations. Students may elect to take these examinations either simultaneously or singly in any two successive examination periods. It is normally desirable to take them at the same time. These examinations are normally given in the third and fourth weeks of the autumn and spring quarters.

f. Doctoral candidates who apply for the A.M. degree will be awarded that degree upon completion of the requirements outlined in the description of the Master of Arts program.

g. As part of the Ph.D. program, the candidate will normally serve as a teaching assistant for several quarters.

MINOR AND TEACHER’S CREDENTIAL

Minor in Political Science—Candidates in other departments, offering a minor in political science, select two fields in political science in consultation with the Graduate Student Adviser, and submit to her or him, or to a member of the faculty designated as a minor adviser, a program of study for approval. No individual shall take less than 20 units in Political Science, including at least one graduate seminar in each field. Candidates will be examined in their fields in the general oral examination.

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, at least 40 units in political science, including courses listed under 2A. For a minor, the applicant should have completed 24 units, including course 10.

ASSISTANTSHIPS, SCHOLARSHIPS, AND PRIZES

The Department uses teaching assistantships in connection with a number of courses. These customarily are granted to applicants only after they have been at Stanford for one year.

A number of scholarships and fellowships are also available. Graduate students, specializing in comparative politics, may apply for fellowships under the National Defense Education Act. The attention of undergraduate students is called to the annual Edwin A. Cottrell Memorial Prize for the best student in Political Science 1, the Arnaud B. Leavelle Memorial Prize for the best student in Political Science 150, the Lindsay Peters, Jr., Memorial Prize for the year’s outstanding student each quarter in Political Science 10.

SUMMER SESSION

During the summer quarter the Political Science Department offers a variety of courses and seminars. The specific offerings depend on the summer quarter faculty.

INTRODUCTORY COURSES

1. Major Issues of American Public Policy—Alternative public policies in selected areas, including control of monopoly, social welfare, poverty, government corruption, foreign policy. Political process; influence of
cultural, economic, political factors on determination of public policy.

5 units, Aut (Marshall) MTWThF 10
Win (Marshall) MTWThF 11

8. Introduction to the Study of Political Behavior—This seminar-workshop, limited to fifteen first and second-year undergraduates, will review some interdisciplinary approaches in the study of individual and group political behavior. In addition to the instructor’s presentations and discussion of relevant readings, there will be a workshop introducing the student to computer-aided analysis of quantitative data. However, no special computational skill is required.

5 units, Win (Eulau) MT 2:15-4:05

10. American Government — Congress, the President, political parties, and pressure groups; the process of policy formation in the federal government. Mr. Horn emphasizes the Constitution, the Supreme Court, and judicial review. Mr. Manley emphasizes Congress and the Presidency.

5 units (Manley) given 1975-76
Spr (Horn) MWF 11

11. Politics and Public Opinion

5 units, Aut (Weatherford) MTWThF 9

15. Introduction to Political Development — Analysis of the formation and development of political systems, from the primitive state to the post-industrial society. The course focuses on several central problems of politics (participation, economic distribution, authority, the structure of political organizations) and discusses the emergence and resolution of these problems at different levels of development.

5 units, Spr (Harding) MTWThF 9

20. Introduction to Comparative Government and Politics — Political development, governmental institutions and political processes in selected political systems, such as England, the Soviet Union, and Japan.

4 to 5 units, Aut (Steiner) MTWThF 10

50. Freedom and Order in Western Political Theory—An introductory survey of political thought since the Reformation, with particular attention to varying conceptions of the nature and conditions of political and social freedom.

5 units, Win (Drekmeier) MTWThF 11

ADVANCED COURSES AND UNDERGRADUATE SEMINARS

Advanced undergraduate courses are open to undergraduates who have the necessary prerequisites and also graduates where advisable. Undergraduate seminars are open, with the consent of the instructor, to juniors and seniors and to graduates where advisable. Enrollments will be limited. Some graduate seminars also may be open with consent of instructor to undergraduates.

ADMINISTRATION

100. Public Administration — Relation of public policy-making to administration, planning, principles of organization, problems of supervision and personal motivation, framework of decision-making, the budget, administrative responsibility.

5 units, Aut (Walker) MTWThF 11

102. Leadership in Organizations — The problems of leadership in complex organizations, such as universities, schools, hospitals, business firms, armies, and public bureaucracies. Special attention to the role of major executives. (Same as Education 333 and Sociology 262.)

4 units, Spr (March) given 1975-76

103. Organizational Decision Making — An examination of the process of decision making in modern complex organizations, such as universities, schools, hospitals, business firms, armies, and public bureaucracies. The impact of information, power, resources, organizational structure, and the environment. Alternative models of choice and their implications. (Same as Education 120 and Sociology 263.)

4 units, Win (March) MW 1:15-2:45

106. Seminar on the Evaluation of Government Performance—How can one evaluate the effectiveness of government programs in general and social service programs in particular? What factors account for failure to reach stated goals? To what extent might administrative changes increase program effectiveness? The seminar will consider these questions while examining the record of federally-funded manpower training and public service employment programs. Graduate enrollment permitted.

5 units, Win (Abernethy) W 2:15-4:50

109. Directed Reading in Administration—
Advanced individual study in public administration.

Any quarter (Staff) by arrangement

For graduate courses in Administration, see Graduate Courses.

COMPARATIVE POLITICS

111A. European Politics: The British Political System—The development of the British political system; political socialization and culture; the structure and functions of parties, interest groups, media of communication, parliament, cabinet and civil service; evaluation of performance and prospects.

4 to 5 units, Aut (Almond) MWTh 11

111B. European Politics: Government and Politics in Germany—Governmental institutions and the political process in the Federal Republic of Germany; determinants of domestic and foreign policies; processes of political socialization.

4 to 5 units, Spr (Weiler) given 1975-76

111C. European Politics: The Austrian Political System—The development of the Austrian political system; the demographic, economic, and institutional framework of politics; political culture; and the performance of political functions in contemporary Austria. Desirable prerequisite: 15 or 20.

4 to 5 units, Win (Steiner) MTWTh 10

112. Contemporary Asian Politics—Major problems of the area; evolutionary and revolutionary processes of change; and attempts to build viable political structures.

4 to 5 units, Win (Ike) MTWTh 9

114. Government and Politics in Japan—Focus will be on contemporary politics. Lectures will deal with the historical background, the social context of politics, political institutions, political forces, parties and elections, and the political process.

4 to 5 units, Win (Ike) MTWTh 9

115. Government and Politics of China—An overview of Chinese politics from 1800 to the present, with particular emphasis on the politics of the People’s Republic of China. The course has three themes: the origins of revolution in modern China, the politics of modernization in China since 1949, and the processes by which policies are made and implemented. Particular emphasis is given to the Cultural Revolution as the reflection of major issues and interests in Chinese politics.

5 units, Aut (Harding) MTWTh 10

116. Revolution, Protest, Reform: Communist Parties—Examination of selected non-ruling communist parties (Italian, Japanese, Venezuelan, Israeli, Finnish, etc.) in terms of their development, recruitment, membership, style, function, and structure patterns. Emphasis is on the distinctions among these parties, their causes and consequences. Desirable prerequisite: 20 or 126.

4 to 5 units, Spr (Triska) given 1975-76

116C. Comparative Communist Systems—A comparative study of the variety of experience and variability of communist political systems. The focus is on divergent patterns of development and experience with common problems encountered at various stages of communist rule.

5 units, Win (Cocks) given 1975-76

117C. Slavic Civilization—(Same as Slavic 117C.) An interdisciplinary introduction to the political, social, economic, and cultural history of the Slavic peoples of Bulgaria, Czechoslovakia, Poland, Russia, and Yugoslavia from the time of the Slavic migrations to the present. Readings and lectures will stress the similarities and differences among the Slavs themselves as well as the continuing tension of their relationship to the more familiar western experience. Three lectures a week will be offered by faculty from various departments, and a two-hour discussion section will be included as an integral part of the course.

5 units, Spr (Dallin, Triska, Staff) MTW ThF by arrangement

118A. Government and Politics in Tropical Africa—Examines the colonial situation, the growth of nationalism, the achievement of political independence, ethnic patterns in new states, civilian and military leadership, the role of party and bureaucracy, and problems in development planning.

5 units, Aut (Abernethy) MWF 9

118B. Government and Politics in Southern Africa—Examines the political histories of five white-ruled African territories and five neighboring African-ruled states. Stresses the interaction of domestic and international politics, through an analysis of apartheid’s international implications, regional transport networks, African liberation movements, the
role of multi-national corporations, and patterns of foreign aid.

5 units, Win (Abernethy) MWF 9

118L. Political Leadership.

5 units, Win (Lewis) MWF 9

119. Socialism in Cuba and Chile—An examination of the two socialist experiences in Latin America. The interrelationships between political, economic, and cultural change will be stressed.

5 units, Aut (Fagen) TWTh 2:15-4:05

119A. The Soviet Union: Politics and Society Since 1917—(Same as History 123A.) Survey of major trends and developments since the Revolution, and discussion of selected topics, including alternative interpretations, elite conflicts, role of ideology, social stratification, and changing values.

5 units, Spr (Packenham) Th 2:15-4:05

119B. International Communism—Survey of communism as an international movement, both under the Comintern and since its dissolution, with emphasis on organization, ideology, and appeals; discussion of tensions and cleavages among and within communist parties social bases of support; and patterns of successes, failures, and adaptation. (Same as History 123B.)

5 units, Aut (Dallin) MTWTh 10

121A. Seminar: Social Science, Ideology, and Public Policy—The main purpose of this seminar is to explore the utilities and limitations, in the United States and in other societies, of social science for public policy, and the methods and criteria by which such assessments may be made. Related topics, such as the nature of social science work, its similarities to and differences from political activity, and the limits and possibilities of objectivity in social and political analysis, are also treated. Principally for undergraduates.

5 units, Spr (Packenham) Th 2:15-4:05

122A. Seminar in Comparative Politics: Modernization and Democracy in Asia—Political change in Japan, Philippines, and India.

5 units, Spr (Ike) Th 2:15-4:05

123. Seminar: Contemporary Brazilian Politics and Society—Major themes in Brazilian society and politics. Special attention to the issues of autonomy and dependency and to various developmental problems and outcomes. Prerequisite: consent of instructor. Principally for undergraduates.

5 units, Win (Packenham) T 4:15-6:05

123A. Seminar: Latin American Dependency Theories—Analysis of the main themes in contemporary Latin American dependency theories and the intellectual and social roots and implications of these ideas. For both undergraduates and graduates. Reading knowledge of Spanish or Portuguese is recommended.

5 units, Spr (Packenham) T 4:15-6:05

123H. Seminar on Authoritarian Politics—Comparative analysis of the emergence, operation, and transformation of authoritarian political systems. Discussion topics will include the bases of support for authoritarianism, the nature of political conflict and decision-making in hierarchical systems, and the role of ideologies and charismatic leadership in authoritarian politics.

5 units, Spr (Harding) M 2:15-4:05

125. Seminar in the Politics of China—Prerequisites: 115 or the equivalent and consent of instructor.

5 units, Win (Lewis, Li) M 2:15-4:05

126. Comparative Politics: Eastern Europe—Systematic examination of the eight East European political systems in terms of their historical development, the policy-making processes, and their system maintenance and adaptation.

4 to 5 units, Spr (Triska) TWTh 1:15

127A. Seminar in Comparative Politics: West Germany—Case studies and analyses of data on voting behavior, political attitudes, political socialization.

5 units, (Weiler) given 1975-76

127B. Seminar on Education and Politics in Europe—(Same as Education 108.) The politics of educational innovation in selected countries of Western Europe; education and political socialization and recruitment.

5 units, Aut (Weiler) given 1975-76

128B. Seminar in Comparative Politics: The Prospects of Democracy—Crises of industrialized democracies; political alternatives in The New Nations; democratic impulses in authoritarian systems.

5 units, Spr (Almond) Th 10-12

128C. Seminar in Comparative Survival
Strategies—A systematic comparison of how different human societies go about meeting their basic survival and reproductive needs. The overall configuration of survival strategies and behaviors will be considered, and students will be required to take a holistic approach, drawing upon data and research from a variety of disciplines. However, particular emphasis will be given to the role of politics and political systems.

5 units, Spr (Corning) T 2:15–4:05

129. Directed Reading in Comparative Politics—Advanced individual study in comparative politics.

Any quarter (Staff) by arrangement

For graduate courses in Comparative Politics, see Graduate Courses.

INTERNATIONAL LAW AND RELATIONS

130. Introduction to International Law—A broad overview of theories, development, present state and propensities of international law as a process in various critical arenas of international interaction.

4 to 5 units, Win (Triska) TWTh 1:15

130C. Seminar: International Communism—(Same as History 218S.)

5 units, Win (Dallin) T 2:15–4:05

131C. International Dependency—What is meant when we say that one state is dependent upon another, more powerful state? What are the implications of a dependency relationship for the domestic political economy of both parties? These questions will be examined through case studies of the United States and a Latin American country, France and an African country, and the Soviet Union and an Eastern European country. Desirable prerequisite: 135C.

5 units, Spr (Abernethy) MWF 10

133. The International System and Comparable Systems—A comparison, in terms of conflict and integration, of historical and contemporary international systems with selected inter-city systems (in ancient Greece, for example), certain inter-band and inter-tribal systems, and the like, with consideration for some possible future trends.

5 units, Win (North) T 4:15–6:05

133C. International Organizations in World Politics—Analysis of the role of international organizations in contemporary world politics. Attention will be concentrated on new issues facing international organizations arising from increased interdependence in a variety of issue-areas. The experience of European integration will be discussed, as well as that of the United Nations and its affiliated agencies.

5 units, Win (R. Keohane) MTWTh 9

135. Diplomatic Revolution of Our Time—(Same as History 135.) An investigation of the problems raised by the collapse of the traditional system of Western diplomacy as a result of two world wars, the expansion of the diplomatic community, the breakdown of its internal homogeneity, the emergence of new nations, tensions between great and small powers, negotiations between states with conflicting national and cultural traditions, the functions and limitations of international organizations, and the new dimensions of diplomacy that have emerged since 1945.

5 units, Win (George, Staff) MWTh 11

135C. How Nations Deal With Each Other—(Same as History 135C.) A general course in international relations, emphasizing the interaction of political, economic, social and cultural factors. Special attention will be given to problems of international conflict and distribution of wealth. A variety of analytical approaches, drawn from economics, history, political science and moral philosophy, will be used to develop explanations of events and prescriptions for policy.

4 to 5 units, Aut (R. Keohane) MWThF 11

136A,B. Colloquium and Seminar in Soviet Foreign Policy—Contemporary Soviet foreign policy decision-making, instruments of Soviet foreign policy, Soviet interaction with the communist party-states, the developing nations, the West, and the U.S. Testing of hypotheses concerning Soviet and communist international organizations; diplomacy, negotiation, and risk-taking; agreements; and conference behavior.

136A. Colloquium.

5 units, Aut (Triska) Th 4:15–6:05

136B. Seminar—Students research.

5 units, Win (Triska) Th 4:15–6:05

137C. International Aspects of Environmental Disruption—Many environmental problems transcend national borders. Others are at least partially the result of international politics and economic activities. In this seminar,
students will explore the environmental crisis as a sub-set of international relations, with particular emphasis on ocean and waterway problems. Desirable prerequisite: 135C.

5 units, Spr (Corning) T 2:15-4:05

137W. Underdevelopment and Foreign Policy—An examination of the problems which the condition of underdevelopment poses for foreign policy and alternative ways of dealing with those problems. Particular attention will be given to the nonaligned movement and its meaning; foreign policies of independence and foreign policies of development; the nature of foreign policy elites and the domestic political determinants of foreign policy; foreign aid, investment, neo-colonialism, and dependency relationships; problems of dealing with multi-national corporations, and “resource diplomacy,” with emphasis on the experience of OPEC and the politics of oil. Illustrations will be drawn mainly from Southeast Asia.

5 units, Aut (Weinstein) MTWThF 1:15

138A,B. Arms Control and Disarmament—General international security relations, stressing political, conceptual, and technological problems of arms control. 138A is a prerequisite to 138B; the second quarter will provide for individual research.

138A. 5 units, Win (Lewis, L. Weiler, Staff) MTWTh 1:15

138B. 5 units, Spr (Lewis, L. Weiler, Staff) MWF 1:15 and tutorials, by special arrangement

138W. Security and Strategy in East Asia—The development of American and Japanese strategic perspectives on Asia, and Asian perspectives on the United States; the application of US strategic doctrines in Asia; the nature of conflict in the region; and problems of alliances, commitments, and military aid.

5 units, Spr (Weinstein) MTWThF 11

139. Chinese Foreign Policy—Analysis of China's goals and conduct in world affairs. The principal themes of the course are the historical roots of Chinese foreign policy; China's dilemmas as a revolutionary power; and the domestic context of China's foreign relations.

5 units, Win (Harding) MTWTh 9

141L. Seminar-Workshop on United States-China Relations.

5 units, Spr (Lewis, Li) Th 2:15-4:05

143A. Seminar on the Political Economy of U.S.-Latin American Relations—Limited to advanced undergraduates, knowledge of Spanish or Portuguese recommended. Consent of instructor required.

5 units, Win (Fagen) T 2:15-4:05

143B. Seminar in the Politics of Development: Eastern Europe — A comparative study of the social pressures and consequences which economic development and modernization produce on the nature and structure of political authority in the East European political systems. Three pilot survey research studies on social participation (Czechoslovakia, Hungary, and Yugoslavia) will be available for the seminar participants.

5 units, Win (Triska) given 1975-76


144A. Focus on presidential-level decision-making, the organization and operation of the National Security Council and the informational and advisory role of other departments and agencies in the Executive Branch. Theoretical approaches and case studies. Enrollment limited to 15 juniors and seniors with previous courses in international relations and public administration.

5 units, Aut (George) given 1975-76

144B. Student Research — Prerequisite: 144A.

5 units, Win (George) given 1975-76

145. Seminar in the Dynamics of International Conflict — Expansion, competition, arms races, conflicts and crises.

5 units, Win (North) Th 4:15-6:05

145A,B. Seminar on Force and Diplomacy in the Modern Era.

145A. Critical examination of crises and conflicts in the post-World War II era with reference to lessons for theory and practice of foreign policy. Topics examined will include deterrence, coercive diplomacy, crisis management and escalation control, war termination, détente.

5 units, Win (George) WF 2:15-4:05

145B. Student research — Prerequisite: 145A.

5 units, Spr (George) WF 2:15-4:05

147. Seminar on Soviet-Chinese Relations.

5 units, Aut (North) Th 4:15-6:05
147L. Chinese Perspectives on International Law—(Same as Law 291.)
3 units, Aut (Li) ThF 12:50–2:05

149. Directed Reading in International Law and Relations—Advanced individual study in international law and relations.
Any quarter (Staff) by arrangement
For graduate courses in International Law and Relations, see Graduate Courses.

POLITICAL THEORY

150. Political Thought: Myth and Speculation in the Ancient World—The beginnings of political speculation in preliterate societies, the ancient world, and pre-Socratic Hellas; the philosophical systems of Plato, Aristotle, and the Hellenistic schools; Roman institutions and theories of law and politics.
5 units, Aut (Drekmeier) given 1975–76

151. Political Thought: Augustine to Hobbes—The search for a principle of authority consistent with spiritual ideals, with new forms of social integration, and with the private goals of the individual.
5 units, Aut (Drekmeier) MTWThF 11

152. Political Thought: Machiavelli to Rousseau—The development of political thought in the early modern era. Concepts of liberty, authority and obligation as presented in the work of six major theorists. Attempts to define the means and goals appropriate to political action, and the different sorts of methods employed in the study of political phenomena will receive attention.
5 units, Win (N. Keohane) MWTh 10
Sections by arrangement

153. Political Thought: The Modern Period—Democratic theory, liberalism, socialism, communism and anarchism from 1785 to the present. The course will undertake critical analysis of attempts to adapt the ideals of democracy and social justice to the large modern state. The Federalist papers, Tocqueville, Mill, Marx, Bakunin and Lenin will be read, along with briefer selections from other works.
5 units, Spr (N. Keohane) MWith 10

157. Theory of Revolution—Modern revolutions are multistratified phenomena and their theoretical treatment in political sciences is correspondingly confused. The present Colloquy has the purpose of disentangling the strata. There will be treated, first, the complex of economic grievances and social injustice. This is the body of issues dealt with by classical politics. The second stratum to be separated will be the hope of a perfect society. This is the complex that goes back to the Jewish and Christian Apocalyptic of Antiquity. The third stratum is the modern transfer of apocalyptic hope to the expectation of a perfect society to be realized by immanent man within history. The interplay of economic grievance, social injustice, hope of a perfect society, and immanentist politics characterizes the contemporary debate.
5 units, Spr (Voegelin) MWF 9

158A,B. Theory, Power, and Social Science. 158A. The development of modern social science and social philosophy: discussions of value, the nature of man, human interaction, the organization of power, belief systems, social change, and related themes in the different idealist, formalist, and positivist schools of thought. No prerequisite, but 153 or a course in modern philosophy or intellectual history will be helpful. This course provides the historical and philosophical background for 158B.
5 units, Win (Drekmeier) given 1975–76

158B. The theory of political structure and process: typology of social relationships, organization and leadership, social class and ideology, alienation and participation, etc. Political sociologies of elites, bureaucracy, and class in the writings of Marx, Toennies, Simmel, Weber, Mannheim, Durkheim, Michels, and contemporary theorists. Psychoanalytic, phenomenological, and other conceptions of the nature of consciousness and experience will be considered in the analysis of behavioral aspects of the subject. 158A strongly recommended.
5 units, Spr (Drekmeier) given 1975–76

159. Seminar: Utopias—A study of the psychology and institutions of Utopia. Descriptions of ideal societies from Plato to Skinner will provide the greater part of the reading for the course. Modern anti-utopias will also be analyzed, as well as essays describing the utopian impulse as a special way of thinking about politics.
5 units, given 1975–76

160A,B. “Modernisms”—“Modern” thought characteristically seeks insight into its own
roots. The course will consider how such increased awareness of subjectivity affects subsequent action or expression. The lectures will also consider salient "family resemblances" (Wittgenstein) discernable in the period of 1900–1940 in fields as divergent as social and political theory, legal theory, philosophy, historiography, literature, art, and even music.

160A. 5 units, Win (Rogat) M 2:15–4:05
160B. 5 units, Spr (Rogat) M 2:15–4:05

161. Seminar in Power, Authority, and Disobedience.
5 units, Win (Drekmeier) M 4:15–6:05

163. Seminar on Freedom and Equality—An analysis of the tensions between these two values, and varied treatment of these concepts, in modern social thought. Readings will be taken from contemporary political philosophers as well as from selected earlier theorists, including Hobbes, Rousseau and Tocqueville.

5 units, Aut (N. Keohane) given 1975–76

164. Seminar on the Public Interest — An analysis of the meanings of private and public interest in selected political philosophers, with special attention to contemporary attempts to define the "public interest" and provide empirical referents for it, or to deny its validity. Open to advanced undergraduates and graduate students.

5 units, Spr (N. Keohane) W 2:15–4:05

168. Alienation and Detachment—The history and theory of concepts of estrangement, objectivation, and alienation and their place in the development of the philosophy of politics, society, and art.

5 units, Spr (Drekmeier) M 4:15–6:05

169. Directed Reading in Political Theory—Advanced individual study in political theory.

Any quarter (Staff) by arrangement

For graduate courses in Political Theory, see Graduate Courses.

PUBLIC LAW

170. The Supreme Court and the Constitution—Theory and practice of constitutional government in the United States. Formation of the Constitution; federal court system; separation of powers; judicial review; Congressional and Presidential authority; citizenship, suffrage and representation; emphasis on nature of legal reasoning and judicial process. Prerequisite: third-year standing.

5 units, Aut (Horn) MTWThF 1:15

171. Seminar in American Federalism—Evolution and current condition of U.S. federal system. Relationship of constitutional developments to political, economic, and cultural change. Enrollment limited to 15 juniors and seniors. Prerequisite: 170 or consent of instructor.

5 units, Win (Horn) given 1975–76


5 units, Spr (Horn) MTWThF 1:15

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; religious liberties; rights of ethnic minorities. Prerequisite: third-year standing.

5 units, Win (Horn) MTWThF 1:15

174. The Criminal Law and the Criminal System—(Same as Law 107 and Sociology 132.) Exploration of the purposes and processes of the criminal law with emphasis on the actual operation of the system, and application of theory to contemporary problems. Topics will include the police, the trial, sentencing, corrections and "non-victim" crimes.

5 units, Spr (Kaplan) MWF 1:15

175. Law in East and West Germany—(Same as Law 307.) The course will analyze the legal systems of East versus West Germany with special emphasis on the typical ways in which a socialist state differs from a bourgeois state in the use of law as a means of social transformation. We will focus in particular on those areas of law which either directly confront the individual with state authority or require a ranking between state and individual interests: constitutional law, certain areas of administrative law, proce-
The different functions of individual rights in these areas (protecting the individual against infringement by the state in the Federal Republic, educating and inducing the individual to contribute to socialist progress in the GDR) will be contrasted with the fairly similar functions of individual rights in horizontal relationships in both states, e.g., civil law, family law, etc.

5 units, Aut (Markovits) TTh 11:00–12:30

179. Directed Reading in Public Law — Advanced individual study in public law. Any quarter by arrangement with Public Law faculty

For graduate courses in Public Law, see Graduate Courses.

AMERICAN POLITICS

182. Introduction to Political Psychology — An introduction to the dynamics of public opinion and attitude change; the study of personality and politics; the analysis of social conformity and deviance; and the sources and consequences of alienation and political disaffection in America.

5 units, Win (Sniderman) MWF 10

183. Criminal Justice in America — The course will explore the administration of justice in America. Topics include police behavior, the process of arrest, the quality of defense counsel, prosecutorial discretion, plea-bargaining, sentencing, and correction.

5 units, Aut (Casper) MW 10; section by arrangement

184. Legislative Behavior — Congressional elections, constituent relations, policy making and leadership, relations between Congress and administrative and executive agencies; the committee system, seniority and procedure; Congress as an element in the party system. Prerequisites: third-year standing and 10 or equivalent.

5 units (Manley) given 1975–76

185A. Introduction to Models in Social Science — (Same as Education 110 and Sociology 271.) An introduction to models in social science. Models of choice, exchange, adaptation, diffusion, and structure are used to make predictions in a variety of situations involving human behavior. Emphasis is placed on the invention and application of models more than on the testing of them.

4 units, Aut (March) MW 1:15
sections M 10 or 11

186. Politics and the American Legal System — The relationship of legal institutions to the broader political system. Topics will include judicial recruitment and decision-making, litigation and social change, and the impact of court decisions.

5 units, Win (Casper) MW 10; section by arrangement

191. Seminar: The Warren Court and Civil Liberties — A discussion of the impact of the Warren court upon civil liberties and civil rights. Reading will include court decisions and materials dealing with the relationship of the court to other branches of government.

5 units, Aut (Casper) M 2:15–4:05

192A. Urban Structure and Policy — This urban studies core seminar analyzes the interaction of metropolitan economic trends, social structure, culture, and political activity, particularly as it affects the quality of urban life. The spring quarter focuses on the development of city planning and competing visions toward which the city should be planned. Limited to undergraduates with a strong interest in urban studies, the course emphasizes class discussion of readings, short papers, and student presentations. (Same as Urban Studies 100A,B.)

192A. 5 units, Win (Mollenkopf) Th 2:15–4:05
192B. 5 units, Spr (Mollenkopf) Th 2:15–4:05

193. Seminar on the U.S. Congress — Provides students with an opportunity to study in depth the U.S. Congress. Readings and lectures will deal with the House and Senate from the New Deal to the present. Prerequisite: Political Science 10.

5 units, Win (Manley) W 2:15–4:05

193A,B. Seminar in American National Government: Congress and the Presidency — This seminar is designed for junior and senior majors in political science and graduate students where advisable. The purposes of the seminar are to acquaint the student with a variety of research strategies and methods used in the study of American politics and to provide a context for the development of individual research projects. Prerequisites: consent of instructor. Students should plan to take both A and B.

193A. 5 units (Manley) given 1975–76
193B. 5 units (Manley) given 1975–76
194. Twentieth Century American Political Thought—This seminar, designed for third- and fourth-year undergraduates, will examine the contributions of some major thinkers to an understanding of American society and politics: Herbert Croly, John Dewey, Walter Lippmann, Thorstein Veblen, C. Wright Mills, and John Kenneth Galbraith.

5 units, Spr (Eulau) M 2:15-4:05

195. Introductory Seminar in Politics—Historical, social, and ideological factors affecting American politics, emergent patterns in the party system; analysis of the nature of public opinion and voting behavior.

5 units, Aut (Rosenzweig) given 1975-76

196A,B. Seminar on Presidential Decision-Making

196A. Role of personality factors in incumbent's conception of the Presidency, his organization and management of the policy-making system, use of advisers, performance as a decision-maker. Enrollment limited to 20 juniors and seniors. Desirable prerequisite: previous courses in American government, policy-making, organization theory, psychology.

5 units, Aut (George) TTh 2:15-4:05

196B. Student Research — Prerequisite: 196A or equivalent.

5 units, Win (George) Th 2:15-4:05

198. Directed Reading in American Politics—Advanced individual study in politics. Prerequisite: 10 or equivalent.

Any quarter (Staff) by arrangement

204. Seminar in Planning and Administration for Metropolitan Areas—Urban planning in the context of political and administrative decision-making; governmental structure and divisions as factors in land use development and control.

5 units, Win (Walker) T 2:15-4:05

205. Seminar in Intergovernmental Relations and Urban Government—Jurisdictional patterns and influences in metropolitan areas; administrative conflicts and coordination in selected service areas.

5 units, Spr (Walker) T 2:15-4:05

207. 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 decision-making process. Recommended: Economics 1.

5 units, Win (Marshall) T 2:15-4:05

208. Seminar in Administrative Responsibility — Conflicting loyalties, accountabilities of administrative officials in decision-making processes; responsibility to public at large, pressure groups, chief executive, legislature, profession. Case study method used.

5 units, Spr (Marshall) T 2:15-4:05

210. Administrative Behavior — Environment of administrative action; political, social, psychological factors in management; problem of incentives.

Any quarter (Staff) by arrangement

210A. Non-Rational Factors in Administrative Management—Special psychological problems in supervisory and subordinate roles; impact of cultural expectations and personality structure on organizational behavior.

5 units, Spr (Walker) MTWTh 11

211A. Theories in Comparative Politics—Concepts, models, theoretical frameworks, and typologies in comparative politics; theoretical approaches to political development; methodology in cross-national research.

5 units, Win (Almond) T 4:15-6:05

211B. Comparative Political Institutions and Processes — Cross-national analysis of
specific institutions, processes, and problems such as political parties, interest groups, bureaucracies, legislatures, political socialization, political leadership, political system performance, and the like.

5 units, Spr (Almond, Staff) T 4:15-6:05

220. Seminar in Comparative Political Socialization—Theories of political socialization; political socialization and political culture; analysis of the functioning of agents of political socialization in various political systems; political socialization and political change.

5 units, Spr (Steiner) T 4:15-6:05


5 units, Win (Ward) W 2:15-4:05

221. Seminar in Comparative Politics: Parties and Party Systems—Development and functions of parties; typologies of parties and of party systems; parties and political participation.

5 units, Win (Steiner) T 4:15-6:05

222. Education and Political Development—(Same as Education 306B.) An introduction to the comparative analysis of the relations between educational and political systems. The lectures and discussion sections will deal with (a) problems of political socialization and recruitment and (b) the politics of educational development and innovation.

4 to 7 units (Weiler) given 1975-76

224. Seminar in Comparative Local Politics—Subnational institutional structures in various political systems; local-national linkages with emphasis on the relationship of decentralization to development and democracy; comparative urbanism; community power in comparative perspective.

5 units (Steiner) given 1975-76

225. Seminar on the United States and the Pacific—An analysis in political, strategic, economic, and cultural terms of recent and contemporary United States' relationships with major states and regions bordering the Pacific Ocean. Attention will be focused on the process by which a society and polity that has always been Atlantic and European in its principal orientations has gradually acquired an increasingly important Pacific orientation as well.

5 units, Spr (Ward) T 2:15-4:05

226. Seminar on Chinese Political Development—Discussion of political development and decay in contemporary China. Special attention will be given to the problems of participation, organization, and authority in modern Chinese politics.

5 units, Aut (Harding) M 4:15-6:05

227. Seminar in Comparative Politics: Africa—Examines the record of selected African states in formulating and implementing public policy, with special reference to rural development. Open to selected undergraduates who have taken an Africa-related course.

5 units, Spr (Abernethy) W 2:15-4:05

227C. Seminar in Decision-making and Bureaucratic Politics in the Soviet Union—A study of the problems and processes of Soviet decision-making. Particular attention given to the changing nature and role of institutional structure, administrative theory, organizational behavior, and bureaucratic politics in policy making and implementation. For both undergraduate and graduate students.

5 units, Win (Cocks)

229. Directed Reading in Comparative Politics.

Any quarter (Staff) by arrangement

231A,B. Case Studies and Theory Development in International Relations.

231A. Critical review of efforts to employ case studies for developing international relations theory with special attention to the emergence in political science of the method of structured, focused comparison of multiple cases. In this context specific attention will be given to research strategies for bridging the gap between theory and practice of foreign policy.

5 units, Win (George) given 1975-76

231B. Student research. Prerequisite: 231A.

5 units, Spr (George) given 1975-76

240A,B. Seminar on Political Leadership.
240A. Readings and discussion of current approaches to study of political leadership: social background elite analysis; ideology and "operational code" belief systems; political style and political skill; charismatic leadership; political personality; role and personality; psychobiography.

5 units, Aut (George) given 1975–76

240B. Student research. Prerequisite: 240A.

5 units, Win (George) given 1975–76

241C. Seminar on Transnational Relations—From the perspective of theory in international relations, this seminar will attempt a critique of traditional state-centric models of world politics. From a substantive point of view, the focus will be on the politics of international economic issues and ways in which international arrangements might be constructed to deal with them. Students will have the opportunity to investigate at least two issue-areas in depth.

5 units, Spr (R. Keohane) T 4:15–6:05


5 units, Spr, (Ike, North, Triska)
Th 4:15–6:05

243C. Seminar in International Relations Theory—Examines and compares both traditional and some of the more contemporary approaches to international relations theory from an interdisciplinary viewpoint. Realists, idealists, behavioralists, environmentalists, socio-cultural evolutionists, futurists, and others.

5 units, Aut (North) T 4:15–6:05


248A. Focus on problems of foreign policy-making and decision-making in the Executive Branch. Critical examination of theories of rational decision-making, organizational behavior, and "bureaucratic politics" as they bear on the organization and performance of Presidential-level decision-making in the foreign policy sphere.

5 units, Aut (George) given 1975–76

248B. Student research.

5 units, Spr (George) given 1975–76

249. Directed Reading in International Law and Relations.

Any quarter (Staff) by arrangement


5 units, Aut (Drekmeier) M 4:15–6:05

266. Political Science in Political Philosophy—An analysis of the work of four major political theorists—Aristotle, Machiavelli, Hobbes, and Montesquieu—each of whom has been regarded, by himself or by others as "the first political scientist." Their methods, beliefs about their purposes and achievements, and statements on crucial questions in political theory will be compared and criticized. The seminar is designed especially for graduate students who want to develop some acquaintance with the teachings of important political thinkers of the past; it will also serve the needs of those who plan to take the examination in political theory. Exceptionally well-qualified undergraduates may be admitted with the consent of the instructor.

5 units, Win (N. Keohane) Th 4:15–6:05

267. Rousseau and Marx—A comparative study of two great social theorists, both radical social critics with a vision of a better life, with very different ways of approaching their work. Their ideas about the development of the human species, the connections between the individual and community, economic and social roots of alienation, freedom, authority, theory and practice will be closely analyzed.

5 units, Win (N. Keohane) given 1975–76

269. Directed Reading in Political Theory.

Any quarter (Staff) by arrangement


5 units, Win (Horn) T 4:15–6:05

276. Seminar on the Constitutional Scope and Limits of "Free Speech"—The seminar
will consider the historical origins and the major analytic problems of the laws regarding “free speech.”

5 units, Aut (Rogat) M 2:15–4:05

279. Directed Reading in Public Law.

Any quarter (Staff) by arrangement

280A. Contemporary Problems in Social Institutions—(Same as Education 202 and Sociology 180.) An examination of the social structure, process, problems, and ideology of a specific social institution. The institution to be considered varies each year.

4 units, Aut (March) M 7–10:00 p.m.

281E. Seminar in Empirical Political Theory—An inquiry into the logics, psychologies and sociologies of elitist and pluralistic as well as representative and participatory theories of democracy. Limited enrollment; open to graduate students and advanced undergraduates.

5 units, Aut (Eulau) given 1975–76

283E. Seminar in the Politics of American Federalism—An inquiry into the political origins, transformations and dynamics of the American federal system, with special emphasis on the problem of representation (rather than adjudication and administration). Limited enrollment; open to graduate students and advanced undergraduates.

5 units, Win (Eulau) given 1975–76

287A,B. Voting Behavior Seminar.

287A. 5 units, Win (Brody) M 4:15–6:05

287B. 5 units, Spr (Brody) M 4:15–6:05

288. Seminar on Legal Institutions and Processes—A discussion of legal institutions and the political process. Topics will include judicial recruitment, the analysis of judicial decision-making, techniques for lobbying courts, and the impact of court decisions.

5 units, Win (Casper) M 2:15–4:05

290. Introduction to Political Data Analysis.

5 units, Aut (Brody) M 2:15–4:05
Lab Th 1:15

294A,B. Research Seminar in Political Behavior—Intensive review of and independent research on, public opinion, attitude change, political alienation, participation, and voting. Students must take both quarters.

294A. 5 units, Win (Sniderman) F 2:15–4:05

294B. 5 units, Spr (Sniderman) F 2:15–4:05

295. Micro-Macro Political Analysis—For graduate students and undergraduates planning to do graduate work in the social sciences. An introduction to the level of analysis problem, with particular emphasis on political representation. Review of metatheoretical foundations; the phenomenon of emergence; theoretical and methodological fallacies; the nature of unit properties and their transformation; inter-level linkages and contextual effects.

5 units, Aut (Eulau) W 2:15–4:05

298. Directed Reading in Politics.

Any quarter (Staff) by arrangement

GRADUATE COURSES

300. Thesis.

Any quarter (Staff) by arrangement

304A,B,C. Advanced Research in Organization Theory—(Same as Education 418A, B,C, and Sociology 365A,B,C.) A research seminar for advanced graduate students. Emphasis is placed on developing original theoretical formulations of major concepts in organization theory. Prerequisites: advanced courses in organizations, research methods, consent of instructor.

304A. Advanced Research in Organization Theory, I.

4 units, Aut (March, Staff) to be arranged

304B. Advanced Research in Organization Theory, II.

4 units, Win (March, Staff) to be arranged

304C. Advanced Research in Organization Theory, III.

4 units, Spr (March, Staff) to be arranged

313A,B. Graduate Seminar-Workshop on Dependence and Development in Latin America — Emphasis on the interplay between political and economic, and domestic and international factors in Latin American development and underdevelopment. An advanced research seminar; knowledge of Spanish or Portuguese highly recommended. Consent of the instructor required. Normally
a two-quarter sequence for 5 units each quarter.

313A. 5 units, Win (Fagen) Th 2:15-5:15
313B. 5 units, Spr (Fagen) Th 2:15-5:15
Continuation of 313A. Cannot be taken without 313A.

322. Research on the Politics of Britain, France, Germany—The interaction of politics and public policy in Britain, France and Germany.
5 units, Win (Almond) W 2:15-4:05

323. Research Seminar on the Comparative Study of Political Socialization—(Same as Education 408.) The seminar emphasizes the conceptual and methodological problems involved in studying the role of education as a source of political learning in different cultural and sub-cultural settings. It is based on empirical data from field studies in different cultures and includes some secondary analysis of such data. Requires previous course work in the general area of political socialization, and facility in the handling of empirical data.
4 units, Spr (Weiler) given 1975-76

5 units, given 1975-76

336. Research Seminar in Comparative Foreign Policy: Eastern Europe—Workshop in the problems posed by comparative study of foreign policies. (Offered jointly with the Department of History.)
5 units, Spr (Triska, Lederer) given 1975-76

384A,B. Seminar in American Politics and Public Policy-Making — The first quarter consists of a broad and critical exploration of the literature on American national government and national policy-making, with an emphasis on Congress and the Presidency. The second quarter is a research seminar. Joint sessions may be held with graduate students at Berkeley. Students should plan to take both A and B.
384A. 5 units, Win (Manley) given 1975-76
384B. 5 units, Spr (Manley) given 1975-76

**PSYCHOLOGY**

**Emeriti:** Paul R. Farnsworth, Ernest R. Hilgard, Maud Merrill James, Quinn McNe mar, Lois Meek Stolz, Robert R. Sears (Professors)

**Chairman:** Eleanor E. Maccoby

**Vice Chairman:** Douglas H. Lawrence


**Associate Professors:** J. Merrill Carlsmith, Herbert H. Clark, Leo Ganz, Leonard M. Horowitz, Edward E. Smith, Ewart A. C. Thomas.

**Assistant Professors:** Sandra L. Bem, Cedric C. Clark, S. Shirley Feldman, Mark R. Lepper (on leave spring quarter 1974/75), Daniel Osherson, Lee Ross, Barbara Sa Kitt, Jeffrey J. Wine.

**Lecturers:** Norman H. Mackworth, Harriet N. Mischel

**OFFERINGS AND FACILITIES**

The Department of Psychology comprises facilities and personnel housed in Jordan Hall, where it maintains extensive laboratory and shop facilities. Several of the laboratories are equipped with computers and others are linked directly to the University's Computer Center. The Department maintains a nursery school close to the Escondido married students' housing area. This provides a laboratory for child observation, for training in nursery school practice, and for research.

The Department provides: (1) courses designed for the general student; (2) a major program leading to the degree of Bachelor of Arts; and (3) programs of graduate study and research leading to the degree of Doctor of Philosophy. Applications are not accepted for the Master's degree.
PROGRAMS OF STUDY

BACHELOR OF ARTS

For the Bachelor's degree, a total of 40 units of psychology are required, including 1, 60, and at least two courses from Group A and at least two courses from Group B.


The listing of courses under Groups A and B are not rigid and may change from year to year; students are encouraged to check with the Department Secretary for additional information.

No more than 10 units of independent study (104, 182, 184 and 188) may be counted toward the 40 units.

A transfer student must take at least 15 units of course work in the Department in order to receive the Department's recommendation for graduation. Transfer students may receive transfer units for courses completed in psychology at any accredited university or college provided they were taught by a regular faculty member. There is no limit to the number of units that may be transferred, but all students must still meet the "core course" requirement through courses completed at Stanford.

SENIOR HONORS PROGRAM IN PSYCHOLOGY

A Senior 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. Admission to the Program will be made at the end of the student's junior year on the basis of demonstrated desire to do research. The Program 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 concentrated study in the field. The Program includes arrangements for continuous supervised research activity during the student's senior year. At the end of the year, the student will submit a written report of his or her research as a thesis.

ADVANCED DEGREES

There are no specific course requirements for admission to the doctoral program. However, an applicant should have research experience as an undergraduate, as well as the equivalent of an undergraduate major in psychology. The major focus of the doctoral program is on research training, and admission is highly selective. The department would like to increase the proportion of women in the graduate doctoral program, particularly in the areas of cognitive, mathematical and physiological psychology and urges qualified women to apply.

Applicants for admission must file a report of their scores (aptitude and advanced psychology) on the Graduate Record Examination as part of the application. This examination may be taken at most universities and colleges (see your registrar for further information.)

Except for students also enrolled in the School of Medicine or the Graduate School of Business, no student will be accepted who does not plan to continue through to the doctorate. The taking of a degree of Master of Arts is optional. A Stanford graduate is ordinarily not accepted for an advanced degree in the Department unless he or she is also registered in the School of Medicine or the Graduate School of Business.

MASTER OF ARTS

For the degree of Master of Arts, at least 27 units in psychology beyond the equivalent of an undergraduate major are required as well as sufficient additional units outside of psychology to make up a program totaling 45 or more units. In partial fulfillment of this unit requirement Psychology 151 must be elected as well as two other courses from the content areas, one to be selected from 208, 209, 210, 214, and 215, and one to be selected from 211, 212, and 213. The student is normally expected to spend one-half of his or her time in research and must present a thesis based on a portion of that research. The student will normally take no more than 9 units of course work each quarter.
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 and also 152 and 207 must be completed by all candidates for the doctorate. These requirements should normally be met by all graduate students during their first year of graduate work. If a student already has a Master’s degree in psychology from another institution, he or she must present evidence of competence in these course areas during his first year at Stanford. This may be done either by examination or by taking the courses.

2. It is expected that the student will spend at least one-half of the time in research from the beginning of the first year of graduate study to the completion of the Ph.D. At the end of the first year of graduate study, the student must file with the Department a written report of his or her first-year research activities.

3. In addition to the course requirements above, the student must show competence in three additional content areas. This requirement normally should be completed during the second year of graduate study and may be met either by taking the appropriate courses (at least one to be selected from 208, 209, 210, 214, and 215, and at least one to be selected from 211, 212, and 213) or by special examination in these areas. Further course work prior to the admission to doctoral candidacy is to be arranged under the guidance of the student’s adviser.

4. The candidate shall either complete a University minor, satisfactory to the minor department, or may elect to have the minor waived by selecting 12 approved units outside the Department.

5. The candidate shall select a dissertation reading committee satisfactory to the Department. The minimum membership of this committee is to be: (1) the principal dissertation adviser; (2) a second member from within the Department; and (3) a third member chosen from either Psychology or another department.

6. The candidate shall pass the University Oral Examination which will cover the relevant literature to his or her doctoral research and a defense of the dissertation proposal.

7. The candidate shall complete a dissertation satisfactory to the Dissertation Reading Committee.

Ph.D. candidacy expires five years after admission to candidacy by the University Committee on Graduate Studies. Reapplication will require Departmental reexamination.

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 an A.B. in psychology, of which at least 15 units must be taken as a graduate student at Stanford. Of these 15 units in the Department at least two courses must be from those numbered 200 or above. 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 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 that 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 and seminars are provided to assist in this learning, and a student is expected to work out a program, with his or her adviser, that will permit the student to secure such knowledge in the most stimulating and economical fashion.

A second aspect of training is one that cannot be gained from courses or seminars. This is the firsthand 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. Students are provided with whatever opportunities they need to reach those
levels of competence representative of doctoral standing. 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.

Each student will achieve competence in somewhat unique ways and at a somewhat unique rate. Each student and adviser share in planning a program which will lead to the objectives discussed.

**Fellowships, Scholarships, and Assistantships**

In past years, the Department has provided four years of support to all students who make reasonable progress toward the Ph.D., and we have every hope of continuing this policy. Research and teaching assistantships, United States Public Health Service traineeships, and some University Fellowships are available. The type of support offered may vary from year to year. The Department, of course, depends on the fact that a number of its students receive outside awards. Qualified applicants are asked to take the initiative in applying for predoctoral fellowships from the National Science Foundation, the Danforth Foundation, the Ford Foundation, and the United States Public Health Service. Applications may be made by college seniors planning to work for a higher degree. Students should apply early in the fall of the senior year. For information concerning application forms and procedures consult representatives from the financial awards office of your home institution.

All prospective Ph.D. candidates, regardless of the source of financial support, are expected to gain teaching experience as an integral part of their graduate training. Each student is required, as part of his or her graduate training, to participate in four quarters of teaching while at Stanford, normally one quarter each year. The student progresses from closely supervised teaching to more and more independent work. Typically, this might involve giving a section in statistics or a laboratory course during the first year, leading a section of introductory psychology during the second year, co-teaching a small advanced course during the third year, and giving a supervised but essentially independent seminar during the fourth year.

**Psychology Colloquium**

The Psychology Colloquium meets on most Wednesday afternoons at 3:45. Topics of current interest are presented by speakers from Stanford and from other institutions. Graduate students are expected to attend.

**Summer Session**

The courses announced for the Summer Session are those regularly scheduled in the Department curriculum. Additional courses may be announced in the *Summer Session Bulletin*, to be issued in February, 1975.

**Courses Open to All Students**

Additional courses not listed here are frequently offered in the areas of their special research competence by selected postdoctoral or terminal Ph.D. personnel. These are listed in the quarterly time schedules, and the course descriptions are circulated in advance.

1. General Psychology—A survey of the major topics, theories, and research results of contemporary psychology. Personality development, motivation and emotional adjustment, social behavior, learning, perception, and the physiological basis of behavior are among the topics presented.

   4 units, Aut (D. Bem) MWF 10
   Win (SakItt) MWF 11
   Spr (Zimbardo) MWF 1:15-2:30

1A. General Psychology Discussion Section—Optional supplement to Psychology 1. Small discussion groups led by graduate teaching assistants. Prerequisite: concurrent enrollment in 1.

   1 unit, Aut/Win only (Staff) by arrangement

60. Statistical Methods—To acquaint the student with the elements of statistical description (measures of average, variation, correlation, etc.) and, more importantly, to develop an understanding of statistical inference. Emphasis is placed on those statistical methods of principal relevance to psychology and related social sciences.

   5 units, Aut (Horowitz) MTWThF 9
   Win (Thomas) MTWThF 9
   Spr (Calfee) MTWThF 9

102. Perception—A survey of the traditional topics in visual and auditory perception. The course deals with the psychological aspects
of brightness and color vision, the perception of objects, space, and movement, and briefly with the effects of attention and set. Similar topics are discussed in the area of audition. Prerequisites: 1 and 60.

3 units, Win (Lawrence) MWF 2:15

102A. Perception Laboratory — Optional supplement to 102. Laboratory demonstrations and experiments on varied topics of visual and auditory perception. Prerequisite: concurrent enrollment in 102.

2 units, Win (Lawrence) by arrangement

103. Learning and Performance — The course deals primarily with instrumental and classical conditioning and the attempts to build comprehensive theories of learning on the data from these experimental paradigms. Prerequisites: 1 and 60.

3 units, Spr (Lawrence) MWF 2:15

103A. Learning and Performance Laboratory—Optional supplement to 103. Laboratory demonstrations and experiments. Prerequisite: concurrent enrollment in 103.

2 units, Spr (Lawrence) by arrangement

104. Special Laboratory Projects — Independent study. Offered for pass/no credit, except on special arrangement with the instructor. Can be repeated for credit. Prerequisites: 1 and 60, and consent of instructor.

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

106. Human Memory—A survey and analysis of the major topics in human memory, with an emphasis on contemporary research and theory. Related topics in perception and thought will also be presented. Prerequisites: 1 and 60.

3 units, Spr (Smith) TTh 1:00-2:15

106A. Human Memory Laboratory — Optional supplement to 106. Laboratory demonstrations and experiments on varied topics in human memory, including substantial opportunity for original research. Prerequisite: concurrent enrollment in 106.

2 units, Spr (Smith) by arrangement

107. Physiological Psychology: Basic Mechanisms—A survey of neural interactions underlying behavior. Connecting patterns of nerve cells and synaptic mechanisms will be stressed. Prerequisite: 1 or equivalent.

4 units, Aut (Wine) MWF 10


4 units, Win (Pribram) MWF 8

109. Physiological Psychology: Brain Structures and Perceptual Processes—An analysis of the structure of our sensations as it is determined by physiological encoding mechanisms. We will examine neuronal machines which produce our perception of color, brightness, movement, and shape. Prerequisite: 1 or equivalent.

4 units, Spr (Ganz) MWF 9

111. Developmental Psychology—Child development from birth through middle childhood. A broad introduction to the nature of change during childhood to the theories of development. No prerequisites, but Psychology 1 recommended.

5 units, Aut (Maccoby) MWF 11; sections by arrangement

111B. Developmental Psychology Accelerated—Topics covered in Psychology 111 will be explored more deeply by means of some additional readings and a weekly seminar. Professor Maccoby's Psychology 111 lectures are an integral part of the course. Permission of the Instructor required. Intended primarily for graduate students.

3-4 units, Aut (Osherson) by arrangement

114. Exceptional Children—The study of children who deviate markedly in respect to mental, emotional, or social development.

4 units, Spr (Owen) TTh 3:15-4:05

115. Social Development—The study of socialization and the development of interpersonal relationships. Topics to include cooperation and competition, conscience and conduct, social expectations and behavior. Prerequisite: 111 or equivalent.

4 units, Aut (Lepper) TTh 10-11:30

116. Middle Childhood — This course focuses on the cognitive, personality, and social development of children between the ages of five and eleven. Prerequisite: 111 or equivalent.

3 units, Aut (Feldman) MWF 9

117. Observation of Children—Enrollment
limited to 16. Prerequisites: 111 or equivalent, and consent of instructor.

3 to 5 units, Aut, Win, Spr (Dowley)
Th 2:15–4:05 and by arrangement

118. Nursery School Practice — Supervised experience with the nursery school child. Prerequisites: 111, 117, and consent of instructor.

4 units, Aut, Win, Spr (Dowley)
T 2:15–4:05 and by arrangement

120. Developmental Lab — Experience in designing, executing, and criticizing experiments in developmental psychology will be provided. The sequence of experiments carried out by the students will be designed to clarify a complicated issue in development: Children’s changing conception of the physical world around them. Prerequisites: 111.

3 units, Aut (Osherson) by arrangement

121. Social Psychology—The study of interpersonal behavior. A survey of relevant research concerning attitudes, groups, person perception, and selected topics in social psychology. Prerequisite: 1 or equivalent.

4 units, Win (Carlsmith, Lepper) MWF 11

122. Selected Topics in Social Psychology—Designed to deal with a selection of topics not typically covered in Psychology 121, including social psychological research on personality differences, societal ideologies, and the social psychology of psychology. Prerequisites: Psychology 1 or equivalent.

3–4 units, Spr (D. Bern) TTh 3:15–4:45

123. Communication and Community Psychology I—(Same as Communication 123.) This course is designed for undergraduates interested in relating theory and action with respect to community involvement activities. Primary emphasis is placed on student initiative in selecting community-related projects which will be the basis of a two-quarter written report. Students will be expected to survey both the theoretical and practical literature dealing with the theory of social organization and community development.

4 units, Aut (C. Clark) TTh 10
and by arrangement

124. Communication and Community Psychology II—(Same as Communication 124.) This is a continuation of 123. Prerequisite: 123.

4 units, Win (C. Clark) TTh 10
and by arrangement

127. Selected Problems in Personality and Social Psychology—Lectures will deal with current problems and research in contemporary personality and social psychology which can fruitfully be approached through attribution, self perception, and other “cognitive” approaches. Discussion sections will concern themselves with the role of self perception in existential and humanistic psychology. Prerequisites: 1, and one course in either social psychology or personality.

4 units, Aut (Ross) TTh 2:15–4:05 and by arrangement

129. Theories in Child Development—The relation between theory and data will be stressed in evaluating prestigious theories of language acquisition, cognitive development, and perceptual development. Theorists to be examined include Bruner, Piaget, Skinner, E. J. Gibson, and Chomsky. Prerequisites: 111 and Human Bio 3B.

3 units, Win (Osherson) TTh 10

130. Psychology of Sex Roles—An examination of the antecedents and consequences of sex-role differentiation. Representative topics include: theories about sex differences, biological and environmental causes of sex differences, sex-role socialization, achievement motivation in women, and the effects of maternal employment. Prerequisite: 1 or equivalent.

3 to 4 units, Win (S. Bern) MW 1:15–2:30

132. Theories of Personality—An introduction to psychodynamic, humanistic, and social learning approaches to understanding the maintenance and modification of personality. The course will examine naturalistic and artificially induced changes in personality and behavior throughout the life cycle. Topics will include normal and abnormal development, education, and psychotherapy. Recommended: 1 or equivalent.

3 to 4 units, Win (H. Mischel) TTh 10:30–12:00

134. Personality and Assessment—Theories and findings regarding the psychological causes, assessment, and modification of personality. Focuses on major approaches and findings in the analysis and modification of complex normal and deviant human behavior. Prerequisite: 1 and 60, or equivalents, and at least junior standing.

3 units, Spr (W. Mischel) M 2:15–5:00

136. Abnormal Psychology — Genetic, psy-
chodynamic, behavioral and social psychological aspects of positive and negative abnormalities. Approaches to behavior change, including drugs, institutionalization, psychotherapy and behavior modification. Prerequisites: 1 or equivalent, and at least junior standing.

4 units, Win (Rosenhan) TTh 8:15–9:50

138. Selected Topics in Personality — In-depth exploration of some particular area of research in personality, e.g., defensiveness. Specific topic may change from year to year. Primarily intended for majors in psychology. Prerequisite: consent of instructor.

3 to 4 units, Spr (S. Bem) by arrangement


3 units, Spr (Krumboltz) M 3:15–5:05 and by arrangement

141. History of Psychology — This course will explore the development of psychological theory from an historical perspective. Major systematic positions such as structuralism, Gestalt theory, behaviorism and psychoanalysis will be discussed in some detail. The historical roots of major contemporary positions will be explored. Prerequisites: students should usually have taken 3 courses in Psychology.

4 units, Spr (Hastorf) TTh 11–12:15

143. Experimental Psychology of Reading—(Same as Education 389.) Review of research literature on the reading process, and acquisition of reading. Emphasis on critical evaluation of process research, and on interaction of psychological, linguistic, and educational aspects of reading. Prerequisites: 1 and 60 or equivalents.

4 units, Spr (Calfee) MWF 9

145. Psychological Foundations of Education—(Same as Education 215.) Introductory course in application of psychological principles to educational practices. The spring quarter offering is planned especially for teachers in training. Prerequisite: 1 or equivalent.

4 units, Aut (Cronbach) TTh 3:15–5:05
Spr (Gage) TTh 4:15–6:05
Sum (Staff) MTWTh 10 and by arrangement

146. Language and Thought—Surveys current topics of interest in language and thought, including language acquisition by children, language comprehension and production, phonological perception, biological bases of language, meaning, linguistic relativity, bilingualism, and aphasia. These topics will be treated from a cognitive point of view and will be related to other cognitive processes such as perception and reasoning. Prerequisite: 1 or equivalent.

4 units, Aut (H. Clark) MWF 1:15

147. Animal Behavior: Neurobiological Aspects—(Same as Biology 164.) Ethological viewpoints of behavior will be presented, with an emphasis on understanding their physiological substrates. Recommended: Psychology 107, Biology 146 and 153.

4 units, Win (Wine) by arrangement

151. Statistical Methodology —Prerequisite: 60 or equivalent.

3 to 4 units, Win (Horowitz) MWF 9

152. Analysis of Data — Prerequisite: 151 or consent of instructor.

3 to 4 units, Spr (Carlsmith) MWThF 9

155. Human Abilities — (Same as Education 255.) The nature, development, and measurement of intellectual abilities. Prerequisites: 1 and Stat 60, or equivalent.

3 units, Spr (Snow) MWF 10

157. Sleep and Dreams — A survey of current knowledge in the area of sleep, dreams and sleep pathologies. Physiology of REM sleep versus NREM sleep, circadian rhythms, developmental and phylogenetic aspects, the insomnias, the hypersomnias, sleep walking, sleep talking, night terrors, sleeping pills, dream content and psychophysiological correlation. Course will only touch on dream interpretation. No prerequisite.

3 units, Win (Dement) MW 11

157A. Sleep and Dreams Discussion Sections — Optional supplement to Sleep and Dreams. Prerequisite: concurrent enrollment in 157.

1 unit, Win (Staff) by arrangement

160. Mathematical Methods in the Behavioral Sciences—An Introduction to calculus, probability, set theory, and other mathematical topics with some examples of their applications in psychology. This course is not
intended for students with sophisticated backgrounds in mathematics. Prerequisites: Psychology 1 and high school mathematics.

3 units, Aut (Sakitt) TTh 1:15–2:45

163. Mathematical Psychology—(See 215.)
164. Mathematical Representation of Structures in Psychological Data—(See 218.)

165. Mathematical Models of Learning and Memory—Mathematical models of psychological processes are introduced, and their applications to memory, learning, and cognition are illustrated. Prior familiarity with probability theory and the psychology of learning is desirable, though not required.

4 units, Win (Bower) TTh 11:00–12:15

166. Mathematical Theories of Perception and Psychophysics—(See 222.)

4 units, Spr (Sakitt) TTh 1:15–2:45

170. Hypnotic Phenomena — Demonstrations, lectures, readings, and discussions on hypnosis, with emphasis on experimental studies. Limited to graduate students in psychology and graduate students in other fields by special consent, and to senior majors in psychology.

3 units, Aut (Hilgard, Morgan) T 2:15–4:05
Win (Hilgard, Morgan) T 2:15–4:05

172. Psychology of Perceptual Experience — An examination of phenomena of normal perception, illusions, imagery, dreaming, electrically and hypnotically induced hallucinations, and dissociation (including that demonstrated in “split-brain” patients) for what these phenomena can tell us about the mechanisms underlying our conscious experience of the external world. (The title has been changed from the previously listed “Psychology of Mental Phenomena” to reflect the course’s relative emphasis on primarily perceptual phenomena.) Prerequisite: 1 or equivalent.

4 units, given 1975–76

175. Brain and Choice: the Neuropsychology of Skill—Theories and experimental research concerned with the psychology of skills will be reviewed. Emphasis will be placed on an analysis of skills in terms of information processing models and their relation to brain function. Prerequisite: consent of instructor.

3 units, Aut (Mackworth) M 2:15–4:05

176. Psychology of the Reading Process—This seminar will review experimental and theoretical research dealing with the reading process. Primary emphasis will be on providing a general theory within which to view the reading process and within this theoretical framework to consider reading difficulties and optimal methods of instruction. Prerequisite: consent of instructor.

3 units, Win (Mackworth) M 2:15–4:05

180. Undergraduate Seminar: Selected Topics in Psychology—(Refer to quarterly time schedules for seminar listings.)

182. Senior Honors Seminar — Limited to students in the Senior Honors Program. Can be repeated for credit.

4 units, Aut, Win, Spr (Staff) by arrangement

184A. Individual Participation and Study in Paraprofessional Programs — Four programs within the broadly defined area of Community Mental Health will utilize a limited number of Stanford volunteers. Each program provides training sessions and academic credit for participants.

Two programs involve work with young children. At the Zonta Children’s Center in San Jose, students will begin behavior modification techniques while working with schizophrenic and autistic children at the center. At the Children’s Health Council volunteers will be assigned responsibility for one child with emotional behavior problems and will work within a family setting, serving as a combined “big brother or sister,” counselor, tutor, therapist and friend. Volunteers at the Veterans Administration Hospital work with middle-aged male outpatients. The program uses classroom instruction and a “community outreach” project to assist the mental patients in acquiring the skills and confidence required for social interaction. Awalt High School also uses a number of Stanford undergraduates to serve as “Environmental Counselors” to help adolescents with emotional and academic problems. (Note: “Share” volunteers may also receive credit for Psychology 184.)

These programs demand a heavy commitment in terms of time and energy (8 to 12 hours per week) but offer an unusual opportunity for mature, responsible and dedicated individuals. They are particularly recommended for students who anticipate careers in counseling, clinical, community, or
educational psychology. Prerequisite: students must be prepared to take this course for two consecutive quarters.

3 to 5 units, Aut (Ross) by arrangement

184B. Individual Participation and Study in Paraprofessional Programs — (Same as 184A.)

3 to 5 units, Win (Ross) by arrangement

184C. Individual Participation and Study in Paraprofessional Programs — (Same as 184A and 184B.)

3 to 5 units, Spr (Ross) by arrangement

188. Reading and Special Work — Independent study. Offered for pass / no credit, except on special arrangement with instructor. Can be repeated for credit. Prerequisite: consent of instructor.

1 to 3 units, any quarter (Staff) by arrangement

189. Endocrines and Behavior—This course focuses on the influences of hormones on behavior. In particular, reproduction and reproductive behavior, nocturnal behavior, courtship and aggression will be discussed in terms of gonadal hormonal influences. Further, the influences of the pituitary-adrenal system on sensory processes, learning and memory will also be discussed. The neuro-endocrine control of hormonal systems will be covered.

5 units, Win (Levine) MWF 9

Given 1975-76

190A. Undergraduate Seminar: Early Experience—Primarily intended for majors in psychology. Prerequisite: consent of instructor.

5 units, Win (Levine) MWF 9

190C. Special Topics in Sleep Research—This intensive undergraduate seminar is designed to allow students to cover, in great detail, selected areas of sleep research. Students will read journal articles dealing with a topic of their own choice and report in weekly class discussions. A fundamental background in chemistry, physiology, psychological psychology or biology is recommended. Prerequisites: Psychology 157 and permission of instructor.

3 units, Spr (Mitler) by arrangement

191. Undergraduate Seminar: Behavior Change — Application of social learning principles to the modification of prosocial and deviant behavior. Primarily intended for majors in psychology. Prerequisite: consent of instructor.

3 units, Win (Bandura) MW 10

192. Undergraduate Seminar: Aggression—Primarily intended for majors in psychology. Prerequisite: consent of instructor.

3 units, Spr (Bandura) M 2:15-4:05

194B. Undergraduate Seminar: Moral Development—Prerequisite: consent of instructor.

3 units, Win (Lepper) by arrangement

194C. Undergraduate Seminar: Socialization—Prerequisite: consent of instructor.

3 units, Spr (Maccoby) by arrangement

195. Undergraduate Seminar: Personality—Open to both non-majors and majors in psychology. Prerequisite: consent of instructor.

3 units, Spr (Mischel) by arrangement

196. Human Relations in the Nursery School—The course will explore the many ways in which children, teachers, parents and other adults affect the behavior and learning of the preschool child. Observations of adult-child and child-child interactions in a variety of naturalistic settings and role-playing sessions in class will provide the focus. Prerequisites: 117 and 118 and consent of instructor.

3 to 4 units, Spr (B. Shepard) by arrangement

197. Undergraduate Seminar: Theoretical Issues in Psychology—Primarily intended for Psychology Majors. Prerequisite: consent of the instructor. This seminar will take up a small group of theoretical issues each year and explore them in some depth.

3 units, Win (Hastorf) TTh 10-12

198. Undergraduate Seminar: Experimental Studies of Selective Perception—Primarily intended for majors in psychology. Prerequisite: consent of instructor.

3 units, Aut (Lawrence) T 2:15-4:05

**Courses Primarily for Graduate Students**

Undergraduate students may be admitted only by consent of instructor.

207. Contemporary Viewpoints in Psychology—A survey of major issues in contempo-
sary psychology with their historical back-
grounds. Required of and limited to first-
year graduate students in psychology.
3 units, Aut (Hastorf) MWF 11–12

208. Physiological Psychology — Advanced
physiological psychology focusing on the
neural mechanisms operative in the control
and modification of behavior. Prerequisite:
108 or equivalent, or consent of instructor.
3 units, Win (Ganz, Pibram, Wine)
MW 10–12

209. Perception—Advanced treatment of
visual perception. Prerequisite: graduate
standing in Psychology or consent of instruc-
tor.
3 units, Aut (Ganz) MWF 9

210. Memory and Learning—Prerequisite: graduate
standing in psychology or consent of instruc-
tor.
3 units, Aut (Smith) TTh 12:30–2:05

211. Developmental Psychology—Prerequi-
site: graduate standing in psychology or con-
sent of instructor.
3 units, Win (Maccoby, Osherson)
MW 1:15–3:05

212. Social Psychology—Prerequisite: graduate
standing in psychology or consent of instruc-
tor.
3 units, Spr (Lepper, Ross) by
arrangement

213. Personality — Prerequisite: graduate
standing in psychology or consent of instruc-
tor.
3 units, Aut (W. Mischel) by
arrangement

214. Psycholinguistics—Prerequisite: graduate
standing in psychology or consent of instruc-
tor.
3 units, Spr (H. Clark) TTh 2:30–3:45

215. Mathematical Psychology — A survey
of mathematical theories of choice behavior,
decision-making, psychophysical judgments,
utility and motivation, learning, memory,
and concept formation. Prerequisite: graduate
standing in psychology or consent of instruc-
tor.
3 units, Spr (Thomas) MW 11

218. Mathematical Representation of Struc-
tures in Psychological Data—Theory and
methods of multidimensional scaling, hierar-
chical clustering, and related methods for
discovering and representing structures un-
derlying psychological data (with particular
attention to data from experiments on per-
ception and cognition). Prerequisite: consent
of instructor.
3 units, Aut (Shepard) TTh 3:15–5:00

222. Mathematical Theories of Perception
and Psychophysics—Mathematical theories
of perception and psychophysics including
signal detection theory, Fourier analysis and
its applications in perception, information
theory and other topics. Prerequisite: Psy-
chology 1 and some calculus.
4 units, Spr (Sakitt) TTh 1:15–2:45

224. Models of Thought Processes—(Same
as Computer Science 224.) Introductory sur-
evay of concepts and problems in artificial in-
telligence research; heuristic processes in
problem solving, and heuristic program-
ning; information processing models as ex-
planations of human cognitive and affective
behavior. Prerequisite: Computer Science
105 or 106, or equivalent.
2 units, Spr (Green) TTh 1:15–2:30

228. Seminar in Animal Communication—
(Same as Hearing and Speech Sciences 281
and Biological Sciences 200.) A general sur-
evay of the communicative aspects of social
behavior of animals, including man. Empha-
sis will be placed on diversity of signal sys-
tems and the contrasts between these systems
and human linguistic behavior. Prerequisite:
consent of instructor.
4 units, Win (Dewson) by arrangement

230. Seminar in Neural Substrates of Hu-
man Communication — (Same as Hearing
and Speech Sciences 390.) Prerequisite: con-
sent of instructor.
4 units, Spr (Dewson) by arrangement

231. The Auditory Process — (Same as
Hearing and Speech Sciences 292.) A system-
atic survey of our current knowledge of
the operation of the auditory system. Em-
phasis is placed on acquiring a knowledge
of the acoustic signal, and on an under-
standing of the methods of measuring a sen-
sory process. Prerequisite: consent of in-
structor.
3 to 4 units, Aut (Schubert) by
arrangement

232. Selected Topics in Psychoacoustics —
(Same as Hearing and Speech Sciences
392.) A detailed study of the normal audi-
tory mechanisms with particular emphasis on the use of psychoacoustic methods of analysis. Evaluation of current theories regarding auditory processing of information. Prerequisite: consent of instructor.

3 to 4 units, Win (Schubert) by arrangement

233. Peripheral Auditory Mechanisms — (Same as Hearing and Speech Sciences 393.) Study of the mechanisms and electrophysiology of the middle and inner ear. Analysis of the ear as a transducer and of the neural encoding process. Prerequisite: consent of instructor.

3 to 4 units, Spr (Schubert) by arrangement

235A. Seminar in African Psychology I—This course, the introductory part of a three-part seminar, is designed for graduate students interested in the field of human consciousness: its origin, its nature, and its relationship to overt behavior. Particular attention will be paid to the African origins of consciousness. Various branches of the “occult” and original African sciences will be examined in relationship to current African (Black) behavior. Prerequisites: non-psychology students should have a strong background in philosophy, physics, or anthropology, and/or an interest in the philosophy of science.

3 units, Aut (C. Clark) TTh 3–5

235B. Seminar in African Psychology II—This course is a continuation of 235A. Students will begin research on specialized topics relating to: (a) the history and/or philosophy of Western science; or (b) to African conceptions of space and time. Prerequisite: 235A.

3 to 4 units, Win (C. Clark) TTh 3–5

235C. Seminar in African Psychology III—This course is a continuation of 235B. Students will complete research connected with projects initiated during the previous quarter. Prerequisite: 235B.

3 to 5 units, Spr (C. Clark) TTh 3–5

239. Graduate Seminar: “Intelligence”—Issues in its Definition and Assessment—This course will examine the psychological foundation of intelligence testing. The topics: Definition of intelligence; the logic of reliability and validity and the hereditability controversy. Supervised practice test administra-

istion will be provided. Pre-requisite: consent of the Instructor.

3 units, Win (Feldman) T 1:15–3:05

240. Child Language I—(Same as Linguistics 260.) Review of present knowledge of processes of language acquisition from a linguistic point of view. Survey of recent and past literature. Prerequisites: Linguistics 100 or 230, or consent of instructor.

4 units, Aut (E. Clark) TTh 10:00–11:30


4 units, Win (E. Clark) by arrangement

242. Graduate Seminar: “Infancy”—An examination of perception and learning in the first two years. The infants response repertoire will be studied in order to explore ways to measure what an infant “knows.” Among the particular topics to be included are assessment of infant abilities, the importance of the state variable, and prediction of later behavior from behavior at infancy.

3 units, Win (Jacklin) by arrangement

243. Issues in Early Childhood Education—(Same as Education 244.) The course is designed for graduate students interested in the education and development of the child during the first eight years of life. Philosophies and practices of various current early childhood programs will be reviewed in social, psychological and historical perspective. Such topics as: environments for early learning; teacher-child relationships; the role of curriculum in early childhood development; the effects of federal, state and local legislation on early school programs; the involvement of parents in the education of their children; will be explored as well as behavior change; school grouping; early reading; staffing; budgets, in-service teacher education.

3 units, Win (Dowley) TTh 4:15–5:30

244. Advanced Seminar in Developmental Theory—This will be a detailed and critical examination of much of Piaget’s theory. Topics include naturalistic thinking, logical thinking in children and adolescents, and spatial concepts. The relation of Piaget’s theory to the data will be emphasized. If time permits, the cognitive developmental
theory of J. S. Bruner will be similarly examined.

3 units, Spr (Osherson) by arrangement

245. Socialization of the Young in Contemporary Society—(Same as Education 311A, B.) Students in this course will examine the role of the family, public school, preschool, and day care in socializing young children. Particular attention will be given to the processes through which institutions and social structures of the society affect individual behavior. Topics will include: discontinuities and continuities in socialization, diffuse socialization through mass media, variations by social class and ethnic groups in the U.S., national differences (Britain, China, Russia, Israel, Cuba, etc.) which illustrate relationships between socialization and political ideology.

3 units, Win, Spr (Ambron and Hess) TTh 9

248. Introduction to Test Theory—(Same as Education 252.) Concepts of reliability and validity; mathematical models underlying commonly used procedures for test analysis. Test scales and norms. Prerequisite: Statistics 60 or Psych. 60 or equivalent.

3 to 4 units, Aut (Snow) MW 2:15–4:05

249. Problems in Measurement — (Same as Education 353.) For prospective research workers. Survey of alternative mathematical models used in test construction and analysis covering such topics as profile analysis, measurement of gains, factor analysis, theory of personnel decisions. Prerequisites: 152 and 248, or Education 250B and 252, or equivalent.

3 to 4 units, Spr (Cronbach) MW 2:15–4:05

251. Methodology in Social Science — Issues, approaches, and technical problems in field research, survey analyses, and experimental analyses in social science. Selected statistical techniques for assessment of behavioral and social data. Prerequisite: consent of instructor.

3 units, Aut (Thomas) MW 11:00–12:20

252. Seminar in Psychology and Law — (Same as Law 336.) — The implications of psychological research and theory for law and legal process will be explored. Issues to be examined include the notions of responsibility and intention, the reasonable man, reasonable doubt, and insanity. The implications of equity theory and the "just world" hypothesis for pretrial detention; group processes and their effects on juries; stereotyping and arrest; witness reliability; the social psychology of institutions; the implications of dissonance theory for torts and bankruptcy.

3 units, Aut (Rosenhan) by arrangement

255. Graduate Seminar: Social Learning—Prerequisite: graduate standing in psychology or consent of instructor.

3 units, Aut (Bandura) M 2:15–4:05

257. Individually Supervised Practicum — Can be repeated for credit. Prerequisites: graduate standing in psychology and consent of instructor.

3 to 5 units, Aut, Win, Spr (Staff) by arrangement

257A. Practicum in Teaching—Enrollment limited to students serving as teaching assistants in selected psychology courses. Can be repeated for credit.

3 to 5 units, Aut, Win, Spr (Staff) by arrangement

263. Graduate Seminar: Perception—Prerequisite: consent of instructor.

3 units, Win (Ganz) by arrangement

264. Graduate Seminar: Topics in Human Learning—Prerequisite: consent of instructor.

3 units, Win (Bower) T 1:15–3:05

267. Graduate Seminar: Social Perception —Prerequisite: consent of instructor.

3 units, Spr (Hastorf, Ross) by arrangement

269. Graduate Seminar: Personality—Prerequisite: consent of instructor.

3 units, Win (W. Mischel) by arrangement

271. Graduate Seminar: Reading—Prerequisite: consent of instructor.

3 units, Win (Smith) by arrangement

272. Graduate Seminar: Topics in Psycholinguistics—Prerequisite: consent of instructor.

3 units, Spr (H. Clark) by arrangement

273. Graduate Seminar: Personality Differences and the Prediction of Behavior—Prerequisite: consent of instructor.

3 units (D. Bem) given 1975–76
274. Graduate Seminar: Semantics and Memory—Prerequisite: consent of instructor. Given 1975-76.
   3 units, Win (Smith) by arrangement

275. Research — Research of intermediate nature, whether or not to be used toward Master’s thesis, to be undertaken with members of Department faculty. Prerequisite: consent of instructor.
   (Staff) by arrangement

276. Graduate Seminar: Psychoanalytic Theories of Defense Mechanisms—This seminar will examine selected literature on the defense mechanisms. It will critically explore the theoretical ideas and examine attempts to objectify the concepts empirically from cognitive, behavioral and motivational standpoints.
   3 units, Spr (Horowitz and Suppes)
   M 2-4

277. Seminar on Sex Roles and the Psychology of Women—Prerequisite: consent of instructor.
   3 units, Aut (S. Bem) by arrangement

278. Graduate Seminar: Internal Representation—Can be repeated for credit. Prerequisite: consent of instructor.
   3 units, Spr (Shepard) by arrangement

280. Doctoral Research — For dissertation. Prerequisite: consent of instructor.
   (Staff) by arrangement

301. Current Issues In Memory and Learning—Seminar reviewing the contemporary literature in cognitive psychology. Limited to advanced level students in Psychology.
   2 units, Win, Spr (Atkinson and Bower)
   W 12:00-2:05

305. Research Seminar in Cognitive and Mathematical Psychology—Can be repeated for credit. Prerequisite: consent of instructors.
   1 unit, Aut, Win, Spr (Staff) F 3:15-4:30

308. Research Seminar in Neuropsychology —Can be repeated for credit. Prerequisite: consent of instructor.
   1 to 3 units, Aut, Win, Spr (Pribram)
   F 10-12

310. Human Evoked Potentials in Psychology: Selected Papers—(Same as Psychiatry 203.) A survey of the contribution of evoked brain potentials to understanding perception, attention, and other cognitive functions. Prerequisite: consent of instructor.
   3 units, Aut (Roth) M 3:15-5:05

311. Research Seminar in Developmental Psychology—Can be repeated for credit. Prerequisite: consent of instructors.
   1 unit, Aut, Win, Spr (Staff)
   by arrangement

312. Graduate Seminar on Penal and Therapeutic Institutions—An examination of two somewhat different types of “Total Institution”: the Prison and the Mental Hospital. We will discuss the legal and other problems relating to the treatment, custody, discipline and legal rights of prisoners and mental patients. Emphasis will be on the common problems and the differences in treatment of inmates in the two types of institutions as well as upon the burgeoning field of legal controls of their administrators.
   2 units, Aut (Rosenhan) by arrangement

RELIGIOUS STUDIES

Chairman: William A. Clebsch

Professors: Robert M. Brown, William A. Clebsch (Religious Studies and Humanities), Edwin M. Good, David S. Nivison (Chinese and Philosophy and, by courtesy, Religious Studies), Lewis W. Spitz (History and, by courtesy, Religious Studies)

Associate Professors: Lawrence V. Berman, Lee H. Yearley

Assistant Professors: Winston-B. Davis, Jerry A. Irish, Nancy R. Lethcoe

Lecturers: Robert G. Hamerton-Kelly, Wilhelm Pauck

OFFERINGS AND FACILITIES

As one of the humanities, the study of religion aims to understand works of religious literature, historical developments of religious tradition and practice, modes of religious thought, and varieties of world views in and among religions.

BACHELOR OF ARTS

The following Departmental requirements are in addition to the University’s basic requirements for the Bachelor’s degree:

1. At least two courses on particular religious traditions (111-129).
At least two courses on interactions of religions with particular cultures (131-149).

3. At least two courses on religious thinkers or schools of thought (151-189).

4. At least three advanced courses with prerequisites (211-299).

5. At least 12 units in cognate courses in other departments (from an approved list).

6. The Senior Seminar (200).

The Bachelor's degree with honors in Religious Studies may be earned by students who are recommended by their advisers and who meet additional requirements.

**Doctor of Philosophy in Religious Studies**

University regulations regarding this degree are found in the section "Degrees" in this Bulletin. The following requirements, dealing with residence, fields, courses, examinations, languages, and the dissertation are in addition to the University basic requirements for the Ph.D.

**Residence:** For the Ph.D. degree each student must complete three years (nine quarters) of full-time work, or their equivalent, in graduate study beyond the Bachelor of Arts degree. He or she will be expected to offer at least 90 units of graduate work in addition to the dissertation, of which at least the last 60 units must be taken at Stanford.

**Fields of Study:** The fields of East Asian Religions, Near Eastern Religions, Modern Religious Thought, and American Religions are approved and guidelines are established for each of them. Students may propose for approval any other substantial field of study in which there is a coherence of strengths in the faculty in Religious Studies and other faculty in the University.

**Courses:** Each student takes courses subject to the approval of a faculty member designated as the adviser. One advanced seminar in preparation for each part of the preliminary examinations must be completed satisfactorily before those examinations are taken.

**Examinations:** Written preliminary examinations are set for all students before the end of the second year of graduate study, save those whose performance during the first four quarters warrants the terminal A.M. degree at the end of the second year. These preliminary examinations test students' ability to approach their fields of concentration in the following ways: the interpretations of religious texts, the histories of religious movements, the systems of religious thought, and the comparisons of religious traditions. A student may petition to substitute a group of approved courses for only one of the four examinations. The preliminary examinations may be retaken only once, during the third year of graduate study. After passing these examinations, the student applies to qualify for the Ph.D. degree.

The University oral examination is normally taken in the spring quarter of the third year.

**Teaching internships:** At least two teaching internships under close supervision by faculty members are required during the third year, after the preliminary examinations have been passed without conditions. Students receive academic credit for the required internships, which are projects of academic training and not of employment.

**Language requirements:** Each student seeking the Ph.D. degree must demonstrate by examination a reading knowledge of two modern foreign languages, including French or German, before beginning the second full year of graduate work at Stanford. Prior to written preliminary examinations, students must demonstrate reading knowledge of ancient or other modern languages if relevant to the field of concentration. Knowledge of additional languages may be required for certain areas of concentration.

**Supporting programs:** A coherent and substantial supporting program shall be taken in advanced and graduate courses in other departments of the University.

**Dissertation:** During the University oral examination, the student engages in a colloquium on the proposed dissertation topic, demonstrating readiness to proceed with the dissertation. The dissertation must contribute to the humanistic study of religion and be written in acceptable English style. The dissertation is written under the direction of the candidate's adviser and at least two other members of the faculty, at least one of whom shall be a member of another department.

**Joint Ph.D. in Religious Studies and Humanities**

Religious Studies participates in the Graduate Program in Humanities leading to the joint Ph.D. degree in Religious Studies and
Humanities. For a description of that program see the section on “Humanities Special Programs” in this bulletin.

COURSES

GENERAL

17. Comparative Religion — Comparative approaches to various religions in their social, personal, and intellectual dimensions. Designed as series but may be taken individually.
   A. Varieties of Religious Community.
      3 units, Aut (Davis) MWF 11
   B. Varieties of Religious Personality.
      3 units, Win (Clebsch) MWF 11
   C. Varieties of Religious Thought.
      3 units, Spr (Yearky) MWF 11

21A. Jesus in the Gospels—Varying interpretations of Jesus and his teaching.
      3 units, (Hamerton-Kelly) given 1975–76

21B. Theology of Paul — The religious thought of Paul within its cultural and historical context.
      3 to 5 units, Aut (Hamerton-Kelly) TWTh 11

47. Christian Ethics—The ethics of Augustine, Aquinas, Kant, and Niebuhr; their theological context and uses in decision-making.
      3 to 5 units, Spr (Irish) MTW 1:15

61. Old Testament—Styles of varying parts, ideas, cultural and religious settings.
      3 to 5 units, Aut (Good) MWF 9

69A,B. Hebrew—Introduction to classical Hebrew language.
      5 units, Aut, Win (Good) MTWThF 10

73. Liberation Theology—Third World theologians, black theology, women’s liberation, etc., stressing the relation of liberation to social and political revolutionary movements, consideration of the problem of violence.
      5 units, Win (Brown) MTWTh 9

RELIGIOUS TRADITIONS

113. Hinduism.
      3 to 5 units, Win (Lethcoe) MWF 10

114. Buddhism—Thought and practice; selected scriptures.
      3 to 5 units, Spr (Lethcoe) MTWTh 9

115. Confucianism and Taoism — Writings from the classic period: Confucius, Mencius, the Tao Te Ching, and others.
      3 units, Aut (Yearley) MWF 10

117. Shinto—Outline of the general religious patterns called “Shinto,” emphasizing folk traditions.
      3 to 5 units, Spr (Davis) MWF 10

123. Judaism—Talmudic and post-Talmudic Jewish thought: Midrash, Mishnah, and Talmud; codification of the law; Karaitism; theology and philosophy; Kabbalah and Hasidism.
      3 to 5 units, Aut (Berman) TTh 4:15–6:05

      3 to 5 units, Spr (Clebsch) MTW 9

127. Islam—Analysis of the Koran; traditional literature; basic concepts of law; sects; theology and philosophy; mysticism.
      3 to 5 units, Win (Berman) TTh 11:00–12:40

RELIGIONS AND CULTURES

      5 units, Win (Good) MTWTh 9

      3 to 5 units, Spr (Lethcoe) TTh 11:00–12:40

137. Religion in Japan—Religious life in Japan: Shinto, Buddhist sects, Confucian schools; religious outlook of the folk, court, and the learned.
      3 to 5 units, Win (Davis) MWTh 1:15

138A. Palestinian Jewry in the Time of Jesus—The political, social, and religious history of Judea in the period ca. 30 B.C.E. to 70 C.E.
      5 units, Spr (Hamerton-Kelly) TTh 4:15–6:05

141. Christian Theology since the Enlightenment.
      3 to 5 units, Win (Irish) TTh 4:15–6:05

142. Foundations of Modern Jewish Thought — Talmudism, Hasidism, and En-
lightenment; origins of Zionism and other secular trends; European Jewry and the Holocaust.

3 to 5 units, Spr (Berman) TTh 2:15–4:05

143. Modern European Theologians—Barth, Buber, Tillich, Teilhard de Chardin, Bonhoeffer, Rahner, and Moltmann.

5 units, Aut (Brown) MTWTh 9

148A. American Religion.

5 units, Aut (Clebsch, Irish) TTh 10, W 4:15 (One section counts as Humanities 195A.)

155. Mahayana Buddhist Thought.

5 units, Win (Lethcoe) TTh 11:00–12:40

RELIGIOUS THINKERS


5 units, Win (Good) MW 2:15–4:05

163. Prophets of Israel—Hebrew prophets as poets and religious functionaries.

5 units (Good) given 1975–76

164. Muhammad and the Koran—The life of the founder of Islam as portrayed in the Koran and the traditional literature; the Near Eastern religious background.

3 to 5 units, Aut (Berman) MW 4:15–6:05

165. Islamic Theology and Philosophy: Avicenna.

3 to 5 units (Berman) given 1975–76

171. Augustine—The thought in its historical setting.

5 units, Aut (Yearley) TTh 2:15–4:05

172. Maimonides—Scripture and its interpretation; concept of God and universe; prophecy; the political role of the law.

5 units (Berman) given 1975–76

173. Aquinas—The thought in its historical setting.

5 units (Yearley) given 1975–76

174. The Protestant Reformers: Calvin—His theology and his work. (Same as History 211.)

5 units, Spr (Pauck) TTh 11:00–12:40

182. Christian, Islamic, and Jewish Political Philosophies in the Middle Ages—(Same as Medieval Studies 182.) Comparative study of major political philosophers; their differing social and religious backgrounds.

5 units, Win (Berman, Bernstein)

M 4:15–6:05

185. Modern Catholic Thought.

5 units (Yearley) given 1975–76


5 units, Spr (Brown) MW 4:15–6:05

ADVANCED COURSES

200. Senior Seminar—Major works on the theory of religion. Limited enrollment. Prerequisites: senior standing and five previous courses in Religious Studies.

5 units, Spr (Davis) MW 2:15–4:05

211. Buddhist Sutras—Critical Examination of The Perfection of Wisdom Literature. Prerequisite: one course in Buddhism.

5 units, Aut (Lethcoe) MTWTh 1:15

215. Chinese Religious Thought—(Same as Philosophy 280.) Prerequisite: Consent of instructor.

5 units, Spr (Nivison, Yearley)

TTh 2:15–4:05

261. Old Testament Poetry—The use of poetry as a vehicle for religious thought and expression; styles and techniques in representative poems. Prerequisite: consent of instructor.

5 units (Good) given 1975–76

262. The Gilgamesh Epic—Prerequisite: consent of instructor.

5 units, Spr (Good) TTh 4:15–6:05

271. The Christian Story: Theology as Narrative—The content of Christian faith as expressed through the medium of story: myth, biography, autobiography, historical narrative, folk tale, novel, etc. Prerequisite: consent of instructor.

5 units, Win (Brown) TTh 2:15–4:05

272. The Christian Story: Theology as System—Transformation of narrative into doctrinal form. Prerequisite: consent of instructor.

5 units (Brown) given 1975–76
5 units (Staff) given 1975–76

276. Topics in Religious Thought—Prerequisite: consent of instructor.  
5 units, Spr (Irish) MW 4:15–6:05

5 units, Aut (Davis) MW 4:15–6:05

278. Problems in Religious Thought.  
5 units (Yearley) given 1975–76

299. Individual Work.  
(Staff) by arrangement

GRADUATE COURSES

301. Interpretations of Religious Texts — Required of all doctoral students in Religious Studies; may be repeated for credit. Literary genres that communicate religious meaning: narratives, systematic treatises, liturgies, sermons, etc. Prerequisite: consent of instructor.  
4 units, Aut (Brown) MW 2:15–4:05

303. Histories of Religious Movements — Required of all doctoral students in Religious Studies; may be repeated for credit. Prerequisite: consent of instructor.  
4 units (Staff) given 1975–76

305. Systems of Religious Thought — Required of all doctoral students in Religious Studies: may be repeated for credit. Prerequisite: consent of instructor.  
4 units, Win (Irish) MW 2:15–4:05

307. Comparisons of Religious Traditions—Required of all doctoral students in Religious Studies; may be repeated for credit. Prerequisite: consent of instructor.  
4 units (Staff) given 1975–76

(Nivison, Lethcoe) by arrangement

313. Buddhism.  
(Davis, Lethcoe) by arrangement

317. East Asian Religions.  
(Davis, Lethcoe, Nivison, Yearley) by arrangement

(Davis) by arrangement

343. Medieval Religious Thought and Movements.  
(Berman, Spitz, Yearley) by arrangement

345. Medieval Jewish Thought.  
(Berman) by arrangement

346. Medieval Islamic Thought.  
(Berman) by arrangement

(Good) by arrangement

363. Judaism.  
(Berman) by arrangement

364. Islam.  
(Berman) by arrangement

365. Arabic Philosophical and Theological Texts.  
(Berman) by arrangement

366. Hebrew Philosophical and Theological Texts.  
(Berman) by arrangement

(Good) by arrangement

368. Ancient Near Eastern Religions.  
(Good, Berman) by arrangement

375. Modern Theology.  
(Irish, Brown, Yearley) by arrangement

376. Nineteenth and Twentieth Century Religious Thought.  
(Brown, Clebsch, Irish, Yearley) by arrangement

377. Topics in Theology.  
(Brown, Irish, Yearley) by arrangement

(Irish, Clebsch) by arrangement

390. Teaching in Religious Studies—Supervised internship. Limited to graduate students in Religious Studies who have passed all preliminary examinations. Prerequisite: consent of instructor.  
2 to 5 units, Aut, Win, Spr (Staff) by arrangement

(Staff) by arrangement

399. Directed Reading for Graduate Students.  
(Staff) by arrangement
CENTER FOR
RUSSIAN AND
EAST EUROPEAN
STUDIES

Committee in Charge: The Committee on Russian and East European Studies, a sub-committee of the Committee on International Studies

Chairman: Wayne S. Vucinich, Department of History

The Center for Russian and East European Studies administers a Co-Terminal A.B./A.M. Program in Russian and East European Studies. The program is established for two types of students:

1. Advanced undergraduate students who need a coherent interdisciplinary program of study to assemble the skills and credentials necessary for admission to a Ph.D. program in the Russian and East European field.

2. Those students who wish to specialize in Russian and East European Studies as preparation for careers in government, law, journalism, business, or teaching at other than the college or university level.

The degree program is administered by a Masters Committee of faculty members constituted as a subcommittee of the Committee on Russian and East European Studies. The Masters Committee reviews each student's program and advises him or her as to the distribution of courses most appropriate to his or her interests and preparation.

The basic prerequisite for admission to the Co-Terminal Program is completion of a minimum of one year's study of Russian language (First-Year Russian). Two years of the language (Second-Year Russian) or the equivalent are to be completed before the awarding of the A.M. degree.

To qualify for simultaneous awarding of the A.M. degree, the student must, in addition to completing department requirements for the A.B. degree:

1. Petition the Masters Committee for admission to the Program no earlier than the beginning of the eighth quarter of undergraduate work. The petition, to be accepted, must be approved by both the Masters Committee and the Chairman of the department in which the student is a candidate for the A.B. degree.

2. Include in the petition a schedule of the proposed program, by quarter, to its completion. The student should seek the advice of members of the Masters Committee in drafting this schedule.

3. Complete fifteen full-time quarters or the equivalent, or three quarters after completing 180 units.

4. Complete, in addition to the 180 units required for the Bachelor's degree, a minimum of 40 units for the Master's degree. These units must be distributed as follows:

   a) A minimum of five graduate courses in the program field, three of which are to be taken in at least two departments other than that of the undergraduate major.

   b) The remaining courses required to make up the 40 units may include advanced undergraduate courses and may be taken in various departments, but all are to be in the Russian or East European field.

   N.B. At some time prior to completing the A.M. unit requirements, the student should take the basic undergraduate courses in Modern Russian History, Modern Russian Literature, and Soviet and East European Politics. This course work may be applied to the units required for the A.M. only when doing so does not interfere with completion of language—or graduate course requirements. Ordinarily, a student admitted to the Program will do course work on both Soviet and East European topics. Students wishing to specialize in one or the other alone may do so, subject to the prior approval of their programs by the Masters Committee.

5. Apply for each degree at the appropriate time.

Inquiries concerning this program should be addressed to the Chairman, Center for Russian and East European Studies, 237C History Building, Stanford, California, 94305.

The Center also administers an introductory undergraduate course in Slavic Civilization. The approach is an interdisciplinary
one, utilizing lecturers from the various disciplines with competence in the field and integrating readings and lectures so as to give the student an understanding of the distinct contributions made by the various Slavic peoples. The course treats the histories and cultures of Bulgaria, Czechoslovakia, Poland, Russia and Yugoslavia:

Undergraduate Special 10: Introduction to Slavic Bibliography.
  2 units, Aut (Zalewski)

History/Slavic 117A: Slavic Civilization to 1700.
  5 units, Aut (Todd, Staff)

History/Slavic 117B: Slavic Civilization from 1700 to 1914.
  5 units, Win (Atkinson, Staff)

History/Slavic/Political Science 117C: Slavic Civilization from 1914 to the Present.
  5 units, Spr (Triska, Dallin, Staff)

SLAVIC LANGUAGES AND LITERATURES

Emeriti: Jack A. Posin (Professor); Sarra Kliachko, Elisabeth Stenbock-Fermor (Assistant Professors), Nicholas S. Pashin (Senior Lecturer)

Chairman: Joseph A. Van Campen

Professors: Edward J. Brown, Joseph A. Van Campen

Associate Professor: Lawrence L. Stahlberger

Assistant Professors: Dina B. Crockett, Richard Schupbach, William Mills Todd, III

Acting Instructor: Hasya Pekurovskaya

OFFERINGS AND FACILITIES

The Department accepts candidates for the degree of Bachelor of Arts, Master of Arts, and Doctor of Philosophy. Particular requirements for each degree are described below.

MASTER OF ARTS IN TEACHING

The degree of Master of Arts in Teaching is offered jointly by this Department and the School of Education. Detailed requirements for the degree are outlined in the School of Education section of this bulletin. The program includes 45 units of which 25 must be in the teaching field and 12 in education. Specific language requirements are established in consultation with the Department.

JOINT PH.D. IN SLAVIC LANGUAGES AND LITERATURES AND HUMANITIES

The Department of Slavic Languages and Literatures participates in the Graduate Program in Humanities leading to the joint Ph.D. degree in Slavic Languages and Literatures and Humanities. For a description of that program, see the section "Humanities Special Programs" in this bulletin.

PROGRAMS OF STUDY

BACHELOR OF ARTS: RUSSIAN

Candidates must have completed the first- and second-year courses in reading, composition, and conversation (or their equivalent).

1. Concentration in Literature. Candidates are expected to complete a minimum of 35 units, selected with the approval of their adviser, to include in any case courses numbered 111, 112, 113, 145, 146, 147, 148, 187, 188.

2. Concentration in Russian Language with Translators Certificate Awarded by the Department. Besides the basic first- and second-year sequence or its equivalent, candidates should complete a minimum of 35 units, including in any case courses numbered 111, 112, 113, 161, 162, 163, 192, 193 with the remainder to be selected from the following: 114, 115, 116, 145, 146, 147, 148, 170, 187, 188, 191, 193, 198, 220. (Students who entered the Translators Program in the spring of 1974 will be permitted to fulfill the requirements listed in the 1973-74 catalog.) In addition, candidates are required to produce a publishable translation of a Russian text of substantial length not previously translated into English. (A translation of a text previously rendered into English will be accepted only if the student can demonstrate that his translation constitutes a substantial improvement over earlier versions.)

Students not majoring in Slavic Languages and Literatures can qualify for the departmental Translators Certificate by meeting the following requirements: (1) Completing with a grade of B− or better the following courses: 111, 112, 113, 161, 162, 163, 192, 193, and (2) producing a publishable translation in accordance with the requirements outlined in the preceding paragraph.
In addition to the 35 units mentioned above, students not enrolled in the Honors program in Humanities (for a description see "Humanities Special Programs" in this bulletin) are to select with the help of their advisor a minimum of three general courses (9 units) in support of their major program.

**Honors Program in Slavic**

Majors with a minimum grade average of "B+" in Russian courses are eligible to participate in the department’s Honors Program. Students wishing to do serious research in Russian literature are referred to section A below. Those wishing to do honors work in the Russian language should be guided by section B.

A

1. Language prerequisites: Three years of Russian, and two years of college-level study in another European language, preferably French, German, or a second Slavic language.
2. Requirements in Russian literature: Slavic 145, 146, 147, 148, 187, 188, 200 (the last to be taken during the Autumn quarter of the candidate’s senior year).
3. Requirements in other literatures (minimum): Humanities 61, 62, 63, or three courses in one West European literature to be selected in consultation with the student’s faculty adviser.
4. Slavic 199, Individual Work. 5 units per quarter during the Winter and Spring quarters of the candidate’s senior year. To receive honors, the candidate must receive a grade of "B" or better on a thesis written during this period.
5. Strongly recommended courses in other disciplines: A course sequence in Russian History and/or Russian Intellectual History.

B

**Required**

1. Four years of Russian, including Slavic 111–116, 161–163, 167–169, 170A,B,C.
2. At least two additional courses within the department to be chosen from among the following: 191, 194, 196, 197, 198, 211, 212.
3. Slavic 199, Individual Work. 6 to 9 units during the candidate’s senior year. To receive honors, the candidate must receive a grade of "B" or better on a thesis or project conducted under the close supervision of a member of the professorial staff.

**Recommended**

4. Strongly recommended courses in Russian literature: 145, 146, 147, 148, 187, 188.
5. Recommended courses in other departments: Communications 100, 102, 107; Computer Science 105, 106, 109 or 111; History 120A, 120B, 123A; Linguistics 100, 200, 206, 208, 215, 230, 240, 252, 253; Mathematics 1; Philosophy 57A, 181.

**Master of Arts: Russian**

**Admission to Candidacy**—The requirements for admission to candidacy are:

1. A Bachelor of Arts degree (or its equivalent) from an accredited college or university.
2. A command of the Russian language sufficient to permit the student to do satisfactory graduate work in his or her area of specialization.
3. A familiarity with Russian literature sufficient to permit the student to perform adequately in courses at the graduate level.

The applicant’s previous academic training in Russian language and literature must normally serve as a tentative indication of competence. Accordingly, the Department will not ordinarily consider applications from students who have not had at least three years of college Russian and some undergraduate training in Russian literature of the 19th and 20th centuries.

However, before registering for the first quarter’s work in the Department, all entering graduate students are required to take placement examinations in language and literature. Students who fail to perform satisfactorily on such examinations will be required to register for remedial courses in the area or areas in which they are deficient. Such remedial courses, which must normally be completed within the first three quarters of residence, will carry no credit toward either the A.M. or the Ph.D. degree.

**Course Requirements**—Candidates for the A.M. who are not also candidates for the Ph.D. should plan their course load to insure that they will be adequately prepared for the A.M. Final Examination by the end
of their third quarter of work. Those who are also candidates for the Ph.D. degree with a concentration in language and linguistics should include in their first year's work any courses needed for the A.M. examination in that area. Candidates for the Ph.D. with a concentration in literature should attempt to include as many of the Department's basic course offerings as possible in their first-year program in order to insure that they have sufficient time to complete the A.M. thesis during their fourth quarter of registration.

Candidates for the M.A. degree must complete a program of 36 units, of which 27 units must be selected from the courses given by the department. The other 9 units may, with the approval of the candidate's adviser, be selected from courses in related fields. Of the 27 units based on the department's courses, a minimum of 9 must be in language courses, a minimum of 9 must be in literature courses, and the remaining 9 may be distributed in accordance with the needs and interests of the individual student, with the advice and approval of the student's departmental adviser.

It should be noted that no credit toward the A.M. degree will be allowed for first- or second-year courses in non-Slavic languages required for the Ph.D. degree.

Final Examination — Students not enrolled in the Ph.D. program are required to take a final examination. Regardless of the area of specialization, the student will be required to demonstrate on a written examination (1) a command of the phonology, morphology, syntax, and lexicology of contemporary Standard Russian sufficient to allow him to teach beginning and intermediate courses at the college level; (2) an ability to read contemporary Standard Russian sufficient to permit him to be a reliable guide to students studying contemporary Russian poetry or literary prose; and (3) sufficient familiarity with Russian literature of either the 19th or the 20th century to handle successfully survey courses dealing with his or her chosen period.

The examination should be passed at the end of the final quarter of required course work.

Doctor of Philosophy: Slavic

Candidates are not obliged to present a minor, but they are urged to offer one. Candidates for the doctorate in literature, whether or not they elect to present a full minor will be required in any case to complete a sequence of basic courses (normally 12 units) taken outside the Department of Slavic Languages and Literatures. The following choice of patterns may be offered:

either

(1) A sequence of three courses in one West European literature, to be selected in consultation with the adviser, or

(2) Three basic courses in Comparative Literature to be selected in consultation with the graduate adviser and the Comparative Literature Department, or

(3) A course sequence in Russian History and/or Russian Intellectual History

If the student elects to present a minor in French, German, or Spanish, it should be equivalent to the course requirements for the degree of Master of Arts. Students wishing to do advanced work in Polish should consider spending a year abroad under the Stanford-Warsaw exchange. Students considering minors in other areas, such as Asian Languages, English, or Comparative Literature, should consult with their adviser and the chairman of the Slavic Department.

Candidacy — Candidates should read carefully the general regulations governing the conferring of this degree, as described in the section "Degrees" in this bulletin. For specific Departmental requirements and recommendations, the student should consult with the Department chairman. 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.

Admission to candidacy for the Ph.D. degree will be determined at the end of the fourth quarter of graduate studies. The candidate must by that time (1) have demonstrated his commitment to graduate studies by having successfully completed a minimum of 48 quarter units of credit with an average grade of B+ or better; (2) written an acceptable M.A. thesis, to be completed before the end of the 4th quarter. Failure to comply with the above two requirements will result in termination of candidacy for the Ph.D. degree. The terminated student may, at the discretion of the faculty, be given the opportunity to take the M.A. written ex-
aminations. If successful, he will then be awarded the M.A. degree, but will not be accepted as a candidate for the Ph.D. degree.

General Requirements—All candidates, regardless of their field of specialization, are expected to fulfill these requirements.

1. Have a reading knowledge of French and German, to be demonstrated by passing an examination.

2. Pass written and oral Departmental general qualifying examinations covering the following areas:
   a) the history and structure of the Russian language and its relationship to the other Slavic languages;
   b) the history of Russian literature including its relationship to the development of other Slavic literatures, or of European literature; or to Russian intellectual history.

(One or more sections of the written and/or oral examinations will be conducted in Russian, and the evaluation of the student's performance on these sections will include an evaluation of the command of the Russian language.)

3. Pass a University Oral Examination in the defense of a dissertation proposal covering: content relevant to the area of study, rationale for the proposed investigation, and strategy to be employed in the research.

4. Write a dissertation that embodies such results of research as would merit publication.

Specialization

Candidates in Slavic Languages and Literatures specialize either in language and linguistics or literature. Candidates may draw up individual programs of study and research in consultation with the graduate adviser. Requirements will thus vary according to the nature of the specialized program requested.

Continuation

Continuation in the Ph.D. program will be contingent upon the following: for first-year students, a high quality of performance in course work (decided by departmental evaluation); for second-year students in literature, an A.M. thesis, and for linguistics students, a written examination based on course materials and a reading list. Both the thesis and the written examination should be completed no later than the end of the first quarter of the second year.

Course Work and Overall Scheduling

1. Candidates for the Ph.D. degree are allowed as much freedom as possible in the selection of their course work. However, candidates will be held responsible for all the areas covered by the general examinations, regardless of whether they have registered for the Department's offerings in a given field. It should be noted that students may not normally register for individual work in a given area until they have covered the basic course offerings in that area. First-year students will be permitted to register for individual work only under special circumstances and must obtain the written approval of the graduate adviser. Those candidates who are also candidates for the A.M. degree should consult the section dealing with course requirements for that degree in planning their first year's work. For University residency requirements, see page 7. The A.M. thesis or written examination should be completed by the end of the fourth quarter of graduate study at the latest. The remainder of the second year of graduate study should be devoted to course work designed to prepare the student for the general qualifying examination and to fulfill the requirements for his or her minor, if any. The Departmental general qualifying examinations must be taken by the end of the first quarter of the third year of study; they may be taken during the second year if the student and the adviser feel this is appropriate. During the two quarters following the general qualifying examination the student should be primarily concerned with preparation for the University Oral Examination. (The latter should take place no later than the end of the third quarter of the third year.) However, students may, if necessary, do limited amounts of course work not directly related to the dissertation proposal.

The fourth year should be devoted to the completion of the dissertation.

2. Students possessing the equivalent of the Stanford A.M. will normally be expected to adhere to the schedule for the second.
third, and fourth years of work outlined under 1, above.

3. Students in the Ph.D. program will normally be expected to do four quarters of teaching after they have passed the qualifying examinations.

Note on Non-Slavic Language Requirements

It should be noted that no credit toward either the A.M. or the Ph.D. degrees will be granted for first- or second-year courses in non-Slavic languages. It is assumed that on entering the program the student will have a reading knowledge of both German and French or, at the very least, of one of these languages. The reading examination in one of these languages must be passed by the end of the second year of study. The second examination must be passed before the candidate takes the University Oral Examination, i.e., before the end of the third year.

GENERAL COURSES

Courses in this category may be of interest to students in other literatures, in comparative literature and in Russian area studies. These courses are primarily for undergraduates; however, by special arrangement with the department they can be taken for graduate credit.

10. Undergraduate Special — Introduction to Slavic Bibliography. (Enroll in Undergraduate Special 10.)

2 units, Aut (Zalewski) MWF 1:15-3:05

145. Russian Nineteenth-Century Prose — Close reading of selected novels and short fiction by Pushkin, Gogol, Turgenev, Chekhov, and others. Discussions will focus on problems of literary structure with reference to Russian society and related developments in European literatures. Open to all students, including freshmen.

4 units, Aut (Todd) MWF 8

146. Russian Literature of the Twentieth Century—Selected works of Bely, Mayakovskiy, Gorky, Zamiatin, Pasternak, Sholokhov, Olesha, Solzhenitsyn, and some others. Stylistic and thematic developments in the twentieth century will be emphasized. Readings in English. Undergraduate majors will take this course in conjunction with 148.

4 units, Win (Brown) MWF 11

149. Introduction to the Culture and Literature of the Slavic Peoples—No foreign language required.

4 units (Stahlberger) given 1975-76

150. Romanticism Among the Slavs—Concentrates on three representative romantic writers of the first half of the 19th century: Adam Mickiewicz, the Pole; Karel H. Mácha, the Czech; and Aleksandr Pushkin, the Russian.

4 units (Stahlberger) given 1975-76

151. Dostoevsky—Reading of major works in English translation with reference to related developments in European literature and intellectual history. Open to all students, including freshmen. Lectures and discussion sections.

4 units, Win (Todd) MWF 9

152. Gogol—Reading of major works in English translation with reference to related developments in European literatures. Open to all students except freshmen. Undergraduate majors and graduate students in Slavic will do assigned portions of the reading in Russian.

4 units (Todd) given 1975-76

153. Leo Tolstoy—(Same as Comparative Literature 153.) Reading of major works in English translation including War and Peace, Anna Karenina, and Resurrection. Some comparative reference to the European novel in general, English and French. Open to all students.

4 units, Aut (Stahlberger) MWF 11

154. The Russian Drama—A survey of the major Russian plays from Fonvizin to Mayakovskiy, including Gogol and Chekhov. Particular attention will be paid to tradition and innovation in the development of Russian dramatic comedy. Open to all students. Readings and lectures in English.

4 units, Aut (Stahlberger) MWF 1:15

SLAVIC COURSES

UNDERGRADUATE COURSES

By special arrangement with the department, courses numbered 100-159 can be taken for graduate credit. The Department urges students to take all three quarters of first-year, second-year, and third-year language series in the same academic year.
1. First-Year Russian.
   5 units, Aut (Crockett, Staff) MTWThF 8, 12, and 1:15

2. First-Year Russian—Continuation of 1.
   5 units, Win (Crockett, Staff) MTWThF 8, 12, and 1:15

3. First-Year Russian—Continuation of 2.
   5 units, Spr (Crockett, Staff) MTWThF 8, 12, and 1:15

5. Intensive First-Year Russian — Equivalent to 1, 2, and 3 combined. Enrollment limited. Consent of instructor necessary. One hour of work daily required in Language Laboratory, by arrangement, in addition to class times.
   12 units, Sum (Staff) MTWThF 8:00-9:30 and 10:30-12:00

51. Second-Year Russian—Systematic review of first-year materials. Controlled expansion of first-year vocabulary through limited reading of selected texts and introduction to study of word formation.
   5 units, Aut (Van Campen, Pekurovskaya, Staff) MTWThF 12 and 1:15

   5 units, Win (Van Campen, Pekurovskaya, Staff) MTWThF 12 and 1:15

   5 units, Spr (Van Campen, Pekurovskaya, Staff) MTWThF 12 and 1:15

111-113. Third-Year Russian—Emphasis on reading, vocabulary building and textual analysis. It is strongly recommended that students take 114–116 in conjunction with this series. Prerequisite: 53 or equivalent.
   3 units, Aut, Win, Spr (Schupbach) MWF 9

114-116. Third-Year Russian Conversation and Composition—Coordinated with and to be taken in conjunction with 111–113.
   2 units, Aut, Win, Spr (Pekurovskaya) TTh 9

117A,B,C. Slavic Civilization — (Same as History 117A,B,C, and Political Science 117G in Spring quarter.) An interdisciplinary introduction to the political, social, economic, and cultural history of the Slavic peoples of Bulgaria, Czechoslovakia, Poland, Russia, and Yugoslavia from the time of the Slavic migrations to the present. Readings and lectures will stress the similarities and differences among the Slavs themselves as well as the continuing tension of their relationship to the more familiar western experience. Three lectures a week will be offered by faculty from various departments, and a two-hour discussion section will be included as an integral part of the course.
   5 units, Aut, Win, Spr (Todd, Atkinson, Dallin) MTW 10

118A,B. Russian Intellectual History — (Same as History 118A,B.) Study of major trends and documents in the history of Russian thought from the late 18th century to the First World War. Attention will focus on the development of “general ideas” about man’s ethical, moral, and aesthetic nature, society, and politics. Readings (in translation) will be drawn from literature, criticism, memoirs and correspondence, political and social theory, philosophy and history. A two-quarter course open to advanced undergraduate and graduate students. Enrollment limited to 30, permission of instructors required.
   8 units (Brown, Emmons) given 1975–76

147. Russian Nineteenth-Century Prose — Discussion of selected problems, based on readings in Russian. This course must be taken concurrently with General Course 145.
   3 units, Aut (Todd) M 4:15–6:05

148. Russian Twentieth-Century Prose — Discussion of selected problems, based on readings in Russian. This course must be taken concurrently with General Course 146.
   3 units, Win (Staff) by arrangement

TRANSLATORS PROGRAM

Students wishing to take any of the courses in the translators series who have not had the preceding courses in the series will be required to pass a qualifying examination given at the beginning of the quarter. Students planning to enter the Translators Program should give serious consideration to taking one or more of the following courses...
in their freshman and sophomore years at Stanford: Communications 100, 102, 107; English 1, 2.

THIRD-YEAR LEVEL

161. Third-Year Russian (for Translators) — Reading and translation of unglossed texts from contemporary Soviet journals plus written and oral drills on constructions presenting particular difficulty to the translator.

3 units, Aut (Van Campen) TTh 11

162. Third-Year Russian (for Translators) — (Continuation of 161.) Reading and translation of more specialized texts in areas corresponding to the interests of individual students. Emphasis on style and fluency of English translation.

3 units, Win (Van Campen) TTh 11

163. Third-Year Russian (for Translators) — Continuation of 162. Reading and translation (written and sight) of technical materials in the physical sciences and mathematics, as well as other areas.

3 units, Spr (Schupbach) MWF 11:00

FOURTH-YEAR LEVEL

192. Introduction to Independent Translation — Translation of texts in the student's area of interest. Prerequisites: 161, 162, 163, or equivalent.

3 to 5 units, Aut (Schupbach)

W 2:15–4:05

193. Independent Translation — Translation of texts in fulfillment of requirements for the Translators Certificate. May be taken more than once for credit. Prerequisite: 192, or equivalent.

1 to 5 units, Aut, Win, Spr (Van Campen, Schupbach, Todd) by arrangement

ADVANCED AND GRADUATE COURSES

165. Introduction to the Structure of Russian — Analysis of the phonology and morphology of contemporary Russian.

3 units (Crockett) given 1975–76

167–169. Fourth-Year Russian — Reading and discussion in Russian of literary texts, with compositions on material discussed.

2 units, Aut, Win, Spr (Pekurovskaya)

TTh 10

170A,B,C. Advanced Russian — Fourth-year level course conducted in Russian. Program will include translation from English into Russian, phonetics, lexicology, and stylistics, plus supplementary practice for students interested in interpreting. Emphasis on preparation for work in news media and in cultural exchange programs. For each hour of class, students will have to spend no less than two hours working at home or in the Language Laboratory. A three quarter course.

10 units, Aut (Pashin) TTh 2:15–4:05

Win, Spr, TTh 2:15–3:45

172. Pushkin.

3 units (Stahlberger) given 1975–76

186. Turgenev — (Same as Comparative Literature 186 and Modern Thought and Literature 186.) Reading of the major works in English translation with comparative study of certain western novelists and of mid-nineteenth century social and intellectual currents. Open to all students. Undergraduate concentrators and graduate students in Slavic will do assigned portions of the reading in Russian.

4 units, Spr (Brown) TTh 2:15–4:05


4 units, Win (Stahlberger) MWF 1:15


4 units, Spr (Stahlberger) MWF 1:15

189. Russian Literature of the Middle Ages — Interested students from other departments should consult with instructor before registering for the course.

4 units (Todd) given 1975–76

190. Russian Literature of the Eighteenth Century — Emphasis on poetry: theory of genres, the satire, the ode, the mock-epic.

4 units (Stahlberger) given 1975–76

191. Derivational Morphology.

3 units (Schupbach) given 1975–76

194. Stylistics — Seminar for graduate and
advanced undergraduate students. Reading and discussion of attempts to define the concept of style and the role of language in literature, consideration of possible empirical approaches to the study of style, and exploratory analyses of individual works.

4 units, Aut (Crockett) W 2:15-4:05; F 2:15-3:05

196. Russian Pronunciation — Prerequisite: 53 or equivalent.
3 units (Staff) given 1975-76

197. Russian Lexicology and Phraseology.
3 units (Staff) given 1975-76

198. Russian Syntax — Study of sentence structure and word order in contemporary Russian with emphasis on differences from English.
3 units (Crockett) given 1975-76

199. Individual Work — Open to Russian majors or students working on special projects. May be repeated for credit.
1 to 5 units, any quarter (Staff) by arrangement

200. Proseminar in Russian Literature — The terms and concepts of literary study; the various approaches of literary criticism; versification and poetic language; bibliography and research methods. Required of all entering graduate students; recommended for others.
4 units, Aut (Brown) M 2:15-4:05

211. Introduction to Old Church Slavonic and Early Russian Texts.
3 units, Aut (Van Campen) by arrangement

212. History of the Russian Literary Language — A survey of the major structural and semantic changes from the tenth to the nineteenth century. Readings in Russian from various periods and genres are assigned. Prerequisite: 211.
3 units, Win (Schupbach) by arrangement

220. Problems of Literary Translation.
4 units, Spr (Brown) M 2:15-4:05

221. Studies in Russian Fiction: The Age of Realism — The development of realism over the first two-thirds of the nineteenth century, with special attention to problems of content and style as well as to social and philosophical background, both Russian and European.
4 units (Brown) given 1975-76

222. Studies in Russian Fiction: From Realism to Modernism — The evolution of naturalist, symbolist, neo-realist, and ornamentalist forms and movements in Russian prose in the late nineteenth and early twentieth centuries with special emphasis on stylistic and structural developments. To be taken in conjunction with 146.
4 units, Win (Brown) by arrangement

230. Russian Formalist and American "New" Criticism — (Same as Comparative Literature 230.) Readings in the works of Russian Formalists and certain American "New Critics." A knowledge of French, German or Russian is highly desirable.
4 units (Brown) given 1975-76

277. Gogol — Also open to qualified undergraduate students.
4 units (Todd) given 1975-76

279. Dostoevsky — A study of Dostoevsky's shorter works and of critical approaches to Dostoevsky. Readings in Russian. Also open to qualified undergraduate students and to those without Russian by arrangement with the instructor. May be taken in conjunction with Slavic 151.
4 units, Win (Todd) M 2:15-4:05

299. Individual Work — Exclusively for graduate students in Slavic working on thesis or engaged in special work.
1 to 12 units, any quarter (Brown, Crockett, Pashin, Schupbach, Stahlberger, Todd, Van Campen) by arrangement

300. Graduate Seminar — Subjects to be announced in the Time Schedule.
4 units, Aut (Brown)
Win (Stahlberger)
Spr (Todd)

For additional offerings in literature, see Comparative Literature.

SOCIAL THOUGHT AND INSTITUTIONS
Chairman: Charles Drekmieer
Professors: Robert McAfee Brown, W. Bliss Carnochan, Raymond Giraud, Robert
STATEMENT OF PURPOSE

As an interdisciplinary honors program, Social Thought and Institutions is designed to meet the needs of students wishing special preparation in areas of study which draw on the materials of two or more of the social sciences. It aims at a clearer understanding of the contributions the social sciences are able to make to one another and to a specific problem, an awareness of differences and agreements in their theoretical assumptions, and facilitation of communication among these disciplines. It seeks to combine rigorous training with the breadth of knowledge interdisciplinary study provides.

The Program is organized around the study of a particular idea or problem. During the next several academic years the topic will be peace and the seminars will be concerned with conflict analysis, techniques of conflict resolution, the preconditions of peaceful and just relationships at the interactional and institutional levels, and similar considerations. The objective is a balanced and comprehensive program responsive to student interest in the role of values in social life, responsive to the social need for informed institutional analysis and innovative recommendations for social change, and the academic need for closer association of theory and research with short- and medium-range proposals and policies.

REQUIREMENTS

Two year-long seminars (Social Sciences 101-103 and Social Sciences 111-113) will be offered. Students wishing honors work will enroll in Soc. Sci. 101, which has a stronger philosophical emphasis than the other series, and will be expected to complete an honors thesis in the area of peace, conflict, and social change studies. From five to fifteen units of credit will be allowed for the thesis, and no more than five units may be taken in any single quarter. After the student's plans for an honors project have been approved by the administrative committee, he or she will be assigned an adviser. In most cases the committee will arrange for the appointment of a second adviser in the major field. It is customary for the student to take the 101 sequence in the junior year and write the thesis in the senior year. (Approximately fifteen students are admitted to the seminar each year.)

Students interested in a peace studies concentration but not desiring an honors program may take the 111-113 series. This seminar will have a somewhat more practical orientation, with opportunities for field projects. In addition to the seminar, students wishing certification in peace studies must complete at least three courses relevant to the themes of the seminar.

Though the Honors Program is intended to supplement a regular departmental major, there may be areas of study which cannot be related to a department in this way. In such instances a major may be offered under the supervision of the committee and requirements for graduation will be determined by the committee in consultation with the student's advisers. No more than two or three students will be accepted as majors in Social Thought and the usual expectation is that they will complete between seventy and eighty units of social science and philosophy courses by the time of graduation.

Students not in the honors seminar are not eligible for the major.

ADMISSION TO THE PROGRAM

Students wishing admission to the Honors Program should provide evidence of superior academic achievement (at least a 3.0 average). All students may apply in the spring quarter of the freshman or sophomore years or during the following fall registration. Mr. Brown, Mr. Stone, or Mr. Drekmeier may be consulted about admission to the Honors Program (Mr. Drekmeier's office is in the Department of Political Science). Students interested in the 111 series may apply for admission to the program at the first meeting of that seminar.

SPECIAL COURSES OF INSTRUCTION

101. Honors Seminar.
   4 units, Aut (Staff) by arrangement

102. Honors Seminar—Continuation of 101.
   4 units, Win (Staff) by arrangement

103. Honors Seminar—Continuation of 102.
   4 units, Spr (Staff) by arrangement
   4 units, Aut, Win, Spr (Staff) by arrangement

186. Nonviolence and Liberation.
   4 units, Aut (Staff) by arrangement

193. Senior Thesis and Directed Reading.
   1 to 5 units, any quarter (———) by arrangement

SOCILOGY

Emeriti: Richard T. LaPiere, Charles N. Reynolds (Professors)
Chairman: W. Richard Scott
Associate Professors: Elizabeth G. Cohen, John W. Meyer
Assistant Professors: J. Victor Baldridge, Patricia R. Barchas, Francesca M. Cancian, Michael T. Hannan, Jr., Anne M. McMahon, Stephen M. Olsen, William G. Ouchi (by courtesy), Nancy Tuma, Barbara Rosenblum. Acting: Barry J. Edmonston (by courtesy)

PROGRAMS OF STUDY

BACHELOR OF ARTS

OFFERINGS AND FACILITIES

The Department of Sociology offers courses appropriate for most students. Some courses help to equip the student for his interactions in large and small social systems. Other courses aid the student in professional work such as law, medicine, journalism, business, architecture, education, service work with people, and public policy areas in which assessment of social science knowledge is necessary.

A wide range of specialities and course offerings is represented in our faculty, but three major concentrations are:

a) Comparative Sociology: organization and change in societies and institutions.

b) Formal Organizations: functioning of large-scale formally-structured associations oriented to the pursuit of specialized goals, e.g. schools, hospitals, corporations and political bureaucracies.

c) Social Psychology and Interpersonal Behavior: the social organization of individual identity, beliefs and behavior, and with the organization of behavior in interpersonal interaction.

Pre-professional students may find some offerings particularly useful. Suggested courses from which pre-professionals may create a concentration are:

Pre-Medicine: Soc. 131, 133, 140, 150, 200, 210, 242 and 260;
Pre-Law: Soc. 130, 131, 132, 150, 151, 152, 240, 241, 260;
Pre-Social Work: Soc. 120, 121, 130, 131, 133, 200, 210, 251;
Pre-Business: Soc. 150, 151, 200, 210, 251, 260, 261, 262 and 263;
Pre-Education: Soc. 120, 121, 150, 160, 243, 260 and 261.

Students may pursue degrees in Sociology at the Bachelors, Masters, or Doctoral level. The Department has formal ties with Psychiatry, Education, Human Biology, the School of Business and the School of Law. Laboratory and computer facilities are accessible.

Bachelor's degree students are required to take 45 units including Sociology 80, 280, and three courses numbered above 200. To develop necessary technical skills, students are encouraged to take the statistics sequence 60, 61 and 62. Related courses in other departments, if approved by the department adviser, may fulfill up to 15 units for the degree. Students are encouraged to arrange tutorials and to work closely with individual advisers.

Courses numbered 0-200 are open to all students without prerequisites. Courses numbered from 200-300 are intended for undergraduates with previous exposure to Sociology, for majors, and for graduates.

HONORS PROGRAM IN SOCIOLOGY

The Honors Program is designed for those energetic and interested students who are capable of carrying out an intensive, individualized program of study. Such programs usually involve close contact with one or more faculty as the student carries out an independent research project. The student submits an Honors Thesis, for which ten units of credit are granted. Honors students may be admitted to graduate level courses.
There is no fixed number of course credits in Sociology to fulfill an Honors Program; rather, the courses of study are individually planned.

**Major in Social Sciences (Sociology)**

This degree is designed for students interested in interdisciplinary work with some emphasis on Sociology. The requirements for the Bachelor degree in Social Science (Sociology) are 45 units of course work with thirty units from Sociology including an introductory course in Sociology and a course in methodology (Sociology 180, for example). The remaining fifteen units are chosen from related departments (Communication, Economics, Political Science, Psychology, Anthropology, and Linguistics).

**Graduate Study**

**Admission to Graduate Standing**

Although it is desirable to have had undergraduate preparation in sociology, the Department does consider for admission to its graduate program students without such preparation. Admissions forms and forms for requesting financial assistance may be obtained from the Office of Graduate Admissions and, once completed, should be returned to that office. Applicants are required to submit results of the Graduate Record Examination, both the quantitative and the verbal tests. The GRE Advanced Test in Sociology may also be taken, but is not mandatory.

**Master of Arts**

Ordinarily, the Department does not admit students who are candidates solely for the Master's degree in Sociology. This degree is granted as a step toward the fulfillment of Ph.D. requirements. To receive it, the student must complete 45 units of approved work with an average grade of B or better. All course work should be at level 200 or greater and at least 30 of the course units must be taken within the Department.

Graduates enrolled in law, medicine, business, education or any other advanced degree program at Stanford may wish to obtain a Masters in Sociology. In such cases the usual admission requirements are waived. Interested students should contact the department secretary for further information. Students may also apply for the co-terminal Masters program as described in the Degrees section of this catalogue. Information may be obtained from the department secretary.

**Doctor of Philosophy**

The Department presumes that all students admitted will be recommended for admission to candidacy. For the first three quarters in residence all students have probationary status. During the Spring Quarter the Department decides whether each student not yet admitted to candidacy will be (1) admitted to candidacy, (2) terminated, or (3) continued on probation for an additional year. This decision is made by the entire faculty of the Department and is based upon whether the student is making satisfactory progress toward the goal of a professional career of teaching and research in Sociology. The decision to admit the student to candidacy implies that the student's position in the Department is secure, subject only to continued satisfactory progress toward completion of remaining departmental and University requirements.

After admission to candidacy for the Ph.D., the student must: (a) have a Master's degree or its equivalent; (b) complete a Research Apprenticeship, working at least two quarters in a faculty research program and collaborating in associated publications or preparing a report of professional quality based on his or her experiences; (c) complete a Teaching Apprenticeship, working at least two quarters as a teaching assistant under the supervision of a faculty member; and (d) develop a thorough grounding in sociological theory and research methods. To accomplish this, five graduate courses are required: Sociology 287, 370, 371, 381, and 382 or 383. In addition, students entering with little background in statistics are required to take an elementary course in the first quarter after entering. (e) Finally, each student must select two fields in Sociology as his or her areas of special competence, and pass written examinations in these fields in order to complete the requirements for candidacy. Examples of such fields are Small Groups, Socialization, Family and Kinship, Sociology of Education, and Comparative Institutions. Theory or Methods may be offered as a field only when the candidate has an exceptional grasp of material in the area, since competence is assumed for all graduate students.

Finally, the student must pass the University Oral Examination, and following this, complete a doctoral dissertation.
MASTER OF ARTS IN TEACHING

This degree is offered jointly by the Department and the School of Education. The degree is intended for candidates with a teaching credential who wish further to strengthen their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education.

JOINT PROGRAM WITH THE LAW SCHOOL

The faculties of the Law School and the Department of Sociology conduct joint programs leading to either a combined J.D. or J.M. degree with an A.M. degree in sociology or to a combined J.D. or J.M. degree with a Ph.D. in sociology.

Normally, the student interested in pursuing an A.M. degree in sociology will complete one full year of his or her Law School program, applying for admission to the Department of Sociology during the first year of Law School. If admitted, the student would be expected to complete 45 semester units (for the J.D. degree) in the Law School and meet the Sociology Department requirements. Applications for a joint program must be approved by the Research and Interdisciplinary Studies Committee of the Law School and by the Sociology Department. Faculty advisers from both the Department and the School will participate in the planning and supervise the study program of students admitted to joint degree status.

The joint J.D.-Ph.D. degree program is designed for students who wish to prepare themselves for research or teaching careers in areas relating legal and sociological concerns. Participation in this program requires application for admission to both the Law School and the Department of Sociology and acceptance by each. Upon admission, the student may elect to begin his or her study program in either the Law School or the Sociology Department. Normally, the student will spend the first full year in one program and the second full year in the other. Thereafter, the student may take courses concurrently until requirements for both degree programs have been met.

COURSES OPEN TO ALL STUDENTS

1. Introduction to Sociology—A review of basic concepts, theories and principles that enable us to explain human behavior in various social contexts. Emphasis will be given to what sociologists actually do and how they think about social life.
   5 units, Aut (Rosenblum) MTWThF 11
   5 units, Win (Staff) MTWThF 10
   5 units, Spr (Meyer) MTWThF 11

4. Social Problems: Or How to Read a Newspaper—This course takes some of the central ideas of sociology and applies them to some current social problems. Abstract principles are related to concrete experiences in today's world. Materials drawn from daily newspapers are used to develop such topics as social inequality, crime, racial conflict, ritualistic conformity, and bureaucratic inefficiency.
   3 to 5 units, Aut (Dornbusch) MW 3:15-5:05

80. Departmental Seminar for Undergraduate Majors—Designed to introduce students to Sociology as an academic discipline, to acquaint them with career opportunities in the field, and to expose them to current faculty research interests. Required of all sociology majors.
   2 units, Aut (Scott) T 4:15-6:05

110. The Structure of Social Encounters—An introduction to theories and research results on the study of interpersonal behavior. The topics covered include: affiliation, social perception and social comparisons, conformity and persuasion, and social exclusion.
   3 units, Spr (McMahon) MWF 10

110A. Structure of Social Encounters Laboratory—Optional laboratory to 110. Laboratory and field investigation of a number of topics addressed in 110. Prerequisites: concurrent enrollment in 110.
   2 units, Spr (McMahon) TTh 10

SERIES OF PROBLEMS IN CONTEMPORARY SOCIETY

120. Childhood and Modern Society — A study of the ways the lives of children are organized in modern society, the ways in which this situation is changing and the relation of this situation to views of how childhood experiences affect adult life.
   3 to 5 units, Aut (Meyer) MWF 2:15

121. Sex Roles in Modern Society.
   3 to 5 units, Spr (Staff) MWF 10

122. Causes of Women's Liberation Move-
ment—Many American women are joining together to redefine themselves and to acquire more power and status. What social conditions explain this movement? We will study Women’s Liberation in the U.S. and other countries, and compare it with other social movements such as Black Power, Gay Liberation and the Labor Movement.

3 to 5 units, Spr (Cancian) MW 3:30–5:05

130. Poverty and Public Policy—Why does large-scale poverty persist in America and what are the effects of poverty on the individual? The course will consider conflicting views on the two questions and relate the issues to current public policy.

3 to 5 units, Aut (Hannan) MWF 1:15

131. Deviance and Social Control—Deviance as socially created, defined and organized. Its uses in society and its relation to systems of regulation. Emphasis on crime, illness and disorder—their social creation and social reactions to them.

3 to 5 units, Win (Rosenblum) TTh 8:30–10

132. The Criminal Law and the Criminal System—(Same as Law 107 and Political Science 174.) Exploration of the purposes and processes of the criminal law, with emphasis on the actual operation of the system, and the application of theory to contemporary problems. Topics will include the police, the trial, sentencing, corrections, and “non-victim” crimes.

5 units, Spr (Kaplan) MWF 1:15

133. Alcohol, Drinking and Alcoholism—Deals with the use of alcohol in the United States and its effects on interaction in large and small groups.

3 to 5 units, Spr (Barchas) MWF 9

140. Doctors, Patients and Medical Care Settings.

3 to 5 units, Aut (Staff) MWF 9

150. The World of Organizations—Talking to people about organizations is like trying to talk to fish about water. We are sufficiently immersed in them that we hardly recognize their presence. Life was not always like this. Bureaucratic organizations came into existence as a solution for certain problems. They, in turn, have created new problems which require new solutions. New organizations with novel structures are coming into being that represent important modifications of the bureaucratic model. The old and new world of organizations will be explored using novels, selections from the sociological classics and recent empirical studies. Regular lectures will be enriched by guest speakers and case discussions.

3 to 5 units, Spr (Scott) MWF 1:15

151. Control over Organizations: Power in a Bureaucratic Society—Examination of the conditions which affect the balance of power between individuals and organizations in modern society.

3 to 5 units, Win (McMahon) MWF 10

152. Power Elites in American Society—Analysis of the conflicting views on the reality and importance of power elites in American society.

3 to 5 units, Win (Zelditch) MWF 11

153. Stratification in the Capitalist World System—This course examines the emergences of centers and peripheries in the world system and the relations between them. It focuses on the dynamic aspects of international inequalities and the question of economic imperialism and its effects on the periphery.

3 to 5 units, (Chase-Dunn) MWF 10

160. Ethnic Relations in Modern Society—Examination of the relations among ethnic and racial groups in industrial societies. Focus on the causes of large-scale ethnic movements and of ethnic violence and the consequences of ethnic conflict. Cases considered include the “Black movement” in the U.S. and Britain, the religious conflict in Northern Ireland and the rise of the “blue-collar ethnic” in the U.S.

3 to 5 units, Win (Hannan) MWF 9


5 units, Win (Kirk) MTWTh 9

180. Contemporary Problems in Social In-
stitutions—(Same as Education 202 and Political Science 280A.) An examination of the social structure, process, problems, and ideology of a specific social institution. The institution to be considered varies each year.

4 units, Aut (March) M 7–10 p.m.

181. Law and Social Science—(Same as Law 311.) The purpose of this course is to broaden the approach to law by examining some major problems which law shares with other social sciences. Consideration will be given to definitions of law attempted by various social sciences, the impact of law on behavior of various kinds, the social forces which mold law, the influence of the legal system on the various actors within it, and theoretical efforts to explain the relationship of law and society.

3 to 5 units (Friedman) given 1975-76

190. Undergraduate Directed Research.
1 to 6 units (Staff) by arrangement

COURSES INTENDED FOR UNDERGRADUATES WITH PREVIOUS EXPOSURE TO SOCIOLOGY, FOR MAJORS, AND FOR GRADUATES

SMALL GROUPS AND SOCIAL PSYCHOLOGY

200. Interpersonal Processes—An examination of research in such areas as power and prestige structures in small groups; status characteristics in social interaction; deviance, conformity, and social control.

5 units, given 1975-76

210. Social Psychology—A survey of selected problem areas in social psychology chosen from such topics as: attitudes and attitude change; balance and exchange processes; conformity and deviance; status and role; perception of self and others; socialization. Prerequisite: previous work in social psychology or consent of instructor.

5 units, Win (McMahon) MW 3:15–5:05

211A. Personality and Social Structure—(Same as Education 208A.) Lectures and discussion of leading ideas, theories, and research on the relations of personality and social systems, with special emphasis on the ways in which personality modes influence the functioning of institutions. Among the issues reviewed are suicide, juvenile delinquency, recruitment to and performance in school and job, socialization, and political participation. Undergraduates with some background in personality theory or sociological analysis will be accepted. Enrollment limited to 65.

3 to 5 units, Win (Staff) TTh 4:15–6:05

211B. Personality and Social Structure— (Same as Education 208B.) The course will be a continuation of 211A. Topics reviewed will include political participation, national character, psycho-history, and social change. Students will be encouraged to pursue their own interests, such as success in school being a function of the fit between student personality and the educational institution. Sociology 211A will be a prerequisite. Students who have taken Sociology 176 (Education 208) in previous years will be admitted.

3 to 5 units, Spr (Staff) by arrangement

220. Collective Behavior and Social Movements—Crowds, riots, demonstrations, rumors, fads, fashion, cults, mobs, social movements—these are some examples of what comes under the heading of collective behavior. The impact of media will be examined: how did TV help turn the complaints of a few Los Angeles housewives into a national meat boycott?

5 units, Aut (Rosenblum) TTh 8:30–10

225. Values, Identities and Social Structure—A research seminar that will explore how norms and values affect action, and how the kind of person that you are supposed to be is related to social structure. Our main activity will be doing research. Possible topics include: (1) What is the effect of family and school on an adolescent's identity and actions? (2) How does being a man vs. a woman or a parent vs. an employer affect the kind of person that you are supposed to be in a particular situation? Open to advanced undergraduates and graduates in the social sciences.

5 units, Win (Cancian) M 2:15–5:05

COMPARATIVE SOCIAL ORGANIZATIONS AND INSTITUTIONS

231. Human Ecology—Introduction to the use of ecological theory in the study of human social organization. Principles of ecology are presented in the context of four applications: family organization, urban structure, ethnic group relations, and societal evolution.

5 units, Spr (Hannan) MWF 9
240. Class, Status, and Power—Analysis of stratification in simple and complex groups and societies. General theories of stratification are analyzed and evaluated.

5 units, Win (Zelditch) MWF 11

241. Political Sociology—Empirical and theoretical studies of political structure, political organization, and individual political behavior, particularly in modern industrial societies. Prerequisite: previous work in Sociology or Political Science.

5 units, Aut (Meyer) MWF 10

242. Family and Kinship—This is an introduction to: (1) the relation between the family and the larger social system in tribal, peasant, and modern societies; and (2) role relationships within the family, especially parent-child and husband-wife. We will consider U.S. family organization in different social classes, ethnic groups, and in utopian communities.

5 units, Spr (Cancian) MWF 9

243. Education and Society—The political and economic determinants and effects of educational systems. Structural connections between the social status “student” and other social institutions and their consequences for the organization, behavior, and socialization of students. Prerequisite: previous work in sociology.

5 units, Win (Meyer) MWF 11

244. The Social Structure of Science—The objective of this course is to analyze science as a social institution. The course is designed to introduce the student to sociological analysis and also to acquaint the student with some general features of science.

5 units, Win (Cohen) MWF 10

246. Seminar in the Sociology of Art—An examination of art as a major social institution in America. Topics to be considered are: artists’ careers; the “art world”; systems of rewards; distribution of art products; conventions and innovations in art styles.

5 units, Win (Rosenblum) T 2:15–5:05

247. Ethnic Groups and Movements—A comparative view of the social organization of cultural differences within contemporary national societies. (A) Theories and ideologies of ethnic group relations, including assimilation, pluralism, revitalization, internal colonialism, etc. (B) Structures of interaction and dependence; economic and ecological dominance; individual social mobility and ethnicity. (C) Cultural and political response; language and cultural maintenance/creation; intermarriage; separatist movements and inter-ethnic violence. Examples drawn from contemporary Europe, Asia and Latin America as well as from North America.

5 units, Spr (Olsen) MWF 1:15

COMMUNITIES

250. The Community—A comparative view of the social organization of communities having widely different economic, spatial, and cultural bases. An attempt to understand the changing significance of local community in relation to national structures of power, identification, and movement.

5 units (—) given 1975–76

251. The City—An introduction to understanding the city: (a) man and the city, focusing on distinctive aspects of the behavior of “urban man,” (b) the city and its environment, including the immediate physical environment, other cities, and the larger society, and (c) the internal affairs of the city, including the distribution of power and privilege, voluntary and official community organizations, and neighborhoods.

5 units, Win (Olsen) MWF 10

ORGANIZATIONS

260. Formal Organization—An introduction to the sociological literature on formal organizations. The structural characteristics of organizations (e.g., the power and status arrangements) are examined as are selected factors which affect them (e.g., characteristics of the environment, task performed). Competing perspectives for analyzing the structure of organizations are described and evaluated. Prerequisite: consent of instructor.

5 units, Aut (Scott) MTWThF 9

261. Organizational Behavior—Continues the analysis of organizations begun in 105A but emphasizes social psychological processes relevant to the analysis of organizations. Personality and organizations; power, influence, and leadership; production and morale; intraorganizational conflict; stability and change. Prerequisite: 260 or consent of instructor.

5 units, given 1975–76

262. Leadership in Organizations—(Same
as Education 333 and Political Science 102.)
The problems of leadership in complex organizations, such as universities, schools, hospitals, business firms, armies, and public bureaucracies. Special attention to the role of major executives.

4 units, Spr (March) given 1975-76

263. Organizational Decision Making —
(Same as Education 120 and Political Science 103.) An examination of the process of decision making in modern complex organizations, such as universities, schools, hospitals, business firms, armies and public bureaucracies. The impact of information, power, resources, organizational structure, and the environment. Alternative models of choice and their implications.

4 units, Win (March) MW 1:15—2:45

THEORY

270. Introduction to Sociological Theory—
An examination of some basic theoretical issues such as the integration of the individual and society, social classes, and alienation. Readings include Durkheim, Goffman, Marx, Parsons, and Weber. Required of all sociology majors. Prerequisite: previous work in the social sciences.

5 units, Win (Cancian) MWF 1:15

271. Introduction to Models in Social Science—(Same as Education 110 and Political Science 185A.) An introduction to models in social science. Models of choice, exchange, adaptation, diffusion, and structure are used to make predictions in a variety of situations involving human behavior. Emphasis is placed on the invention and application of models more than on the testing of them.

4 units, Aut (Cohen) MW 1:15—2:05; sections M 10 or 11

272. Mathematical Models of Social Structure—An introduction to abstract treatments of structure and process with particular attention to problems of application to large scale, complex social systems. Substantive topics include: Stratification and social mobility, organizational behavior, and vacancy chains. Prerequisites: 1 and some background in calculus.

5 units, Aut (Tuma) F 2:15—5:05

273. Computer Models of Social Behavior—(Same as Computer Science 127, Education 218, Political Science 180M, and Psychology 154.) Models of human behavior in social situations. Particular attention is given to specifying simulation models, determining their properties, and testing them. Enrollment limited to 20. Prerequisites: knowledge of at least one programming language; advanced courses in social science; consent of instructors.

4 units, Spr (March, Feigenbaum) given 1975-76

METHODS

280. Introduction to Sociological Research —The aim of this course is to provide the consumer of social research with standards by which to evaluate the findings of sociological studies; to present a critical analysis of some basic notions and theories used in sociological analysis. Lectures and laboratory exercises consider problems of collecting observations, constructing theory, testing hypotheses and generalizing research results. Required of all sociology majors.

5 units, Aut (Cohen) MWF 11; lab. T, W or Th 2:15—5:05

281. Statistics for Sociological Research—An introduction to the rationale and application of methods of statistical analysis for both experimental and nonexperimental research in the social sciences. The additional (optional) unit is given for computer exercises illustrating the practical usage of various statistical methods. Prerequisite: Stat. 60 or equivalent.

5 to 6 units, Spr (Tuma) MWF 11:00—1:00

282. Field Work Methodology—A practical, "how-to" course providing the student with experience in a field setting. Each student will select an area of interest (student culture, hospitals, police work, behavior in public places, etc.) to study for the term. Class discussion will center on sharing field problems, particularly the changes a field worker goes through during the research process. Readings will concentrate on recording, coding and analyzing qualitative data.

5 units, given 1975-76

290. Individual Study.
(Staff) by arrangement

291. Honors Seminar—Colloquium focusing on problem selection, formulation, and research design for honors students preparing to carry out individual research leading to a senior thesis.

2 units, Spr (Staff) by arrangement
292. Undergraduate Research Apprenticeship.
   1 to 10 units (Staff) by arrangement

293. Senior Thesis.
   3 to 10 units (Staff) by arrangement

COURSES PRIMARILY FOR GRADUATE STUDENTS

300A,B,C. Graduate Proseminar — Limited to first-year graduate students in Sociology.
   2 units, Aut (Staff) T 12
   Win (Staff) T 12
   Spr (Staff) T 12

315. The Social Psychology of Modernization—(Same as Education 309.) Exploration of the impact of political, economic, and socio-cultural change on the individual in developing countries. Review of standard works in the scientific literature, with special emphasis on data from the Project in Social and Cultural Aspects of Economic Development in Six Developing Countries, and presentation of results from research of advanced students. Education, mass communication, community development, technical innovation and political participation are illustrative of the topics on which students work. Enrollment will be limited to fifteen, the selection, if necessary, to be made at the first meeting.
   3 to 5 units, Spr (Staff) Th 4:15-6:05

316. The Social Psychology of Organizational Settings—(Same as Education 308.) An exploration of the human response to social climates, this seminar will treat the differential response which individuals and groups make to variation and alteration in the form of social organization in which they are involved. The participants will review available evidence in search of the answer to questions of this type: Do open classrooms increase teacher motivation and foster student development? Does a less restrictive atmosphere in prisons insure fewer riots and lower rates of recidivism? Can cooperative farming give traditional villagers a greater sense of personal efficacy? Settings to be studied will include, among others: schools, colleges, hospitals, factories, co-operative farms, housing developments, and villages. Strong emphasis will be placed on the theory and method for studying organizational climates and for judging the personal response to those climates. Open to graduate students with some preparation in sociology and psychology.
   4 units, Spr (Staff) MW 9-11

331. Population Problems—(Same as Food Research 235.) For graduate students. See 170.

332. Seminar: Demography of the Developing Countries—(Same as Food Research 285.) The demographic situation of each of the major regions—Latin America, tropical Africa, Islam, India, and East Asia—in relation to economic and social development. Population forecasts and prospects. Present and possible policies for restricting population growth. Each student will be required to lead a seminar and prepare a paper based on a term project. Prerequisite: 331 or consent of instructor.
   5 units, Spr (Kirk) MW 1:15-3:05

340. The Social Sciences and Educational Administration: Introduction to the Sociology of Education — (Same as Education 220C.) An analysis of the links between education and the stratification systems in the United States. Topics include: structure of class systems, social mobility and education, barriers to educational and social opportunity with a special focus on race and sex, and the recent debates over the meaning and existence of equality of educational opportunity.
   4 units, Spr (Baldridge) MW 9-11

341. Research Problems in the Sociology of Education—(Same as Education 310/210.)
   4 to 6 units, Aut (E. Cohen) MW 9-11

342A. The Low Status Student: Race and Social Class—(Same as Education 312A.)
   This course provides an attack on a problem of great contemporary interest in education from the point of view of sociological theory, research and analysis. The relationship of research to policy formulation will be stressed. Relevant sociological theory and research will be covered from the areas of stratification, socialization, and race relations. Applications to "education for the disadvantaged" will be made. Because students must be prepared to contribute analyses and research formulations in class presentations, Education 310 or its equivalent is a prerequisite.
   4 units, Spr (E. Cohen) M 7-9 p.m. and by arrangement
342B. Interaction Processes in Education—
(Same as Education 312B.) With increased use of group work as a classroom technique and the new developments in team teaching, the educational researcher can benefit from selected theory and research by sociologists and social psychologists in the small group setting. Topics will include the social processes of evaluation, influence, and role differentiation. The student should acquire skills in selecting theory and research from a heterogeneous behavioral science area that have some promise for problems in the educational setting. Methods for studying interaction in educational settings will be included. The course will involve some field work in observation and scoring of small groups in the educational setting. Because students must be prepared to contribute analyses and research formulations in class presentation, Education 310 or its equivalent is a prerequisite.

4 units, Spr (E. Cohen) TTh 3:15-5:05

343. Policy Research in the Social Sciences and Education—(Same as Education 330.) An analysis of the ways social science can be used to aid in policy decisions, especially in complex organizations and educational areas. The focus is on the marshalling of social science evidence and research that can be used to make practical policy decisions. Areas of concern include: problem identification and definition; searching for relevant, manipulable variables; gathering research upon which decisions can be made, offering alternative policy recommendations based on the same data; determining political and/or educational consequences of various recommendations. Students will work in teams, each selecting a different area for policy analysis.

4 units, Spr (E. Cohen) given 1975-76

364. Change and Innovation Processes in Complex Organizations—(Same as Education 328.) A study of organizational change which focuses both on deliberate and non-deliberate types of change. Particular attention will be paid to administrative strategies for promoting desired changes in professional organizations, such as schools, universities, welfare agencies. Topics about change will include structural design, human relations strategies, evaluation processes, long-range strategic planning, political dynamics, etc. Prerequisite: Ed. 329 or Soc. 260 or 261.

4 units, Spr (Baldridge) M 2:15-5:05

365A,B,C. Advanced Research in Organizational Theory I, II, III—(Same as Education 418A,B,C and Political Science 304A,B,C) A research seminar for advanced graduate students. Emphasis is placed on developing original theoretical formulations of major concepts in organization theory. Prerequisites: advanced courses in organizations, research methods, consent of instructor.

4 units, Aut, Win, Spr (Staff) by arrangement

370. Theory Construction — Prerequisite: consent of instructor.

5 units, Win (Berger) W 2:15-5:05

371. Basic Problems in Sociological Theory —Selected sociological problems are pursued from their origins in the classical literature through to contemporary formulations. Prerequisite: consent of instructor.

5 units, Spr (Zelditch) T 2:15-5:05

380. Introduction to Sociological Research —Graduate students attend lectures in 280 but have special laboratory sessions.

5 units, Aut (Cohen) MWF 11; labs. by arrangement

381. Design and Analysis of Sociological Research—A consideration of the principles of experimental and nonexperimental design and analysis from a causal inference perspective. Prerequisites: 280, 281.

5 units, Aut (Hannan) MW 3:15-5:05

382. Causal Models in Social Research—Sociological applications of structural equations methods with special emphasis on path analysis, confirmatory factor analysis, and models with unobservable variables. Prerequisite: 381.

5 units, given 1975-76
5 units, Spr (Cohen) given 1975–76

384. Demographic Methods — (Same as Food Research 286.) Methodology of population analysis, including actuarial procedures, fertility measurement, stable population analysis, cohort analysis, population projection, and construction of demographic models.
3 to 5 units, Spr (Edmonston) TTh 10–12

385. Survey Design and Analysis—(Same as Education 327.) A basic course in the design of surveys for social science research, including educational problems. Topics include: basic research cycle and judgments about when surveys are appropriate; variable language and indicators; construction of questionnaires (including simple indexes); strategies for interviewing and for mail questionnaires. A data analysis clinic will begin at the first of the course using existing data and will continue throughout the course. Prerequisite: basic statistics course.
5 units, Aut (Baldridge) MW 9–11

GRADUATE INDIVIDUAL STUDY

390. Graduate Individual Study.
(Staff) by arrangement

391. Special Colloquia.
(Staff) by arrangement

392. Graduate Research.
(Staff) by arrangement

393. Teaching Apprenticeship.
(Staff) by arrangement

394. Research Apprenticeship.
(Staff) by arrangement

(Staff) by arrangement

SPANISH AND PORTUGUESE

Emeriti: Aurelio M. Espinosa, Jr., Juan B. Bael, Isabel Magaña Schevill (Professors); Grace Knopp (Assistant Professor)
Chairperson: Jean Franco
Professors: Fernando Alegria, Jean Franco, Bernard Gicovate, Ronald Hilton

Associate Professor: Joaquim-Francisco Coelho
Senior Lecturer: Phillip Petersen
Assistant Professor: Rubén A. Gamboa. Acting: Robert Ball, Rina Benmayor, Gustavo Valadez

The Department of Spanish and Portuguese accepts candidates for the degree of Bachelor of Arts, Master of Arts in Spanish and Portuguese and Doctor of Philosophy in Spanish and Portuguese, 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.

PROGRAMS OF STUDY

BACHELOR OF ARTS

Candidates are expected to complete a minimum of 45 units from courses in this Department numbered 100 or higher. Language competence equivalent to Spanish 113 is required.

For students in the Honors Program in Humanities, up to six units of that program may be applied toward completion of the Spanish major.

Extended majors in Spanish and Portuguese may be arranged through the adviser with other Departments by taking a minimum of 40 units (instead of the required 45) in Spanish and Portuguese plus 15 or 20 units in a related field.

Candidates for the B.A. in Spanish and Portuguese have the opportunity to select any one of the following areas of concentration, without, however, limiting their choices exclusively to that area. It is important that intending majors request from the Department the name of an adviser who will be responsible for helping them select courses.

1) Language. Students primarily interested in Spanish and/or Portuguese as language should take courses in language and linguistics above the 160 level.

2) Literature. Students concentrating on Spanish or Latin American literature should take courses from the Spanish 230 or from the 260 series in sequence if possible. In consultation with the adviser, they may also take courses in the 300 series.

3) Hispanic Studies or Latin American Studies. The aim of the program, which permits maximum flexibility, is to allow students
to plan a more broadly based major than is possible in other areas of concentration. The student can combine the study of the Spanish, Portuguese or Latin American language and civilization with such fields as Political Science, History and Anthropology. The requirements are (a) 35 units to be taken within the Department (b) 25 units of courses outside the Department but in the Spanish, Portuguese, and Latin American field to be planned and presented to the Department by the student.

4) Spanish for Chicano Students. In consultation with an adviser, students will be required to take courses in Language, Literature, Linguistics and History and may also select from optional courses on Chicano culture. (Further details may be obtained from the Chairperson of the Department.)

5) Combined Major in Spanish and Portuguese.

Extended Major in English and Spanish Literature. Candidates for the A.B. in English and Spanish Literature should register with the Department of English.

STANFORD SPANISH PROGRAM
IN SALAMANCA

Majors in Spanish and allied disciplines may spend two quarters in Spain as participants in the Stanford Program at the University of Salamanca. Students reside in residencias de estudiantes and attend courses both at the University and with the faculty supervisor who accompanies the group. Application forms may be obtained from the Department.

Courses Taught at Salamanca. Spanish Civilization; Spanish Literature from 1870 to the Present; Co-ordinating Seminar taught by the Director. Students also enroll in courses given in the Facultad de Filosofía y Letras at La Universidad de Salamanca.

Lima Program. Inquiries about programs in Lima or in other parts of Latin America should be addressed to the Center for Latin American Studies, Bolivar House.

INTENSIVE SUMMER PROGRAM

Stanford University offers intensive study at various levels in both Spanish and Portuguese during the summer.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the "School of Education" section of this bulletin and the Credentials Secretary, School of Education.

MASTER OF ARTS IN TEACHING SPANISH

The degree of Master of Arts in Teaching Spanish is offered jointly by this Department and the School of Education. The degree is intended for candidates who have a teaching credential and who wish further to strengthen their academic preparation. The program consists of a minimum of 45 quarter units of graduate study, 36 of which must be completed at Stanford. A minimum of 25 units of courses taken must be in the teaching field and at least 12 units must consist of graduate courses in the School of Education at Stanford.

For general requirements, see School of Education.

Specific requirements:
Language Study: Advanced Conversation, Grammar, and Composition
Literature: Chosen from courses in Hispanic Literature or Civilization numbered from 220 up
Language Laboratory 215
Methods: Spanish 301
Courses in Education

GRADUATE PROGRAM IN HUMANITIES

The Department of Spanish and Portuguese participates in the Graduate Program in Humanities leading to a joint Ph.D. degree. For a description of that program see the section "Humanities Special Programs" in this bulletin.

Additional courses in literature of interest to graduate students in Spanish may be found in the section "Comparative Literature" and "Modern Thought and Literature" in this bulletin.

Students who choose a minor in Comparative Literature should consult Professor Herbert Lindenberger, Chairman, Committee on Comparative Literature, Room 34A. Students who choose to minor in Modern Thought and Literature should consult Albert J. Guerard, Chairman, Committee on Modern Thought and Literature.

MASTER OF ARTS IN SPANISH

This program is designed for those students who do not intend to continue their studies through the Ph.D. degree. By University regulation, students desiring the A.M. degree must complete a minimum of 45
units, 36 of which must be completed at Stanford.

Requirements for A.M. A reading knowledge of one foreign language other than Spanish or Portuguese.

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>203 Advanced Grammar and Composition (3 units)</td>
<td>3</td>
</tr>
<tr>
<td>Introduction to Literary Theory or equivalent courses</td>
<td>5</td>
</tr>
<tr>
<td>301 Methods of Teaching Spanish</td>
<td>2</td>
</tr>
<tr>
<td>Two courses each from two of the following areas (making four courses in all):</td>
<td></td>
</tr>
<tr>
<td>Linguistics, Spanish Literature and Civilization, Spanish American Literature and Civilization, Brazilian Literature and Civilization</td>
<td>16</td>
</tr>
</tbody>
</table>

Total ............................................. 26

In addition, students may take additional units of graduate level courses in Spanish or Portuguese and/or approved courses in related fields such as Linguistics, Comparative Literature, Philosophy, History of Art.

Doctor of Philosophy

The requirements of the Ph.D. are (1) a minimum of 36 graduate units during the first year of graduate study and a minimum of 9 units per quarter during six quarters following the first year; (2) a reading knowledge of one foreign language other than Spanish and Portuguese; (3) the writing of a dissertation.

In consultation with the adviser, students will select one major field of study from the following: (1) Philology and Linguistics, (2) Spanish Literature up to 1700, (3) Spanish Literature from 1600, (4) Spanish American Literature, (5) Latin American Studies, (6) Luso-Brazilian Literature. In addition candidates will also select two secondary areas of study outside the major field from one of the following: (1) Spanish Medieval Literature, (2) Spanish Literature of the Golden Age, (3) Modern Spanish Literature, (4) Portuguese Literature, (5) Brazilian Literature, (6) Linguistics, (7) Spanish American Literature of the colonial period, (8) Spanish American Literature from Independence, (9) Chicano Literature, (10) Literary theory, (11) Hispanic Civilization, (12) Portuguese and Brazilian Civilization.

One secondary area of concentration may be taken outside the department in consultation with the adviser. At the end of the first year of study, a preliminary examination will be taken, consisting of an oral examination and an examination in practical criticism. Candidates are also asked to submit one of their term papers. All Ph.D. candidates must fulfill the requirements for the A.M. before proceeding to the qualifying examination.

Candidates with an A.M. from another University may petition to waive the preliminary examination.

After the preliminary examination, students concentrate on the major field of study. After completion of course work requirements at the end of the second year of study they will take the qualifying examination which is based on a comprehensive list of reading in the candidate's specialized field.

A University Oral Examination will be taken usually one or two quarters after taking the qualifying examination. This examination will cover (1) the field of concentration (as defined by the student and the student's adviser); (2) plans for the dissertation based on a prospectus approved by the adviser.

The candidate should file a formal application for candidacy as prescribed by the University no later than the end of the second year. As early as possible Ph.D. candidates will be expected to find a topic requiring extensive original research and to seek out a member of the Department as his or her adviser. The adviser will request the Chairperson to appoint a committee to supervise the dissertation. The committee may well advise extra preparation within or outside the Department, and time should be allowed for such work. Ph.D. dissertations must be completed and approved within five years from the date of filing the application. Candidates taking more than five years will be required to reinstate their candidacy by passing the written qualifying examination again.

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 the Ph.D. degree. Dissertations may not be submitted during the summer quarter.

General Courses (A)

These courses, taught usually every other year, are open to all students. When registering, students are advised to prefix the identifying letter A to the course number.
75. Don Quixote in Translation.
3 units

121. The World as Seen through Travel Literature—Open to Spanish and Portuguese majors, who will be expected to study travel literature about Spain, Portugal, and Latin America. Advanced and graduate students enroll under Spanish 221.
3 to 5 units, Aut, Win, Spr (Hilton)

122. Europe and the World—A cooperative seminar open to Spanish and Portuguese majors, who will be expected to concentrate on Spain, Portugal and Latin America. Advanced and graduate students enroll under Spanish 222.
3 to 5 units, Aut, Win, Spr (Hilton)

123. The Civilization of Spain, Portugal and Latin America—Students may either make a general survey of the subject or concentrate on one subject which is of special interest to them. Advanced and graduate students enroll under Spanish 223.
3 to 5 units, Aut, Win, Spr (Hilton)

3 to 5 units, Spr (Cicovate)

5 units, Spr (Islas) MTTh 2:15

3 units

185. Brazilian Literature in Translation—Analysis, discussion of representative works.
3 units

SPANISH COURSES

FIRST- AND SECOND-YEAR
(Under the Direction of Rina Benmayor)

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.

Courses Numbered 1 Through 99 are Introductory Language Courses

1. First-Year Spanish, First Stage
5 units, Aut, Win, Spr, Sum (Staff) MTWThF, plus additional work in the Language Laboratory

2. First-Year Spanish, Second Stage—Continuation of 1.
5 units, Aut, Win, Spr (Staff) MTWThF

3. First-Year Spanish, Third Stage—Continuation of 2.
5 units, Aut, Win, Spr (Staff) MTWThF, plus additional work in the Language Laboratory

5. Intensive First-Year Spanish—Offers preparation in comprehension, speaking, reading, and writing the language. Since classes are limited to 15, applicants should consult the Department as soon as possible.
15 units, Sum (Staff) MTWThF 8:00–9:30 and 10:30–12:00 Language Laboratory by arrangement

10. Reading 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 seniors and graduate students only.
4 units, Spr (Staff) MTWTh 1:15
Sum (Staff) MTWThF 10

22. Second-Year Spanish—Prerequisite: 3.
3 units, Aut, Win, Spr (Staff) MWF, plus additional work in the Language Laboratory

3 units, Aut, Win, Spr (Staff) MWF, plus additional work in the Language Laboratory

3 units, Aut, Win, Spr (Staff) MWF, plus additional work in the Language Laboratory

9 units, Sum (Staff) MTWThF 8 and 11

50. Intermediate Spanish Conversation—May be repeated for credit. Prerequisite: 23
SPANISH AND PORTUGUESE 503

or 53 or equivalent. Enrollment limited to 10 per class.

3 units, Aut, Win, Spr (Staff) MWF 12:00

52. Intensive Second-Year Spanish.
5 units, Aut (Staff) MTWThF, plus additional work in the Language Laboratory

52BL. Intensive Second-Year Spanish—Especially designed for bilingual students.
5 units, Aut (Staff) MTWThF, plus additional work in the Language Laboratory

53. Intensive Second-Year Spanish — Continuation of 52.
5 units, Win (Staff) MTWThF, plus additional work in the Language Laboratory

53BL. Intensive Second-Year Spanish—Especially designed for bilingual students.
5 units, Aut (Staff) MTWThF, plus additional work in the Language Laboratory

99. Individual Reading — Enrollment only by special consent. Prerequisite: 23 or 53.
1 to 5 units, any quarter (Staff) by arrangement

Courses Numbered 100 Through 199 are Third and Fourth Year Language and Beginning Literature and Civilization

100. Advanced Spanish Conversation — May be repeated for credit. Prerequisite: 24 or equivalent. Enrollment limited to 10 per class.
3 units, Aut, Win, Spr (Staff) MWF 1:15

111. Third-Year Spanish—Prerequisite: 123 or 53.
3 units, Aut (Staff) MWF 9 or 10

111B. Third-Year Spanish — Prerequisite: 54B. Especially designed for bilingual students.
3 units, Aut (Staff) MWF

112. Third-Year Spanish — Continuation of 111.
3 units, Win (Staff) MWF 9 or 10

112B. Third-Year Spanish—Continuation of 111B. Especially designed for bilingual students.
3 units, Win (Staff) MWF

113. Third-Year Spanish — Continuation of 112.
3 units, Spr (Staff) MWF 9–10

113B. Third-Year Spanish—Continuation of 112B. Especially designed for bilingual students.
3 units, Spr (Staff) MW 10

135. Spanish Cultural Readings—The geography, history, art and music of Spain. Prerequisite: 23 or equivalent.
3 to 5 units, Spr (Benmayor) given 1975–76

138. Spanish-American Cultural Readings—Prerequisite: 23 or equivalent.
3 to 5 units, Aut (Staff) MWF 1:15

140. Introduction to Hispanic Literature—An introduction to literary texts and to the analysis of genre.
3 to 5 units

151. Selected Works of Spanish Literature I—Readings of poetry, drama, and novels of the Golden Age. Prerequisite: 23 or equivalent.
3 to 5 units, Spr (Ball)

152. Selected Works of Spanish Literature II—Readings of poetry, drama, and novels of the 19th and 20th centuries. Prerequisite: 23 or equivalent.
3 to 5 units, Spr (Valadez) given 1975–76

161. Selected Works of Spanish American Literature I—Prerequisite: 23 or equivalent.
3 to 5 units, Spr (Gamboa)

162. Selected Works of Spanish American Literature II—Prerequisite: 23 or equivalent.
3 to 5 units, Spr (Gamboa) given 1975–76

4 units, Sum (Staff)

COURSES NUMBERED 200 THROUGH 299 ARE COURSES IN LANGUAGE, LITERATURE AND CIVILIZATION OPEN TO ADVANCED UNDERGRADUATE AND GRADUATE STUDENTS

3 units, Aut (Ball) TTh 1:15
202. Advanced Grammar and Composition II—Analysis of structural patterns. Prerequisite: 201 with grade of B or equivalent.

3 units, Win (Gamboa)

203. Advanced Grammar and Composition III—Prerequisite: 202 with grade of B or equivalent.

3 units, Spr (Gamboa)


3 units, Spr (Petersen) TTh 10

212. History of the Spanish Language.

3 units, Win (Petersen)

216. Bilingualism in the Chicano Community—(Same as Linguistics 146.)

3 units, Spr (Hernández) TTh 12:30

217. Areal and Social Dialectology—(Same as Linguistics 249.)

4 units, Aut (Hernández) MW 11-12:50

221. The World as Seen through Travel Literature—(See under General Courses, Spanish 121.)

3 to 5 units, Aut, Win, Spr (Hilton)

222. Europe and the World—(See under General Courses, Spanish 122.)

3 to 5 units, Aut, Win, Spr (Hilton)

223. The Civilization of Spain, Portugal, and Latin America—(See under General Courses, Spanish 123.)

3 to 5 units, Aut, Win, Spr (Hilton)


3 to 5 units, Aut, Win (Staff)

230. Spanish Literature I—Survey of medieval literature, from its origins to 1500. Open to majors in Medieval Studies.

3 to 5 units, Win (Benmayor) given 1975–76

231. Spanish Literature IA—Medieval poetry: the Spanish narrative and lyric traditions, from 1040 to 1500. Open to majors in Medieval Studies.

3 to 5 units, Aut (Benmayor)

232. Spanish Literature IB — Medieval prose: historical, didactic and fictional composition, including early Renaissance fiction, from 1250 to 1550.

3 to 5 units, Win (Benmayor)


3 to 5 units, Win (Ball)

241. Spanish Literature IIA—Golden Age poetry: from Garcilaso to Quevedo.

3 to 5 units, Spr (Ball) given 1975–76

242. Spanish Literature IIB—Golden Age drama: from Gil Vicente to Calderón.

3 to 5 units, Win (Benmayor) given 1975–76

243. Spanish Literature IIC—Golden Age prose: from Fernando Rojas to Gracián.

3 to 5 units

251. Spanish Literature III — Survey of Spanish literature from 1650 to 1898.

3 to 5 units, Aut (Valadez) given 1975–76


3 to 5 units


3 to 5 units, Aut (Gamboa)


3 to 5 units, Win (Gamboa)


3 to 5 units, Aut (Gamboa) given 1975–76


3 to 5 units, Win (Gamboa) given 1975–76


4 units, Aut (Franco) given 1975–76

272. Spanish Literature in a Social Context II—(Same as Comparative Literature and Modern Thought 272.) Modernism and traditionalism in the Generation of 1898 and in the works of Ortega y Gasset and Unamuno.

4 units, Win (Franco) given 1975–76

273. Spanish Literature in a Social Context III—(Same as Comparative Literature and
Modern Thought 273.) The artist and the people in the 1930's. The Romancero de la Guerra Civil.

4 units, Spr (Franco) given 1975–76

274. Latin-American Literature in a Social Context II.—(Same as Comparative Literature and Modern Thought 274.) Cultural nationalism: Indigenismo and Afro-Cubanismo.

4 units, Aut (Franco)


4 units, Aut (Franco)

276. Latin-American Literature in a Social Context III.—(Same as Comparative Literature and Modern Thought 276.) Art and social change: Problems of commitment from the Mexican to the Cuban Revolution.

4 units, Aut (Franco)

278. Chicano Literature.—(Same as English 62.) An intensive study of the emergence of a new literature.

4 units, Aut (Islas) MTTh 2:15

279. The Chicano Experience through Chicano Literature.

3 to 5 units, Aut (Valadez) given 1975–76

280. Creative Writing: A Workshop.

3 to 5 units, Win (Alegria)


3 to 5 units, Aut, Win (Valadez)

291. The Poem Itself—(Same as Portuguese and Comparative Literature 291.) A course on practical criticism based on the famous poems of Spain, Portugal, Brazil, and Spanish America. Students will be expected to write short papers on the texts discussed. Classroom debates as well as poetry readings will be encouraged. Reading knowledge of Spanish and/or Portuguese required.

3 to 5 units, Spr (Coelho)

292. The Theater of Garcia Lorca and His Contemporaries.

3 to 5 units, Spr (Valadez)

293, 294. Hispanic Poetry of the 20th Century.

3 to 5 units, Aut, Win (Gicovate) Th 2:15–4:05


3 to 5 units, Aut (Alegria)


3 to 5 units, Win (Alegria)

299. Individual Work—May be repeated for credit. Open only to majors in Spanish.

1 to 12 units, any quarter (Staff) by arrangement

COURSES NUMBERED 300 TO 399 ARE GRADUATE SEMINARS IN LITERATURE, LINGUISTICS AND CIVILIZATION. OPEN TO UNDERGRADUATES, WITH PERMISSION

300. Hispanic Bibliography—Bibliography and library research methods for the study of Spanish literature.

3 units, Aut (Benmayor) given 1975–76

301. Methods of Teaching Spanish.—(Same as Education 292.) See also Language Laboratory 215.

2 units, Aut (Petersen) Sum (Petersen) MTWThF 11

302. Historical Spanish Phonology.

3 units, Aut (Petersen), given 1975–76

303. Historical Spanish Morphology.

3 units, Win (Petersen) given 1975–76

308. Seminar on Literary Translation.

4 units, Win (Staff)

311. Practical Criticism.

4 units, Aut (Staff), given 1975–76

318, 319. Proseminar in Problems and Methods of Research in Hispanic Literature.

3 to 5 units, Aut, Win (Gicovate), given 1975–76

321. Critical Analysis of Selected Books—This seminar trains Graduate Students in research techniques and writing.

3 to 5 units, Aut, Win, Spr (Hilton)

328. Chicano Workshop for Graduate Students.

3 to 5 units, Aut (Franco, Staff)

331. Seminar on Narrative Poetry: The Spanish epic and ballad—Open to majors in
Spanish and Medieval Studies with permission of instructor.
3 to 5 units, Spr (Benmayor)

334. Seminar on the *Libro de Buen Amor* and the courtly love tradition—Open to majors in Spanish and Medieval Studies with permission of instructor.
3 to 5 units, Win (Ball)

339. Seminar on *La Celestina*—Open to majors in Spanish and Medieval Studies with permission of instructor.
3 to 5 units, Spr (Benmayor), given 1975–76

345. Seminar on Cervantes: *Don Quijote and the Theory of the Novel*—(Same as Comparative Literature 345.)
3 to 5 units, Spr (Ball), given 1975–76

347. Seminar on Baroque Poetics: Imitation and deconstruction in the lyric poetry of Gongora—(Same as Comparative Literature 347.) Readings include 17th- and 20th-century theories of imitation and parody, as well as poems by Donne, Tasso, Marino, and Théophile de Viau. Reading knowledge of Spanish required.
3 to 5 units, Aut (Ball)

3 to 5 units, Spr (Ball)

3 to 5 units, Win (Valadez), given 1975–76

354. Comparative Seminar on Galdós, Eça de Queirós, and Machado de Assis—(Same as Comparative Literature 354.)
3 to 5 units

358. Graduate Seminar in Hispanic Literature: Garcilaso and San Juan de la Cruz.
3 to 5 units, Spr (Gicovate) Th 2:15–4:05

3 to 5 units, Spr (Gicovate)

361. Seminar on Sor Juana Inés de la Cruz.
3 to 5 units, Aut (Gamboa)

374. Seminar on Spanish-American Modernismo.
3 to 5 units, Win (Gamboa) given 1975–76

3 to 5 units, Aut (Alegria)

3 to 5 units, Win, Spr (Franco) given 1975–76

389. The Shorter Narrative—(Same as Comparative Literature 389.) A seminar on critical approaches to the shorter narrative with special reference to Spanish-American writers.
3 to 5 units, Win (Franco)

399. 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

**PORTUGUESE COURSES**

**FIRST- AND SECOND-YEAR**

1. First-Year Portuguese.
5 units, Aut (Staff) MWThF 1:15, plus additional work in the Language Laboratory

2. First-Year Portuguese—Continuation of First-Year Portuguese 1.
5 units, Win (Staff) MWThF 1:15, plus additional work in the Language Laboratory

3. First-Year Portuguese — Continuation of First-Year Portuguese 2.
5 units, Spr (Staff) MWThF 1:15, plus additional work in the Language Laboratory

9. Portuguese for Students of Spanish — Accelerated course for beginners with advanced knowledge of Spanish. Designed to give students of Spanish a reading knowledge of Portuguese for research purposes.
3 to 5 units (Coelho)

15. Intensive First-Year Portuguese—Equivalent to 1, 2, and 3 combined. Enrollment limited. Consent of instructor necessary.
15 units, Sum (Staff) MTWThF 8:00–9:30 and 10:30–12:00
22. Second-Year Portuguese—Prerequisite: First-Year Portuguese 3.
   3 units, Aut (Staff) MWF 12
   3 units, Win (Staff) MWF 12
99. Individual Reading — Enrollment only by special permission. Prerequisite: 23.
   1 to 5 units, any quarter (Staff) by arrangement
131. Selected Works of Portuguese Literature.
   3 to 5 units
132. Selected Works of Brazilian Literature.
   3 to 5 units

ADVANCED UNDERGRADUATE AND GRADUATE
181. Advanced Portuguese.
   3 units, Aut (Staff) MWF 1:15
182. Advanced Portuguese — Continuation of 181.
   3 units, Win (Coelho) MW 2:15
   3 to 5 units, Spr (Petersen)
230. Portuguese Literature I—Survey of literary trends and authors of Portuguese Literature.
   3 to 5 units (Coelho)
240. Portuguese Literature II—Survey of literary trends and authors of Portuguese literature.
   3 to 5 units (Coelho)
250. Brazilian Literature I—Survey of literary trends and authors of Brazilian literature.
   3 to 5 units, Aut (Coelho)
260. Brazilian Literature II—Survey of literary trends and authors of Brazilian literature.
   3 to 5 units, Win (Coelho)
291. The Poem Itself—(Same as Spanish and Comparative Literature 291.) A course on practical criticism based on the famous poems of Spain, Portugal, Brazil, and Spanish America. Students will be expected to write short papers on the texts discussed. Classroom debates as well as poetry read-
ings will be encouraged. Reading knowledge of Spanish and/or Portuguese required.
   3 to 5 units, Spr (Coelho)
295. Introduction to the Lyrical Poetry of Camões—Study of the most significant lyrical poems of Camões, with emphasis on the Sonnets.
   3 to 5 units (Coelho)
299. Individual Work—May be repeated for credit.
   1 to 12 units, any quarter (Staff) by arrangement
302. History of the Portuguese Language.
   3 to 5 units, Spr (Petersen) given 1975–76
354. Comparative Seminar on Galdós, Eça de Queiros, and Machado de Assis—(Same as Spanish and Comparative Literature 354.)
   3 to 5 units, Spr (Franco, Coelho)
356. Seminar on Fernando de Pessoa—A study of the poetry of Fernando de Pessoa, as well as the poems of his “heterónimos” Alberto Caeiro, Ricardo Reis, and Alvaro de Campos.
   3 to 5 units (Coelho)
360. Seminar on Brazilian Modernism: Carlos Drummond de Andrade and the modern poetry of Brazil—A critical analysis of the main currents of Brazilian modern lyric through a detailed study of Drummond’s poetics. Reading knowledge of Portuguese required.
   3 to 5 units, Spr (Coelho) given 1975–76
368. The Luso-Brazilian Short Story—A seminar on the shorter narrative of Portugal and Brazil with special emphasis on modern and contemporary writers. Reading knowledge of Portuguese required.
   3 to 5 units, Spr (Coelho) given 1975–76
399. Individual Work—Exclusively for graduate students in Portuguese working on thesis or engaged in special work.
   1 to 12 units, any quarter (Coelho) by arrangement

STATISTICS
Emeritus: Quinn McNemar (Professor)
Chairman: Ingram Olkin
Professors: Theodore W. Anderson (on leave 1974–75), Herman Chernoff (on leave
Offerings and Facilities

The Department's goals are to acquaint students with the role played in science and technology by probabilistic and statistical ideas and methods, to provide instruction in the theory and application of techniques that have been found to be commonly useful, and to train research workers in probability and statistics. There are courses for general students as well as for those who plan careers in statistics in government, business, industry, and teaching.

The requirements for a degree in statistics are flexible, depending on the needs and interests of the students. Some students may be interested in the theory of statistics and/or probability, whereas other students may wish to apply statistical and probabilistic methods to a substantive area. The Department has long recognized the relation of statistical theory to applications. It has fostered this by encouraging a liaison with other departments in the form of joint faculty appointments: Economics (T. W. Anderson), Education (I. Olkin, R. Sitgreaves, H. Solomon, P. Suppes), Electrical Engineering (T. Cover), Family, Community and Preventive Medicine (B. W. Brown, B. Efron, R. G. Miller, L. E. Moses), Geology (P. Switzer), Operations Research (G. J. Lieberman). The research activities of the Department reflect an interest in both applied and theoretical statistics and probability. The courses themselves generally tend to be theoretical. However, there are two practicum workshops, in biology-medicine and behavioral sciences, in which graduate students are faced with actual consultations.

In addition to courses for statistics majors at the undergraduate or graduate level, the Department offers a number of courses designed for users in other departments. These tend to emphasize the application of statistical techniques rather than a theoretical development.

A candidate considering graduate work in statistics may be interested in the brochure "Careers in Statistics," which is available upon request from the American Statistical Association, 806 15th St., N.W., Washington, D.C. 20005, or from the Department. A mathematical background at the level of advanced calculus or mathematical analysis is essential; a year of probability and statistics (at the level of Statistics 116, 119, 120) is needed. The Department offers a combination course 119–120 during the Summer Quarter; students who have not had this background are advised to try to make up the deficiency during the summer. However, promising students may remove the deficiency during the first year.

The Department of Statistics is located in its own building. Space for Ph.D. graduate students is provided adjacent to faculty offices.

Computer facilities are available at the Center for Information Processing, which maintains an IBM 360/67 computing system with high-speed disks for on-line storage of user's programs and data. For use in research and teaching, the Department maintains a terminal unit, a Hewlett-Packard 9810A computer, and a number of smaller computers.

The Department has approximately 10–15 graduate fellowships and assistantships for incoming doctoral students. It is advantageous for students who are able to obtain fellowships from other sources to do so. The Master's degree program is normally a full one-year program. The doctoral program is normally a four-year program—three years of course work and one year for the dissertation. However, it is advisable for the student to become involved in research projects early in the program.

Programs of Study

Bachelor of Science in Mathematical Sciences

The Statistics Department participates with the Departments of Mathematics, Com-
puter Science, and Operations Research in a program leading to the degree of Bachelor of Science in Mathematical Sciences. See Program in Mathematical Sciences in this bulletin.

**BACHELOR OF SCIENCE**

The following Departmental requirements are in addition to the University’s basic requirements for the Bachelor’s degree:

1. Mathematics 45 or equivalent, and Mathematics 113.
2. Computer Science 106.
3. Statistics 116, 119, 120, and four additional courses chosen from offerings in the Statistics Department (24 units). Students can receive credit toward fulfilling this requirement for, at most, one of the following courses: Statistics 40, 50, 60, 70, or 110.
4. Four additional courses chosen from offerings in the Statistics Department or from authorized courses in other departments.

**MASTER OF SCIENCE**

The Department requires that the student take 45 units of work from offerings in the Statistics Department or from authorized courses in other departments. If advanced statistics courses are included in the program, the total number of units may be reduced to 40. A thesis is not required.

Each student will normally fulfill the following requirements for the Master of Science degree:

2. Mathematics 113 and Computer Science 106. Substitutions of other courses in Mathematics and Computer Science may be made with consent of the adviser.
3. Three additional courses from offerings in the Statistics Department.
4. Additional units to complete the requirements chosen from offerings in the Statistics Department or from authorized courses in other departments.

Students who are interested in mathematical statistics should concentrate on more advanced courses in the Department.

Students interested in operations research will normally be interested in the application of quantitative techniques to business and industrial technology. They may take 136, 180, 207, 240, 250, 251, 252, 257, 355, 358, 359 within the Department, as well as authorized courses from other departments.

Students interested in economics may easily relate courses in economics with statistics courses. They may take Statistics 136, 150, 180, 206, 207, 221, 222, 223 and 240 within the Department.

Students interested in sociology, political science, or communications may take 140, 150, 160, 161, 162, 180, 203, 204, 205, 206, 208, 209, 221, 222, 223, 257.

Students interested in computer science may easily arrange for a Master’s degree in Statistics.

In general, combinations of courses may be arranged to suit particular interests in most fields.

A 2.75 grade point average will be required for all Statistics courses which are taken for a letter grade toward an M.S. degree, and all Statistics courses required for the M.S. degree (116, 217, 218, 219, 220, and 3 additional courses) which are offered for letter grades must be taken for letter grades.

**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.

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. Mathematics. Mathematics 205A and 206A (or equivalent) and one of the following alternatives: (a) two 200-level quarter courses in Mathematics, or (b) two doctoral level quarter courses in Mathematics, Computer Science or Operations Research together with demonstrated competence in topology and modern algebra as indicated by a grade of B or better in graduate or advanced undergraduate courses in these subjects.
2. **Probability and statistics.** Statistics 221, 230A,B,C, 236A,B,C. These courses provide familiarity with the mathematical theory of probability and the major divisions of statistical theory. In addition, a Ph.D. candidate must offer at least six quarter courses from the advanced courses offered in specialized fields such as Decision Theory, Sequential Analysis, Large Sample Theory, Multivariate Analysis, Non-parametric Inference, Time Series, Robust Estimation, Geometric Probability, Stochastic Processes. Other advanced topics may be offered with the consent of the adviser. Normally students should consider completing three to four of the basic advanced topic courses.

3. **Examinations.** Two written examinations in statistics—an elementary examination based on Statistics 116, 217, 218, 219, 220, and an advanced examination based on Statistics 230A,B,C and 236A,B,C. These tests are intended to assess the student's problem-solving ability and mathematical ingenuity. As such they are designed to serve as prognostic tests of the student's chances of success in the program.

4. **Experience.** All students working for the Ph.D. are required as a part of their program to obtain experience including any or all of: research, consulting, teaching assistance. These duties are deliberately kept light enough to permit full-time study.

**Doctor of Philosophy Minor**—The Statistics Department will devise individual Ph.D. minor programs, but the department urges all graduate students in other fields who wish to have a subspecialty in Statistics to study for an M.S. degree instead. The unit requirement for an M.S. degree is 40-45 units, depending on the degree of difficulty of the courses, whereas the number of units required for a minor averages around 30. This difference of 10-15 units can be made up by the student including in his M.S. program courses from his or her own field which are related to Statistics or applications of Statistics.

**FELLOWSHIPS AND ASSISTANTSHIPS**

A variety of fellowships and assistantships are available for doctoral candidates. The duties are variable and may include any or all of, grading papers, teaching sections of undergraduate courses, research and computation assistance to investigators. All applicants for financial assistance are required to take the Aptitude Test and the Advanced Test in Mathematics of the Graduate Record Examination. For details concerning this test see the *Information Bulletin*. Overseas applicants, who may not receive the *Information Bulletin* promptly, should write directly to the Educational Testing Service, 20 Nassau Street, Princeton, New Jersey 08540.

**A. Introductory Courses**

Introductory courses for general students with an interest in the problems of descriptive statistics and statistical inference are: Statistics 10, 40, 50, 60, 61, 62, 70, 80. These courses have no mathematical prerequisites; they satisfy the Natural Science, Mathematics and Technology distribution requirement. Statistics 10 is designed to familiarize the student with the general ideas of descriptive and inferential statistics as used in daily life, e.g., newspaper and magazine reports, polls, etc. It is a terminal course and does not serve as a prerequisite for further work. Statistics 40 covers discrete probability theory and its applications in statistics. Statistics 50 studies the theory of making decisions in the face of uncertainty. The sequence 60, 61, 62 emphasizes mainly the techniques and methods of statistical inference. Statistics 70 is designed for students interested in biological and medical applications of statistics. Statistics 80 is designed to provide some guidance in the use and meaning of some of the statistical packages.

The courses 116, 119–120 (219–220), 217–218 are introductory but have a calculus prerequisite. Statistics 110 covers the most important techniques used in the analysis of experimental data in engineering and science. Statistics 116 provides a general introduction to the theory of probability. It may be followed by 119 and 120 (219, 220), which deal with statistical theory, or by 217 and 218, which deal with stochastic processes. The sequence 116, 119, 120 is a basic one-year course in mathematical statistics; the sequence 116, 217, 218 is a basic one-year course in probability theory.

10. **Basics of Descriptive and Inferential Statistics**—This course is designed for students who wish to gain familiarity with statistical ideas. The emphasis will be on descriptive measures such as mean, median,
mode, variance, and on computational techniques and graphic methods for representing data. The interpretation of examples of data which occur in daily life, e.g., in newspapers, magazines, polls, etc., will be stressed. This course is a terminal course and is not acceptable as a prerequisite for later courses.

4 units, Aut (Staff) MWF 1:15

40. Introduction to Probability and Its Applications — Designed as a precalculus course for the non-mathematical student. Emphasis is on the use of probability in applied problems. Basic probability theory, random phenomena, special distributions, multivariate distributions, laws of large numbers, random walks, Markov chains. Applications drawn from the social, behavioral, physical, biological sciences. (Graduate students enroll in 140.)

3 units, Aut (Staff) MWF 10

50. Elementary Decision Theory — An introduction to decision-making in the face of uncertainty using statistical decision theory. This course is especially designed as an introduction to probability, utilities and risks, descriptive and inferential statistics for non-statistics majors. Emphasis will be placed on the evaluation of alternative courses of action facing the industrialist, administrator, and layman. (Graduate students enroll in 150.)

5 units, Aut (Sitgreaves) MWF 9:00-10:50

60. Introduction to Statistical Methods I—Especially designed as a nonmathematical study of statistical methods used in the social sciences and other disciplines. Organization of data and methods of summarization, including averages and measures of variability and association. Statistical inference based on a brief introduction to probability theory, including tests of hypotheses, estimation, and confidence intervals. (Graduate students enroll in 160.)

5 units, Aut (Sager) MTWThF 2:15

61, 62. Introduction to Statistical Methods II, III — This two-quarter sequence is planned as a continuation of Statistics 60 and will treat in detail the rationale and application of the most useful statistical methods, tests of significance, estimation of parameters, and analysis of data. Chi-square tests, the analysis of variance, least squares methods in regression, correlation, nonparametric methods, sample surveys, elementary design of experiments. Prerequisite: Statistics 60 or consent of instructor. (Graduate students enroll in 161, 162.)

61. 4 units, Win (Sager) MTWF 2:15

62. 4 units, Spr (Sager) MWF 2:15

70. Biostatistics—(Enroll in Family, Community and Preventive Medicine 202.) Introduction to statistical reasoning, with applications to research in biology and medicine. Estimation and significance testing; frequency tables; correlation; analysis of variance; retrospective and prospective studies; clinical trials. Prerequisite: high school algebra.

3 units, Aut (Brown) MTW 1:15-2:05

104. Sampling from Human Populations—For undergraduates. Lectures same as 204.

3 units, Spr (Staff) T 10-12 plus Th 10

110. Statistical Methods in Engineering and the Physical Sciences—Designed as a first course for the study of the most important statistical techniques commonly used by engineers and physical scientists, with the use of each technique illustrated by examples drawn from these fields. Provides a thorough grounding in the necessary fundamentals of probability theory required for an understanding of statistics. Statistical decision-making as approached from the viewpoint of designing and analyzing experiments. Point and interval estimation, tests of hypothesis, nonparametric methods, curve fitting by least squares, analysis of variance and elementary experimental design.

4 units, Aut (Staff) TTh 10 and MW 4:15

116. Theory of Probability — Probability spaces as models for phenomena with statistical regularity. Discrete spaces (e.g., binomial, hypergeometric, Poisson) and combinatorics. Continuous spaces (e.g., normal, exponential) and densities. Random variables, expectation, independence, conditional probability. Distribution theory: standard probability laws and transformation of variables techniques. Introduction to the Laws of Large Numbers and Central Limit
Theorem. Examples from genetics, quality control, traffic situations, gambling, and the social sciences. Prerequisite: Mathematics 44 or equivalent.

4 units, Aut (Staff) MTWF 10
Win (Staff) MTWF 10
Spr (Staff) MTWF 9
Sum (——) MTWThF 11

116E. Theory of Probability—A course similar to 116 designed especially for engineering students. Prerequisite: Mathematics 45.

3 units, Aut (Staff) MWF 11


4 units, given 1975–76

119, 120. Statistical Inference — Designed as a first course in the theory of mathematical statistics. Modern statistical procedures are derived from a mathematical framework, with the use of each technique illustrated with practical examples. Review of probability theory, statistical inference, decision theory; point and interval estimation, tests of hypotheses; Neyman-Pearson theory, Bayesian analysis, large sample theory, non-parametric methods, sequential analysis, least squares methods in regression, correlation, elementary analysis of variance and design of experiments. Prerequisite: 116. (Graduate students enroll in 219, 220.)

119. 4 units, Win (Staff) MWF 9
120. 4 units, Spr (Staff) MWF 9
119–120. 8 units, Sum (Haley) MTWThF 8:00–9:50

140. Introduction to Probability and Its Applications — For graduate students. Lectures same as 40.

3 units, Aut (Staff) MWF 10
Sum (——) by arrangement

150. Elementary Decision Theory — For graduate students. Lectures same as 50.

5 units, Aut (Sitgreaves) MWF 9:00–10:50
Sum (——) by arrangement

152. Introduction to Operations Research I —(Enroll in Operations Research 152.) Introduction to deterministic models in operations research. Linear, non-linear, and dynamic programming. Network analysis, inventory theory, simplex method, transportation problem, dual theorem, convex programming, integer programming, structure of deterministic dynamic programming problems, minimax theorem. Matrix notation will be introduced. Not open to graduate students. See 252. Prerequisite: Mathematics 43.

3 units, Win (Veinott) TTh 4:15–5:30


3 units, Spr (Jacobs) TTh 4:15–5:30

160. Introduction to Statistical Methods I —For graduate students. Lectures same as 60.

4 units, Aut (Sager) MTWThF 2:15
Spr (Calfee) MTWThF 1:15
Sum (——) by arrangement

161, 162. Introduction to Statistical Methods II, III — For graduate students. Lectures same as 61, 62.

161. 4 units, Win (Sager) MTWF 2:15
162. 4 units, Spr (Sager) MWF 2:15

180. Statistical Computer Packages—It is customary for users of data to apply one of several statistical packages to analyze his data. Special attention will be paid to BMD (biomedical computer programs) and SPSS (Statistical Packages for Social Scientists). Some time will be spent on the implementation of packages. Most emphasis will be on the statistical implications of the methods applied. Some attention will be given to bugs and to numerical analysis problems. Preferably for current or prospective users of packages. Prerequisite: a first course in Statistics or consent of instructor.

3 units, Aut (Thisted) TTh 9

199. Independent Study — For undergraduates.

(Staff) by arrangement

B. COURSES PRIMARILY FOR STUDENTS IN OTHER DEPARTMENTS AND FOR MASTER’S CANDIDATES

Courses in this category have been designed for particular use in applications,
either by professional statisticians or by researchers in other fields.

200. Statistics for Non-Statisticians — Will discuss statistical methods of wide use in data analysis: linear models, correlation and regression, maximum likelihood estimation, analysis of variance, t and F tests, discriminant analysis, principal components, nonparametric tests, chi-squared and binomial regression models. The emphasis will be on a broad understanding of statistical methodology rather than on deep theoretical analysis or the details of specific applied areas (though some real applications will be used for illustration purposes). Prerequisites: a good understanding of matrix algebra at the level of Mathematics 113, multiple integration at the level of Mathematics 46, and elementary probability theory at the level of Statistics 116.

3 units, Aut (Staff) MWF 9

203. Introduction to Analysis of Variance and Design — The analysis of variance (“ANOVA”) is the most widely used statistical technique in both the sciences and social sciences. Its purview includes the proper designs and interpretation of experiments as well as the understanding of observational data. Topics will include regression, t tests, F tests, one- and two-way factorial experiments, orthogonality, matching, proper error estimates. Prerequisites: a basic course in statistics (Statistics 62, 110, or 120).

3 units, Aut (Moses) MWF 1:15

204. Sampling from Human Populations—An introduction to the theory of sampling from finite populations. Simple random sampling, stratified sampling, cluster sampling, efficiency of various designs, with particular emphasis on applications. Projects include carrying out and analyzing an actual survey. Prerequisites: a basic course in statistics (Statistics 62, 110, or 120). (Undergraduates enroll in 104.)

3 units, Spr (Staff) T 10–12 plus Th 10
Sum (——) MTWTh 9

205. Introduction to Nonparametric Statistics—Nonparametric methods are designed to deal with “messy” data that are difficult to analyze with the standard parametric models. They have proved particularly useful in biology, psychology, sociology, etc. Presentation will include nonparametric analogs of the one- and two-sample t tests and the analysis of variance: the sign test, mediantest, Wilcoxon’s tests, Kruskal-Wallis test, and permutation methods in general. Goodness-of-fit tests, including chi-square, contingency tables, and Kolmogorov-Smirnov methods will also be discussed. Prerequisites: a basic course in statistics (Statistics 62, 110, 120, or 200). (Concurrent registration in 120 is permitted.)

3 units, Win (Staff) MWF 10

206. Applied Multivariate Analysis—Multivariate methods are necessary when several correlated measurements are made on each experimental unit. These methods are much used in education, psychology, sociology, genetics, and other areas. Topics: bivariate and multivariate normal distributions, quadratic forms, Hotelling’s $T^2$ and other hypothesis tests, factor analysis, and multiple regression. Prerequisites: A basic course in statistics (Statistics 62, 110, 120, or 200). (Concurrent registration in 120 is permitted.)

3 units, Spr (Staff) MWF 2

207. Introduction to Time Series Analysis—Time series models are used extensively in economics, engineering, physics, geology, and other sciences. Topics will include trend fitting, autoregressive schemes, moving average models, periodograms, second order stationary processes, and spectral analysis. Prerequisites: Stat 116 and a basic course in statistics (Statistics 62, 110, 120, or 200). (Concurrent registration in 120 is permitted.)

3 units, Spr (Staff) MWF 11

208. Mathematical Models in Behavioral Sciences: Psychometrics — Examination of mathematical models in factor analysis, mental testing, latent structure analysis, scaling theory, and related topics. Prerequisite: Statistics 120.

3 units, Win (Solomon) MWF 1:15

209. Mathematical Models in Behavioral Sciences: Sociometrics — Examination of mathematical models in social and psychological processes; equilibrium states, Poisson processes, and related topics. Prerequisite: Statistics 120.

3 units, given 1975–76

C. COURSES PRIMARILY INTENDED FOR MASTER’S DEGREE STUDENTS

The core courses for the Master’s degree program are:

116, 217, 218, 219, 220.
The following are courses of a theoretical nature; other courses that are more applied are listed in Category B.

136. Introduction to the Theory of Games—Game trees, strategies, equilibrium points; two-person zero-sum games, matrix games, min-max solutions, infinite games, games of timing (duels); non-zero-sum games, the Nash solution; n-person games, the Shapley value. Pre- or corequisites: 116 and Mathematics 113.

3 units, Aut (Cover) MWF 3:15


217. 3 units, Win (Mittal) MWF 2:15
218. 3 units, Win (Staff) MWF 2:15
Spr (Staff) MWF 3:15

217–218. 6 units, Sum (——) MTWTh 10:00–11:50

219, 220. Statistical Inference—For graduate students. Lectures same as 119, 120.

219. 3 units, Win (Staff) MWF 9
220. 3 units, Spr (Staff) MWF 9

219–220. 6 units, Sum (Haley) MTWThF 8:00–9:50

221. Analysis of Variance I—Theory of general linear models for the normal distribution. Study of maximum likelihood estimates and their associated tests and confidence intervals. Analysis of variance for standard statistical designs (e.g., one-way and two-way classifications, Latin square). Techniques of simultaneous inference (e.g., Tukey and Scheffé). Analysis of covariance. Prerequisite: 120 and knowledge of matrix algebra, or consent of instructor.

3 units, Win (Staff) MWF 10

222. Analysis of Variance II—Random effects and mixed model analysis of variance. Permutation tests and randomization basis of inference. Study of the effects on statistical inference of departures from the assumptions of normality, equal variances, and independence. Prerequisite: 221.

3 units, Spr (Staff) MWF 10

223. Data Analysis—Statistical analysis of actual case material. Illustrative topics include: bioassay, mortality studies, multidimensional contingency tables, multiple regression, transformations combining independent tests and estimates. Prerequisite: 222 or consent of instructor.

3 units, given 1975–76


3 units, Spr (Iglehart) TTh 4:15–5:30

252. Operations Research—(Enroll in Operations Research 252.) For graduate students who have not had the equivalent of Operations Research 152 and 153. Prerequisites: Calculus and Statistics 40 or 110 or 116. May be taken concurrently.

4 units, Aut (Staff) MW 3:15–5:05
Win (Jacobs) TTh 4:15–6:05

257. Simulation—(Enroll in Operations Research 257.) Random number generators, discrete-event simulations, simulation languages, statistical analysis of the output of simulations, and applications to stochastic models in operations research.

3 units, Spr (——) TTh 3:15–5:30

262A,B. Advanced Statistical Analysis in Educational Research—Applied multivariate analysis including multiple regression, canonical analysis, discriminant analysis, factor analysis, cluster analysis. Prerequisites: Statistics 220 or equivalent and consent of instructor. (Enroll in Education 351A,B.)

262A. 4 units, Win (Olkin) MWF 11:00–12:30

262B. 4 units, given 1975–76

299. Literature of Statistics—Intensive study of literature of any special topic, usu-
ally culminating in the preparation and presentation of reports upon topics studied.

*Any quarter (Staff) by arrangement*

**D. COURSES PRIMARILY DESIGNED FOR DOCTORAL STUDENTS**

The 230A,B,C and 236A,B,C sequences comprise the fundamental sequence which serves as a general introduction to and prerequisite for further work. Subsequent courses are special topics courses and delve more deeply into these areas.


- **230A.** 3 units, Aut (Diaconis) MWF 1:15
- **230B.** 3 units, Win (Staff) MWF 1:15
- **230C.** 3 units, Spr (Staff) MWF 1:15

**236A,B,C. Mathematical Statistics—A survey of classical and modern statistics from an advanced mathematical point of view. Probability, games and decision theory, estimation, testing hypotheses, confidence intervals, Neyman-Pearson theory, large sample theory, nonparametric inference, sequential analysis, design of experiments. Prerequisites: 220; completion of or concurrent registration in Mathematics 205A.**

- **236A.** 3 units, Aut (Efron) MWF 11
- **236B.** 3 units, Win (Staff) MWF 11
- **236C.** 3 units, Spr (Staff) MWF 11

**240. Linear Programming—(Enroll in Operations Research 240.) This course will survey linear programming, emphasizing standard model formulation, fundamental theorems, variations of the simplex method and parametric programming. Corequisite: Mathematics 113.**

- **3 units, Aut (Hillier) TTh 1:15-2:30**
- **Sum (——) TTh 1:15-3:00**

**250. Deterministic Models in Operations Research—(Enroll in Operations Research 250.) Formulation, solution, and analysis of mathematical programming models in operations research, including those of integer programming, nonlinear programming, network flow theory, dynamic programming, and game theory. Prerequisite: Operations Research 240.**

- **3 units, Win (Cottle) TTh 4:15-5:30**

**260A,B,C. Workshop in Biostatistics — Applications of statistical techniques to current problems in medical science. Problems are often presented by medical faculty, and tentative or final statistical analyses are proposed and discussed by biostatistics faculty, graduate students, and visitors. Intended primarily for doctoral students in statistics. Enrollment for credits may involve extra reading or consulting and requires permission of the instructor.**

- **260A. 1 to 5 units, Aut (Brown, Miller) Th 1:15-3:05**
- **260B. 1 to 5 units, Win (Brown, Miller) Th 1:15-3:05**
- **260C. 1 to 5 units, Spr (Brown, Miller) Th 1:15-3:05**

**261A,B,C. Workshop in Behavioral Science Statistics—Practicum in consulting on behavioral science problems, emphasizing both the theoretical and practical aspects of the problem. A team of students will function as a consultant; they meet with consultee and try to arrive at a solution to the problem. This is then presented to the group. Open to doctoral students. Prerequisite: consent of instructor.**

- **261A. 2 to 3 units, Aut (Olkin) Th 12**
- **261B. 2 to 3 units, Win (Olkin) Th 12**
- **261C. 2 to 3 units, Spr (Sitgreaves) Th 12**

**314. Matrix Analysis and Inequalities — A study of various topics in matrix theory and inequalities having applications in computer science, operations research, and statistics. The subjects covered will be chosen from the following list: matrix factorizations, patterned matrices, determinants, pivot theory, special classes of matrices; linear inequalities, matrix inequalities, moment inequalities, stochastic inequalities, condition number inequalities, unification of certain types of inequalities, extremal problems; integrals and functional equations with matrix argument. Prerequisites: Mathematics 102 or 113, and approval of an instructor.**

- **3 units, Aut (Olkin) MWF 10**
324A,B,C. Multivariate Analysis — General theory of multivariate distributions; specific distributions: multivariate exponential distribution; multivariate normal distribution and related distributions such as the Wishart distribution and Hotelling's $T^2$. Statistical inference related to the multivariate normal distribution: tests for means, variances and covariances, multivariate analysis of variance, multiple regression, principal components, canonical correlations. General problems of classification and clustering of high-dimensional data. Discussion of estimation of the mean of the multivariate normal distribution from a decision-theoretic point of view. This course may differ depending on whether the approach uses coordinates or is coordinate-free. The third quarter will normally be devoted to special topics.

324A. 3 units, Aut (Staff) MWF 8:30–10:00

324B. 3 units, Win (Staff) MWF 8:30–10:00

324C. 3 units, Spr (Staff) MWF 2:15

326A,B. Sequential Analysis—The Wald sequential probability ratio test, operating characteristics and applications; Bayes sequential decision problems; asymptotic shapes; sequential design of experiments; special topics. General theory of optimal stopping with applications to sequential statistical decision problems.

326A. 3 units, Aut (Staff) TTh 11

326B. 3 units, Win (Staff) TTh 11

328A,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.

328A. 3 units, Aut (Staff) MWF 3:15

328B. 3 units, Win (Staff) MWF 3:15

330. Stochastic Processes — Topics in stochastic processes to be announced. Typical choices have included: Martingales, branching processes, extreme values and regular variation, weak convergence, Brownian motion, additive processes and regenerative phenomena. Prerequisites: 230A,B,C.

3 units, Spr (Staff) MWF 4:15


3 units, Aut (Staff) TTh 11:00–12:15

333. Robust Estimation — The concept of "robust" statistical procedures (i.e., procedures which continue to be effective when the parametric assumptions under which they are "optimal" are violated) will be developed with particular emphasis on the estimation of location for symmetric distributions. Examples from the recent literature will be treated in detail. Robustness in hypothesis testing will also be discussed. Prerequisites: 236A,B,C.

3 units, Win (Staff) TTh 11:00–12:15

336A,B. 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.

336A. 3 units, Aut (Staff) MWF 2:15

336B. 3 units, Win (Staff) MWF 2:15


343A. 3 units, Win (Staff) T 2:15–3:30; Th 3:15–4:30

343B. 3 units, Spr (Staff) T 2:15–3:30; Th 3:15–4:30

351A,B. Geometrical Probability and Applications—Distribution of points in Euclidean space, random lines in a plane and in space, coverage problems, packing problems, measure and density for sets of geometrical objects, integral geometry for functions of convex plane figures and surfaces; emphasis on breadth of the fields of application (for example, astronomy, atomic physics, biology,
crystallography, physical chemistry, sampling theory); unsolved problems.

351A. 3 units, Aut (Solomon) MWF 11
351B. 3 units, Win (Staff) MWF 11


3 units, Aut (Lieberman) TTh 1:15–2:30

358. Queueing Theory — (Enroll in Operations Research 358.) Structure of queueing processes, limit theorems for single and multiple server queues in light and heavy traffic. Emphasis will be on nonparametric assumptions and classical limit theorems. Prerequisite: 359.

3 units, Win (Staff) TTh 2:45–4:00


3 units, Spr (Iglehart) TTh 11:00–12:15


3 units, Win (Cover)

363. Statistical Complexity—(Same as Electrical Engineering 477.) Statistical complexity measures. Interaction of degrees of freedom, complexity of classification algorithms, and sample size. Kolmogorov complexity; Schnorr Martingale test for randomness. A goal of this course will be to consider and develop universal statistical tests. Prerequisite: Statistics 116.

3 units, Spr (Cover) TTh 11:00–12:15

378. Generation of Pseudo Random Numbers—The linear congruential generator is used to produce uniformly distributed pseudo random numbers. The joint distributions of pairs and of triples are studied. Multiple linear recursive generators. Efficient methods of producing non-uniform random numbers include the inversion method, rejection method, table methods and comparison methods. Special methods for the normal, gamma, beta, Poisson and binomial distributions are studied. Prerequisite: 217 or consent of instructor.

3 units, Spr (Staff) MWF 3:15

399. Research — Research work as distinguished from independent study of nonresearch character listed in 199 and 299.

Any quarter (Staff) by arrangement
SCHOOL OF LAW

Dean: Thomas Ehrlich
Professors: Marc A. Franklin, Lawrence M. Friedman, John Kaplan, John Henry Merryman, Robert L. Rabin, David Rosenhan
Associate Professors: Paul A. Brest, Victor H. Li
Lecturers: Inga Markovits, George Torzsay-Biber

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 professional degree in law (J.D.) constitutes an adequate preparation for the practice of law in any English-speaking jurisdiction. Graduate work leading to the degrees of Master of the Science of Law and Doctor of the Science of Law is also offered. (For full Law School Curriculum and Faculty see the School of Law Programs of Study.) The Law School is on a two-term academic calendar. Registration for the autumn term will be held on September 4, 1974, and classes for spring term will terminate on June 7, 1975.

COURSES

GRADUATE

The following courses are open to qualified graduate students of other departments of the University upon permission of the instructor:

235. Art and the Law — In this course we will consider selected problems at the intersection of law and the visual arts (painting, sculpture, and graphic art) including: the protection of national art treasures and the international traffic in them; art forgery and its control; the artist’s “droit de suite” and attempts to establish its equivalent in this country; legal relations between artists, dealers, museums, collectors, and auction houses; the work of “Volunteer Lawyers for the Arts” (a voluntary legal services organization); etc. Merryman and Elsen, Law and the Visual Arts (preliminary edition).
3 term units, Spr (Merryman)

243. China, Law and Society in the People’s Republic of—This course examines the questions: What norms of behavior do the Chinese leaders want the people to adopt? How are these norms articulated and communicated to the people? What means are used to get the people to follow these norms? What happens to those who refuse to follow? For all these questions, an effort is made to identify the ideological, cultural, and other factors which affect the choices made by the Chinese leaders. Attention is centered on the operation of the criminal process, the powers and practices of the police, the role of the neighborhood apparatus, and the influence of the Communist Party in legal work. Special emphasis is placed on comparing Chinese and Western legal concepts, institutions, and practices. Cohen, The Criminal Process in the People’s Republic of China, 1949–1963: An Introduction (1968) and mimeographed materials.
3 term units, Spr (Li)

291. International Law, Chinese Perspectives on—(Same as Political Science 147-L.) This course examines the traditional international law subjects using materials from the People’s Republic of China. The topics covered include the sources of international law, treaties, sovereignty, war, international organizations, settlement of international disputes, and international trade. Particular attention is paid to whether China’s different cultural, ideological, and economic background has led to a different understanding of an attitude toward international law and practice. The topics covered include the sources of international law, treaties, sovereignty, law of the sea, and trade. Most of these topics will be discussed in the context of U.S.-China relations.
3 term units, Spr (Li)

297. Justices Black and Frankfurter: Two Judicial Worlds — Law courses generally analyze judicial opinions in terms of their internal logic, doctrinal importance, and societal impact. This seminar attempts to broaden this perspective by examining se-
lected opinions of Justices Black and Frankfurter as consequences of the interplay between their personal experiences, their philosophies, the judicial milieu (briefs, precedent, seemingly unrelated cases awaiting decision, court blocks, etc.) and the societal milieu at the time the cases were decided. The historical perspective is sharpened by confining the discussion to a small number of cases while expanding the relevant reading to include manuscripts, biographies, and other extra-judicial materials. The emphasis throughout will be on obtaining an enhanced understanding of the process of judicial decision making. There will be no examination, but the course writing requirement will center on individual preparation of an opinion from briefs.

3 units, Aut (Danzig)

300. Education and Law—(Same as Education 300.) Addressed to major issues of educational policy in terms of their legal and social science aspects. Topics will include integration, decentralization and community control, the allocation of educational resources, federal involvement in education, control of expression and conduct in the schools, conflicts between parent and state over the child’s ideological and educational exposure, and the roles of private schools. A recurrent concern will be identifying the meanings of, and evaluating the methods of, achieving educational opportunity. Limited enrollment. Prerequisite: consent of instructor.

3 units, Aut (Levin, Brest) F 9:00–11:30

311. Law and Social Science—(Same as Sociology 181.) The purpose of this course is to broaden the approach to law by examining some major problems which law shares with other social sciences. Consideration will be given to definitions of law attempted by various social sciences, the impact of law on behavior of various kinds, the social forces which mold law, the influence of the legal system on the various actors within it and theoretical efforts to explain the relationship of law and society.

3 term units (Friedman) given 1975–76

307. Law in East and West Germany — (Same as German Studies 276 and Political Science 175.) The seminar will analyze the legal systems of East vs. West Germany with the purpose of ascertaining the typical ways in which a socialist state differs from a bourgeois state in the use of law as a means of social transformation. We will focus in particular on those areas of law which either directly confront the individual with state authority or require a ranking between state and individual interests: constitutional law, certain areas of administrative law, procedure, etc. The different functions of individual rights in these areas (protecting the individual against infringement by the state in the Federal Republic, educating and inducing the individual to contribute to socialist progress in the GDR) will be contrasted with the fairly similar functions of individual rights in horizontal relationships in both states, e.g., civil law, family law, etc.

3 units, Aut (I. Markovits)

323. Legal Systems of Western Europe and Latin America—The purpose of this course is to examine the traditions, attitudes, institutions and processes that are shared by the legal systems of major Western European and Latin American nations — the so-called civil law nations—and to understand some of the more important ways in which they differ from the Anglo-American common law. Cappelletti, Merryman, and Perillo, *The Italian Legal System: An Introduction* (1967) and Merryman, *The Civil Law Tradition* (paperback ed.).

3 term units, Aut (Merryman)

330. The Making of the Constitution—This seminar will be devoted to using primary and secondary historical materials, first, to gain an understanding of the thought of the framers of the Constitution and of the social milieu in which they worked, and then to seeing whether and how that understanding bears on some contemporary constitutional issues, including, for example, the reach of the first amendment, or the power of the executive vis-à-vis Congress. Required readings will include Bailyn, *Ideological Origins of the American Revolution*, and Wood, *Creation of the American Republic*.

3 units, Spr (Danzig)

336. Seminar in Psychology and Law — (Same as Psychology 252.) The implications of psychological research and theory for law and legal process will be explored. Issues to be examined include the notions of responsibility and intention, the reasonable man, reasonable doubt, and insanity; the implications of equity theory and the “just world” hypothesis for pretrial detention; group pro-
cesses and their effects on juries; stereotyping and arrest; witness reliability; introductory materials on the social psychology of institutions; the implications of dissonance theory for torts and bankruptcy.

2 term units, Aut (Diebold, Rosenhan)

341. Roman Law—Study of Roman law as it has developed from the time of Augustus to that of Justinian. Although the private law will be studied in its entirety, emphasis will be on those parts which are still operative in modern civil law systems and in international law. Legal institutions will be studied through actual problems drawn mainly from Justinian’s Digest and their solutions will be discussed in historical context. The main purpose of the course is to identify and study the fundamental principles of Roman law and, in addition, to provide a background for further study in jurisprudence, legal history, and comparative law. Roman text will be provided in English translation. Some knowledge of Latin is desirable but not required. A paper will be required.

3 term units, Spr (Torzsay-Biber)

NONPROFESSIONAL

The following nonprofessional courses, open to juniors and seniors, as well as to graduate students in other departments, may be counted toward the A.B. degree but not toward professional degrees in law.

104. Courts and the Legal Process — This course is designed for students who do not intend to undertake the professional study of law. Its purpose is to provide insight into how the law and legal institutions function as one important means of social control. The primary focus is on courts—a philosophical and functional study of their role and their relationships with other branches of government. Though not ignoring constitutional law, our main concern is with courts in their nonconstitutional role. We will explore this in a context relevant to communication: the law of defamation, privacy, government regulation of broadcasting, and free speech. Court opinions and readings provide the basis for class discussion.

5 units, Spr (Franklin)

107. The Criminal Law and the Criminal System—(Same as Political Science 174 and Sociology 157.) Exploration of the purposes and processes of the criminal law, with emphasis on the actual operation of the system, and the application of theory to contemporary problems. Topics will include the police, the trial, sentencing, corrections, and “non-victim” crimes. (Open to all undergraduate and graduate students.)

5 units, Spr (Kaplan)

110. The Administrative Process — This course has two principal objectives: (1) to develop an understanding of the role administrative agencies are currently playing in the resolution of major issues of socioeconomic conflict, and (2) to explore the inherent practical and theoretical limitations, if any, on the administrative process as a tool for implementing social change. The core of the course is an examination of the impact of various constituencies in shaping administrative policy in areas such as broadcasting, consumer protection, and conservation. In addition, special emphasis will be placed on the role of the courts in developing a body of administrative law.

4 units, Spr (Rabin)
The School of Medicine was established as a department of the University in 1908, when the Cooper Medical College, which had been operating in San Francisco, was transferred to Stanford. Until 1959 clinical teaching and some teaching of the basic medical sciences were carried out in San Francisco, while the remainder was conducted on the University campus near Palo Alto.

In 1953 the Trustees of the University determined that the School of Medicine should be consolidated on the University campus in new facilities. Following many months of planning and preparation, the development of a new program of medical education, and the construction of the Stanford Medical Center buildings for teaching, research and patient care activities, the School began its operation at Stanford in September 1959.

The purposes of the School of Medicine are to provide a basic education in medicine for students working toward the Doctor of Medicine degree, to offer advanced work in the basic sciences leading to the Doctor of Philosophy degree, and to conduct teaching and research programs to advance knowledge of the medical and related sciences and to apply that knowledge to problems of illness and health.

The curriculum offered students in the M.D. Program of the School of Medicine is an outgrowth of the Stanford Plan of Medical Education that was implemented at the time the Medical School moved from San Francisco to the University campus near Palo Alto. The goals of the Stanford Plan are:

1. To bring medical education into the University environment as a continuation of general education and to relate knowledge of the medical sciences to other fields of knowledge.
2. To provide all students with fundamental knowledge of the medical sciences, while simultaneously encouraging each student to develop as an individual in line with his abilities and interests.
3. To emphasize the unity of the medical sciences.
4. To promote in students awareness of the place of medicine in society, and of the patient and physician as members of society.
5. To produce practitioners of medicine who are trained in the scientific method, who acquire excellence in clinical skills and clinical judgment, and yet who maintain a humanistic approach to patients.
6. To encourage interested students toward academic medicine as a career.
7. To foster a graduate approach to medical education.

The School believes that the goals of the Stanford Plan of Medical Education are best achieved if each student can plan his or her curriculum within a flexible educational system in which the diversity of students' career goals and educational backgrounds is recognized. Accordingly, in 1968, curricular changes were introduced which provide each student with maximum flexibility in formulating an individualized curriculum that best takes into account the student's past experience and future career goals. Under this plan students need not take courses in areas in which they feel they already have adequate knowledge. In addition, students are encouraged to take advantage of curricular offerings on the University Campus as well as in the School of Medicine. The duration of the curriculum varies depending upon background and career goals. It may be as short as nine quarters for students who have already completed appropriate graduate work, to as many as eighteen quarters for students who include extensive research experience. Students interested in combined M.D.-Ph.D. programs must first apply for admission to the M.D. Program. Subsequent and separate application to a specific department is then required for candidacy for the Ph.D.

Students are encouraged to prepare for medical school with a thorough exposure to the basic natural sciences. This includes basic courses in physics, chemistry, and biology. Because of its importance to an understanding of medicine, course work in mathematics and the behavioral sciences is highly recommended. The general requirements for admission are in the Medical School Bulletin. For application materials write to: Chair-
man, Committee on Admission, Stanford University School of Medicine, Stanford, California 94305.

ALLIED MEDICAL SCIENCES

DIVISION OF PHYSICAL THERAPY

Emerita: Sarah Semans (Associate Professor)
Director: Helen Blood
Associate Professors: Lucille Daniels. Clinical: Catharine Graham
Assistant Professors: Helen Blood, Barbara E. Kent
Lecturers: Carolyn R. Houser, Linda Van Hoesen, Katharine B. Robertson, Katherine F. Shepard
Clinical Teaching Assistant: Elaine M. Hansen

OFFERINGS AND FACILITIES

The Division of Physical Therapy in the Stanford University School of Medicine offers a Master's degree curriculum for students entering the field of physical therapy. The program encompasses two academic years (6 quarters) and a summer internship between the two, and includes basic courses required for state licensure. Students must complete one of three specialty areas, Administration and Community Health, Curriculum Development and Instruction or Pediatric Physical Therapy, as well as research requirements.

Classes are held at the Stanford Medical Center, which houses physical therapy lecture, laboratory, seminar and research rooms and a library. Students have two- and three-week periods of directed clinical experience at Stanford Hospital and affiliated health facilities during the first year, and a full-time assignment during the summer quarter. The sequence of clinical periods provides students with the opportunity to move toward full utilization of their clinical skills in planning and administering treatment programs.

The curriculum is approved by the Council on Medical Education of the American Medical Association in collaboration with the American Physical Therapy Association.

ADMISSION

Requirements for admission are a Baccalaureate degree, completion of prerequisite courses, filing of an application including scores from the Aptitude Test of the Graduate Record Examination by January 15, and, upon request, a personal interview, and completion of supplemental admission tests and forms.

Students are admitted autumn quarter each year. Dates for registration and general information will be found in the Information Bulletin of the University.

TRAINEESHIPS, SCHOLARSHIPS, AND LOANS

The resources for traineeships and scholarships awarded by the Scholarship Committee of the Division of Physical Therapy are limited and vary from year to year.

The Marian Williams Memorial Scholarship is awarded each year by the Committee, and a few private agencies offer special scholarships for physical therapy students.

The Western States (including Hawaii and Alaska) without a physical therapy program provide part of the tuition of legal residents through WICHE (Western Interstate Commission for Higher Education).

The Stanford Information Bulletin lists the long-term loan policies of the University and the details of the National Defense Student Loan Program.

PREREQUISITES AND OTHER COURSES

Basic prerequisites are courses in biology, chemistry, human anatomy, human physiology, psychology (2), sociology, and statistics. Mathematics, physics, and courses in oral and written communication are highly recommended. Each student's academic background will be reviewed on an individual basis for admission.

As part of the physical therapy program, students will enroll in courses offered by other departments in the Medical School and other schools in the University. Electives related to the student's program may be selected primarily in the second year.

Graduate students from other depart-
ments may attend courses in the Division with the consent of the instructor.

COURSES

220. Human Motion and Therapeutic Procedures I—Functional anatomy; biomechanics of body motion, analysis and practice of therapeutic exercise procedures; tests for and evaluation of physical disability, prosthetics and orthotics, and basic medical lectures in pathology, medicine, surgery, and specialty areas, with emphasis on problems of patient care.
  4 to 6 units, Aut (Kent, Staff) MW 8:00–11:50; F 8:00–9:50

221. Human Motion and Therapeutic Procedures II—Continuation of 220.
  4 to 6 units, Win (Kent, Staff) MW 8:00–11:50; F 8:00–9:50

222. Human Motion and Therapeutic Procedures III—Continuation of 220, 221.
  3 to 5 units, Spr (Staff) MWF 8:00–10:50

225. Neuroanatomy and Physiology of Human Motion—Emphasis on the neuroanatomical and physiological basis for normal and abnormal movement as it relates to physical therapeutic procedures.
  3 units, Aut (Houser, Staff) TThF 10:00–11:50

226. Neurophysiological Basis of Human Motion I—Neurophysiology of the central control systems for movement; pre- and postnatal development of motor action; the assessment of neurological patients. Prerequisite: 225.
  5 units, Win (Houser) TTh 8:00–11:50; F 10:00–11:50

227. Neurophysiological Basis of Human Motion II—Analysis of treatment approaches for the neurological patient; assessment and program planning for patients with neuromuscular disabilities. Prerequisite: 226.
  4 units, Spr (Houser) TTh 8:00–11:50; F 10:00–11:50

230. Physical Agents—Analysis of the principles underlying the use of electrotherapy, massage, and hydrotherapy; practice of essential techniques.
  3 units, Aut (Robertson, Staff)
  MW 1:15–3:05

  3 units, Aut (Robertson) by arrangement

232. Clinical Electromyography—Clinical application of procedures and techniques.
  3 units, Win (Robertson) by arrangement

244. Directed Clinical Experience in Physical Therapy I—Students are assigned for a select period full time during a portion of the quarter to health care facilities for a clinical laboratory; includes ethics and selected basic skills.
  1 to 5 units, any quarter (Kent, Staff) by arrangement

245. Directed Clinical Experience in Physical Therapy II—Continuation of 254.
  1 to 5 units, any quarter (Kent, Staff) by arrangement

247. Internship in Physical Therapy—Students are assigned to treatment facilities for full-time clinical experience.
  1 to 9 units, any quarter (Kent, Staff) by arrangement

248. Advanced Internship in Physical Therapy—A practicum in an approved clinical facility planned by the student, adviser and preceptor.
  3 units, any quarter (Staff) by arrangement

250. Social and Psychological Aspects of Illness and Disability—Special problems related to reactions to illness and disability, patient-therapist relationships; emphasis on total needs of the patient as related to his unique life style. (Open to undergraduates with consent of instructor.)
  4 units, Spr (Shepard) MWF 1:15–2:05

251. Family Focus—Clinical study of the patient as a unique personality who lives in a family, who in turn lives in a society with distinctive ethnic and socio-economic characteristics. Intensive work with selected patients and their families in both in-hospital and out-of-hospital settings.
  2 units, Aut (Shepard) by arrangement

252. Advanced Therapeutic Procedures for Cancer Patients—Emphasis on integrating specialized knowledge and physical therapy procedures with psycho-social aspects related to the care of the patient and family.
  3 units, Aut (Shepard-Van Hoesen) by arrangement
257. Organizational Behavior and Physical Therapy — Interpersonal and inter-professional relationships, leadership styles, group dynamics and related areas and the application to physical therapy.

3 units, Win (Shepard) T 1:15–3:05; Th 1:15–2:05

258. Seminar: Special Topics — Current issues and problems related to developing knowledge, techniques and practice.

3 units, Win (Staff) MW 8:00–9:50

259. Organization and Delivery of Health Care — Basic concepts of organization and delivery of physical therapy in relation to total health care; includes budgeting, supervision, consultation, and regulation.

3 units, Aut (Blood, Daniels) MW 10:00–11:50

SPECIALTY AREAS

Courses listed between 260 and 285 are related to the specialty areas. Students must complete one of the following groups:

Administration and Community Health—260, 261 and 262
Pediatrics—265, 266 and 267
Curriculum Development and Instruction —275, 276 and 277

260. Administration and Community Health in Physical Therapy I — Program planning, budgeting, cost analysis, selected management techniques; systems for delivery of health care; community strategies; economic, sociocultural, legal, and political impacts on care. Includes projects and field work.

3 units, Aut (Daniels, Blood) by arrangement

261. Administration and Community Health in Physical Therapy II — Continuation of 260.

3 units, Win (Daniels, Blood) by arrangement

262. Administration and Community Health in Physical Therapy III — Continuation of 260 and 261.

3 units, Spr (Daniels, Blood) by arrangement


3 units, Aut (Houser) by arrangement

266. Pediatric Physical Therapy II — Continuation of 265.

3 units, Win (Houser) by arrangement

267. Pediatric Physical Therapy III—Continuation of 265 and 266.

3 units, Spr (Houser) by arrangement

275. Curriculum Development and Instruction in Physical Therapy I—Learning theory; objectives, content and evaluating of courses and curricula; directed teaching in selected areas.

3 units, Aut (Staff) by arrangement


3 units, Win (Staff) by arrangement


3 units, Spr (Staff) by arrangement

282. Directed Teaching.

1 to 5 units, any quarter (Staff) by arrangement


1 to 8 units, any quarter (Staff) by arrangement

RESEARCH COURSES

Research requirements of the Division must be satisfied by completing either 291 or 292.

290. Seminar in Research—Basic principles of research with emphasis on material applied to physical therapy.

3 to 5 units, any quarter (Staff) by arrangement

291. Research.

1 to 10 units, any quarter (Staff) by arrangement


1 to 10 units, any quarter (Staff) by arrangement

ANATOMY

Emeriti: Donald J. Gray, William W. Greulich, Hadley Kirkman, Robert S. Turner (Professors)
ANATOMY

Acting Chairman: Lawrence H. Mathers, Jr.
Visiting Professors: Edward W. Dempsey, Donald Duncan, Otto Mortensen
Associate Professor: Donald L. Stilwell, Jr.
Visiting: John A. Gosling
Acting Instructors: Marta Martner, Carmo Trindade
Clinical Lecturers: Burt L. Davis, Jr., Reuben Stutch, Bernard O. A. Thomas

PROGRAMS OF STUDY

Instruction in the Department of Anatomy is planned primarily to meet the needs of students in medicine, but, insofar 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. It is to be noted that this Department requires the Graduate Record Examination, plus the advanced test in Biology. 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

101. Practical Anatomy — Brief survey of the human body by dissection, study of anatomical preparations, lectures. Enrollment limited to those for whom this course is required, e.g., students of nursing, physical therapy, and education.

5 units, Aut (Cunha)

201. Human Anatomy — Embryology, dissection, demonstrations, lectures. Enrollment normally limited to medical students.

5 units, Win (Mortensen, Duncan, Sokol, Taslitz, Trindade, Gosling)

202. Human Anatomy — Continuation of 201. Prerequisite: 201.

5 units, Spr (Mortensen, Duncan, Sokol, Taslitz, Trindade, Gosling)


1 unit, Win–Spr (Staff)

204. Histology — Structural and functional organization of cells, tissues and organs, as seen with the light and electron microscopes.

4 units, Aut (Friedberg, Kirkman, Martner)

205. Histology—Continuation of 204.

4 units, Win (Friedberg, Kirkman, Dempsey, Martner, Mathers)

207. Medical Embryology — Lectures and demonstrations of normal and abnormal human prenatal development, including cellular and organ system viewpoints. Limited to medical and other graduate students. Prerequisites: Human Anatomy, Histology.

3 units, Win (Cunha)

208. Advanced Practical Anatomy — Lectures and prospected material used in a survey of human anatomy. Emphasis is placed on the functional anatomy of limbs and vertebral column. Intended for students of physical medicine.

1 unit, Aut–Win (Staff)

209. Neuroanatomy — Study of the human nervous system, with prepared slides, dissections, and lectures. Enrollment of non-
medical students by consent of instructor. Prerequisite: Histology.
4 units, Aut (Mathers, Stilwell, Taslitz)

296. Individual Work — Specialized work carried on under supervision of one or more members of the staff.
Any quarter (Staff) by arrangement

299. Research — By individual arrangement, approved by Department faculty.
Any quarter (Staff) by arrangement

301. Research Topics in Neurobiology — Extensive coverage of selected topics in neurobiology, including laboratory demonstrations and student presentations.
2 units, Spr (Mathers)

BIOCHEMISTRY

Chairman: Paul Berg
Assistant Professors: Douglas Brutlag, Ronald W. Davis
Consulting Professor: Abraham White

PROGRAMS OF STUDY

The Department offers a first-year course in modern biochemistry open to medical students, qualified graduate students, and senior undergraduates. Also a series of advanced courses is given by the Department; these are open to medical and graduate students who have completed the first-year course. (Additional qualifications are necessary for certain courses.)

ADVANCED DEGREES

The degree of Doctor of Philosophy is given by the Department. Remission of fees and a personal stipend are available to those students accepted. For further information, applicants should write to the Department of Biochemistry. A strong undergraduate background in chemistry (both physical and organic) is recommended. General University regulations about the Ph.D. degree are summarized in the section “Degrees” in this bulletin, the requirements of the Biochemistry Department are tailored to fit the background and interests of the student. Graduates students in other departments who wish to choose Biochemistry as a minor must obtain the approval of the Department.

Postdoctoral research training is available to graduates holding a Ph.D. or M.D. degree. Several fellowships, carrying stipends at current national levels, are awarded by the Department. Qualified graduates may apply to the departmental executive for further information. At present the chief research interests of the Department are in nucleic acids and proteins: their enzymatic synthesis, chemical structure, physical chemistry, and biochemical functions; in the biochemistry of viral infection; in the biochemistry of the nervous system; in the biochemistry and control of developmental processes; and in the structure and function of membranes.

COURSES

200, 201. General Biochemistry — Deals with basic biochemistry, and with special biochemical aspects of the various life processes. Open to medical, graduate, and advanced undergraduate students.
200. 5 units, Aut (Staff) MTWThF 1:15
201. 5 units, Win (Staff) MTWThF 1:15

203. Mammalian Protein Synthesis — Special emphasis will be given to processes which are different in mammalian and bacterial systems, such as formation of mRNA-protein complexes, post-transcriptional modification of mRNA, transport of mRNA from nucleus to cytoplasm. Prerequisites: Biochemistry 200 and 201.
3 units, Spr (Stark) given 1974-75

204. DNA Replication — Enzymological aspects of DNA synthesis in bacteria and eukaryotic cells with attention to viral-induced systems. Weekly lecture and weekly group analysis of an assigned paper.
3 units, Win (Kornberg) given 1974-75

205. Mechanism and Control of Transcription in Bacterial and Higher Cells.
2 units (Davis) given 1976-77

211. Molecular Biology of Development — Prerequisites: Biochemistry 200 and 201.
3 units (Kaiser) given 1976-77

212. Enzymology of Nucleic Acids.
3 units (Lehman) given 1975-76
213. The Arrangement of Information in Chromosomes.
   2 units (Hogness) given 1976–77
   3 units (Baldwin) given 1975–76
217. Advanced Tutorial in Special Topics—
   Readings in special topics conducted under
   the guidance of advanced graduate students
   and postdoctoral fellows. Areas covered will
   include: membrane biochemistry, enzyme
   mechanisms, chromosome structure, bio-
   chemical genetics, animal tumor viruses,
   nucleic acid enzymology, immunochemistry.
   2 units, Aut, Win, Spr (Staff)
   by arrangement
270. Seminar.
   By arrangement
299. Research and Special Advanced Work.
   By arrangement

GENETICS

Chairman: Joshua Lederberg
Professors: L. L. Cavalli-Sforza, Leonard A.
   Herzenberg, Joshua Lederberg, Eric M.
   Shooter (on Sabbatical 1974–75)
Associate Professors: H. Cann, A. T. Ganesan
Senior Scientists: Elliott C. Levinthal,
   G. Loew

PROGRAMS OF STUDY

The Department offers courses for graduate students in Ph.D. and M.D. programs
as well as for advanced undergraduates; programs of study and research training leading
to a Ph.D. in Genetics and for medical students in the course of an M.D. program; and
postdoctoral research experience for holders of the Ph.D. or M.D. The Department also
participates in an interdepartmental program leading to a Ph.D. in Neuro- and Bio-
behavioral Sciences.

The Department of Genetics is interested
in applicants for the Ph.D. degree who have
an interest in fundamental aspects of biology. It welcomes applicants with a back-
ground in biology, biochemistry and also chemistry, physics and mathematics or com-
putation. The Department administers a
Ph.D. program of unusual flexibility which makes special provision to support training
in biology for students whose main back-
ground is in the physical sciences. Courses available in the Genetics Department and also in the Biochemistry, Biology, and other departments provide a broad basis for overall training.

The Genetics Department is also part of
the Lt. Joseph P. Kennedy, Jr. Laboratories
for Molecular Medicine, which have been
dedicated to further basic research in the
etiology of mental retardation and the path-
ology of intellectual development. These
facilities offer unusual opportunities for re-
search and study in the fields of molecular
biology, heredity, neurobiology, and develop-
mental medicine. The program of the Labora-
tories together with courses in the various neurological sciences divisions of the
Medical School and in the Biology Depart-
ment cover the requirements of the Ph.D.
degree in Neurological Sciences.

An Instrumentation Research Laboratory,
in the department was founded with NASA
support for basic research in exobiology. In
collaboration with other faculty, students
have access to advanced instrumentation for
chemical and biophysical analysis with so-
plicated computer support. Besides labor-
atory instrumentation, the department sup-
ports research in the quantum theoretical
analysis of biologically important molecules.

The department is also the seat of the
SUMEX-AIM computer system. This is a
new facility sponsored by the NIH Biotech-
nology Resources Branch, designed to serve
the local research groups as well as a na-
tional community of investigators in the field
of artificial intelligence as applied to bio-
medical research. It offers unusual oppor-
tunities for training in advanced applications
of computers in areas like the emulation of
scientific reasoning and the design of experi-
ments in biochemistry and genetics.

The principal areas for which research
training is available at the present time are
the function of DNA in bacteria, genetics
of hemoglobin, genetic and cellular immu-
nology, biochemical neurogenesis, biochemi-
cal genetics of mental disease, the interact-
ions of cultural and biological evolution,
the investigation of extraterrestrial life, ap-
plication of new physical methods and of
quantum theory to biochemical analysis, cell
detection and sorting procedures, genetic de-
mography, and population genetics.
Financial support is available from an NIH training grant, for details of which application should be made to the department. In addition, some support opportunities exist through appointments as part-time research or teaching assistants, which can also carry tuition benefits. Applicants are also strongly encouraged to apply independently for National Institutes of Health, National Science Foundation, or any other fellowships. Predoctoral applicants are encouraged to take the Graduate Record Examination in Biology, Chemistry, or Physics. Further inquiries should be directed to the Graduate Student adviser (predoctoral applicants) or the appropriate faculty member (postdoctoral applicants).

For further information on the availability of the following courses, consult the quarterly Time Schedule, or inquire at the Department Office. Additional courses in genetics are included in the listings of the Department of Biological Sciences and the Program in Human Biology.

**COURSES**

**130. Human Genetics** — Human genetics viewed in the light of population genetics. To include equilibrium conditions under heterosis and other conditions leading to balanced polymorphisms, kinetics of selection, estimation of mutation rates, loads, population structure, genetic drift, and genetic demography, genetics of complex loci, polygenic inheritance, social aspects of human genetics, interactions between cultural and biological evolution. Prerequisite: basic knowledge of genetics and statistics.

*4 units, Spr (Cavalli-Sforza) MWF 4:15*

**201. Medical Genetics** — Case presentations and lectures on applications of genetics to human disease, and other issues of human evolution and social policy. Prerequisite: consent of instructor for nonmedical students.

*3 units, Win (Cann, Staff) MWF 9*

**208. Human Cytogenetics and Its Clinical Applications** — After a review of normal human chromosome structure and normal chromosome segregation in mitotic and meiotic divisions, abnormal patterns of chromosome segregation and abnormalities of chromosome morphology are discussed. Present knowledge of gene action and gene mapping of human chromosomes are reviewed. Human clinical syndromes related to chromosomal abnormalities of both sex chromosomes and autosomes are presented together with available information on the epidemiology of such syndromes and their patterns of inheritance. Modern experimental approaches to cytogenetic problems are discussed. Concurrent with the seminar sessions, there is opportunity for practical demonstrations in the laboratory and presentation of patients with chromosomal diseases. Limited to 20 students, minimum of 5. Prerequisites: biology and basic genetics, or consent of instructor.

*2 units, Spr (Luzzatti, Ganesan) by arrangement, alternate years*

**213. Mechanism of Antibody Synthesis: Genetic, Molecular and Cellular Considerations** — Structure and genetics of immunoglobulins, cellular and molecular events in antibody induction and synthesis, theories of antibody formation, genetics of the immune response. Minimum 6 students. Prerequisites: Biochemistry 200, 201, Biology 10, Medical Microbiology 200, or equivalents, or consent of instructor.

*3 units, Win (Herzenberg, McDevitt) M 4:15-5:30, F 4:15-5:00*

**217. Computers in Medical Statistics** — The course is designed to give instruction in computer use, and an understanding of the statistical methods employed in the analysis of complex data. Special attention will be paid to problems of computerized assistance to diagnosis.

*3 units, Spr (Buchanan, Brown) by arrangement*

**249. Cytogenetics** — (Same as Biological Sciences 249.) Principles and modern biochemical methods of chromosome analysis. Structure, function, and replication of chromosomes in prokaryotic and eukaryotic organisms. The influence of chromosomal changes in development and evolution. Analysis of human chromosomes and their behavior in cell hybrids. Prerequisites: Biology 21, 22, and 23, knowledge of genetics and biochemistry.

*3 units, Aut (Ganesan)*

**260. Supervised Study** — Prerequisite: consent of the instructor.

*Any quarter (Staff) by arrangement*

**270. Genetics Seminar.**

*Any quarter (Staff) by arrangement*
271. Immunology Literature Reviews — Discussions by course participants of selected recent articles in an area of immunology. Limited to 12 students. Prerequisites: a working knowledge of biochemistry, genetics, and immunology, and consent of instructor.

2 units, any quarter (Herzenberg, Strober) Th 8:30 p.m.

299. Individual Research.

Any quarter (Staff) by arrangement

HEALTH SERVICES ADMINISTRATION
(MASTER OF SCIENCE PROGRAM IN)
DEPARTMENT OF FAMILY, COMMUNITY AND PREVENTIVE MEDICINE

Acting Director: Count D. Gibson, Jr., M.D., Chairman, Department of Family, Community and Preventive Medicine
Assistant Director: Floyd A. Grolle, Ph.D., Lecturer, Department of Family, Community and Preventive Medicine
Assistant Professors: John C. Hershey, Ph.D., and Harold S. Luft, Ph.D.
Instructor: Joan M. Gianaris
Affiliated Faculty: 15 faculty members from the Schools of Medicine, Business, Engineering and Humanities and Sciences

The Master of Science degree in Health Services Administration is an interdisciplinary program training students in administrative and analytic skills for careers in the growing health industry as innovative health managers, planners, systems analysts and policymakers. Students concluding their first year of graduate study at Stanford are eligible to apply for the degree which is granted by the Department of Family, Community and Preventive Medicine in Stanford’s School of Medicine. The degree may be pursued concurrently with the second and subsequent years of graduate study and is awarded upon completion of approximately 45 units of course work and a one-quarter, full-time practicum. Each student’s program is planned to meet individual interests in health services in addition to fulfilling HSA core course requirements.

A limited number of candidates for the M.S. in Health Services Administration will be accepted each year. Students from all graduate schools at Stanford are eligible to apply and emphasis will be placed on preserving the interdisciplinary nature of the program.

For additional information, address inquiries to the Program Administrator, Health Services Administration Program, Dept. of Family, Community and Preventive Medicine, School of Medicine, Stanford University, Stanford, California 94305.

COURSES

The following are selected courses offered through the Health Services Administration Program which are open to graduate students at Stanford. Information on additional courses can be obtained by contacting the Program Administrator.

225. Clinical Overview of Health Care Services — The objectives of the course are to expose non-medical students to clinical decisionmaking at the bedside and, in addition, expose them to the major components of the medical care delivery system. The course will be composed of observation of specific health settings and seminar discussions.

4 units, Aut (Eliastam) MF 8:00–9:50

230. The Economics of Health — Provides an overview of the economic problems, and examples of the use of economic analysis, in the health sector. Topics include uncertainty and insurance, demand for health care, supply and distribution of physicians’ and other providers’ services, production functions and behavioral models for various types of health care institutions, and roles of government and third parties.

4 units, Aut (Luft), by arrangement

240. Systems Analysis and Operations Research in Health Care — The course is organized around four topic areas: (a) systems analysis in hospitals, (b) management control systems, (c) cost effectiveness analysis, and (d) health planning and implementation. It makes possible an understanding of the range of problem areas dealt with in the health sector applying operations research, systems analysis, and quantitative methods.

4 units, Win (Hershey) TTh 1:15–3:05
250. Health Sociology and Organization—An introduction to medical sociology with an overview of topics, concepts, and examples of current research. The course covers social factors in the illness process: etiology, symptoms, seeking care, medical care organization, therapy, course of disease, and outcome. Emphasis on formal organizations in the health setting (hospitals, clinics, group practices), interorganizational relations, and professionals in health organizations. An attempt is made to relate sociological material to health planning and administration.

4 units, Win (Gianaris) TTh 10:10-12:00

280. Management of Hospitals and Other Health Care Institutions—Covers various administrative aspects of health care institutions. Among those discussed are: organizational elements of hospitals, administration, financial issues and problems, hospital departmental relationships, quality of patient care, principal external pressures (both governmental and non-governmental), consumerism, and community influence.

2 units, Win (Hofmann) MF 3:15-5:05

PROGRAM IN HEARING AND SPEECH SCIENCES

Emeriti: Virgil A. Anderson, Jon Eisenson (Professors)
Director: James H. Dewson III
Professor: Earl D. Schubert
Associate Professors: James H. Dewson III, Dorothy A. Huntington
Assistant Professor: Theodore J. Glattke

Cooperating in the offerings of the Program is Clara N. Bush, Associate Professor of Linguistics

OFFERINGS AND FACILITIES

The aims of the Program are two-fold: (a) to make available to doctoral and postdoctoral students the material essential to a complete understanding of behavioral and physiological aspects of normal and defective processes of human communication; and (b) to provide, at the undergraduate level, a systematic understanding of these processes as a complement to formal study in such disciplines as Psychology, Biology, Linguistics, etc. Students may be preparing for careers in university teaching or research, or they may have primary interest in another discipline, e.g. Medicine, with a desire for specialized study in some area of human communication.

The available facilities include fully equipped new laboratories for basic and applied research into every major aspect of the hearing and speech sciences. A direct relation with the Division of Otolaryngology of the Stanford Medical School makes it possible to offer excellent opportunities for training and research in the clinical aspects of communication disorders. Strong working relationships with other departments of the University, both within the School of Medicine and elsewhere, provide further for a well-balanced undergraduate and postgraduate academic environment.

PROGRAMS OF STUDY

Each student's doctoral program is planned individually with the needs and interests of the candidate in mind. Candidates may include a formal minor as part of their 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. The student will take a qualifying examination prior to admission to the University oral examination. The University oral examination will be focused on the dissertation. The general University requirements for the doctorate are followed as they apply to residence, application for candidacy, etc. (See the section "Degrees" in this bulletin.)

For further information write to the Director.

COURSES

200. Individual Study—Study under direction in fields or subjects of special interest. Prerequisite: consent of instructor.

1 to 3 units, any quarter (Staff) by arrangement

212. Phonetic Theory—(Same as Linguistics 216.) Consideration of the fundamental assumptions implicit in phonetic descriptions and of the evidence available for assessing their validity; the concept of universal phonetics; the relative roles of articulatory, acoustic, and auditory parameters. Consent of instructor.

4 units, Win (Bush) by arrangement
230. Physiology of Speech Production — Study of the structure of the speech mechanism and its function. Includes laryngeal control in the production of segmented and prosodic features of speech as well as articulatory coordinations and control.

4 units, Win (Huntington) by arrangement

231. Speech Perception — Perceptual and physiological correlates of the acoustic constituents of speech.

3 units, Spr (Huntington) by arrangement

235. Assessment of Auditory Function — An overview of measurement techniques and a comparison of normal and pathological findings for absolute and differential thresholds, pitch, loudness, adaptation, and speech perception.

2 to 3 units, Win (Glattke) by arrangement

268. Selected Topics in Audiometry — Detailed consideration of current tests of auditory function with special reference to psychological and physiological interpretation of results.

4 units, Aut (Dewson) by arrangement

281. Seminar in Animal Communication — (Same as Biological Sciences 200 and Psychology 228.) A general survey of the communicative aspects of social behavior of animals, including man. Emphasis will be placed upon diversity of signal systems and the contrasts between these systems and human linguistic behavior.

4 units, Win (Dewson) by arrangement

292. The Auditory Process — (Same as Psychology 231.) A systematic survey of our current knowledge of the operation of the auditory system. Emphasis is placed on acquiring a knowledge of the acoustic signal, and on an understanding of the methods of measuring a sensory process.

3 to 4 units, Aut (Schubert) by arrangement

300. Independent Study — Advanced individual study under direction in fields or subjects of special interest. Maximum 12 units in any one quarter.

Any quarter (Staff) by arrangement

301. Research — Individual research projects under direction. Maximum 12 units in any one quarter.

Any quarter (Staff) by arrangement

308. Special Topics in Speech Science.

3 to 4 units, Spr (Huntington, Bush) by arrangement

310. Experimental Phonetics — In-depth coverage of the motor, acoustic, and perceptual correlates of speech. Material will vary, hence may be repeated any quarter for credit. Prerequisite: consent of instructor.

4 units, any quarter (Huntington) by arrangement

370. Clinical Internship — In-service clinical practice and observation in selected speech and hearing centers.

1 to 12 units, any quarter (Staff) by arrangement

390. Seminar in Neural Substrates of Human Communication — (Same as Psychology 230.)

4 units, Spr (Dewson) by arrangement

391. Selected Topics in Psychoacoustics — (Same as Psychology 232.) A detailed study of the normal auditory mechanism with particular emphasis on the use of psychoacoustic methods of analysis. Evaluation of current theories regarding auditory processing of information.

3 to 4 units, Win (Schubert) by arrangement

393. Peripheral Auditory Mechanisms — (Same as Psychology 233.) Study of the mechanics and electrophysiology of the middle and inner ear. Analysis of the ear as a transducer and of the neural encoding process.

3 to 4 units, Spr (Schubert) by arrangement

394. Central Auditory Mechanisms — Anatomy and electrophysiology of auditory nervous system. Emphasis will be placed on a review of correlates to perceptual phenomena.

3 to 4 units, Spr (Glattke) by arrangement

400. Doctoral Research.

1 to 15 units, any quarter (Staff) by arrangement
Professors: Leonard Hayflick, Sidney Raffel, Carlton E. Schwerdt, Bruce A. D. Stocker
Associate Professors: Robert J. Roantree, Leon T. Rosenberg. Clinical: Orland A. Soave
Senior Lecturer: John P. Steward
Instructor: Eric J. Stanbridge
Senior Scientists: Monroe D. Eaton, Esther M. Lederberg

PROGRAMS OF STUDY

The Department of Medical Microbiology offers a program leading to the degree of Bachelor of Science to undergraduates. Requirements include: Biological Sciences, 15 quarter units; Chemistry, 19 quarter units; Physics, 12 quarter units. The following courses in the Department are required: Medical Microbiology 101, 201, 202, 204, 206, and 270. In addition, Biochemistry 200 and 201 are required.

Students in this program can arrange to take units in research (see 199—Special Problems).

ADVANCED DEGREES

MASTER OF SCIENCE
Preferrence in selection of students for available places is given to candidates for the Ph.D. degree. Under special circumstances candidates are occasionally accepted for the degree of Master of Science. They will be expected to have completed the preliminary requirements listed above for the B.S. degree, and Quantitative Analysis. In addition, the candidate is expected to complete 45 quarter units of work related to microbiology; at least 15 of these units should concern research devoted to a thesis subject. The candidate is expected to pass an oral examination covering the fundamentals of medical microbiology, bacterial genetics, immunology, and virology at the end of the first year of work, and to complete a thesis.

DOCTOR OF PHILOSOPHY

A candidate for the degree of Doctor of Philosophy must meet the preliminary requirements listed for the Master's degree and will follow a program designed for the candidate's interests, subject to general University regulations covering this degree. During the first year or two of graduate work, the foreign language requirement (French or German or a language approved by the Department) should be met, and courses taken in biochemistry (Biochemistry 200, 201), statistics (Community and Preventive Medicine 202, Psychology 60 or Statistics 50), principles of computer science (e.g., Computer Science 105 or 106, Genetics 217), and molecular biology (e.g., Biological Sciences 210, 250, 251, 256, 257). These general recommendations should be discussed with faculty advisers. Other recommendations contingent upon individual previous experiences and interests include: parasitology (Community and Preventive Medicine 204); histology (Anatomy 204, 205); genetics (e.g. Biological Sciences 249, 252; Genetics 201); biochemistry (e.g., Biochemistry 204, 205, 211, 212, 213, 214, 217); physical chemistry (e.g., Chemistry 171, 173); calculus (Mathematics 10, 11, 21, 22, 23); virology (Biological Sciences 213); pathology (Pathology 200); electron microscopy (Pathology 207, 281.) The choice among these (or other) formal courses should be discussed with an adviser.

The student is expected to pass qualifying examinations at the end of the first year of graduate work. These will consist of an oral defense of a research proposal selected by the candidate and a written examination covering the general fields of the Department's offerings. Students entering the Department with advanced standing from other institutions are expected to take final examinations in such courses as may be stipulated, at the earliest time these examinations are regularly scheduled. Such students are required also to pass the qualifying examinations at the end of their first year of residence.

COURSES

1. Principles of Immunology—The basic principles of host responses to "foreign" incursion will be covered in 20 lectures. The emphasis will be on responses to microbes. Medical Microbiology 101 may, but need not, be taken concurrently. Prerequisite: Biological Sciences 1 or 21 (or equivalent).

   2 units, Aut (Rosenberg) TTh 2:15

101. General Microbiology—A lecture and laboratory course providing an introduction to the biology of bacteria, bacterial viruses, animal viruses, and fungi. Coverage will include physiology, metabolism, immunology, genetics, and host-parasite relationships. Prerequisites: Biological Sciences 1 and
Chemistry 4 and 5, or Chemistry 31, 33, and 35.

5 units, Aut (Roantree) MWF 2:15; lab. MWF 3:15-5:05

199. Special Problems—Individual study or research in microbiology by arrangement with a faculty member. Possible fields of study include: general bacteriology, bacterial genetics, mycoplasmology, microbial pathogenicity, immunology, virology, viral oncology, and cell biology including cell hybridization and human aging at the cellular level. (Appropriate backgrounds for these various areas are required; to be discussed with the faculty member concerned.)

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

200. Immunology—Immunology as related to medicine is emphasized. Designed principally for medical, graduate, and advanced undergraduate students. Some background in biochemistry and histology is strongly recommended.

3 units, Win (Raffel, Rosenberg) M 2:15-4:05; F 2:15-3:05

202. Medical Microbiology — A course of lectures and laboratory exercises covering the fundamentals of pathogenic microbiology, with particular reference to bacteria and viruses. The course includes a discussion of some aspects of immunology, of laboratory diagnosis, and of preventive measures.

4 units, Spr (Staff) M 1:15-3:05; TTh 1:15; F 1:15-3:05

204. Bacterial Genetics—(Same as Biological Sciences 204.) A course of lectures on inheritance in bacteria. Prerequisite: 101 (or equivalent).

3 units, Win (Stocker) MWF 11

206. Virology—Lectures on the general nature of plant and animal viruses, and their relationships with their hosts. Prerequisites: 101 or 202, and Biochemistry 200.

3 units, Win (Schwerdt) MWF 9

210. Advanced Medical Bacteriology — A systematic coverage of pathogenic bacteriology in greater depth than that presented in 202. Minimum enrollment of six students. Prerequisite: consent of instructor.

2 units, Win (Roantree, Stocker) TTh 2:15

212. Mammalian Cell as a Microorganism: An Introduction to the Biology of Cells in

Culture—Lecture course. Brief description of tissue culture techniques. Main emphasis will be on aspects of the biology of cells in culture and applications of cell culture techniques in biomedical research, e.g., somatic cell genetics, development, cell recognition, malignancy, immunology, aging, prenatal diagnosis, etc. Prerequisite: consent of instructor.

2 to 3 units, Spr (Stanbridge) by arrangement

260. Literature Reviews—Review of literature on special topics to be assigned by instructor.

3 to 5 units, any quarter (Staff) by arrangement

261. Current Topics in Immunology—A review of the current literature in one or a few selected areas of interest. Prerequisite: consent of the instructor.

2 units, any quarter (Rosenberg) by arrangement

270. Seminar—Reports, discussions on selected topics by outside speakers. Required of all graduate students.

1 unit, Aut, Win (Staff) by arrangement

299. Research — Students who have satisfactorily completed necessary foundation courses may elect research work in: general bacteriology, bacterial genetics, microbial pathogenicity, immunology, virology, viral oncology, aging, and cell biology. Grade average of B in microbiological subjects required for admission to research or thesis work.

15 units maximum, any quarter (Staff) by arrangement

**NEURO- AND BIOBEHAVIORAL SCIENCES PROGRAM**

Committee on Neuro- and Biobehavioral Sciences: Eric M. Shooter, Professor of Genetics and of Biochemistry, Chairman; K. L. Chow, Professor of Neurology; Raymond B. Clayton, Professor of Biochemistry in Psychiatry; Donald Kennedy, Professor of Biological Sciences; Seymour Levine, Professor of Psychiatry and of Psychology; David A. Prince, Professor of Neurology; two student members elected annually by the students in the program.

The Neuro- and Biobehavioral Sciences
Program is an interdepartmental program which offers instruction and research opportunities leading to a Ph.D. in Neuro- and Biobehavioral Sciences. The Faculty of the Program is drawn from the Departments of Biological Sciences, Psychology, Anatomy, Anesthesiology, Genetics, Neurology, Pathology, Pharmacology, Physiology, Psychiatry and Surgery.

PROGRAM OF STUDY

A small number of highly qualified applicants will be admitted to the Program each year. Applicants should present strong undergraduate background in four of the five following areas:

1. Mathematics (through integral and differential calculus)
2. Physics (the “50” series at Stanford or its equivalent)
3. Biology (the “20” series at Stanford or its equivalent)
4. General chemistry (through organic chemistry)
5. General psychology (through physiological psychology)

Occasionally a well-qualified student not having all the prerequisites may be allowed to make up deficiencies in previous training by taking the appropriate courses at Stanford during the first year. The requirements for a Ph.D. degree follow those of the University and in addition are tailored to fit the background and interests of the student.

The graduate course program consists of a series of course tracks defined for students who wish to emphasize the biochemical, neurophysiological, neuroanatomical or behavioral aspects of the neurosciences. Since students enter with differing backgrounds and the laboratories in which they may elect to work cover several different disciplines, the specific program for each student is worked out individually with his or her advisory committee and may cover more than one course track. It is anticipated that the required course work will be completed by the end of the second year. Successful passing of a comprehensive oral preliminary examination given by the student’s advisory committee is required for admission to Ph.D. candidacy. This examination is usually taken in the second year of study and must be completed by the end of the second year. Students are strongly encouraged to begin research on entry or at the latest during the winter quarter of the first year. The student will be required to present a Ph.D. thesis which is the result of independent investigation and which contributes to knowledge in an area of neuroscience and to defend his or her thesis in a University oral examination, including a public seminar.

Medical students may also participate in this program provided they meet the prerequisites and satisfy all the requirements of the graduate program as listed above. The timing of their program may be adjusted to fit in with their special circumstances.

Courses included in the current tracks:
- Anatomy 209. Neuroanatomy
- Anatomy 214. Neuroanatomy Laboratory
- Biochemistry 200, 201. General Biochemistry
- Biochemistry 215. Regulatory Mechanisms
- Biochemistry/Genetics 216. Selected Topics in Neurobiology
- Biological Sciences 153. Physiological Basis of Behavior
- Biological Sciences 253. Laboratory in Neurophysiology
- Biological Sciences 280. Mathematical Modeling of Biological Systems
- Neurology 204. Physiology of Mammalian CNS
- Pharmacology 201. Principles of Pharmacology
- Pharmacology 203. Pharmacology of the Nervous System
- Physiology 203. Neurophysiology
- Physiology 210. Neuroendocrinology
- Physiology 260. Readings in Neurophysiology
- Psychiatry 271. Neurochemical and Neurophysiological Mechanisms of Normal and Pathological Behavior
- Psychology 107, 108, 109. Physiological Psychology
- Psychology 190. Endocrines and Behavior
- Psychology 208. Physiological Psychology: Brain and Behavior

PATHOLOGY

Emeriti: Bruno Gerstl, David Glick (Professors)
Chairman: David Korn
Professors: Klaus G. Bensch, Ronald F. Dorf-
man, Richard L. Kempson, David Korn, Lelland J. Rather, Lucien J. Rubinstein
Associate Professors: Amico Bignami, Luis F. Fajardo, Jon C. Kosek, Irving L. Weissman, Paul L. Wolf
Clinical Associate Professor: Lysia Forno
Assistant Professors: Robert W. R. Archibald, David A. Clayton, Errol C. Friedberg, Mary M. Herman, Gerald D. Levine, Klaus Lewin. Acting: Hun Kim, Mahendra Ranchod
Clinical Assistant Professors: Michael Malker, Carl Grumet
Acting Instructor: Sharon DeWit
Visiting Instructor: Fintan Dowling
Senior Scientist: Lawrence Eng
Research Associates: Dionysios Bonikos, Doris Dahl, Klara Efron, David Sedwick, Teresa Wang, Lorraine Wyman

PROGRAMS OF STUDY

The Department of Pathology offers a sequence of basic courses in general pathology, special pathology, and neuropathology which are open to medical students and to qualified graduate students. In addition there are a number of advanced courses in selected aspects of pathology and three major clerkships which afford interested medical students the opportunity for full-time, intensive participation in diagnostic medical, surgical, and neuropathology. The Department does not offer advanced degrees in pathology, but qualified graduate students who are admitted to the Department of Biological Sciences may elect to pursue their thesis requirements in the research laboratories of the Pathology Department.

The discipline of pathology has traditionally served as a bridge between the preclinical and clinical sciences, and is concerned with the application of advances in the basic biological sciences both to the diagnosis of disease in man and to the elucidation of the mechanisms of abnormal molecular, cellular, and organ structure and function that manifest themselves in clinical disease. Accordingly, the research interests of the Department encompass a broad range that extends from fundamental molecular biology to clinico-pathological correlations. A primary emphasis of the departmental research program is in experimental oncology.

At the present time, the major areas of investigation in the Department include DNA replication and repair in prokaryotes and in cultured eukaryotic cells, genomic derepression in human neoplasms, structure of the mitotic spindle, ultrastructural and cytochemical studies of human tumors adapted to tissue culture, purification and characterization of marker proteins and lipids that are unique to the central nervous system, organelle dysfunction in central nervous system disease, developmental cellular immunology, tumor immunology, differentiation in human and experimental tumors of the nervous system, a variety of clinico-pathological studies with particular emphasis on diseases of the cardiovascular and lymphoreticular systems, and the control of plasmid replication in prokaryotes. Research training in all of these areas is available at the present time for qualified medical graduate students by individual arrangement with the appropriate faculty member.

COURSES

Pathology 200, 201A, and 201B, intended to provide the student with a basic understanding of disease, are prerequisites for all advanced and special courses.

200. General Pathology — Lectures and demonstration providing an introduction to general pathology.
Spr (Korn, Staff)

201A. Special Pathology — Lectures and clinico-pathological conferences considering the pathology of human disease based upon disordered structure and function of individual organ systems.
Aut (Korn, Staff)

201B. Special Pathology—Continuation of 201A.
Win (Korn, Staff)

202. Surgical Pathology — Covers the major areas of surgical pathology and emphasizes clinico-pathological correlation.
Aut, Win, Spr (Dorfman, Kempson, Staff)

205. Clinico-Pathological Correlations — Correlation of clinical histories with autopsy material, including microscopy.
Win, Spr (Kosek, Fajardo, Bignami)

206. Special Topics in Neuropathology and Neurohistopathology—Lectures on cerebral
edema, disorders of myelin and glial structures, slow viruses, lipidoses, presenile dementias, pathology of mental deficiency, Parkinson's disease, peripheral nerve disease, myopathology, and experimental neuro-oncology. Laboratory sessions for general review of histopathological processes affecting the brain, spinal cord and peripheral nerves.

Win (Bignami, Herman, Forno, Rubinstein)

   Aut, Win, Spr (Haydon) by arrangement

208. Interpretation of Electron Micrographs.
   Spr (Haydon) by arrangement

210. Transplantation Biology.
   Spr (Weissman, Lucas) alternate years; given 1973-74

212. Systemic Pathology Laboratory.
   Aut, Win (Rather, Clinical Staff)

   Any quarter (Wolf)

281. Practical Introduction to Electron Microscopic Techniques.
   Any quarter (Haydon) by arrangement

290. Research in Experimental Neuropathology.
   Spr (Bignami, Eng, Forno, Herman, Rubinstein) by arrangement

299. Research.
   Any quarter (Korn, Staff) by arrangement

300. Pathology Clerkship — Exposure to clinical and anatomical pathology through clinical pathological correlations in the autopsy room where students perform autopsies under supervision.
   (Stanford University Hospital—Lewin, Staff); (Veterans Administration Hospital—Kosek, Fajardo, Staff)
   'full-time for six or twelve weeks

301. Neuropathology Clerkship—Participation in the neuropathological diagnostic service of the department and conferences for the members of the neuropathology unit.
   Aut, Win, Spr (Forno, Herman, Rubinstein) (Full-time for six or twelve weeks)

302. Surgical Pathology Clerkship — Participation in the surgical pathology diagnostic service.
   Any quarter (Kempsom, Dorfman, Staff)
   full-time for six or twelve weeks

Immunology Literature Reviews—See Genetics 271.

CONFERENCES

Autopsy Demonstration.
   Any quarter (Korn) MTWThF 1:00

Brain Cutting.
   Any quarter (Rubinstein, Herman) W 2:00

Neuropathology Conference.
   Aut, Win, Spr (Rubinstein, Forno) W 5:00

Research Seminar.
   Aut, Win, Spr (Korn) T 4:30

PHARMACOLOGY

Emeriti: Robert H. Dreisbach (Professor), Leon Kolb (Clinical Associate Professor)
Acting Chairman: Lewis Aronow
Professors: Avram Goldstein (on leave 1974-75), Oleg Jardetzky, Sumner M. Kalman, Tag E. Mansour, Robert T. Schimke
Consulting Professors: Ralph I. Dorfman, Richard K. Richards
Assistant Professors: Henry F. Epstein, Leslie Wilson
Senior Scientist: Dora B. Goldstein

PROGRAMS OF STUDY

The Department presents a series of basic courses in contemporary pharmacology (201-203) and advanced courses open to qualified medical and other graduate students.

A program of study and research training is offered leading to the Ph.D. degree. Postdoctoral research training is available to graduates having the Ph.D. or M.D. degree. Research opportunities also exist for medical students and a limited number of undergraduate students during the summer.

The Ph.D. program is designed for students with a background in biology, chemistry, physics, or mathematics who wish to pursue a career of research in a field that lies between biology and medicine. Modern pharmacology is concerned with understanding the mechanisms of drug action at
the cellular and molecular levels, and utilizing this knowledge for the rational development of new drugs, and their proper use in man. The major fields of research interest in the Department are molecular pharmacology, biochemical pharmacology, drug metabolism, and drug tolerance and drug addiction.

Research in molecular pharmacology seeks to extend our knowledge of the interactions of chemical agents with biological systems at the molecular level in order to shed more light on the precise mechanisms whereby drugs exert their specific effects. Present fields of investigation include: hormone actions on target cells and organs, cell regulatory mechanisms in carbohydrate metabolism, regulation of macromolecular synthesis in mammalian cells, mechanism of action of antimitotic agents and the biochemical and pharmacological properties of microtubules, genetic regulation and mutagenesis in higher organisms, nuclear magnetic resonance studies of the nature of the interactions between drugs and macromolecules, and biochemical mechanisms associated with drug addition and tolerance. Research in drug metabolism and toxicology is directed toward gaining a better understanding of the variables that influence drug action in man in order to improve the clinical effectiveness of drugs and reduce their toxicity.

Students desiring to become candidates for advanced degrees should consult the general University regulations regarding such degrees, as summarized in the section "Degrees" in this bulletin. Further information can be obtained from the Department. Consult Time Schedule for additional advanced courses.

**Basic Courses**

Pharmacology 201, Medical Pharmacology, and its continuation courses, Pharmacology 202 and 203, will provide the medical and graduate student with a broad exposure to the principles of pharmacology and the properties of the major drug groups relevant to the proper use of drugs in man. Pharmacology 203 (Pharmacology of the Central Nervous System) is concerned specifically with drugs that affect the nervous system, and is offered for both medical students and students more specifically interested in behavioral sciences. Students may elect a program within this context that best meets their individual needs, and while many medical students will choose to take the entire sequence in their second year, others will defer or omit entirely certain of these courses.

**201. Medical Pharmacology**—A lecture and demonstration course on the principles of pharmacology and the major drug groups used in medicine. Major topics include the drug-receptor interaction, kinetic aspects of drug absorption, distribution and elimination, and a discussion of drugs affecting the peripheral nervous system, the cardiovascular system and the kidney. The emphasis will be on the mechanisms of action of drugs in relation to their use in man. Prerequisites: mammalian physiology and biochemistry.

3 units, Aut (Staff) MWF 1:15

**202. Medical Pharmacology**—Continuation of 201. Major drug groups to be considered include the chemotherapeutic agents and the hormones. Also to be considered are topics such as pharmacogenetics, toxicity, mutagenesis, teratogenesis, carcinogenesis, and drug interactions. Emphasis is on pharmacological principles in relation to the use of drugs in man. Prerequisite: Pharmacology 201.

3 units, Win (Staff) MWF 1:15

**203. Pharmacology of the Central Nervous System**—A lecture course on mechanisms of action and therapeutic use of drugs affecting the central nervous system. Drugs discussed include convulsants, anticonvulsants, anesthetics, sedatives, analgesics, tranquilizers, and other psychoactive drugs. Problems of drug abuse are also considered.

2 units, Spr (Staff) MW 1:15

**Advanced Courses**

Advanced courses are open to students in all parts of the University, but the instructor's consent is required prior to registration. In general, these courses require as a prerequisite a good knowledge of physiology and biochemistry and sometimes of microbiology or genetics. Students are advised to consult with the instructor about the adequacy of their preparation.

**208. Topics in Pharmacology** — Continuation of Pharmacology 207, to be taken in conjunction with Pharmacology 202.

2 units, Win (Staff) F 2:15-4:15
209. Topics in Therapeutics—A series of presentations on clinical uses of drugs, therapeutic problems, and the pharmacological principles underlying use of drugs in patients. Each presentation will generally involve a case presentation, discussion of this case’s therapeutic considerations and the principles which are exemplified. Prerequisites: previous or concurrent Pharmacology 201, 202, 203.

2 units, Spr (H. Epstein) F 1:15–4:00

213. Cellular Regulatory Mechanisms in Carbohydrate Metabolism—Lectures and discussions on the different regulatory processes that keep carbohydrate catabolic reactions in the cell in pace with its energy requirement and the effect of different hormones on carbohydrate metabolism at the cellular and subcellular level.

1 unit, Win (Mansour) by arrangement

215. Drug Metabolism—Lectures and discussions on the metabolic conversion of foreign compounds in the mammalian organism, including factors such as species, age, and genetic variability.

1 unit, Win (Aronow) not given 1974–75

216. Drug Addiction, Tolerance, and Physical Dependence—Lectures and discussions with emphasis on recent research into the biochemical basis of these phenomena.

1 unit, Aut (A. Goldstein) not given 1974–75

219. Alcohol and Alcoholism—Lectures and discussions on the pharmacologic actions of alcohol and on various aspects of alcoholism.

1 unit, Win (D. B. Goldstein) T 4:15, given 1974–75

221. Pharmacological, Biochemical, and Functional Properties of Microtubules—A lecture and seminar/discussion course for graduate students and advanced undergraduate students covering the structure, function, chemical, and pharmacological properties of microtubules. Emphasis will be placed on a discussion of microtubule protein as a drug receptor, and the use of drugs as tools to investigate microtubule function. Laboratory facilities and instruction will be available to a limited number of students desiring laboratory experience in the purification of microtubule protein, in vitro assembly of microtubules, or drug binding assay procedures.

2 units, Aut (L. Wilson) T 4:15–5:50

224. Seminar on Neurobiology—Seminar dealing with current literature and thought on fundamental properties of excitable membranes and the problem of information transfer and storage.

2 units, Win (Jardetzky) by arrangement

225. Frontiers of Pharmacology—Lectures, discussions, and readings on the mechanisms of drug effects at cellular and subcellular levels. Emphasis on topics currently being explored.

1 unit, Spr (Mansour) not given 1974–75


1 unit, any quarter (Staff) Th 4:15–6:05

280. Tutorial Program—Guided readings in the literature of any area of pharmacology. A critical review paper may be required. Primarily for graduate students in pharmacology.

Any quarter (Staff) by arrangement

299. Research.

Any quarter (Staff) by arrangement

PHYSIOLOGY

Emeritus: Jefferson M. Crismon (Professor)

Chairman: Maurice E. Krahl


Visiting: Donald M. Pace, F. Eugene Yates

Associate Professors: Denis A. Baylor, Julian M. Davidson. Visiting: Ardis J. Krahl

Consulting Associate Professor: Noël Thompson

PROGRAMS OF STUDY

The Department of Physiology offers required and elective courses for students in the School of Medicine, open also to other qualified postdoctoral or graduate students. The main emphasis is on training of medical and postdoctoral students. For a very limited number of highly qualified students, the Department offers the Ph.D. degree, but not the Master's or Bachelor's degrees.
GRADUATE STUDY

Students with undergraduate or Master's degrees who have completed a year each of college chemistry (including lectures in organic chemistry), physics, calculus (differential and integral), and biology will be considered for admission to graduate study. An applicant must submit a report of scores (aptitude and advanced biology) on the Graduate Record Examination as part of the application. In the case of certain students, especially those with degrees in engineering or physics, the Department will consider admission even if the above requirements have not been met. In those cases the students will be expected to complete the requirements during their graduate studies.

Emphasis is placed on providing all graduate students with a strong background in the laboratory study of major physiological phenomena, from which they may undertake highly individual courses of advanced research and study. The total course of study is expected to occupy four years, including three summers. Required courses for all students are: General Biochemistry 200 and 201 (without laboratory), Physical Chemistry (Chemistry 171 and 173), and Physiology courses 200, 201, 202, 203, and 214. In addition, students will take at least three other courses selected from Departmental or extradepartmental offerings. Courses in computer science, mathematics, statistics, chemistry, physics, biology, or engineering may be arranged by agreement between the student and the faculty supervisor.

At present the chief research interests of the Department are in Endocrinology, including the control functions of natural trace substances; in Neuroendocrinology and Neurophysiology; and in Immunophysiology.

Qualifying examination — At the end of the second year in residence as a graduate student, each Ph.D. candidate will be given a written examination covering the material of the first two years of courses. This examination may be taken only after the respective course examinations have been successfully passed, and will be more comprehensive than the course examinations. Students may undertake individual programs of study after passing this examination, and the language examination.

Language examination—A reading knowledge of any one of the following languages is required: French, Russian, or German.

Dissertation and University Oral Examination—The results of independent, original work by the students are to be presented in a dissertation. The oral examination will be largely a defense of the dissertation.

FINANCIAL AID

Research assistantships are occasionally available to postdoctoral fellows, or graduate students who have completed substantial work toward the Ph.D. degree in Physiology. Tuition aid may be awarded to students holding research assistantships. Graduate students who are also medical students are eligible for financial aid from the Office of Student Affairs, Stanford Medical School.

In general, graduate students must expect to find the majority of their financial support outside the University.

COURSES

(Commencing autumn quarter, 1972, the course order in Clinical Physiology will be: Clinical Physiology 200, autumn; 202, winter; 201, spring.)


6 units, Aut (Krahl, Harrison, Perlroth)
MWF 10–12

201. Clinical Physiology (Physiology and Medicine) — (Formerly 250.) This interdepartmental course examines normal and disordered function in the respiratory, renal, fluid and electrolyte, and acid base systems. Lectures, demonstrations, clinical presentations, and laboratory projects are used.

8 units, Spr (Krahl, Robin, Maffly, Jamison) MWThF 9–11; W 8–9
(1st three weeks only)

202. Clinical Physiology (Physiology and Medicine) — (Formerly 251.) Endocrinology, reproductive and gastrointestinal function. An interdepartmental course.

7 units, Win (Krahl, Davidson, Reaven, Luetscher, Gray) M 10; TTh 8–10;
F 9–11
203. Neurophysiology — (Formerly 350.) Lectures on the basic physiology of the mammalian central nervous system. Prerequisite: neuroanatomy must be taken previously or concurrently.

3 units, Aut (Grant) MWF 2:15–3:05

205. Biological Systems Analysis — (Formerly 302.) A lecture course for biologists on the mathematical approach to comparative mechanical, electrical and biological systems. Includes treatment of first- and second-order linear systems, forcing functions, Laplace transform and stability analysis. Prerequisite: one year of calculus.

3 units, Win (Thompson) W 4:15–6:05 and F 4:15–5:05, alternate years, given 1974–75

207. Immunophysiology Laboratory—(Formerly 304.) A laboratory course in quantitative immunophysiology emphasizing basic immunochemical phenomena such as isolation and preparation of purified antigens and antibodies, quantitative analysis of specific precipitates, immunoelectrophoresis, immune hemolysis, isotopic labeling, identification of reactants by gel diffusion; quantitative tissue anaphylaxis. Limited to 15 students. Prerequisite: consent of instructor.

4 units, Aut (Feigen) T 7:30–9:00 p.m.; lab. Th 9:00–4:05

208. Current Problems in Muscle Physiology—(Formerly 306.) Discussion of selected biophysical, pharmacological, and immunological aspects of muscle contraction; evaluation of modern theories of contractility.

2 units (Feigen) by arrangement

209. Central Autonomic Neurophysiology —(Formerly 307.) A lecture and discussion course on recent advances in understanding of central nervous mechanisms involved in regulation of body temperature, food and water intake, the cardiovascular system, etc. Predominantly neuroendocrine mechanisms will not be taken up. See Course 210. Prerequisite: Neurophysiology 203.

2 units, Spr (Grant) T 7:30–9:30 p.m.

210. Neuroendocrinology—(Formerly 308.) A lecture and discussion course on selected topics of current interest in the general area of nervous and endocrine system interrelationships. Special emphasis will be placed on mechanisms for control of pituitary function and behavioral aspects of neuroendocrinology. Prerequisites: basic knowledge of neurophysiology, neuroanatomy and endocrinology; consent of instructor.

2 units, Spr (Davidson) M 7:30–9:30 p.m., alternate years, given 1973–74

212. Fundamentals of Neurobiology—Systematic introduction to the normal structure and functions of the nervous system. Topics will include: ultrastructure and biochemistry of neurons, properties of excitable membranes, mechanisms and patterns of nerve conduction, storage, release and action of neurotransmitters, organization and function of neuronal networks, sensory and motor mechanisms, major reflexes and the function of regulatory and coordinating centers. The course is designed to integrate classical material and recent advances and to prepare the first year student for the study of neuropathology, neurology, and general clinical medicine. Limited to approximately 100 students. Prerequisite: consent of instructor.

4 or 5 units (Interdepartmental Staff) dhur

213. Special Topics in Physiology—A seminar course of guided reading and discussion in both introductory and advanced physiological topics. Topics are agreed upon by an individual instructor and interested students. Prerequisite: consent of instructor.

(Staff) by arrangement

214. Physical Chemical Principles in Physiology—(Formerly 310.) A quantitative, experimental approach to problems in thermodynamics, kinetics, transport, and bioelectric phenomena. Restricted to Ph.D. candidates in Physiology, or consent of the instructor.

2 units, Spr (Feigen) Th 9:00–4:05

215. Tutorial in Clinical Physiology — Guided study, with readings and discussions in both introductory and advanced physiological topics, to supplement 200, 201, 202.

1 or 2 units, any quarter (Robin, Krahl, Staff) by arrangement

260. Advanced Readings in Neurophysiology — A tutorial course involving guided study in depth of aspects of neurophysiology selected by individual students in consultation with the instructor. Ordinarily, the student will be expected to present orally and defend a paper based on his reading to other registered students in an open seminar, but critical written review in which the student
is involved may be incorporated in these papers. Prerequisite: Neurophysiology 203.
Units flexible, any quarter (Grant)
by arrangement

282. Marine and Amphibian Toxins—(Same as Biological Sciences 282H.) Lectures, laboratory work and discussion on the biology, chemistry, and mechanism of action of toxins from marine plants and animals and from amphibians. Special emphasis will be given to neurotoxins such as tetrodotoxin, saxitoxin, and batrachotoxin. The course will include discussion of the basic principles of evaluation and mode of action of toxic substances in general, and a systematic presentation of various aspects of marine and amphibian toxins.

6 units, Sum (Fuhrman) See Hopkins Marine Station Bulletin for days and hours

299. Advanced Research — Investigation sponsored by individual faculty members may be undertaken by interested, qualified medical or graduate students. The hours and units may be arranged by the student. The fields of research open to students include: endocrinology, neuroendocrinology, central nervous system function, adrenal cortical functions, immune reactions and anaphylaxis, reproductive physiology, chemistry and mechanism of action of toxins in marine biology, cybernetics (systems analysis and instrumental techniques).

Any quarter (Staff) by arrangement
AFRICAN STUDIES

Professors: Sanford M. Dornbusch (Sociology), St. Clair Drake (Anthropology and Sociology), Charles A. Ferguson (Linguistics), James L. Gibbs, Jr. (Anthropology), Joseph Greenberg (Anthropology), Bruce Johnston (Food Research Institute), William O. Jones (Food Research Institute), Benton F. Massell (Food Research Institute), Robert B. Textor (Anthropology and Education), Gilbert Ansre (Visiting Linguistics)

Associate Professors: David B. Abernethy (Political Science), Scott R. Pearson (Food Research Institute), Elizabeth Traugott (Linguistics)

Assistant Professors: Cedric C. Clark (Psychology), Don Dodson (Communication), J. Paul Irwin (History), Kennell Jackson, Jr. (History), Tetteh Kofii (Food Research Institute), William Leben (Linguistics), Bridget O'Laughlin (Anthropology)

Teaching Fellow: Salisu Abubakar (Linguistics)

Lecturer: Elaine Kaufman (Linguistics), Dapo Adelugba (English, Drama)

Senior Fellows: Peter Duignan (Hoover Institution), Lewis Gann (Hoover Institution)

Overall planning and coordination of African Studies at Stanford is the responsibility of the Committee on African Studies. This Committee is a part of the Commission on International Studies at Stanford. The general aim of the Committee is to develop a broad program in African Studies so that students in a variety of departments can pursue undergraduate and graduate programs with a specialization in African Studies. The offerings are not intended in and of themselves to constitute the basis for an academic major.

The African Studies faculty is available to advise students on work in African Studies throughout the University. A sampling of courses is listed below:

Peoples of Africa—(Enroll in Anthropology 109.) A survey of social structure and process in rural sub-Saharan Africa: emphasis on the political, social, and economic organization of descent groups in both acephalous and state societies.

5 units, Aut (O'Laughlin) MWF 11

African Systems of Production—(Enroll in Anthropology 150, 250.) The relationship of environmental, technological and historical processes in the social organization of production in selected societies of rural Sub-Saharan Africa.

5 units, Spr (O'Laughlin) MWF 9 given 1975-76

Language, Society and Culture—(Enroll in Anthropology 166 or Linguistics 45.) The relationship of language to culture and society and the role of linguistic data in the reconstruction of history.

5 units, Win (Greenberg) MWF 11

Languages of Africa—(Enroll in Anthropology 269, Linguistics 321.) A survey of the history of African linguistic investigation, characteristics of African languages, and sociolinguistics in Africa, including the formation of standard languages, language and educational policy, and language in connection with Colonialism and national policy.

5 units (Greenberg)

Urbanization in African Societies—(Enroll in Anthropology 110.) Ancient centers for urbanism; types of cities arising from contact with Europeans; social problems incident to rapid urbanization; city planning and theoretical issues.

5 units, Aut (Drake) MWF 10

Socio-Political Integration in Contemporary Africa—(Enroll in Anthropology 147.) “Westernization,” “Modernization” as specific forms of the acculturation process; neocolonialism and decolonization since World War II; civilian and military elites in the resolution of conflicts arising from shifts in power, authority and legitimacy, and from the continuing viability of ethnic and kin loyalties as well as traditional political structures.

5 units, Win (Drake) MWF 11

Myth and Ritual in Sub-Saharan Africa—(Enroll in Anthropology 111.) Analysis of particular systems of African folklore: myth, cosmology, tales, legends, epics, and science; the dialectic of transformations between belief and action systems; the mediation of ritual in such transformations.

5 units, Spr (O'Laughlin) MWF 10
Kingdoms of Africa: Society and History—(Enroll in History 147.) The internal structure and dynamics of kingdom societies in the pre-Colonial states of sub-Saharan Africa. Emphasis on the nature of African kingships, the symbolism of the monarchies, the characteristic politics of the kingdoms, and the place of African kingdoms in world centralized-states history. The personalities and policies of particular kings, the slave-trade and the kingdoms, the role of Islam in the formation of West African kingdoms, and the place of European missionaries within kingdom societies will be some of the special topics presented in lecture sessions.

4 to 5 units, Spr (Jackson) MWTh 11

Undergraduate Colloquium: Realism, Romanticism, and the African Intellectual—(Enroll in History 247.) An intensive undergraduate colloquium which attempts to survey the two major trends in modern African intellectual thought. It deals mainly with the problem of how African intellectuals have conceptualized African cultures and societies in the period near the end of Colonial rule and in the post-independence era. Two groups of writers are explored: the romantics and the realists.

5 units, Aut (Jackson) M 2:15-4:05

Graduate Seminar: Field Work in African History—(Enroll in History 447B.) This course will attempt to provide graduate students approaching a field work situation with the fundamental skills for creating and executing a non-archival historical research project. It will survey such topics as oral family histories, village censuses for the historian, phases of field research, and language materials in field work.

5 units, Aut (Jackson) MTWThF 10

The History of West Africa—(Enroll in History 148A.)

4 to 5 units, Aut (Irwin) MTWTh F 10

Islam in West Africa—(Enroll in History 148B.)

5 units, Spr (Irwin)

Graduate Core Colloquium: The Interpretation of African History—(Enroll in History 348B.)

5 units, Aut (Jackson)

Latin America and the African—(Enroll in History 182.) This course examines the economic, political and cultural ties that have existed between Latin America and Africa since the 16th Century. The current prospects for both cooperation and rivalry between the two areas are discussed in some detail.

4 to 5 units, Win (Bowser) MTWTh 11

African Resistance to Colonialism—(Enroll in History 148.)

5 units, Win (Jackson, Irwin) MTWThF 11

Graduate Seminar: African Oral Historical Traditions—(Enroll in History 447.)

5 units, Spr (Jackson) by arrangement

Graduate Colloquium: West African History—(Enroll in History 348.)

5 units, Aut (Irwin) W 2:15

Undergraduate colloquium: Religion and Social Protest in Colonial Africa

5 units, Spr (Irwin) T 2:15

Graduate Seminar: Colonial Africa—(Enroll in History 448A.)

5 units, Win (Irwin) Th 2:15-4:05

Government and Politics in Tropical Africa—(Enroll in Political Science 118A.) Examines the colonial situation, the growth of nationalism, the achievement of political independence, ethnic patterns in new states, civilian and military leadership, the role of party and bureaucracy, and problems in development planning.

5 units, Aut (Abernethy) MWF 9

Government and Politics in Southern Africa—(Enroll in Political Science 118B.) Examines the political histories of five white-ruled African territories and five neighboring African-ruled states. Stresses the interaction of domestic and international politics, through an analysis of apartheid's international implications, regional transport networks, African liberation movements, the role of multinational corporations, and patterns of foreign aid.

5 units, Win (Abernethy) MWF 9

Seminar in Comparative Politics: Africa—(Enroll in Political Science 227.) Examines the record of selected African states in formulating and implementing public policy, with special reference to rural development. Open to selected undergraduates who have taken an Africa-related course.

5 units, Spr (Abernethy) W 2:15-4:05
International Dependency—(Enroll in Political Science 131C.) What is meant when we say that one state is dependent upon another, more powerful state? What are the implications of a dependency relationship for the domestic political economy of both parties? These questions will be examined through case studies of the United States and a Latin American country, France and an African country, and the Soviet Union and an Eastern European country.

5 units, Spr (Abernethy) MWF 10

African Literature: Prose, Poetry, Drama—(Enroll in English 165.) To introduce students to the field of African literature through a few selected texts. The texts act as a springboard to social and political analogies, esthetic and critical responses.

5 units, Win (Adelugba) MTWTh 1:15


4 units, Win (Adelugba) MWF 10

Beginning Swahili—(Enroll in Linguistics 262A,B,C.)

5 units, Aut, Win, Spr (Kaufman, Ndavatt) TTh 1:15

Intermediate Swahili—(Enroll in Linguistics 263A,B,C.)

5 units, Aut, Win, Spr (-----) by arrangement

Beginning Hausa—(Enroll in Linguistics 260A,B,C.)

5 units, Aut, Win, Spr (Leben, Abubakar) MTWTh F 12

Intermediate Hausa—(Enroll in Linguistics 261A,B,C.)

5 units, Aut, Win, Spr, by arrangement

Beginning Yoruba—(Enroll in Linguistics 264A,B,C.)

5 units, Aut, Win, Spr (Kaufman, Ogundimu) by arrangement

(Other African languages such as Amharic and Twi may occasionally be taught on a tutorial basis if facilities are available.)

Language and National Development in West Africa—(Enroll in Linguistics 248.)

4 units, Spr (Ansre)

Tone Languages of Africa—(Enroll in Linguistics 285.) Survey of the tonal systems of selected African languages, with emphasis on the diversity of the accentual phenomena involved, followed by a consideration of possible laws governing the behavior of tone. Topics considered will include downstep, downdrift, "floating" tones, syllable and mora as prosodic units, and the origin of tone languages.

5 units, Aut (Leben) given 1975-76

Field Methods in Hausa Syntax—(Enroll in Linguistics 286.) Work with a native speaker of Hausa to gather crucial data which have a bearing on unsolved or only partially solved aspects of Hausa syntax. Analysis of the data and assessment of implications for syntactic theory and for the grammar of Hausa.

5 units any quarter (Leben)

Structure of Hausa—(Enroll in Linguistics 181.) Survey of the syntax and phonology of Hausa, with emphasis on ways in which it differs from Indo-European languages. Study of the linguistic literature on Hausa.

5 units, Win (Leben)

Economic Development Problems of Third World Economies with Colonial Heritage I and II—(Enroll in Food Research 133, 134.) The making of economic societies, and specifically the evolution of the Third World Economies from traditional economic societies through the colonial period to the present status of economic dependency. An introduction to the literature on economic development theory and theoretical tools for applied economic analysis of development problems.

5 units each quarter, Win, Spr (Kofi) TTh 4:15-6:05

Trade and Development Problems of Tropical Africa—(Enroll in Food Research 160/260.) Analysis of selected international aspects of tropical African economic development. Topics include African-non-African international trade and economic relations (theoretical background, historical perspective, case studies of export-led growth and of the impacts of international capital flows) and intra-African trade and economic integration (customs union theory, historical perspective, case studies of African economic integration).

3 to 5 units, Win (Pearson) MW 4:15-6:05

5 units, any quarter (Gann or Duignan)

Seminar: Economics of Tropical Agriculture—(Enroll in Food Research 365.) Selected topics in organization of production and marketing of agricultural products for home consumption and for export.

5 units, Win (W. O. Jones)

Mass Communication in Developing Nations—(Enroll in Communication 178.) An Introduction to the structure and roles of the mass media in underdeveloped countries. The first half of the course deals with the process of mass communication in national development. The second half focuses on case studies of different press systems in Asia, Latin America, Africa, and the Middle East.

5 units, Win (Dodson) TTh 9

Seminar in African Psychology I and II—(Enroll in Psychology 235B.) This course, a two-part seminar, is designed for graduate students interested in the field of human consciousness: its origin, its nature, and its relationship to overt behavior. Particular attention will be paid to the African origins of consciousness. Various branches of the "occult" and original African sciences will be examined in relationship to current African (Black) behavior. Prerequisites: non-psychology students should have a strong background in philosophy, physics or anthropology and/or an interest in the philosophy of science.

3 units each quarter, Aut, Win (Clark)

by arrangement

Primate Behavior Workshop in Tanzania—(Enroll in Human Biology 161.) An African elective; minimum 2 quarters. Prerequisite: Human Biology 160; limited to 8 Human Biology Majors per year.

15 units, Aut, Win, Spr, Sum

(Goodall) by arrangement

A three-quarter interdisciplinary seminar on the drought and famine in Africa's Sudo-Sahel region will be conducted during the academic year 1974–75 by Stanford's African Studies faculty, with time, place, and credits to be arranged. Further details can be obtained in the office of the Committee on African Studies, Building 460, Room 465.

ASTRONOMY COURSE PROGRAM


STATEMENT OF PURPOSE

Although Stanford University presently does not have a degree program in Astronomy, teaching and research in various branches of astronomy is an ongoing activity in several departments (Applied Mechanics, Applied Physics, Electrical Engineering, Geophysics, Physical Sciences, Physics). For the convenience of students interested in the general areas of astronomy, astrophysics and cosmology, a course program for undergraduate and graduate study is listed below.

Astronomy 10, 15 or 50 are suited for the student who wishes to be informed about the field of astronomy without the need for prerequisites beyond high school algebra and physics. The Astronomy 100 series serves the student interested in an initial scientific study of astronomy; study equivalent to two years of college physics, chemistry, or engineering will be assumed. The courses numbered 200 and above are primarily for graduate students, subject to prior approval by the course instructor.

PROGRAMS OF STUDY

Undergraduate students who wish to concentrate on a course program in astronomy should take the physics course sequence (see under Physics) up to and including the third
year. In the third or fourth year they could take Astronomy 101 to 106. Specially well-prepared students who are following a four-year physics curriculum could in the fourth year follow a more specialized program suitably chosen from the following courses: 240, 249, 295, 353, 354, 360, 361, 362, 363, and 367. The course program should be worked out in consultation with a member of the Astronomy Committee. Undergraduate students who are majoring in chemistry or geophysics could in their fourth year take Astronomy 101 to 105 and 240.

Graduate students in Applied Physics or Physics who wish to follow a course program in astrophysics should, in consultation with their adviser, choose courses from those numbered 200 and above, after having completed the physics courses 210, 211, 220, 221, 230, 231, 232, or their equivalents.

Graduate students in Aeronautics and Astronautics would profit from the courses Astronomy 101 to 105, 240 and 249. Graduate students in Applied Mechanics specializing in the solar system would find the courses Astronomy 101, 102, 240, 249, 295, 360, and 361 suitable to their interest. Graduate students in Electrical Engineering who specialize in radio or radar astronomy could take the courses Astronomy 101 to 106, to be followed by courses chosen from 240, 249, 295, 350, 353, 354, 360, 361, 364, 365, 366, and 450.

**Courses**

10. Special Topics in Physics: Cosmic Evolution—(Enroll in Physics 10.)

   3 units, Win (Wagoner) TTh 2:15, discussion T 3:15

15. The Nature of the Universe—(Enroll in Applied Physics 15.) This course is intended to familiarize undergraduates, with or without scientific background, with the structure, origin and evolution of our universe. It will describe our growing knowledge of the objects which make up the universe; galaxies, stars, planets, etc. Some enigmas of modern astronomy, such as quasars, X-ray sources and pulsars will also be discussed. The presentation will be non-mathematical and will be illustrated with slides and films. There will be opportunities for telescopic observations.

   3 units, Aut (Petrosian) MWF 11

50. Modern Astronomy—(Enroll in Physical Sciences 50.) A review of current concepts and ideas regarding the nature of the solar system, galaxy, and extragalactic systems; essentially nonmathematical discussion of the basis for these concepts. Telescopic observations if possible.

   3 units, Spr (Perkins) MWF 11

101. Solar System Astronomy—(Enroll in Applied Physics 101.) Properties of the sun and of the planets, the solar atmosphere and solar activity, the sun as a star, planetary atmospheres and surfaces, planetary satellites. Minor constituents of the solar system, comets, meteorites, dust, and interplanetary gas. Elemental abundances in the solar system. Theories of the origin of the solar system. Solar activity and solar terrestrial relationships, the solar wind and the solar magnetic field, solar flares, solar cosmic rays, solar induced variations in the earth’s upper atmosphere, ionosphere, and magnetosphere. Methods of astronomical observation, the impact of space probe observations on our concepts of the solar system. Prerequisites: two years of college physics, chemistry, or engineering.

   3 units, Aut (Walker) TTh 2:15–3:30


   102A. 1 unit, Aut (Walker) by arrangement
   102B. 1 unit, Win (Walker) by arrangement
   102C. 1 unit, Spr (Walker) by arrangement

103. Stellar and Galactic Astronomy—(Enroll in Applied Physics 103.) Introduction to stellar, galactic, and extragalactic astronomy: stars, galactic structure, interstellar medium, galaxies. Stellar evolution: star formation,
energy generation, H-R Diagram. Modern developments, pulsars, x-ray stars, black holes. Techniques and technical problems. Prerequisites: two years of college physics, chemistry, or engineering, or Applied Physics 101.

3 units, Win (Staff) TTh 2:15–3:30

105. High-Energy Astronomy — (Enroll in Applied Physics 105.) Introduction to cosmology, extragalactic astronomy and non-thermal phenomena of astrophysics: radio and X-ray radiation and the production of high-energy particles (cosmic rays) by the sun, neutron stars (pulsars), galaxies, and quasars. Discussion of models and evolution of the universe. Prerequisites: two years of college physics, chemistry, or engineering, or Applied Physics 103.

3 units, Spr (Petrosian) TTh 2:15–3:30

240. Space Physics—(Enroll in Applied Mechanics 240.)

3 units, Win, given 1975–76

295. Physics of Planetary Interiors—(Enroll in Geophysics 295.)

3 units, Aut (Kovach) MWF 10

350. Radioscience Seminar — (Enroll in Electrical Engineering 350.)

1 unit, Aut, Win, Spr (Staff) by arrangement

353. Radiometry and Interferometry—(Enroll in Electrical Engineering 353.)

3 units, Aut (Bracewell)

354F. Theory and Application of Radio Wave Scattering.

3 units, Aut, alternate years given 1975–76

360. Solar Terrestrial Relations—(Enroll in Applied Physics 360.)

3 units, Aut (Sturrock) MWF 9

alternate years, given 1974–75

361. The Sun and Solar Activity—(Enroll in Applied Physics 361.)

3 units, Win (Sturrock) MWF 9

alternate years, given 1974–75


3 units, Win (Petrosian) MWF 11

alternate years, given 1974–75

SEMINARS ON SPECIAL TOPICS

The following seminars are offered for this year only:

89. Freshman Seminar—The Stanford Solar Observatory.

3 units, Aut (Wilcox) Th 4:00


3 units, Aut (Wagoner) TTh 2:15, plus discussion section


3 units, Spr (Wagoner) by arrangement

363. Seminar in Astrophysics — (Enroll in Applied Physics 363.)

3 units, Spr (Sturrock) by arrangement [May be repeated for credit]

364. Radiation from Plasmas.

3 units, Aut, alternate years given 1975–76

365. Introduction to General Relativity and Cosmology.

3 units, Aut, alternate years given 1975–76

366. Cosmology and High-Energy Astrophysics.

3 units, Win, alternate years given 1975–76

367. Physical Processes in the Galaxy.

3 units, Spr, alternate years given 1975–76

368, 369. Gravitation — (Enroll in Physics 368, 369.)

3 units, Win, Spr, alternate years, given 1975–76

450A,B,C. Radio Astronomy Laboratory — (Enroll in Electrical Engineering 450, Sec. 1.) Students will be trained to operate the Stanford 5-element radio telescope and will participate in ongoing research programs. These include high-resolution studies of the sun and planets, galactic H II regions, radio galaxies, quasars, and X-ray stars. Results may be published with student as co-author. Open to graduate students and qualified undergraduates on consent of instructor.

450A. 3 units, Aut (Bracewell) by arrangement

450B. 3 units, Win (Bracewell) by arrangement

450C. 3 units, Spr (Bracewell) by arrangement
BLACK PERFORMING
ARTS,
COMMITTEE ON

Chairman: John H. Cochran (Drama)

Committee: James Shields (Music), Janis Miller (Halifu, Women’s P.E.), James Mitchell (Art)

The Committee on Black Performing Arts is an interdepartmental, interschool program designed for students interested in the performing arts. The Committee serves two main functions: to produce its own shows and to act as a liaison with established departments in hiring faculty and devising courses and programs of particular interest to the Black Community. Through the cooperation of the departments and the Committee, students are able to take relevant courses in dance, drama, music, cinema and still photography.

Consult Time Schedule for courses offered through the following departments: Drama, Music, Women’s Physical Education and Art.

ACADEMIC COMPUTING
SERVICES

Academic Computing Services is located in Pine and Polya Halls on the Jordan Quadrangle and in the Medical Center. The equipment currently operated by SCIP for Academic Computing Services includes a drum-based IBM 360/67 computing system with high-speed disks for on-line storage of users’ programs and data. Limited access to an IBM 370/158 system in Encina Hall is also available. There is a variety of peripheral equipment such as tape units, graphical plotters, and terminals. Many of these terminals are located remotely throughout the campus, permitting the Stanford community to make use of the computer without frequent trips to Pine Hall.

Services available on the 360/67 include a text editor and file handler (WYLBUR), a remote job entry facility, and a time-sharing system (ORVYL), as well as the usual batch processing capabilities. Under ORVYL many interactive subsystems are available, including BASIC, WATORV, PLC, ALGOLW and SPIRES II, a generalized information retrieval system. In addition, BALLOTS, the library automation and management information system, has been in operation since 1972; new features are being developed and will be implemented in the coming year.

A comprehensive library of analysis programs and statistical routines is maintained to assist users in solving their data processing problems. Programming languages available on the 360/67 include ALGOL, BASIC, COBOL, FORTRAN, APL, PL360, GPSS, LISP, PL/1, SNOBOL, and 360 Assembler. Many other software packages that run under the IBM operating system OS/360 are also available.

The staff of Academic Computing Services will provide advice on program development and problem solving to present and potential users of the computer. Nevertheless, it is expected that users will do their own programming and will make any necessary adaptations of available programs for their particular application.

At various times throughout the year Academic Computing Services offers short courses in the use of the data processing and time-sharing equipment at Pine Hall as well as in the use of the major programming languages available. Registration is required for
these courses and begins on University registration day in Pine Hall. The schedule of courses is announced each quarter in the Academic Computing Services Bulletin. In addition, with at least one quarter advance notice, special sections or courses can be arranged through the User Services Office (ext. 7-4400).

1. **Introduction to Academic Computing Services**—This one-session course is designed for faculty, staff and students who will be using Academic Computing Services' IBM 360/67 for the first time. Topics covered include language and program availability, computer charges, keyword protection, use of keypunches and use of the Pine Hall lobby terminal. A tour of Pine and Polya Halls is given. This course meets several times during the first week of the quarter. Each session lasts approximately one and one-half hours.

*0 units, Aut, Win, Spr, Sum*

5. **BASIC**—This course is designed to introduce the student to time-sharing concepts and to the time-sharing language, BASIC. For the researcher who is not a sophisticated programmer, this language is uniquely valuable in solving small day-to-day problems. In addition, the immediate and informative responses by BASIC to programming errors make it an ideal language for beginning programmers. Through the extensive use of examples, the student gains not only a comprehensive introduction to the language, but also a knowledge of the types of problems for which BASIC is particularly well suited. Knowledge of elementary algebra and experience with the text editor WYLBUR are essential.

*0 units, Aut, Win, Spr, Sum*

10. **WYLBUR**—This course is intended to familiarize students with the use of the terminal and with the text editing capabilities of WYLBUR. Students who complete this course will have a good understanding of the available features, and will be able to create, modify, and use data sets which contain programs, data, or textual material. Anyone who plans to use the text editor for preparing reports needs no prior programming experience. While not required, some typing experience will prove helpful. Anyone who plans to use WYLBUR for preparing programs should know a programming language.

*0 units, Aut, Win, Spr, Sum*

15. **FORTRAN IV**—This course is designed to provide a thorough introduction to the FORTRAN language. No previous computer experience is needed. An introduction to computer systems, including a description of software services and a typical hardware configuration, is given. The WATFIV compiler is used extensively in this course. A brief comparison of other FORTRAN compilers available on the IBM 360/67 is also presented. The student learns how to input and output data under format control, to use the available program library facilities, and to create SUBROUTINE and FUNCTION subprograms. Some attention is given to the numerical problems encountered when using a digital computer, and good programming practices are emphasized. Throughout the course, the student gains experience in designing, coding, and debugging FORTRAN programs. The student learns enough Job Control Language to use the IBM 360/67 system.

*0 units, Aut, Win, Spr, Sum*

17. **FORTRAN/OS Interface**—This course introduces the experienced FORTRAN programmer to the Job Control Language for Operating System/360, and explains the job, execute, and data definition statements in detail. The FORTRAN H catalogued procedure is used as a source of examples of these statements. Program optimization, the creation and editing of load modules using the linkage editor, and data management techniques applicable to FORTRAN programming are covered. FORTRAN programmers who plan to use tape or disk devices should find this course valuable. Extensive knowledge of FORTRAN and experience in using the language are essential.

*0 units, Aut, Win, Spr, Sum*

18. **PL/I**—This course is intended to provide the student with an introduction to PL/I, a language designed for a wide range of applications. PL/C, a subset of PL/I developed at Cornell University, is used in the course. Besides the language specifications, a brief introduction to computer systems and debugging facilities is included. Previous programming experience is not re-
quired; however, knowledge of elementary algebra is essential.

0 units, Aut, Win

19. LISP—This course is designed to teach the student the language LISP. The intent is not to emphasize techniques in the theory of list-processing but to develop skills in the features inherent in the language itself. The student solves programming problems using the time-shared LISP facility for initial debugging. The problems are oriented around the list-processing areas of information retrieval, symbol manipulation, etc.; however, no previous knowledge of these areas is required. Experience in the use of the text editor WYLBUR is desirable.

0 units, Aut by arrangement

20. 360 Assembler Language—This course introduces experienced FORTRAN programmers to the 360 Assembler Language. In addition to receiving a complete introduction to the language, the student should gain a knowledge of the various applications of the language through the extensive use of examples. Particular attention is given to the linkage of Assembler Language routines with FORTRAN programs. Assembler macros and data management are not covered in this course. A thorough knowledge of FORTRAN and a high degree of programming sophistication are absolute necessities.

0 units, Win

21. SNOBOL—SNOBOL is a general purpose programming language which was originally developed by Bell Telephone Laboratories for string-processing applications. It is a powerful tool for non-numeric computation, and is especially suited to computer applications in the humanities and to symbolic processing in other fields. This course covers both interactive and batch versions of the language.

0 units, Aut, Win

22. General Purpose Simulation System—GPSS (General Purpose Simulation System) is an IBM-supplied language designed to assist the user in modeling transaction oriented systems. GPSS will create and simulate entities (transactions) and move them through the system along the path specified by the programmer. It is especially applicable to problems that deal with queueing. The course is designed to acquaint the student with the tools necessary for writing a program. Some familiarity with simple statistics and some previous programming experience (BASIC, FORTRAN, etc.) are desirable.

0 units, Aut, Spr by arrangement

23. Mathematical Programming System—MPS (Mathematical Programming System) is a language designed for solving linear and separable programming problems. It also allows the user to do sensitivity analysis and parametric programming. The purpose of the course is to acquaint the student with the MPS procedures necessary for linear programming, separable programming, and ranging and parametric analysis. Students are expected to have some familiarity with linear programming techniques; however, no computer experience is required.

0 units, Win, Spr by arrangement

25. Data Management and Utilities—This course provides a general introduction to the data management facilities of the IBM 360. Particular emphasis is given to the physical data set layout, the formation of source and load module libraries and the services provided by the IBM utility programs. In addition, efficient use of data storage facilities is discussed. Programmers who make extensive use of disk and tape storage, including remote terminal (WYLBUR) users, should find the course worthwhile. Knowledge of FORTRAN and Job Control Language is required.

0 units, Aut, Win, Spr, Sum

26. SPSS—This course is intended to introduce the social science student to SPSS, a Statistical Package for the Social Sciences. SPSS is an integrated system of computer programs for the analysis of data. In addition to the usual descriptive statistics, simple frequency distributions, scattergrams, and crosstabulations, SPSS contains statistical programs for simple correlation, partial correlation, multiple regression, factor analysis, Guttman scaling, canonical correlation, and t test comparison of sample means. This course covers the general format and conventions of SPSS control cards, the procedures and options available, and the Job Control Language for various input and output situations. No previous computer experience is required, but a knowledge of elementary statistics will prove helpful since teaching statistics is not a focus of the SPSS course.

0 units, Aut, Win, Spr
27. **Plotting**—This course is designed to introduce the student to the Overall Plotting System. Emphasis is on line graph plotting; bar graphs and free-form design plotting are discussed briefly. Students learn to plot using all the plotting hardware available on the IBM 360/67. Since the Overall Plotting System is a package of FORTRAN callable subroutines, it is assumed that the student has a knowledge of FORTRAN.

0 units, Aut, Spr

28. **PL360**—This course introduces the PL360 programming language as an alternative to Assembler Language. PL360 enables the programmer to write efficient assembly level programs in a high level language style similar to that of ALGOL. The course is designed to provide a thorough introduction to PL360 programming with emphasis on the effective use of the language. Knowledge of the System/360 architecture is advised.

0 units, Aut, Spr by arrangement

30. **Introduction to SPIRES**—This course is intended to introduce students to the Stanford Public Information REtrieval System. Primary emphasis is placed on the search capabilities of SPIRES, using examples from typical bibliography, personnel directory and numerical data files. File updating using the on-line SPIRES processor is also discussed. Anyone who uses SPIRES for searching or updating needs no prior programming experience. Students are expected to be familiar with common WYLBUR commands.

0 units, Aut, Win, Spr, Sum

31. **SPIRES File Definition**—This course covers the file definition capabilities of the Stanford Public Information REtrieval System. Students learn how to describe file structures in SPIRES, to create SPIRES 'sub-files', to specify access or update restrictions for groups of file users, and to use SPIRES processing rules to describe input and output formats. SPIRES is not a programming language; programming experience is not required for this course. Familiarity with WYLBUR is expected, and the Introduction to SPIRES course is a prerequisite.

0 units, Aut, Win, Spr, Sum

**FOOD RESEARCH INSTITUTE**

Emeriti: Karl Brandt, Joseph S. Davis, S. Daniel Neumark, E. Louise Peffer, Vernon D. Wickizer, Holbrook Working (Professors)

Director: Walter P. Falcon

Professors: Walter P. Falcon, Roger W. Gray, Bruce F. Johnston, William O. Jones, Dudley Kirk, Benton F. Massell, Clark W. Reynolds, Pan A. Yotopoulos

Associate Professors: Scott R. Pearson, C. Peter Timmer

Assistant Professors: Omar L. Davies (Geography), Tetteh A. Kofi. Acting: Barry J. Edmonston (Demography)

Associate Statistician: Rosamond H. Peirce

Librarian: Charles C. Milford

Affiliated Faculty:

Professors: Donald Kennedy (Biological Sciences), Keith B. Taylor (Medical School)

**OFFERINGS AND FACILITIES**

The Food Research Institute was founded in 1921 to study problems of food supply, distribution, and consumption in their economic, social, and political aspects on a world-wide scale. The range of its investigations comprises the world food and agricultural economy, domestic and international trade in primary products, agriculture and economic development, and world population problems.

The Institute's specialized library contains some 60,000 items, including up-to-date series of periodicals from over 50 countries, and is open for reference to students and others.

Food Research Institute Studies in Agricultural Economics, Trade, and Development, published three times a year, reflects the research interests in the Institute.

**THE INSTRUCTIONAL PROGRAM**

Graduate teaching leading either to the Master of Arts or Doctor of Philosophy degree has become an integral part of the Institute's program. The program is designed for graduate students with solid undergraduate training in economics or agricultural economics, who possess a special interest in problems lying within the Institute's areas of research.

The Institute does not undertake supervision of studies leading to a Bachelor's degree, though certain of its courses may be counted toward a major in economics and in some other undergraduate programs.
The University requirements for advanced degrees, as set forth under “Degrees” elsewhere in this bulletin, should be consulted by all prospective students. The following are Departmental requirements.

**Master of Arts**

A student who completes at least 25 units of work in the Food Research Institute with an average grade of B or better; and who has completed at least 45 units of approved work in courses numbered 100 or above in the first four quarters at Stanford, with an average grade of B or better, may be awarded the Master of Arts degree. (See also under “Doctor of Philosophy.”)

**Doctor of Philosophy**

1. The first-year program for pre-doctoral students consists of a series of required and elective courses totaling 45 units. Economics 202, 203 (Price and Allocation Theory I and II), Economics 170, 171 (Introduction to Econometrics I and II) and Food Research 200 (Economics of Income, Employment and Structural Change in Disequilibrium Systems) are required. It is expected that the four other courses taken during the first year will be in the fields of the Institute.

2. During the second year of the Ph.D. program the student prepares through lectures, seminars, and directed reading and research in three fields for written examinations that are administered at the end of the second or early in the third year. Normally these are chosen from the following Institute fields: Economics of Agriculture; Economics of Consumption; Economics of Production; Commodity Prices and Markets; Applications of Economics to Development; International Trade Problems and Policies; Economic Geography; and Demography. A student wishing to offer a field outside this list or outside the Institute must secure approval.

3. Each student is required to prepare a detailed prospectus of his or her doctoral dissertation, which is subject to committee approval, and to defend this in a University-administered oral examination. The completed dissertation is subject to faculty approval, but no further formal defense is required.

4. To meet the foreign language requirement, a candidate must demonstrate a reading knowledge of one language other than English. The requirement may be satisfied in either of two ways: (a) by completion with passing grade of an approved reading course for the language concerned or, (b) by passing a special reading examination, to be given by a qualified member of the Food Research Institute or in the relevant language department.

5. At least two years (6 quarters) of graduate registration in the Institute program satisfactorily completed is required for each candidate.

**Fellowships and Scholarships**

The Food Research Institute has available a limited number of University fellowships and scholarships for qualified students, ranging in amount of support to approximately $2100 a year plus tuition. All students receiving University support are expected to accept a Research Assistantship or Teaching Assistantship in exchange for fellowship aid during at least one quarter of residence. Applications for all fellowships and scholarships should be made to the Graduate Admissions Office, Stanford University, Stanford, California 94305.

**Courses**

100. Human Geography — This course seeks to acquaint the student with the geographic point of view and some of the materials of geography fundamental to an understanding of man-environment relations and patterns of resource use. Major themes are the relation between changing earth environments and human evolution, changing man-land relations in culture history, natural environments and contemporary livelihood systems, the determinants of the spatial structure of economic and social institutions, and the determinants of patterns of resource evaluation and utilization. Instruction is given in those branches of physical geography most relevant to the concerns of social sciences.

5 units, Aut (Davies) MTWTh 10

101. Economic Geography — This course provides an introduction to some of the more important concepts in economic geography.
The main themes to be considered are theories of agricultural, industrial and residential location, inter-regional movement, the regional structure of cities, and regional policy and planning. Examination of these themes involves analysis of the structure of market areas, central place theory and the influence of transport costs on economic location.

5 units, Win (Davies) given 1975–76

102. The Geography of Latin America—(May be taken as 202 by graduate students.) The course deals with the economic geography of Latin America, concentrating upon the development of agriculture and the adaptation of rural society to modern conditions. Against the background of an explanatory-descriptive model of Latin American ecological sub-regions it traces the development of the rural economy in its colonial, primary export, and industrialization phases. In examining such problems of modern agricultural development as the adequacy of the performance of agriculture, the current means by which production expands, the influence of land tenure on the efficacy and equity of growth, equal stress is placed on the current state of knowledge and the theory and methodology underlying this analysis.

5 units, Win (Davies) TTh 10–12

103. The World Food Economy—(Same as Economics 106 and Human Biology 121.) This course will examine the individual components essential to a macro-perspective of the world food economy. The biological and economic principles of food production will be used to explain the potential for food supplies. Next attention will be devoted to nutritional, social, and economic factors that influence the consumption of major food groups. Techniques for measuring and evaluating nutritional well-being will be discussed briefly. The last part of the course will examine the world food economy in global perspective.

3 units, Spr (Timmer) MWF 10

105. Commodity Futures Markets and Prices—(Same as Economics 107A.) (May be taken as 205 by graduate students.) Description of the uses and functioning of commodity futures markets, with emphasis upon business uses of the markets. The meaning of hedging and the evolution of hedging practice. Determinants of the level of market use, and the relationship between level of use and market usefulness. Consideration from the evidence of price behavior, trading composition, and external influences, of the performance of futures markets in price determination and other functions. The extent, influence, and importance of speculation in commodity futures.

3 units, Aut (Gray) MW 4:15–6:05

106. Workshop in Commodity Price Analysis—(Same as Economics 107B.) (May be taken as 206 by graduate students.) Applications of various approaches to commodity price analysis and forecasting. Student papers to report on analyses of particular commodities and markets. Prerequisite: 105 or 205 and consent of instructor.

3 units, Win (Gray) W 4:15–6:05

118. The Economics of Underdevelopment—(Same as Economics 118.) This course presents an analysis of development within an historical perspective. The development process is analyzed with regard to the mechanisms of capital accumulation, technical change, and trade. Discussion is focused upon various theories and empirical evidence relevant for understanding the current structure and operation of underdeveloped economies.

5 units, Aut (Yotopoulos) MTWThF 10

120. Marketing, Consumption, and Price Analysis—(Same as Economics 128.) Applications of micro-economic theory to problems of commodity price determination, with major emphasis on methods of analyzing consumption and marketing channels. Agricultural examples are stressed and the marketing analysis has an economic development focus.

3 units, Aut (Timmer) TTh 1:15–3:05

129. Analytical Techniques for Development Planning—(Same as Economics 129.) (May be taken as 229 by graduate students.) This course will emphasize linear programming and benefit/cost analysis as methods of evaluating projects and sectoral programs. The focus will be on applications rather than on theory, and on technique rather than on mathematically sophisticated methodology. Examples will be drawn primarily from the agricultural sector of less developed countries, but the techniques that are examined will be applicable to a much wider set of problems and issues.

3 units, Aut (Timmer) MWF 11
133, 134. Economic Development Problems of Third World Economies with Colonial Heritage I and II—(Same as Economics 127A,B.) (May be taken as 233 or 234 by graduate students.) An analysis of development theories, problems and policies common to third world economies, the evolution of these economies through the pre-colonial, colonial, and post-colonial eras, categorization of empirical growth models and patterns in terms of basic internal structures and institutions and international influences. Topics include development models of closed and open economies, problems associated with monocultures, land tenure systems, agricultural development, foreign investment and multinational businesses, industrialization, balance of payments and debt servicing, terms of trade and remunerative incomes from sales of primary produce, commodity agreements and related problems. Contemporary theories of economic imperialism and dependency models of development will be analyzed.

Research papers initiated in the first or second quarter will emphasize area studies or case studies of individual countries—hypotheses will be formulated and tested qualitatively or quantitatively.

5 units each quarter, Win, Spr (Kofi)
TTh 4:15-6:05

135. Population Problems—(Same as Economics 131 and Sociology 130.) (May be taken as 235 by graduate students.) Contemporary problems of U.S. and world population in a social science context. Economic and sociological causes and consequences of population composition and trends in births, deaths, and migration. Sociological implications of urbanization and of the demography of minority groups. Population growth in relation to food, resources, and modernization in developing countries. Population policies; family planning programs and population control.

5 units, Win (Kirk) MTWTh 9

143. Energy Policy and Economic Analysis —(Same as Economics 155.) This course will examine patterns of energy use in the United States; determinants of energy prices, production, and use; energy policy prior to 1973; factors leading to the energy crisis; measures to deal with the crisis; "Project Independence"; international energy policy; leasing of federal lands; pricing and regulation; tax policy; energy conservation; energy research and development policy. Prerequisite: Economics 51.

3-5 units, Win (Massell) MWF 11

144. Economics of Agriculture: Structure and Policy—(Same as Economics 144.) (May be taken as 244 by graduate students.) The course deals with American agriculture and its historical and contemporary role in the economy. Topics include the structure and characteristics of farming and processing units, the role of agriculture in American economic development, government policy toward commercial agriculture, poverty problems in rural America, and the international dimensions of United States agriculture. Emphasis is on policy alternatives rather than on farm management.

3 to 5 units, Aut (Falcon, Jones) MWF 9

145. U.S. Agriculture: Interaction of Biology and Economics—(Same as Human Biology 153.) The development of agriculture in the United States has been profoundly shaped by biological and by economic influences; sound policy determination usually requires an understanding of the roles of both. This course is devoted to the interaction of these influences. It will consider (a) the biological basis of agricultural practice, including the major groups of cultivated plants, soil and water relations, growth physiology, genetics and plant breeding, agroecosystems and pest control; (b) basic agricultural economics, including the microeconomic basis of production, the supply of agricultural products, technological change, the demand for farm products, and the influence of federal farm programs on agricultural incomes, output, and international trade. In the last part of the course, the scientific and institutional components of selected policy issues in agriculture will be considered.

3 units, Spr (Falcon, Kennedy) MWF 9

150, 151. World Food Problems—(Same as Economics 108A,B.) A two-quarter workshop to examine the current adequacy of world food supplies on a country and regional basis. Members of the workshop will examine concepts and measurement of the quality of nutrition, problems of measurement of food supplies, the incidence and causes of inadequate nutrition, and projections of nutritional problems over time. Each member of
the workshop will investigate the sufficiency of food supplies in a particular less developed country or region and present a report on his findings. Enrollment limited to 12. Prerequisite: consent of instructors.

5 units each quarter, Win, Spr (Jones, Taylor) MTWTh 11

153. Location Theory and Spatial Analysis—(Same as Economics 149.) (May be taken as 253 by graduate students.) This course will be organized as a seminar and students are expected to prepare research papers. It will present the principal theories and techniques that have been found useful for the analysis of the spatial expression of social and economic systems. They include central place theory, models of spatial interaction, the economic theory of location, space in development planning, and certain aspects of spatial statistics. Theoretical and methodological developments will be related to their application to hypothesis testing and planning.

5 units, Spr (Davies) TTh 2:15-4:05

160. Trade and Development Problems of Tropical Africa—(Same as Economics 160.) (May be taken as 260 by graduate students.) Analysis of selected international aspects of tropical African economic development. Topics include African–non-African international trade and economic relations (theoretical background, historical perspective, case studies of export-led growth and the impacts of international capital flows) and intra-African trade and economic integration (customs union theory, historical perspective, case studies of African economic integration).

3 to 5 units, Win (Pearson) MW 2:15-4:05

**Courses Primarily for Graduate Students**

200. Economics of Income, Employment, and Structural Change in Disequilibrium Systems—A framework is developed for the macroeconomic analysis of market interaction in economic systems subject to structural transformation. Special attention is paid to the process of income distribution, welfare, and growth. The relationship between real and financial markets is examined, with respect to the roles of fiscal and monetary policy in the transformation process. Alternative social accounting techniques are evaluated with respect to their usefulness in analyzing regional and national economic change. Several short papers and final exam.

5 units, Spr (Chinn) MW 3:15-5:05

202. The Geography of Latin America—See 102.

205. Commodity Futures Markets and Prices—See 105.

206. Workshop in Commodity Price Analysis—See 106.

218. Development Problems of Latin America—(Given as Economics 123, 223.) (Open to advanced undergraduate students, with the consent of the instructor.) An examination of the historical problems of economic growth and structural change in selected Latin American countries. Emphasis is placed on the application of modern analytical methods to problems of savings and investment, income distribution, employment, trade and finance. Given seminar style with individual research papers.

5 units, Aut (Reynolds) TTh 3:15-5:05

220. Marketing, Consumption, and Price Analysis—Same lectures as Food Research 120, but will include additional discussions on analytical techniques. An empirical investigation will be begun for presentation in Food Research 320 in Winter Quarter.

5 units, Aut (Timmer) TTh 1:15-3:05

221. Economics of Production—The theory of production with special emphasis on agriculture. Production functions, profit functions and input demand functions; supply responsiveness; economic efficiency and technological change in the process of agricultural development. Prerequisite: one course in microeconomic theory and econometrics.

5 units, Win (Yotopoulos) given 1975-76

224. Empirical Investigations in the Economics of Development—The course concentrates on empirical propositions in the theory of economic development. It deals with the formulation of operational hypotheses and the construction of tests and it surveys recent empirical research. It examines selectively some of the important variables of development, e.g., capital, labor; and also some of the significant features of the structure of growth, e.g., efficiency, sectoral change and interrelationships, choice of
techniques and investment criteria, financial and monetary structure, international trade. The agricultural sector receives special emphasis. Prerequisites: one course each in microeconomic theory, economic development, and econometrics.

5 units, Spr (Yotopoulos) given 1975–76

225. Agricultural Development and Economic Growth—A theoretical-historical approach with emphasis on agriculture's role in the development process. Selected issues to be examined include intersectoral relationships and resource flows, dualism, economic rationality and labor-leisure allocations, technical change, land tenure and taxation, and criteria relevant to the choice of strategies for agricultural development.

5 units, Win (Falcon) MW 10–12

229. Analytical Techniques for Development Planning—See 129.


240. Resource Economics—Analysis of economics of depletable resources, externalities and common property resources, public investment decisions, social discount rates, intertemporal allocation, efficiency pricing, regional issues, energy resources, water resources, fisheries, environmental protection, land-use policy. Prerequisite: Economics 202.

3 units, Win (Massell) TTh 1:15–3:05

244. Economics of Agriculture: Structure and Policy—See 144.

253. Location Theory and Spatial Analysis—See 153.


261. Seminar: Policies Governing International Trade and Investment—Discussion of selected policies, especially American, governing international trade, foreign investment, and international payments. Each student will be required to lead a seminar discussion and write a term paper. Open to advanced undergraduate students with consent of the instructor.

3 units, Win (Pearson) T 7:30–10:00 p.m.

285. Seminar: Demography of the Developing Countries—(Same as Sociology 231.) The demographic situations of each of the major regions—Latin America, tropical Africa, Islam, India, and East Asia—in relation to economic and social development. Population forecasts and prospects. Present and possible policies for restricting population growth. Each student will be required to lead a seminar and prepare a paper based on a term project. Prerequisite: 235 or consent of instructor.

5 units, Spr (Kirk) MW 1:15–3:05

286. Demographic Methods—(Same as Sociology 286.) Methodology of population analysis, including actuarial procedures, fertility measurement, stable population analysis, cohort analysis, population projection, and construction of demographic models.

3 to 5 units, Spr (Edmonston) TTh 10–12

320. Seminar: Empirical Analysis of Consumption—The seminar will discuss in depth several research papers prepared for 220, as well as a number of readings essential for preparation for the field examination in the economics of consumption. Food and agricultural topics are highlighted. Prerequisite: 220.

3 units, Win (Timmer) T 1:15–3:05

321. Seminar: Applications of the Theory of Production—The purpose of this seminar is to prepare students for their dissertation fieldwork in the economics of production.

3 units, Spr (Yotopoulos) given 1975–76

365. Seminar: Economics of Tropical Agriculture—Selected topics in organization of production and marketing of agricultural products for home consumption and for export. Prerequisite: consent of instructor.

5 units, Spr (Jones) 7:30–9:30 p.m.

371, 372, 373, 374. Directed Reading and Research.

371. 3 units, Aut (Staff) by arrangement

372. 3 units, Win (Staff) by arrangement

373. 3 units, Spr (Staff) by arrangement

374. 3 units, Sum (Staff) by arrangement

401, 402, 403, 404. Advanced Directed Reading and Research.

401. 3 units, Aut (Staff) by arrangement

402. 3 units, Win (Staff) by arrangement

403. 3 units, Spr (Staff) by arrangement

404. 3 units, Sum (Staff) by arrangement
GRADUATE DIVISION SPECIAL PROGRAMS

Dean of Graduate Studies: Lincoln E. Moses
Associate Deans: J. Merrill Carlsmithe, Frederick W. Crawford
Assistant Deans: Karlene N. Dickey, Lynette N. Hall, Thomas A. Rhue, Patricia D. Weiss

SPECIAL PH.D. PROGRAM

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 a program may be individually planned for an unusually able and well-qualified graduate student who has already been admitted to a department or school of the University to study for the Ph.D. and enrolled therein for at least two full quarters.

A student with a well-considered program not now provided for in the existing departments or special programs of the University may then approach a member of the Academic Council qualified to give him or her guidance. The professor, if he or she believes the program desirable, will gather a sponsoring committee consisting of at least three other members of the Academic Council who represent the student's various fields of interest. Included in this 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 C54) to the University Committee on Graduate Studies:

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 Studies, an advisory committee, which usually but not necessarily will be the same as the sponsoring committee, will supervise the candidate's work and sign the forms ordinarily transmitted by major departments. The chairman of the advisory committee will normally direct the dissertation. Students registering for special research under the guidance of their committee or for the Ph.D. dissertation should use the following course numbers:

400. Research.
   By arrangement
   By arrangement

COURSES FOR GRADUATE STUDENTS

337A, 337B, 337C. Seminar in Public Affairs
—The core seminar in the University's Public Affairs Fellowship Program, focusing on the contemporary role of democratic government and the responsibilities of its leaders; the nature of democratic government and politics; the dynamics of social, economic, and political change; and critical emerging issues of public policy. Credit will be given only for completion of the entire sequence.

337A. 5 units, Aut (Alvarez-Tostado) by arrangement
337B. 5 units, Win (Alvarez-Tostado) by arrangement
337C. 5 units, Spr (Alvarez-Tostado) by arrangement

420A, 420B. Interdisciplinary Transportation Analysis
—This lecture/workshop course provides a broad interdisciplinary view of transportation and its importance to the economic and sociological well being of communities and the nation. Methods of forecasting transportation demand and modal choice and analyzing alternative transportation systems capable of satisfying this demand are studied. The technological and economic characteristics of present and future vehicles, terminal and other infrastructure requirements, impacts on surrounding communities, such as pollution, noise, traffic congestion, effects on tax base, population and employment are all considered in constructing methods of comparative evaluation of the competitive systems.

The interdisciplinary class from various engineering departments, economics, the so-
cial sciences, and the school of business develops solutions to specific transportation problems of importance to the nation and/or the Bay Area. The format is 2 lectures per week plus a 1 hour meeting of student working groups with the instructor. Guest lecturers from various Stanford departments and off campus participate. Seniors may enroll upon consent of instructor.

420A. 3 units, Win (Shevell) MWF 10
420B. 3 units, Spr (Shevell) MWF 9

The following courses, though given within the departments listed, may be taken by any interested graduate students:

**COMPUTER SCIENCE**

105. Introduction to Computing.
106. Introduction to Computing.

**EDUCATION**

106. Education as Cultural Colonialism
109A. Cultural Pluralism: Classroom and Curricular Strategies.
109B. Cultural Pluralism: Classroom and Curricular Strategies.
200. History of Education.
201. History of Education in the United States.
209. Problems of Development Education in Africa.
212. The Politics of Educational Innovation: Comparative Analysis.
216. Cultural Pluralism and American Educational Policy.
220A. The Social Sciences and Educational Analysis: Introduction to the Economics of Education.
242. Bicultural Processes in Education.
302. Colloquium on the History of American Urban Education.
306B. Education and Political Development.
311. Socialization of the Young in Contemporary Society.
346X. Teacher Education: An Urban Cross-Cultural Emphasis.

402. Clinical Seminar in Early Education (with consent of instructors).
411. Seminar in Child Development and Early Education (with instructors' consent).

**FOOD RESEARCH INSTITUTE**

260. Trade and Development Problems of Tropical Africa.

**APPLIED EARTH SCIENCES**

130. Environmental Earth Sciences I.
131. Environmental Earth Sciences II.
132. Environmental Earth Sciences III.

**GRADUATE SCHOOL OF BUSINESS**

For course offerings in the Graduate School of Business, please refer to their current Degree Programs Bulletin.

**HOOVER INSTITUTION**

Note — The following course taught by staff members of the Hoover Institution is offered for academic credit as indicated.


5 units, any quarter (Gann or Duignan)

**INDUSTRIAL ENGINEERING**

208. Biotechnology.
209. Analytical Methods for Industrial Engineers.
229. Engineering Economy.

**GRADUATE AT LARGE**

Graduate at Large status is granted to applicants whose previous academic preparation has not included the necessary prerequisite course work for application to future graduate education. The applicant must (1) hold a Stanford degree, (2) lack some or all prerequisite courses for desired graduate work, and (3) must have maintained a 2.5 grade point average.

If the applicant holds the Bachelor's degree only, he or she must submit both a Graduate at Large and Graduate Division application at least one month before the quarter of desired study begins. If the appli-
cant holds a Stanford advanced degree, he or she must petition the Registrar to change his or her major from the original graduate field to Graduate at Large and submit the Graduate at Large application to the Graduate Division.

No letters of recommendation nor Graduate Record Examination scores are required. No financial aid is available. Further questions should be directed to the Assistant Dean of Graduate Studies, Graduate Division office, Inner Quad, Building 1.
HOOVER INSTITUTION
ON WAR, REVOLUTION AND PEACE

Emeriti: Harold H. Fisher (Chairman); Joseph S. Davis, Edgar E. Robinson, Graham H. Stuart (Councilors); Witold S. Sworakowski (Professor)

Director: W. Glenn Campbell
Associate Director: Richard F. Staar
Associate Director: Richard T. Burress
Assistant Director for Administration and Finance: Sally Vanders
Consultant to Office of Director: Witold S. Sworakowski
Information Officer: Brien Benson


Consultants: Ching-wen Kwang, Yuan-li Wu


Visiting Senior Research Fellow: Yoram Barzel

Executive Secretary, National and Peace Fellows Program: Dennis L. Bark


Peace Fellows: Barton J. Bernstein, Peter A. Corning

Research Fellows: Dennis L. Bark, Paul Cocks, Brian Fry, Robert Hessn, William Ratliff, Charles P. Ridley, P. Craig Roberts


Public Affairs Fellows: Stuart Hardy, Robert Turner, Peter Witonski


Head, Publications Department: Brien G. Benson

Curators: Joseph W. Bingaman (Latin America Collection), Anna M. Bourguina (Nicolaevsky Collection), Peter Duignan (Africa Collection), Richard W. Lyman (Honorary Curator, British Labour Collection), Agnes F. Peterson (Western European Collection), George S. Rentz (Middle East Collection), Vasilii Romanov (Honorary Curator, Imperial Russian Collection), Richard F. Staar (Acting Curator, East Asia Collection), Wayne Vucinich (East European Collection). Deputy Curators: Lewis H. Gann (Africa Collection), Emiko Moffit (East Asia Collection)

Archivist: Milorad M. Drachkovitch

Since its founding by Herbert Hoover in 1919 as a special collection dealing with the causes and consequences of World War I, the Hoover Institution on War, Revolution and Peace has become an international center for documentation, research, and publications on problems of political, economic, and social change in the twentieth century.

The library includes the largest private archive in the United States and outstanding area collections on Africa, East Asia, Eastern Europe, Latin America, the Middle East, and Western Europe.

Holdings 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 materials are open to all Stanford students, faculty, and staff, and to scholars from outside the University.

The Institution has its own resident research staff of historians, economists, and political scientists and promotes basic re-
search and documentary studies. Notable long-term research topics include African colonialism, post-Mao China, and the International Communist movement.

The Institution is currently expanding its domestic research and fellowship programs, which will become comparable in size and quality to the international studies program. Scholars participating in the program will conduct advanced research on current political, economic, and social issues of domestic policy; in addition, there will be conferences, seminars, and lectures that deal with the issues.

Three senior scholars in the domestic studies program have already begun examining such problems. Senior Fellow Martin Anderson has been studying alternative ways of raising an armed force as well as the economics of private enterprise; Senior Fellow Rita Campbell is working on the economics of health; and Senior Fellow Roger Freeman is studying the fiscal growth of the American government.

In addition to its own research staff, the Institution has been used over the years by tens of thousands of American and foreign scholars. Considering the value of the collections, every effort will be made to increase the use of Institution resources by providing more funds for predoctoral and postdoctoral fellowships. Illustrative of this aim is the National Fellows Program, which includes a special category of Peace Fellowships. The program offers by invitation to young scholars time for unrestricted research in modern history, political science, international relations, economics, and sociology.

The Institution also has a publications program, and since 1919 some 275 volumes have been published.

Among the Institution staff members scheduled to teach during 1974-75, together with their areas of specialization and the course designations, are the following: Paul Cocks, Decision Making and Bureaucratic Politics in the Soviet Union; Alexander Dallin, Soviet Politics; Lewis Gann and Peter Duignan, Graduate Division Special Program on Methodology of African History; George Rentz, History of the Islamic World; Wayne Vucinich, (1) Ottoman Empire, (2) Balkan History since 1800, and (3) Colloquium on Eastern Europe. See also Graduate Division Special Programs, in addition to the departments noted above. Curators and other senior staff are particularly willing to work out directed reading arrangements.

**COMMITTEE ON HYDROLOGY**

Committee in Charge: Irwin Remson (Chairman), William E. Brigham, Joseph B. Franzini, Paul Kruger, Ray K. Linsley, Perry McCarty

**PROGRAMS OF STUDY**

The Committee on Hydrology, which includes faculty from the Departments of Applied Earth Sciences, Civil Engineering, Geology, and Petroleum Engineering, administers a program of graduate studies leading to degrees of M.S. in Hydrology and Ph.D. in Hydrology.

The program is interdisciplinary and covers a wide range of the Hydrologic Sciences, emphasizing surface hydrology and groundwater hydrology together with those parts of meteorology and oceanography that are related to the hydrologic cycle. Studies involving the impact of the nuclear age on hydrology are also available.

**MASTER OF SCIENCE**

This program is available to students having the Bachelor's degree in Civil Engineering, Chemical Engineering, Chemistry, Geology, Geophysics, Agronomy, Forestry, Meteorology, Nuclear Science or Engineering, and related fields. In order to earn the M.S. degree in one year, the student should have completed basic courses in physics, chemistry, mathematics through an introduction to differential equations, geology, and elementary fluid mechanics.

The M.S. program will include 45 or more units of which at least 35 will normally come from the following list of courses:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES 284</td>
<td>Engineering Geology</td>
<td>4</td>
</tr>
<tr>
<td>AES 304, 305</td>
<td>Applied Geomathematics</td>
<td>4</td>
</tr>
<tr>
<td>Civil Engr. 203</td>
<td>Statistical Models in Civil Engineering</td>
<td>10</td>
</tr>
<tr>
<td>Civil Engr. 208</td>
<td>Stochastic Processes and Decision Statistics for Civil Engineers</td>
<td>4</td>
</tr>
<tr>
<td>Civil Engr. 201</td>
<td>Environmental Fluid Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>Civil Engr. 262</td>
<td>Ocean and Coastal Engineering</td>
<td>4</td>
</tr>
</tbody>
</table>
Civil Engr. 263. Fluid Mechanics of Closed Conduits 3
Civil Engr. 264. Open Channel Hydraulics and Sedimentation Problems 4
Civil Engr. 222. Water Resources Planning 3
Civil Engr. 266. Engineering Hydrology 4
Civil Engr. 267. Advanced Hydrology 4
Civil Engr. 268. Water Resources Development 4
Civil Engr. 269. Water Resources Seminar 1
Civil Engr. 270. Water Quality in Water Resources Development 3
Civil Engr. 273. Water Chemistry 3
Civil Engr. 273A. Water Chemistry Laboratory 1
Civil Engr. 274. Water Microbiology 3
Civil Engr. 266A. Nuclear Methods in Environmental Sciences 3
Civil Engr. 276B. Environmental Impact of Power Generation 2
Civil Engr. 276C. Environmental Radioactivity 3
Civil Engr. 277. Explosion Construction Engineering 3
Elec. Engr. 292A. Environmental Systems Analysis 3
Geol. 171. Introduction to Geochemistry 3
Geol. 190. Introduction to Probability and Statistics in Geology 3
Geol. 221. Photogeology 3
Geol. 222. Geomorphology 4
Geol. 230. Hydrogeology 5
Geol. 231. Groundwater Resources 3
Geol. 232. Numerical Methods in Hydrogeology 2
Geol. 250. Introduction to Marine Geology 5
Geol. 290. Applications of Probability and Statistics in Geology 3
Pet.E. 151A,B. Reservoir Fluids 6
Pet.E. 151E. Core Analysis Laboratory 3
Pet.E. 172. Natural Gas Engineering 3
Comp.Sci. 106. Introduction to Computing 3
Indus. Engr. 141. Utilization of Computers 3
Stat. 110. Statistical Methods in Engineering and the Physical Sciences 4

The program is subject to approval by the Committee and must represent a strong, coherent course of study in the student's area of professional interest. Inclusion of more than 10 units not listed above may be approved if this aids in assembling a coherent program. The average of grades in graduate work must be at least a B. Sample curricula may be obtained on request from the Committee.

Doctor of Philosophy

Ph.D. programs will be determined by discussion with the Committee on Hydrology but will normally include the substantial equivalent of the M.S. program plus an additional minimum of 45 units of course work totaling at least 90 units. To become a Ph.D. candidate the student must demonstrate proficiency in one foreign language, pass a qualifying examination specified by the Committee and have a grade point average in graduate work of at least a B. Minimum residence requirements for the Ph.D. are nine quarters (six semesters) of graduate study; at least six quarters must be at Stanford. Completion of all requirements including the dissertation is rarely accomplished within the minimum time requirement, and students should expect to spend as much as one year beyond the minimum. A minor in Hydrology is not offered for Ph.D. programs in other departments of the University.

Financial Assistance

In addition to the usual University aid, a limited number of research assistantships are available. Assistants customarily work under supervision of a faculty member on one of the current research projects with which Committee members are involved. Where possible, students are assigned to projects that are in line with their professional interests. Research results are often used by doctoral candidates as a basis for a dissertation.

International Studies (Commission on)

The Commission on International Studies (CIS), appointed by the President of the University, together with an affiliated administrative entity, the Center for Research in International Studies (CRIS), provide mechanisms for coordination and cooperation among international, regional, and comparative programs. These programs are University-wide and include research and teaching activities in the Schools of Humanities and Sciences, Law, Business, Education, and in the Food Research Institute. Within the School of Humanities and Sciences, the Departments of Anthropology, Communication, Economics, History, Political Science, Sociology, and the language departments are those primarily concerned. The Hoover Institution on War, Revolution and Peace is also heavily involved in international affairs.
Neither the CIS nor CRIS offers courses or confers degrees.

The CIS is composed of faculty members and administrators selected from schools, departments, institutes, or centers which have significant international components in their research and teaching programs. The Commission is concerned with major policy questions and decisions and with the ordering of priorities within the overall program.

CRIS

The University established the Center for Research in International Studies in 1967 and assigned to its director and staff the role of coordinating various aspects of the international studies program. These include administering some foundation and government financial support for faculty research, student fellowships, library development, and new faculty appointments. CRIS also provides assistance in seeking funds to advance all aspects of the international studies program. Members of the CRIS Staff are closely associated with the Graduate Overseas and Special Program which administers the Inter-University Center for Japanese studies in Tokyo and the Inter-University Program for Chinese Language Studies in Taipei.

AREA STUDIES

The work of CIS and CRIS is closely related to all of the research and teaching programs having regional or area orientations. Interdisciplinary subcommittees of the CIS concerned with Africa, East Asia, Latin America, and Russia and East Europe coordinate University resources in the study of each region. All area-related courses are offered by individual schools, departments, and institutes and are listed thereunder in this bulletin. Undergraduate degree programs are coordinated by each of these area committees. At the graduate level, special programs leading to the A.M. in Latin American Studies, East Asian Studies, Russian and East European Studies are available. These degree programs are described in the appropriate area sections of this bulletin. No Ph.D. is offered in any area studies program, but a qualified doctoral candidate may design a cross-disciplinary specialization which emphasizes the area interest within the student's disciplinary preparation for the degree.

RESEARCH PROGRAMS

CIS and CRIS also work closely with discipline-oriented research and training programs located in centers, institutes, and schools. These include the Food Research Institute, the Center for Research in Economic Growth, the Comparative Politics program, the International Development Education Center, the Institute for Communication Research, the International Legal Studies program and the Arms Control and Disarmament program. While the emphasis in these research and training programs is on graduate level education, the faculty associated with some of these programs have significant responsibilities for training and counseling undergraduates as well.

UNDERGRADUATE PROGRAM

A special interdisciplinary program in International Relations for undergraduates has been developed in response to initiatives to review this aspect of the international studies curriculum. The relevant course offerings are described under the rubric "International Relations: Special Offerings for Undergraduates" in the School of Humanities and Sciences section of this bulletin.

Inquiries relating to any of the above should be directed to Director, Center for Research in International Studies, Building 460, Room 465, Stanford, California 94305.

INTER-UNIVERSITY CENTER FOR JAPANESE STUDIES IN TOKYO

ADMINISTERED BY STANFORD UNIVERSITY

The Inter-University Center for Japanese Language Studies in Tokyo, Japan, is a cooperative enterprise of 11 major academic institutions in the United States and Canada with Stanford University as the administrative agency. The purpose of the Center is to provide qualified graduate and undergraduate students with intensive audio-lingual Japanese language instruction, as well as to further the students' familiarity with Japanese texts and materials preparatory or leading to research in given disciplin-
nary or professional fields. The location of the Center in Tokyo provides maximum opportunities for students to gain fluency in both the written and spoken language in a Japanese-speaking and Japanese cultural environment. Language study is carried on in small classes or in individual tutorial sessions by Japanese instructors. Advanced and Post-doctoral students may be given opportunities for specialized work in the language, as well as other individual study, dependent upon their linguistic qualifications and their degree programs as established by their home institutions.

The academic year at the Center is equivalent to four full quarters, beginning in early September. Any student may apply for admission provided that he or she (a) is a student in good standing, and is a degree candidate at an accredited university or college; (b) will have successfully completed prior to attendance a minimum of two years of Japanese or its equivalent at the college level; and (c) takes a written screening examination in the Japanese language.

For further information please write to:
Graduate Overseas and Special Programs
Room 465, Building 460
Stanford University
Stanford, California 94305

INTER-UNIVERSITY PROGRAM FOR CHINESE LANGUAGE STUDIES IN TAIPEI
ADMINISTERED BY STANFORD UNIVERSITY

The Inter-University Program for Chinese Language Studies in Taipei, Taiwan, was established in September 1963. It is sponsored by ten American universities, with Stanford University as the administrative agency. The Program is a cooperative effort drawing upon the accumulated experience of the profession in providing advanced language training in a Chinese cultural area and is not intended to be a substitute for strong language offerings at American institutions.

The purpose of the Program is to provide graduate and undergraduate students with intensive audio-lingual language instruction, as well as to further the students' familiarity with Chinese texts and materials preparatory or leading to research in given disciplinary or professional fields.

Undergraduate, graduate, or postdoctoral candidates are eligible to apply to the Program if they have successfully completed a minimum of two academic years, or its equivalent, of Chinese language study at the college level. Applicants must also pass a short written screening examination in the Chinese language.

For further information please address your inquiries to:
Graduate Overseas and Special Programs
Room 465, Building 460
Stanford University
Stanford, California 94305

LIBRARIES

Emeriti: Minna Stillman (Associate Librarian); Alice Charlton (Chief Catalog Librarian); Jeannette M. Hitchcock (Chief of Division of Special Collections); Margaret Wells (Education Librarian); Grace E. Stillson (Assistant Chief Catalog Librarian); Ruth Scibird (Curator of the Stanford Collection); Margaret Windsor (Assistant Chief Librarian); Jennette E. Hitchcock (Chief Catalog Librarian); Charles R. Gorham (Chief Gifts Librarian); Elmer R. Grieder (Associate Director of Libraries); Jack Plotkin (Chief Circulation Librarian); Joseph A. Belloli (Senior Reference Librarian)

University Libraries
Director: David C. Weber
Associate Director: Earl C. Borgeson
Assistant Director for Undergraduate and Branch Services and Librarian, J. Henry Meyer Memorial Library: Robert A. Golter
Assistant Director for Bibliographic Operations: Allen B. Veaner
Building Projects Manager: Philip D. Leighton
Financial and Planning Officer: John Heyeck
Department Chiefs: Ralph W. Hansen (Acquisition); A. H. Epstein (Automation); Philip D. Leighton (Building Services):
Lawrence E. Leonard (Catalog); Sandra K. Korn (Government Documents); Bernard J. Denham (Personnel); B. Jack Pooler (Science); Florian J. Shasky (Special Collections)

University Archivist: Ralph W. Hansen

Curators — Resources Development Program: James Breedlove (Latin American Materials); Peter Frank (Germanic Languages); Paul J. Kann (Romance Languages); Wojciech Zalewski (Russian and East European Materials)

Curators — Honorary: George T. Keating (Music Bibliography); Irving Whittemore Robbins, Jr. (Rare Books and Manuscripts); Elmer E. Robinson (Americana); Albert Sperisen (Typography)

Food Research Institute Library
Librarian: Charles C. Milford

Hoover Institution—See listing elsewhere in this catalog.

J. Hugh Jackson Library of Business
Director: Marion M. Smith
Head, Reader Service: Martha A. Ashmon

Lane Medical Library
Director: Peter Stangl
Coordinator for Library Operations and Services and Head, Acquisitions Section: Ruth Pressman; Head, Cataloging Section: Gloria Linder; Head, Reference Section: Paul S. Hanson; Head, Circulation Section: Betty Vadeboncoeur; Night Supervisor: Tim Furst

Law Library
Law Librarian: J. Myron Jacobstein
Acquisition Librarian: Howard W. Sugarman; Catalog Librarian: Rosalee Long; Reference Librarian: George Torzsay-Biber; Documents and Special Projects Librarian: Adrienne Adan

Linear Accelerator Center Library
Technical Information Officer: George E. Owens
Head Librarian: Robert Gex
Associate Head Librarian: Louise Addis

The Libraries of Stanford University sponsor a variety of instructional activities in order to promote awareness of the library resources and services that are available to the campus community and to expedite their effective use.

The reference librarians in all major library units provide professional advice and consultation on locating and utilizing published information. Curators and branch librarians offer similar bibliographic help within their subject specialties. Other types of instructional aid include tours, audio-visual presentations, and lectures to classes at the instructor’s request.

Numerous library publications are prepared to inform and instruct library users, the most general and basic of these being the Guide to Stanford University Libraries, which is frequently revised and available free at all major libraries. A general description of the libraries, their collections and services, is also included in the Information Bulletin.

The formal courses listed below are intended to serve those students for whom a more extended study of bibliographic organization is useful.

**COURSES**

Library 1. Library Resources and Research Methods—Designed for students at all levels who wish to improve their ability to use libraries in general and the Libraries of Stanford University in particular. Emphasizes major types of material and the use of catalogs, bibliographies, indexes, abstracts, and other aids to study. Directed to the individual student’s subject interests as far as possible.

3 units, Aut, Win, Spr (Staff)

Undergraduate Special 10. Introduction to Slavic Bibliography—The aim of this course is to acquaint students with reference sources, research techniques, and general library use in the field of Slavic studies. Russian and Soviet bibliography will be emphasized. Open to all students, but some knowledge of Russian or other Slavic languages would be useful.

2 units, Aut (Zalewski)

Freshman Seminar 24A,B. The World of Rare Books and Their Collectors Through the Ages—This two-quarter course is designed to teach the student how to describe, compare, investigate, and attribute rare books, both hand-written and printed. The history of parchment and papermaking, of
illuminations and woodcuts, and various techniques of book production will be investigated. Other activities will include printing on the antique hand-press of the Bender Room, and the planning and arranging of a small exhibit.

6 units, Win, Spr (Lenkey)

Music 200. Music Bibliography—Survey of reference and research materials in the field of music. Discussion of scope and organization of the Music Library holdings and access by means of the card catalog and other bibliographic and discographic guides. Practice in the use of reference materials, with emphasis on identification and location of primary resources. Introduction to methods of research through model problems and term projects involving sources, scholarly editions of music and performance materials, and writings found in encyclopedias, monographs, and serial publications.

3 units, Aut (Colby)

Art 236. Colloquium: Art Historical Bibliography and Library Methods—An introduction to and survey of standard works and reference materials in art and architectural history. Subjects covered will include acquisition and research techniques, cataloging and library procedures, indexing and abstracting, the history of the book, papermaking, conservation as it relates to art history and museum practices, and career possibilities in the field of art. Competence in art historical research will be gained through bibliographical problems and the compilation of an annotated bibliography.

4 units, Aut (Colby)

Latin American Studies 260. Colloquium on Latin American Bibliography—This course is directed to the needs of beginning graduate students. Its purpose is two-fold: to acquaint the student with the principal resources for Latin American studies in the humanities and social sciences; and to teach the mechanics of utilizing the bibliographic data available for the study of Latin America in the Stanford University libraries.

2 units, Aut (Breedlove)

German Studies 300A. Introduction to Bibliographical Research—The purpose of this course is to improve the research capabilities of its participants in a subject area noted for the scope, variety, and sophistication of its bibliographical apparatus. Focus will be on both a knowledge of the available bibliographical resources and skill in accessing information by their means. Open to qualified students from every department, and adaptable to individual research needs.

3 units, Win (Frank)

**PHYSICAL SCIENCES (GENERAL PROGRAM)**

Emeritus: Julien A. Ripley, Jr.
Professor: Claudio Alvarez-Tostado
Lecturer: William A. Perkins

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.

**PROGRAMS OF STUDY**

**BACHELOR OF SCIENCE**

The following requirements are in addition to the University's basic requirements for the Bachelor's degree:

- Chemistry 31, 33, 35, 36, Mathematics 41, 42, 43, Geology 1, 2, Physics 21, 23, 29, or equivalents.
- Forty-five additional units of work in chemistry, physics, mathematics, geology, or related fields.

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. 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

5, 6, 7. Physical Science—A study of the development of physical sciences and their interaction with other activities of society. The sequence considers the development of scientific thought from Greek times to the present, using selected topics that seem to illustrate best the nature of scientific activity. Lectures emphasize history and philosophy of science.

5. 3 units, Aut (Alvarez-Tostado) TTh 11:00-12:15
6. 3 units, Win (Alvarez-Tostado) TTh 11:00-12:15
7. 3 units, Spr (Alvarez-Tostado) TTh 11:00-12:15

10. Introduction to Meteorology—A review of current knowledge about weather, with special attention to problems of air pollution. Lectures and problem sessions.

3 units, Aut (Alvarez-Tostado) Lecture TTh 9 and problem session by arrangement

50. Modern Astronomy — A review of current concepts and ideas regarding the nature of the solar system, galaxy, and extragalactic systems; essentially nonmathematical discussion of the basis for these concepts. Telescopic observations if possible.

3 units, Spr (Perkins) MWF 11

99. Directed Reading.
Any quarter (Staff)

Any quarter (Staff)

STANFORD OVERSEAS STUDIES

Stanford Overseas Studies Programs offer a variety of study opportunities overseas to Stanford students. There are large, residential, campus-type centers in Florence, near London, in Tours, and in Beutelsbach (near Stuttgart). In addition, there is a studies center in Vienna with courses offered both by Stanford and the University of Vienna and where students live in Austrian dorms; a center in Berlin for advanced undergraduates, and four centers where students are regularly enrolled in overseas universities: in Paris, Lima, Bonn, and Salamanca. Stanford also administers the Intercollegiate Center for Classical Studies in Rome where students from 45 institutions, including Stanford, are eligible to attend classes.

Language requirements and recommended preparatory courses vary from center to center and students interested should read the appropriate program folder and the catalog Stanford Overseas Studies 1974-76 for further information. Both are available in room 112, Old Union. All courses taken overseas receive regular University credit.

In the listing that follows, descriptions of courses are supplied when available. Further descriptions are available in Course Abstracts for Overseas Studies Centers. Unit values can be found in the course list and program folder in the Overseas Studies Office and in each quarter’s Time Schedule. Courses are not listed for Paris, Lima, Bonn, or Salamanca since students will be choosing from among the offerings of the University in which they are enrolled. Nor are courses listed for Berlin since they were not ready at press time.

BRITISH STUDIES CENTER

Academic and administrative personnel:
Paul K. Ledger, Academic Director
George A.B. Docker, Administrative Director
Felix Aprahamian
John Bender
Christopher Game
Count Gibson
Charles McCorquodale
Rodney Shewan
Geoffrey Tyack
Walter Vincenti
V.C.D. Vowles
Eric Wright
Virgil Whitaker

BRITISH SOCIETY, POLITICS, AND CULTURE

English Society and Politics, 1603-1800—
The development of English society during a period which witnessed the Civil War, the
“Glorious Revolution,” and the inception of the Industrial Revolution, as well as the establishment and breakaway of the American colonies.

*Win (Staff)*

**English Society and Politics, 1800-1914** — The emergence of a class society, the rise of the welfare state, and the managed economy in 19th and 20th century Britain. These themes will be developed in lectures, but students will also be expected to participate in seminars on aspects of social change. Lecture course.

*Spr (Tyack)*

**Policy-Making in Britain** — The structure and functions of the British government. Final choice of decisions and policy areas to be studied will be determined by the students enrolled in the course. Colloquium.

*Aut (Game)*

**Modern British Government and Politics** — An introduction to the main political and administrative institutions of British government and the way they work—the electoral system, the political parties, interest groups, Parliament, the Cabinet and the Prime Minister, the Civil Service, and nationalized industries.

*Aut, Spr (Game)*

**British Architecture from the Anglo-Saxons to 1750** — A chronological history of British architecture, stressing the interaction of political, social, and artistic change, and emphasizing Britain's architectural links with the rest of Europe. Lecture.

*Aut (Tyack)*

**British Architecture from 1750 to the Present** — The development of modern architecture in the context of social changes in England over the past 200 years. Special emphasis will be laid on how stylistic changes have been related to the emergence of new types of building in response to the demands of an increasingly numerous and industrialized society. Colloquium.

*Win (Tyack)*

**English Culture and Society, 1870-1939** — The evolution of modern British attitudes and behavior. Beginning with the Depression of the late 19th century, the course will focus on the impact of economic change on the English way of life up to the Second World War, including a detailed discussion of the effects of World War I. Designed to be taught with Modernism in English Literature, the course will draw on the works of writers and artists who commented on the social history of the period. Colloquium.

*Aut, Win (Tyack)*

**Social Structure of Modern Britain** — An introduction to the social structure and institutions of modern Britain. The first part of the course presents some of the basic themes and concepts of sociology, and these are then employed in an examination of some of the key institutions in British society. Colloquium.

*Win (Game)*

**20th Century Political Thought in Britain** — An introduction to the main currents of 20th century political thought in England, with special emphasis on the following topics: evolution and growth of the modern party system, the consolidation of the trade union movement, and the development of the welfare state and the managed economy. Colloquium.

*Aut, Spr (Game)*

**British Architecture from the Anglo-Saxons to 1750** — A chronological history of British architecture, stressing the interaction of political, social, and artistic change, and emphasizing Britain's architectural links with the rest of Europe. Lecture.
local history, literature, painting, and folk music and oral history. Colloquium.

Win (Tyack)

Education in England and Wales—An introduction to the education systems of England and Wales with emphasis on organizational structure, institutions, and curriculum. Discussion will focus on secondary schools and on the relation of social change to educational reform. Seminar.

Spr (Vowles)

20th Century English Composers — The works of six of the most important contemporary English composers: Elgar, Delius, Holst, Vaughan Williams, William Walton, and Benjamin Britten. Not designed for music majors, although some prior knowledge of music or at least some experience in music listening is helpful. Seminar.

Win (Aprahamian)

Introduction to English Law—An introduction to the English legal system. Study of procedures, civil liberties, the court system, and comparative analyses will be included in the course. Seminar.

Aut (Wright)

BRITISH LITERATURE

Modernism in English Literature, 1870–1950—Advanced colloquium on the development of consciousness in modern literature. Material covered will include novels, plays, poetry, patriotic songs, advertising, and journalism. Beginning with the first rejections of the historicism of the Victorians, the course deals with works through the pre-war and war years up to 1950. Colloquium.

Win (Shewan)

Contemporary British Novel—Introduction to major British novelists of the past 20 years and their works. Special attention will be given to experimentalism, social realism, and escapism. When possible, comparisons will be drawn with novels of previous periods and with those of other countries. Colloquium.

Spr (Shewan)

Practical Literary Criticism—Designed to help students become more accustomed to reading and analyzing poetry. A close examination of a poem (usually modern and unfamiliar to the class) will be made each week, with special emphasis on technique and effect. The aim is to enable students better to enjoy poetry and to question preconceived notions of what is “poetic.” Colloquium.

Aut (Shewan)

English Attitudes to Emotion—An experimental course designed to examine the socio-cultural contexts of literary works, paying special attention to the expression of emotions. Selected works will be examined in terms of the conventions prevailing at the time they were written and of the reactions the authors expected to elicit from their audiences. Colloquium.

Spr (Shewan)

TECHNOLOGY AND SOCIETY

Urban and Technological Change in 19th Century England—The rapid growth of English industrial cities in the early 19th century gave rise to interrelated social, political, and technological stresses not dissimilar to those existing today. In particular, satisfaction of the needs for fresh water and for the disposal of human and industrial waste was attained only after long years of technical, legislative, and administrative innovation. The colloquium will examine these matters more closely. Each student will be responsible for research into a separate social, political, or technical aspect of the matter.

Aut, Win (Vincenti)

Technology and Society in the British Industrial Revolution—The interplay of technological change and societal development in Britain in the 18th and 19th centuries. The underlying concern throughout the course will be with the social history of technology as a frame of reference for understanding our present industrial civilization. The internal history of technology will be emphasized in a way intended to give the non-technical student some appreciation of how it appears from the inside. Lecture.

Aut (Vincenti)

Industrial Archaeology—Industrial archaeology—the study and preservation, not of ancient sites as is usually the case, but of remains from the Industrial Revolution of the 18th and 19th centuries—has generated considerable enthusiasm in Britain in the last decade. The literature of the subject will be studied, British authorities will be invited in for talks and discussion, and field sites will
be visited and scrutinized insofar as is practicable. Colloquium.

Winter (Vincenti)

BRITISH DRAMA AND THE PERFORMING ARTS

Shakespeare—Intensive study of six to eight plays. Selections will include histories, tragedies, and comedies from the major periods of Shakespeare's work. Where possible, the plays chosen will be those currently showing at Stratford and in London. Students will be encouraged to see productions of the plays.

Aut (Whitaker)

Contemporary British Drama—Designed to acquaint students with the broad spectrum of theatrical activity in London. Plays assigned for viewing are usually works of living British playwrights and are produced in workshop and experimental theaters as well as West End theaters. The variety of production and stage techniques is, therefore, wide, but emphasis in the course will be placed principally on the plays' literary content. Colloquium.

Aut, Win (Shewan)

In addition to the regular courses offered during Summer Quarter on British society, culture, politics, and the arts, there will be a special program as follows:

HEALTH CARE DELIVERY AND PUBLIC POLICY

A comprehensive examination of health care policy, using Britain as an example, but framed in terms applicable to health needs throughout the world, including the developing countries. All aspects of health care systems—the technical, political, social, and economic—will be examined. The program is specifically timed and intended for premedical and medical students, but participation of nonmedical students interested in public policy and social welfare is welcome and encouraged. The following is a partial list of courses to be taught in this program:

Health Care Planning and Delivery
  Sum (Gibson)

Health Care Economics and National Planning
  Sum (Gibson)

FRENCH STUDIES CENTER

Academic and administrative personnel:
  Paul LeMoal, Director
  René Borius, Associate Director
  Monique Armand
  Alain Corbin
  Odile de Croizant
  Claude Doubsky
  Pierre Gault
  Oliver Wendell Holmes
  Michele Jomaron
  Jean Dominique Lafond
  Patrick Menget
  Françoise Perdoux
  Jacques Roger
  Douglas Russell
  David Tuttle
  Jean Michel Vaccaro
  Austryn Wainhouse

At the French studies center, courses are organized in two general ways: there is a core curriculum which is intended to provide a general introduction to French culture and civilization; and there is a focus program which explores a particular theme from that culture in some depth.

CORE PROGRAM

Introduction to Contemporary French Civilization—A study of contemporary French economics, politics, society, art, and culture. Also a study of French daily life. Lecture.
  Aut (de Croizant)

L'Existentialisme littéraire—A study of literary existentialism, using novels by Camus (L'Etranger, La Peste, Caligula, and La Chute) and Sartre (La Nausée, L'Être et le Néant, and Huis Clos). Colloquium.
  Aut (Perdoux)

La Littérature existentialiste—Seminar.
  Aut (Jomaron)

La musique electro-acoustique en France—le groupe de recherche musicale de l'O.R.T.F. A study of the important currents of contemporary musical creation in France. Seminar.
  Aut (Vaccaro)

Le cinéma français depuis 1945—Seminar.
  Aut (Gault)

Les monuments du passé sur notre sol—Préhistoire—Le monde Gallo-Romain, Ro-
Introduction to French cultural life: in the 17th and 18th centuries — This course will comprehend the two classical centuries of thought and art in France from a double perspective: that of the underlying foundation which they constitute for all comprehension of contemporary thought, and that of an initiation to recent works, particularly historical works, which have renovated the manner in which we view a period that is much more rich and complex than is contained in the formula "Classical Centuries."

Etude socio-politique et intellectuelle de la science française au XVIIIe siècle — This course will study both external (economic, social, and political) and internal factors which influenced the development of French, and more broadly, European science during the 18th century. Seminar.

Actualité du théâtre de Molière — A study of three major works by Molière (Tartuffe, Le Misanthrope, and Don Juan), with emphasis on his characterizations of human pride, greed, hypocrisy, and alienation. Seminar.

L'Homme devant la vie à travers les Fables de La Fontaine et Candide de Voltaire — A study of 17th century social critics through the poetical works of La Fontaine. Colloquium.

La peinture française de Nicolas Poussin à David — A general study of French painting during the 18th and 19th centuries. Seminar.

La musique classique française — A presentation of the principal musical currents (both vocal and instrumental) of the 17th and 18th centuries, including some theoretical aspects of the music. Seminar.

French Mathematical Thought — A study of the personal lives and professional contributions of a group of mathematicians active in France from 1790 to 1830 as a source of insight into French life during that period. Lecture.

La civilisation française du XIXe et XXe siècles — A study of certain key questions, figures, ideas, problems, and social and cultural phenomena especially representative of the period between the Napoleonic Wars and World War II. Lecture.

"La condition humaine": André Malraux — An in-depth study of Malraux's novel, La condition humaine. Background information on the biographical, historical, and political context of the work will serve as an introduction to the study of characters as embodiments of Malraux's philosophical approach to death, evil, solitude, and the absurdity of the human condition. Seminar.

Luttes et espoirs de la femme française moderne — The role of French women in society has changed significantly in the past ten years. Students will study past and present attitudes of French women to politics, sex, work, family, and men. Seminar.
Le cinéma française des origines à 1945 — Seminar.
Spr (Staff)

An Introduction to French Theater—An introduction to the history of French theatre from Medieval times to the present which will include attendance at selected performances in Tours. Lecture.
Spr (Russell)

Colloquium in Art and Theater—Selected periods in Western art and theatre will be discussed each week. The technique and structural method of selected plays will be analyzed for parallels with the compositional method found in the visual arts of their contemporary periods.
Spr (Russell)

An Introduction to French Art—The history of French art from Roman times to the present will be studied and compared to the artistic development of other European countries. Lecture.
Sum (Russell)

Les grandes voix de la poésie française de Baudelaire à nos jours—A presentation of the main currents of French poetry from Baudelaire to the present. Other poets to be studied include Rimbaud, Breton, Eliard, Aragon, Desnos, Char, Artaud, Michaux, and Claudel. Seminar.
Spr (Jomaron)

FOCUS PROGRAM

Aut (Borius)

Intellectuals and Politics in France—A two quarter course, each quarter independent of the others. A study of the relationship between the emergence of social, political, and historical consciousness and the processes by which men attempted to develop answers for such problems as personal identity, ethical values, and the role of the individual in an increasingly complex society during the 19th and 20th centuries. The course entails an analytic attempt to compare the intimate, and often intricate, interaction of the social, political, and cultural activities of groups of philosophers, theorists, and literary figures in France.
Win, Spr (Holmes)

Bourgeois Literature—Gustave Flaubert's *L'Education Sentimentale* will serve as a focus for the study of the problematic relationships between bourgeois ideology and the 19th century novel in France. Seminar.
Aut (Doubinsky)

Le socialisme française dans la première moitié du XIXe siècle—A study of the link between the structures of French society and the social theories of the 19th century. Seminar.
Aut (Corbin)

Ideology and Politics in France 1914–1945—Europe during and after the First World War, with emphasis on the activities of each of the major European nations, the democracies and the dictatorships, and on the issues leading to the Second World War. Lecture.
Win (Borius)

Win (Jomaron)

Surréalisme—The main tenets of Surrealist theory, as a continuance of the Romantic quest for ultimate unity and reconciliation of opposites, will be studied in the writings of André Breton and in selected examples of Surrealist poetry (Breton, Aragon, Eliard, and others). Seminar.
Win (Doubinsky)

Ideology and Politics in France 1945 to the Present—A study of French political life from the formation of the provisional government after World War II to the present, including such topics as the “decolonization” of Indochina and Algeria, the Fifth Republic, and post-Gaullism. Lecture.
Spr (Borius)

Le Marxisme en France de 1920 à 1974—A study of the comparative naiveté of French Marxist intellectuals and of the extensive role Marxist theory has played in French political life. Seminar.
Spr (Corbin, Holmes)

Paris: May/June 1968—A study from several viewpoints of the events and consequences of the first great student movement
in France during May and June of 1968.

Seminar.

Spr (Armand)

Le Roman français contemporain 1945–1970
—A study of the most prominent novelists of the late forties and of the fifties, and the transformation in the sixties. The course will emphasize the search for a new realism, objectivism, and thingism in the novel as an instrument of recognition of the self and the world.

Seminar.

Spr (Jomaron)

INTENSIVE FRENCH

Intensive French grammar, conversation, and reading will be taught all quarters at the French Studies Center and students will be assigned to classes appropriate to their previous preparation.

MATHEMATICS AND COMPUTER SCIENCE

Math 10, 11, 21, 22, 23, 41, 42, 43, 44, 106, and 130 will be available during Winter and Spring Quarters on a tutorial basis from Professor David Tuttle at the French Studies Center. In addition, a colloquium will be offered on the use of the digital computer both Winter and Spring Quarters for students who have not had any previous mathematical or computer science preparation, as well as for those who are better prepared.

GERMAN STUDIES CENTER

Academic and administrative personnel:

H. Rüdiger Hipp, Director of Studies
Alfred Schmid, Director of Administration
Javene Black
Carl Davis
Richard Gross
Gabriele von Radecki
Michael von Poser
Hartmut Wasser
George Spindler

MODERN GERMANY, EAST AND WEST

Modern Germany II — Designed to introduce students to specific historical and political problems in Germany, from Germany’s rise to a unified national state in the 19th century through World War I, the fate of the first German democracy during the Weimar Republic, and the rise of fascism. Lecture in German.

Aut (Wasser)

East-West Relations: Cold War to Detente
—A survey of relations of the Soviet Union and the allied Western powers during World War II, as negotiators in the international conferences, antagonists in the German question, hostile rivals in the atomic power race (to the Cuban missile crisis); an analysis of West Germany’s foreign policy under the influence of these changing relations. Concludes with a study of the relaxation of tensions between East and West and the détente policies of the Brandt-Scheel government.

Seminar.

Aut (Black)

GERMAN LITERATURE

The Modern German Novel and Social Criticism —This course provides a perspective on German postwar society through the study of works of fiction. Selected novels by Böll, Frisch, Gaiser, and Lenz will be studied from a sociological perspective as well as from a literary one. Students will be expected to read, and write a major paper on, a novel chosen from a list of optional readings as well as to complete the required readings.

Seminar.

Aut (Schmid)

Goethe and His Time, Goethe’s Faust — An intensive study of Goethe’s life, with emphasis on the historical, philosophical, and cultural situation of the 18th and early 19th centuries. Students will read Faust I and explore the history of the Faust legend.

Seminar.

Aut (von Radecki)

GERMAN HISTORY

Hitler, Goebbels, and the Language of the “Third Reich” —A study of Hitler’s views on the nature and function of propaganda and the methods he used. Special attention will be paid to particular stylistic and linguistic patterns, such as repetition, excessive use of superlatives, abbreviations, and special vocabulary. Tapes and transcripts of speeches by Hitler and Goebbels will be carefully examined.

Seminar.

Aut (Hipp)
GERMAN EDUCATION

History of Education—Western European educators and schooling and their social setting, from the Greco-Roman period to the 20th century. Major attention will be given to Germanic theorists and practitioners such as: Francke, Froebel, Hecker, Basedow, Kant, Herbart, Sturm, Schleiermacher, and Steiner. Lecture.

Aut (Gross)

Comparative European Education—Current developments in selected European school systems, emphasizing the clash between tradition and change now evident in representative countries. Major attention will be given to schools and schooling in Germany. The course will include guest lectures by German specialists and field trips to German schools. Seminar.

Aut (Gross)

GERMAN MUSIC

Major German Composers—An introductory survey of the music of the great German composers, from Bach to Schoenberg, with special emphasis on the relationship of a composer’s life to his music. The importance of style and individual musical characteristics associated with each composer will be examined. Lecture.

Aut (Davis)

GERMAN LANGUAGE AND CONVERSATION

Instruction in grammar, reading, conversation, and writing in German. Classes are taught at levels appropriate to students’ prior training, and grammar courses continue sequences begun in German in California.

The German Studies Center is changing locations at the end of December 1974, moving into the middle of the town of Beutelsbach. At press time, only a partial list of courses for Winter and Spring Quarters of 1974–75 was available. They are listed below. For complete and up to date information, see the German program folders available in the Stanford Overseas Studies Office.

19th Century Germany—A history of German-speaking Europe in the 19th century including the rise of Germany to a unified nation-state.

Win (Staff)

20th Century Germany—A history of German-speaking Europe in the 20th century. Topics include: the foundation of the Weimar Republic, the inter-war years and the rise of fascism, the division of Germany, and current German politics.

Spr (Staff)

The Remstal—An introduction to the Remstal, its people, geography, culture, and heritage; primarily intended for newly arrived students.

Win (Spindler)

Spr (Staff)

The Art of Germany—A survey of German art history with major emphasis on the art of the Remstal region.

Aut, Spr (Staff)

The Music of Germany—A survey of German music emphasizing the use of musical offerings in Stuttgart.

Win (Staff)

Daily Life

Win (Spindler)

ITALIAN STUDIES CENTER

Academic and administrative personnel:

Giuseppe Mammarella, Director
Guelfo Frulla, Director of Studies
Sidney Alexander
Ronald Bracewell
Lucia Benini
Franca Celli
William Chace
Guido Fink
Anna Kaiser
Joan Mammarella
Giovanni Scichilone
Maria Todorow
Ezra Zubrow

FLORENCE AND ITALY

Florence in the Past and Present—A multi-level study of the city of Florence from the 13th century to the present. Discussions will focus on the historical, artistic, political, social, and mercantile aspects of Florence through the centuries. Students will be required to visit sites and to offer personal impressions and insights to the class’s study of Florence. Prerequisite: intermediate Italian. Colloquium in Italian.

Win (Benini)
Florence Through the Eyes of Pratolini — A study of selections from at least four of Pratolini's books, accompanied by analysis of his view of Florentines and their social and political problems from the beginning of the century to the present. Students will be required to visit areas of the city described by Pratolini. Class discussions will focus on the readings and students' comparisons of Pratolini's Florence and the Florence they discover through visits and conversations with Florentines. Prerequisite: intermediate Italian. Colloquium in Italian. 

Aut, Spr (Benini)

The Discovery of Tuscany: Writers and Places — The course will familiarize students with the Tuscan region through readings, analysis and discussion of the readings, and visits to sites mentioned. Students will be encouraged to develop their own opinions of the Tuscan people and to present and defend their impressions orally and in writing, referring to their own experiences and to the experiences and opinions of the authors studied. Prerequisite: intermediate Italian. Colloquium in Italian.

Aut, Spr (Benini)

Galileo's Role in Science — A detailed examination of the scientific writings of Galileo with a view to understanding what is meant by the opinion that basic science started with Galileo.

Sum (Bracewell)

Modern Astronomy and Modern Life — A review of current concepts and ideas regarding the nature of the solar system, galaxy, and extragalactic systems; essentially a non-mathematical discussion of the basis for these concepts.

Sum (Bracewell)

GREEK, ETRUSCAN, AND ROMAN CIVILIZATION

Art and Culture of Greece and Magna Graecia — Topics to be covered are: origins, development, and main achievements of Greek culture and art (1050-50 B.C.); the Greek colonies overseas — their political, socioeconomic, and cultural role; role and meaning of the Greek experience in the history of the Western world. Field trips and museum visits will be an integral part of the course. Lecture with limited enrollment in English.

Win, Spr (Scichilone)

Etruscan and Roman Art and Culture — Origin, development, and main aspects of Etruscan culture. The Etruscans and their relations with the Italian world and with other Mediterranean cultures. The Greek contribution to the culture and art of Etruria. Origins of Rome, the Roman Republican world, the Roman Empire and its art, and Roman culture and art in late antiquity. Visits will be made to the Villa Giulia, Tarquinia, Cerveteri, the Roman Forum, Museo Nazionale Romano, Museo della Civiltà Romana, Palestrina, and Ostia Antica. Lecture with limited enrollment in English.

Aut, Sum (Scichilone)

THE RENAISSANCE

Tuscan Art from Giotto to Leonardo — A chronological analysis and study of the stylistic development of the masterpieces of Tuscan art from the 13th to the 15th centuries. Special attention is paid to Giotto, Masaccio, Donatello, Botticelli, and Leonardo. The course is also planned to introduce students to personal discovery of the main works of the Renaissance through required visits to Florentine museums scheduled chronologically in relation to materials studied. Lecture in English.

Aut, Spr (Todorow)

The High Renaissance in the Visual Arts — A study of the two culminating figures of the High Renaissance, Michelangelo Buonarroti and Raffaello Sanzio, their works, their cultural settings, and comparison with some of their contemporaries such as Titian, Caravaggio, and Correggio. Multi-level analysis will be applied, drawing upon Hauser for the sociology of art styles, Panofsky for iconography, Wolfflin for stylistic trends, and Berenson for stylistic schools. Lecture accompanied by slides and assigned visits to major Florentine museums. Prior courses in Renaissance history or in art history are recommended but not required. Lecture in English.

Win, Sum (Alexander)

Michelangelo — An introduction to the major aspects of the art, history, and ideas of the Italian Renaissance through the life and works of Michelangelo Buonarroti.

Spr (Alexander)

The High Renaissance and Baroque in Florence, Rome, and Venice — A study of the
greatest painters of the Renaissance: Raffaello and Michelangelo. Also, a study of the early 16th century Florentine School of painting; of the Tuscan Mannerist painters; of the 16th century Emilian School of painting; and of the Venetian School of painting.

Win (Todorow)

Narrative and Drama of the English Renaissance—A study of selected narrative and dramatic works of the English Renaissance (16th century), among them two translations from Italian narrative poems, which should promote an understanding of the English use of materials common to an international Renaissance style. Seminar.

Spr (J. Chace)

MEDIEVAL ITALIAN LITERATURE

Dante, Petrarch, and Boccaccio—An introduction to the greatest writers of the Italian "Trecento," stressing the difference in and evolution of their visions of man, God, love, learning, tradition, and society, as well as their contributions to the genres of the epic poem, the sonnet, and the novella. Texts will be read and discussed in English, but originals will be available and students will be encouraged to study at least the stylistically outstanding portions in Italian. Seminar in English.

Aut, Sum (Fink)

Dante's Inferno — An analysis of the first part of The Divine Comedy, with special emphasis on some key cantos chosen as bases for discussion of Dante's vision and technique, the historical and political situation in Florence in the 13th century, the great religious debates of the Middle Ages, and symbolism and allegory in medieval art. Seminar in English. Reading in Italian.

Win (Fink)

MODERN LITERATURE IN ITALY

American Writers and the Italian Scene—This course will examine the various ways in which certain Americans, and certain American writers, have seen Italy, have attempted to come to terms with its culture, its people, and its history, and have gone about constructing an "Italy of the imagination."

The course will look at the ways in which American innocence (either real or imagined) has played its part in the Italian-American encounter. It will also look at the means by which certain aspects of Italian culture and experience are employed by Americans to reinforce their own sense of identity. The course will conclude with a brief examination of what Americans want Italy to be for them, and how those expectations are created. Lecture.

Win (W. Chace)

Dante and the Modern Imagination—This course will be both a reading of The Divine Comedy, with some particular attention paid to its special aesthetic, religious, and moral properties, and a discussion of certain literary works of this century which are indebted to, or reflect Dante's achievement.

The course will attempt to ascertain as clearly as possible the character of the poet's moral imagination and to see the various ways in which that moral imagination makes itself felt in works by T.S. Eliot, Ezra Pound, James Joyce, LeRoi Jones, and Hubert Selby. Colloquium.

Win (W. Chace)

Representative Italian and Anglo-American Literature of the 20th Century—This course will present certain selected works in Italian literature (in translation) and Anglo-American literature of this century to see what important connections might be drawn between them. The normal procedure of the course will be to compare two works or authors (e.g., Montale and Eliot, Svevo and Joyce, Bassani and Berenson) in a given week of course meetings. The resemblances and the stark differences will be evaluated. The aim of the course is, first, to read the works, and secondly, to see how the literature and cultural experiences of one country can be made to illuminate those of another. The works have been chosen to make comparisons natural and appropriate. Lecture.

Spr (W. Chace)

Ezra Pound's Italy—The course is designed to make Italy come alive to instructor and students alike as it came alive to the American poet, Ezra Pound. Pound lived in Italy, wrote there, devoted his energies to the cause of Fascism, was imprisoned there, and returned there to live out his last years. A most attentive and idiosyncratic student of Italian culture, Pound can serve as an interesting means of entering that culture. His major poetic work, The Cantos, will in part be read, as will other of his works which
treat of Italy. Some field trips are planned. Colloquium.

Spr (W. Chace)

Pirandello, Dramatist and Short-Story Writer—A general introduction to contemporary literature in Italy, with a special emphasis on theater. Following the introduction, students will read and discuss the following plays by Pirandello: Così è se vi pare, Enrico IV, Sei personaggi in cerca di autore, Il berretto a sonagli, La signora Morli una e due, La patente, Liola, and La giara. Particular emphasis will be placed on Pirandello's view of reality and illusion. The colloquium will be offered to advanced students in Italian.

Spr (Kaiser)

Modern Italian Poetry—A survey concerned with Italian poetry from the turn of the century; the first break with tradition and Romanticism, the violent break of Futurism and other avant-garde schools, the influence of French symbolism and Anglo-Saxon trends, the great "hermetic school." Special emphasis will be placed on the works of Ungaretti and Montale, but other poets will be discussed. General issues will be raised such as the relevance of the various critical tools we use and the various approaches of modern critics. Poems will be read and discussed in Italian. Colloquium.

Spr (Fink)

Modern Italian Theater—A survey of modern Italian theater; the verse drama of the turn of the century (Giacosa and D'Annunzio), Naturalism (Giacosa and Praga), the Futurists, and other avant-garde groups; Pirandello and his influence on world theater; the "grotesque" theater—Betti, Eduardo and his Neapolitan tradition; the present state of Italian theater up to recent experimentalism (Bene and Nanni), parody (Poli), and commitment (Fo). Texts will be read and discussed in English, but some recent works which have not been translated may be assigned in Italian. Seminar.

Win (Fink)

Italo Calvino—Between Fable and Reality—A study of several works of Italo Calvino. Students will read and discuss Calvino's views of reality and myth and of Western Man as anonymous in a crowded, impersonal world. Comparisons may be drawn between Calvino and contemporary American writers. Prerequisite: intermediate Italian. Colloquium in Italian.

Win (Benini)

La Narrativa Italiana e la Società Italiana dal 1930 ad Oggi—A survey of contemporary Italian fiction, focusing on the period after 1930. The course will consist of the reading and analysis of a number of short stories or passages from novels by the major contemporary novelists: Moravia, Vittorini, Pavese, Calvino, Buzzati, Sciascia, and Pas- rise. Discussion will center around each author's style as well as his or her view of the world. Prerequisite: intermediate Italian. Colloquium in Italian.

Win (Celli)

Elio Vittorini, "Conversazione in Sicilia"—The course is designed for advanced students to deepen their knowledge of Italian through a close reading and analysis of Vittorini's Conversazione in Sicilia. Students will pay close attention to his style of narration, use of the language, stylistic devices, and symbolic and mythic implications. Besides providing a means for intensive literary study, the novel will be used as a basis for discussion of the problems of Italian society. Prerequisite: advanced Italian. Colloquium in Italian.

Aut, Spr (Celli)

Sicily Through the Works of Sicilian Writers—An analysis of some of the historical, political, social, and economic problems of Sicily through reading works of major Sicilian authors. Emphasis is on style and content of the works, but students will be expected to develop their speaking skills through class discussion.

Win (Kaiser)

Carlo Emilio Gadda—An advanced literature course examining some of the complex problems in the works of Gadda, in particular La Cognizione del dolore and Quer Pasticciaccio Brutto de Via Merulana. In the opinion of many critics, Gadda (1893–1973) may be considered among the few "modern" Italian authors, especially with regard to his treatment of the Italian language. The course will analyze his linguistic eclecticism, ranging from archaic and traditional usage of dialect to sophisticated linguistic innovations, the division he makes between form and content, and the expansion of his use of dialect from La Cognizione to Pasticciaccio.
Prerequisite: advanced Italian. Colloquium in Italian.

Spr (J. Mammarella)

Tuscan Writers of the 19th and 20th Centuries—An introductory survey of the works of Florentine authors from the last half of the 19th century to the present. In addition to reading original texts, the class will discuss the authors’ influence on, and reflection of, literary and cultural trends of their time. Authors to be studied include Fucini, Pratesi, Tozzi, Cassola, and Pratolini. Colloquium in Italian.

Spr (Benini)

Advanced Exposition—A course in writing narration, description, and exposition. Students will read from the expository and analytical works of English and American travelers in Italy.

Spr (J. Chace)

ITALIAN FILM

Cinema and Italian Society—An analysis of various aspects of Italian life and history, from the great changes of the second half of the 19th century to Fascism, the war, the postwar crisis, and the economic boom as seen in significant Italian movies. Each film will be shown in Italian, but a detailed synopsis in English, and whenever possible, the complete dialogues, will be handed out in class. Discussion will be in English. Seminar.

Aut, Spr (Fink)

Federico Fellini: Passato ed Innovazione—Introductory information on Italy’s film industry, followed by a presentation of Fellini’s career and a perspective of his most important films. Students will read scripts for the following films and then view the films themselves: I Vitelloni, Le notti di Cabiria, La Strada, Giulietta degli Spiriti, Amarcord. Though some attention will be paid to Fellini’s technical skill, more emphasis will be placed on his view of Italian society and the Italians through their myths, their habits, their history, and their concepts of family. Prerequisite: intermediate Italian. Colloquium in Italian.

Winter (Celli)

CONTEMPORARY ITALIAN POLITICS AND SOCIETY

Contemporary Italian Politics—Designed to give students a knowledge and understanding of the basic political problems of modern Italy within the European framework. The course will deal with post-Risorgimento Italy, the conflict between the Catholic Church and the Liberal State, the growth of Socialism in its different trends, the cultural background of the Nationalist Movement, the situation which led, after World War I, to the fascist takeover in its economic, social, and political aspects, and post-World War II history. Combined lecture and discussion in English.

Sum (Giovine)

Mediterranean Problems — A course designed to give students a picture of the political developments in the Mediterranean area from Classical times to the present. There will be a special emphasis on post World War II events.

Spr (Giovine)

Post World War II Italy—Topics of this course include, among others: the fall of Fascism to the Resistance Movement; the anti-Fascist coalition; economic problems of Italy after the war; and the Cold War.

Sum (G. Mammarella)

LANGUAGE RELATED COURSES

The courses listed below are basically language courses, but approach its study through various topics.

Conoscere L’Italia: A General View of Italy
Win (Celli)

Problems of Modern Italy
Win (J. Mammarella)

L’Italiano di Oggi in Testi Contemporanei
Spr (Celli)

Reading and Writing Italian Through the Press
Win (Benini)

Spoken Italian Studied Through the Press
Spr (Benini)

The Italian Woman Today: Her Values, Problems and Expectations
Win (J. Mammarella)

Translation and Creative Writing
Spr (Celli)
THE HISTORY OF ITALIAN SOCIAL PHILOSOPHY

During the Winter and Spring quarters, students will examine Italian social thinkers against the background of Italian history with its relatively late national unification forged from an intensely rich, varied background. The evolution of a common Italian consciousness—language, tradition, social and political interests—will be the major theme. The courses of this program are listed below.

Italian Medieval Political Thought—An introduction to the politics and society of Medieval Florence. Subjects to be studied include: the influence of Christian philosophy on medieval political writers from St. Augustine to St. Thomas; the ideal of a “Communitas Communitatum”; the controversy between Church and State; and political versus spiritual obligations.

Win (Frulla)

Political Ideas in Italy from the Risorgimento to Fascism—A study of political thinking during the Risorgimento, including the following topics: liberal thought and action; the ideology of Nationalism; Futurism; and socialism and communism.

Win (G. Mammarella)

The Italian Communist Party: Its History and Politics—A review of the policies of the Italian Communist Party (PCI), from its origins to the present, within the framework of both the policies of international Communism and Italian political events during and after Fascism. The basic aim of the course is to help the students understand the class content of political life in Italy, and more generally, in Europe; the importance of ideologies, the functioning and policies of a mass party, and the differences between national communisms. The course also attempts to give students an understanding of the role of the Communist Party and policies in Italian politics, traditions, and culture. Prerequisite: Contemporary Italian politics, and a working knowledge of Italian. Seminar in Italian.

Spr (G. Mammarella)

Political Writers of the Renaissance—A comparative study of the major political writers of the Renaissance: Machiavelli, Guicciardini, T. Boccalini, and P. Sarpi. The purpose of the course is twofold: first, to present a comprehensive picture of the political thought of the period, examining its contradictory aspects; second, to study the influence of these writers on modern political thought. A good reading knowledge of Italian is required since many of the texts are available only in Italian. Seminar in English.

Spr (Frulla)

ITALIAN LANGUAGE

Intensive Italian grammar, conversation, and reading will be taught all quarters at the Italian Studies Center and students will be assigned to classes appropriate to their previous preparation.

ITALIAN ARCHAEOLOGY

During the Summer Quarter, there will be a special program in archaeology, including practical work at a local site, visits to excavations in progress in Florence and the surrounding area, and taking advantage of the collections of museums in Italy. The courses involved in this program are listed below.

Prehistoric Archaeology of the Old World—Study of Old World prehistory with a major emphasis on Italian prehistory. Lectures will include materials on chronology, artifactual materials, regional settlement patterns, and cultural history.

Spr, in Palo Alto (Zubrow)

Reconstructing Environment and Society: Problems in Archaeological Method—A study of the variety of methods used to develop reconstruction of environment and society, beginning with the philosophical problems of historical reconstruction and an explanation of cultural evolutionary processes; next, problems in population estimation, economic, social, and ideological reconstruction will be considered.

Sum (Zubrow)

Archaeology: The Field Experience—A course in archaeological field methods and laboratory analysis. The methods to be studied include reconnaissance techniques, carbon and palynological sample taking, stratigraphic interpretation, excavation techniques, and mapping procedures.

Sum (Zubrow)

Art and Culture of Greece and Magna Graecia—(See description under Greek, Etruscan, and Roman Civilization.)

Spr, Sum (Scichilone)
AUSTRIAN STUDIES CENTER

Academic and administrative personnel:
Siegfried Korninger, Director of Studies
Hedwig Thimig, Associate Director
Margaret Mehrl, Coordinator of Language Instruction

Austrian Politics 1848-1914—History and politics from the 1848 revolution and the social changes ensuing from it, to the Austro-Hungarian Empire under Franz Josef I, and the emergence of Vienna and the conditions leading up to World War I.

Autumn (Staff)

Austria 1914-1945—History and politics from the First World War, to the collapse of the Austro-Hungarian Empire, the First Republic, the model of present day Austrian government, and the Second World War.

Winter (Staff)

The Role of Austria in Europe Since 1945—History and politics in Austria’s relationship with the rest of Europe since World War II, the Treaty of Neutrality of 1955, Austria’s continuing role as a neutral country, and the implications of Austria’s proximity to the Socialist States.

Spring (Staff)

Art and Museums in Vienna—This seminar is devised to utilize the many opportunities for immediate confrontation with European art and architecture which exist in Vienna. Visits to, and lectures at museums and art galleries, architectural tours in Vienna, excursions to medieval towns, and to palaces and cathedrals from various periods, will be integral parts of this course. The Fall Quarter will concentrate on the Biedermeier, the Winter Quarter on Art Nouveau and Jugendstil, and the Spring Quarter on Contemporary Austrian Art.

Autumn, Winter, Spring (Staff)

Classical Music in Modern Vienna—Students in this seminar will be introduced to music being played in Vienna, will attend concerts and the operas discussed, and will, given the wide variety of music being played at any particular time, become acquainted with works from all periods of European music. The curriculum of this seminar will depend to a certain degree on the concert and opera repertoire in Vienna at the time.

Autumn, Winter, Spring (Staff)

European Theater in Vienna—This course is designed to put great emphasis on the practical side of theater. Students will become familiar with the development of European theater as far as stage techniques, acting styles, and stage and costume design are concerned. Attendance at plays will be an integral part of this course, but the curriculum will depend to a certain degree on the repertoire of the theaters in Vienna. Each play visited will be discussed thoroughly beforehand, so that every student, regardless of his linguistic ability, will be able to understand it. In the Viennese theater workshops, which are the most extensive of their kind in Europe, students will be able to observe how stage designs for the major theaters in Vienna are developed. In the Spring Quarter students will have the chance to acquaint themselves with international drama during the Vienna Festival.

Autumn, Winter, Spring (Staff)

The Intellectual Scene in Vienna at the Turn of the Century—This seminar will concern the intellectual scene in Vienna during the last decades of the Austro-Hungarian Empire and the period of the First Republic, focusing on the revolutionary thinkers of the time, such as Sigmund Freud, Karl Kraus, Ludwig Wittgenstein, and the neo-positivistic thinkers of the Vienna Circle.

Autumn (Staff)

Political Movements in Austria Between the Wars—The years between the collapse of the Austro-Hungarian Empire and the “Anschluss” of Austria to Nazi-Germany were extremely important ones. This seminar will discuss the First Republic, the emergence of Austrian socialism, the political and social events which led up to the Anschluss, as well as social and political theories such as Austro-Marxism and Political Catholicism. Documentary film material on a number of political events during this period will be used.

Winter (Staff)

20th Century Austrian Literature—Early 20th Century Austrian literature is of outstanding importance for the entire German speaking literary world. A good knowledge of writers such as Schnitzler, Hofmannsthal, Kafka, Musil and Rilke will give the students an insight into the political and social atmosphere of Vienna at the turn of the century and of the Viennese character of today. Short optional field trips to Prague and Buda-
pest will concern these cities not only in their modern content but also as the birthplace and home of some of these writers. Contemporary Austrian literature is also very important for the German speaking world, and writers such as Peter Handke are known well beyond Austria and Germany.

*Spring (Staff)*

**Language Courses**—There will be an intensive German program, designed to accommodate students at all levels of previous preparation; emphasis will be on grammar, conversation, and writing.

Students who are studying at the Austrian Studies Center in Vienna will be able to take all of their classes at the University of Vienna, or all of their classes from the ones listed above, or some combination of the two.

**Spanish Studies Center in Salamanca**

*Academic and administrative personnel:* Gustavo Valadez, Director

**Latin American Studies Center in Lima**

*Academic and administrative personnel:* Clifford Barnett, Director

**German Studies Center in Bonn**

*Academic and administrative personnel:* Josef Hutschneider, Director

**French Studies Center in Paris**

*Academic and administrative personnel:* Pauline Newman-Gordon, Director

**Physical Education and Athletics**

The physical education program is very diverse to accommodate the interests and needs of the University community. For students, courses in a wide variety of aquatic, dance and sports activities and theory are part of the academic curriculum. Here, the aims are to (1) increase understanding of the value and role of physical activities in developing and maintaining total fitness throughout life; (2) provide opportunity for discovering or increasing educational experiences related to avocational or vocational interest; (3) develop leadership competency which has particular application to community service; and (4) encourage, through satisfying learning experiences, the participation habit.

Two major facility locations are utilized for students to elect enrollment in the activity and theory courses and intercollegiate athletics and as well as participation in the club and recreation programs. Roble Gym near Lagunita Court includes facilities for: badminton, basketball, dance, fencing, field hockey, golf, swimming, table tennis, tennis and volleyball with locker, shower and dressing rooms for men and women. The Encina Gym area includes facilities for: baseball, basketball, football, gymnastics, handball, lacrosse, oriental martial arts, rugby, soccer, squash, swimming, tennis, track and field, volleyball, weight lifting, wrestling, water polo with locker and shower facilities. The Riding School, Stanford Golf Course and driving range are additional facilities available for student use.

**Academic Degrees and Teaching Credentials**

In cooperation with the School of Education, the two Departments of Physical Education provide faculty, facilities, and equipment necessary for the conduct of the professional physical education program which leads to graduate degrees and teaching credentials.

Although Stanford does not offer a Bachelor of Arts in Physical Education degree, undergraduate students interested in the credential and/or master's degree program at Stanford should declare their intent early in their undergraduate careers and enroll in selected courses offered by both departments and the School of Education. These courses will satisfy most requirements for eligibility for admission to the graduate program in dance or physical education. Students with a bachelor's degree or equivalent course work in physical education or dance from another accredited college or university may
also apply for admission. Information about the doctoral program is available upon request from Professor John Nixon, School of Education.

See the “School of Education” section in this bulletin or Professors Lidster, Nixon, Ruff, Strathairn or Miss Weiss for further information.

Basic Instructional Program

With few exceptions, as indicated by course descriptions, all courses are open for enrollment by men and women students in either department where the courses are scheduled. Homogeneous skill groupings and limited class size enable each student, the beginner through the advanced performer, to achieve success within the limits of individual interest and potential. The highly skilled in sports and dance have opportunity to pursue their interests through special programs.

Fees—Fees are charged for enrollment in bowling, equitation, sailing, scuba diving, most club sports and golf classes at the driving range.

Equipment—Specific information is available through each of the departments.

Credit—Students may enroll in as many physical education courses as they wish. However, only 12 units of credit of the 1-unit activity courses will be accepted toward graduation. No such limit is placed on the 2- to 5-unit courses.

Intercollegiate Athletics

In keeping with our cultural heritage and American university tradition, Stanford offers a broad intercollegiate athletic program for men and women. As a member of the Pacific Eight Conference and the National Collegiate Athletic Association, the men’s department fields varsity teams in football, basketball, track and field, baseball, swimming and diving, water polo, golf, tennis, wrestling, gymnastics, rugby, soccer and cross country. The fencing varsity team competes through the women’s department which is a member of the Northern California Intercollegiate Athletic Conference and the Association for Intercollegiate Athletics for Women. Women’s varsity teams compete in field hockey, swimming, basketball, tennis, golf, and fencing.

Club Sports

The Club Sports Program is affiliated with the men’s department. This program is sustained by coeducational student interest and has a high level of participation. For further information, see Mr. Fehring.

Intramurals

Students interested in intramural participation may receive information from the IM offices in both departments.

Physical Education

(Encina Gym)

Emeriti: Allen Elward, Edward M. Twiggs, (Directors); C. Myron Sprague (Associate Director); Ernest P. Hunt (Associate Professor)

Director of Physical Education and Athletics: Joseph H. Ruetz

Associate Director: Robert G. Young

Professor: John E. Nixon (Director of Professional Education)

Associate Professor: Wesley K. Ruff (Director of Physical Education for Men)

Directors: Jack Christensen (Football), Howard Dallmar (Basketball), Joe DeMeo (Wrestling), William P. Fehring (Intramurals and Club Sports), Charles E. Finger (Golf), James Gaughran (Aquatics), Richard Gould (Tennis), Payton Jordan (Track), Peter Kmetovic (Rugby), Sadao Hamada (Gymnastics), Fred J. Friddle (Soccer), J. Ray Young (Baseball)

Assistant Directors: Clayton Bowling (Basketball), Marshall Clark (Track), Gunther Cunningham (Football), Dave Currey (Football), Clyde F. Devine (Diving), Thomas Dunton (Baseball), Jeff Hammett (Aquatics), Mark Marquess (Baseball), Norb Hecker (Football), Hudson Houck (Football), Pete Kettela (Football), Art Lambert (Aquatics), George Seifert (Football)

Key to Course Numbers

Numbered courses under 200 are instructional sports classes. Letters added to the numbers are: A—advanced instruction; F—frosh; I—intercollegiate; C—club sports. Courses in the 171 series and those num-
bered 200 are intended primarily for students in the credential program.

**SPORTS INSTRUCTION**

2. Individual Programs — Individually prescribed exercise programs adapted to meet special needs of physically limited students.  
   *Aut, Win, Spr (Ruff) three periods weekly by arrangement*

   *Aut, Win, Spr (Fehring) by arrangement*

10. Sports Instructor Practicum.  
   2 units, *Aut, Win, Spr (Ruff) by arrangement*

   *Spr (Staff) TTh 11*

15. Golf, Beginning.  
   *Aut, Win, Spr (Finger) TTh 11, 1:15, 2:15*

15A. Golf, Advanced.  
   *Aut, Win, Spr (Finger) MTWThF by arrangement*

   *Aut, Win, Spr (Hamada) MW 1:15*

16B. Trampoline and Gymnastics.  
   *Aut, Win, Spr (Hamada) TTh 1:15*

17. Volleyball.  
   *Aut, Win, Spr (Staff) TTh 2:15 or 3:15*

17A. Advanced Volleyball.  
   *Aut, Win, Spr (Staff) by arrangement*

   *Aut, Win, Spr (Staff) MW 11 or 1:15; TTh 9, 10, or 11*

19A. Bowling, Tournament.  
   *Aut, Win, Spr (Staff) by arrangement*

20. Swimming and Diving, Beginning.  
   *Aut, Win, Spr (Hammett) MWF 10*

20A. Swimming, Advanced.  
   *Aut, Win, Spr (Hammett) TTh 10*

21. Tennis, Beginning.  
   *Aut, Win, Spr (Staff) MWF 11, 1:15, 2:15, 3:15, and 4:15*

21A. Tennis, Advanced.  
   *Aut, Win, Spr (Staff) TTh 11, 1:15, 2:15, 3:15, or 4:15*

21B. Tennis, Intermediate.  
   *Aut, Win, Spr (Staff) TTh 11, 1:15*

22. Track, Individual Programs.  
   *Aut, Win, Spr (Clark) TTh 10*

   *Aut, Win (DeMeo) MWF 2:15*

25. Tournament Tennis.  
   *Aut, Win, Spr (Gould) TTh or MW 2:15*

29. Water Polo.  
   *Aut, Win, Spr (Hammett) TTh 11 or 2:15*

39. Soccer.  
   *Aut, Win, Spr (Priddle) MWF 3:15*

40. Physical Conditioning.  
   *Aut, Win, Spr (Staff) TTh 4:15*

41. Skin Diving—This is a prerequisite for SCUBA. Enrollment Winter and Spring quarters.  
   *Aut, Win, Spr (Hammett) TTh 2:15*

42. Skin and Scuba Diving — Prerequisite: Snorkle-Swim test plus ability to swim 400 yards in 7½ minutes. Enrollment limited. See P.E. 40.  
   *3 units, Aut, Win, Spr (Gaughran, Hammett) MWF 2:15 plus field trips.*

45. Life Saving — Prerequisite: swim 400 yards continuously, and stroke test.  
   *2 units, Aut, Win, Spr (Hammett) MWF 11*

46. Water Safety Instructor, Parts 1 and 2—Prerequisite: Current Senior Life Saving certificate.  
   *3 units, Spr, Gaughran, Hammett) MWF Lecture and TTh Lab.*

53. Weight Training.  
   *Aut, Win, Spr (Staff) MWF 11, 1:15, 2:15, 3:15, or 4:15*

92. Techniques of Athletic Management.  
   *Aut, Win, Spr (Davis) by arrangement*

**INTERCOLLEGIATE SPORTS**

**FROSH, VARSITY, AND JUNIOR VARSITY SPORTS**

111F. Frosh Basketball.  
   *Aut, Win (Bowling) MTWThF 2–4 p.m.*

111I. Basketball.  
   *Aut, Win (Dallmar, Bowling) MTWThF 4–6 p.m.*

114F. Frosh Football.  
   *Aut (Cunningham) MTWThF 2–4 p.m.*
1141. Football.
Aut, Spr (Christensen, Staff) MTWThF 4-6 p.m.

1151. Golf.
Aut, Win, Spr (Finger) by arrangement

1161. Gymnastics.
Aut, Win, Spr (Hamada) MTWThF 3:15 p.m.

1201. Swimming and Diving.
Aut, Win, Spr (Gaughran) MTWThF 3:15

1211. Tennis.
Aut, Win, Spr (Gould) MTWThF 3:15

1221. Track.
Aut, Win, Spr (Jordan, Clark) MTWThF 3:15

1231. Wrestling.
Aut, Win (De Meo) MTWThF 3:15

1291. Water Polo.
Aut (Lambert) MTWThF 3:15
Spr (Lambert) MWF 4:15

1301. Baseball.
Aut, Win, Spr (Young) MTWThF 3:15

1391. Soccer.
Aut, Win, Spr (Priddle) MTWThF 4:15

1401. Rugby.
Win (Kmetovic) MWTh 4:15

THEORY AND TECHNIQUE COURSES

Note—Prerequisite: Education 156. Co-ed except for H and J. These courses generally involve lecture and discussion with occasional outside practice assignments.

* Consent of instructor required.

171A. Theory and Technique: Baseball.
2 units, Aut (Young) by arrangement

171B. Theory and Technique: Basketball.
2 units, Aut (Dallmar) Th 10 and by arrangement

171C. Theory and Technique: Football.
2 units, Spr (Christiansen) alternate years, given 1973-74

171E. Theory and Technique: Adapted Physical Education.
2 units, Spr (Ruff) M 1:15, alternate years, given 1973-74

2 units, Spr (Blanchard) by arrangement

171I. Theory and Technique: Waterpolo and Swimming—Prerequisite: Water Safety Instructor’s Certificate, ARC.
2 units, Aut (Gaughran) TTh 11

171J. Theory and Technique: Gymnastics—Prerequisite: 16.
2 units, Win (Hamada) MWF 1:15

171K. Theory and Technique: Tennis.
2 units, Aut, Spr (Gould) by arrangement

171L. Theory and Technique: Volleyball and Soccer.
2 units, Spr (Ruff) by arrangement, alternate years, given 1973-74

201. Seminar on Sports Sociology.
4 units, Sum (Ruff, Nixon) MTWThF 9-10

3 units, Spr (Nixon, Ruff) MWF 10
See Physical Education—Roble Gym for additional offerings.

INTRAMURAL SPORTS

Competing organizations are urged to contact the IM office during registration to obtain meeting dates and times to assure representation. Sign-up lists are often posted at the beginning of each quarter so early organization of competing groups is essential.

CLUB SPORTS

The Club Sports program has achieved remarkable stability in recent years due to enduring student interest. Those clubs currently affiliated with this Department are listed below. The scheduled meeting, practice times, and availability of credit are normally published in the quarterly time schedule.

Crew—127C
Ice Hockey—110C
Karate (Shotokan)—136C
Judo—119C
Aikido—146C
Backpacking—126C
La Crosse—145C
Karate (Kenpo)—135C
Sailing—139C
Tai Chi Chuen—137C
Volleyball—117C
Tae Kwon Do—147C
PHYSICAL EDUCATION (ROBLE GYM)

Emeriti: Maud L. Knapp (Professor), Margaret C. Barr (Associate Professor), Luell W. Guthrie (Associate Professor), Marian S. Ruch (Associate Professor), Sylvia P. Cain (Instructor)

Chairman: Pamela L. Strathairn
Associate Professors: Miriam B. Lidster, Pamela L. Strathairn
Senior Teaching Associate: Carroll G. Diaz, Inga Weiss
Teaching Associates: Susan Cashion, Mary Margaret Neal, Elizabeth P. Weeks
Teaching Specialists: Ronald Blankenhorn, Jean P. Helliwell, Janis Miller, Shirley H. Schoof, Juan Valenzuela

SPORTS AND INDIVIDUAL ACTIVITIES

Except as indicated, all courses are open for enrollment by men and women students.

1. Posture—Figure control and posture improvement with individual conditioning.
   1 unit, Aut, Win, Spr (Diaz) MWF 10 or 1:15

2. Conditioning — Introduction to techniques of training and conditioning for physical and motor fitness, including knowledge of basic physiological and kinesiological principles underlying various conditioning techniques.
   1 unit, Aut, Spr (Staff) MW 11 or 4:15 or TTh 2:15 or 4:15 each with an additional hour
   Win (Staff) MWF 11 or 12; TTh 2:15 plus an additional hour

4. Apparatus Gymnastics: Elementary — See Physical Education (Encina Gym.)

5. Apparatus Gymnastics: Intermediate — See Physical Education (Encina Gym.)

8. Self Defense for Women—This course is designed to enable the woman student to protect herself in assault situations by understanding the philosophy of the various martial arts, the importance of self control and self discipline and to attain self confidence. Women only.
   1 unit, Aut, Win, Spr (Blankenhorn) MWF 11 or 2:15

9. Basic Self Defense—This course will provide men and women students with basic escape stratagems to avoid common street assaults. Emphasis on physical and psychological principles of Ju-Jutsu, Aikido, Judo, and Karate. Prerequisite for Women: 8 or equivalent.
   1 unit, Aut, Win, Spr (Blankenhorn) MWF 10 or 1:15

10. Badminton: Elementary — This course covers basic strokes (serves, clears, drops, smashes, and drives), rules and scoring and practice in game playing.
    1 unit, Aut, Win, Spr (Schoof) TTh 10 and an additional hour

    1 unit, Aut (Diaz) TTh 3:15 and an additional hour
    Win, Spr (Schoof) MW 1–2; Diaz TTh 3:15 and an additional hour

12. Fencing: Elementary—The study of basic movements and practice in coordination and timing.
    1 unit, Aut, Win, Spr (Helliwell) MWF 10 or 2:15

    1 unit, Aut, Win, Spr (Helliwell) MWF 9 or 3:15

14. Fencing: Epee—For men. Prerequisite: consent of instructor.
    1 unit (Helliwell) by arrangement

15. Tennis: Elementary—This course covers fundamental strokes (forehand, backhand, service, and volley), rules and scoring.
    1 unit, Aut, Win, Spr (Neal, Schoof, Staff) TTh 11 or 1 or MW 1 each with an additional hour.

16. Tennis: Intermediate—Review of fundamental strokes, introduction of the lob and overhead strokes, and utilization of strategy and tactics in game playing. Prerequisites: knowledge of rules and scoring, average ability in the fundamental strokes.
    1 unit, Aut, Spr (Neal, Schoof, Staff) TTh 9 or 10 or 2:15 or MW 10 each with an additional hour
OTHER DEPARTMENTS, INSTITUTES, AND PROGRAMS

21. Basketball—Basic skills and conditioning; ball handling, goal shooting skills, individual tactics, team play, strategy and rules. Prerequisites: knowledge of rules and average ability in the game.

1 unit, Aut (Schoof) MW 1–2

23. Field Hockey—This course focuses upon conditioning, stick work, individual tactics, team play, strategy, and rules.

1 unit, Aut (Schoof) MW 1–2

44. Golf: Elementary — Fundamentals of the golf swing, use of various clubs, golf etiquette, and knowledge of the rules to enable a beginner to play a round of golf.

1 to 2 units, Aut, Win, Spr (Diaz) MTWTh 11

45. Golf: Intermediate—Improvement and perfection of previously learned fundamentals. Utilization of these skills in the game. Prerequisite: promoted from 44 or the equivalent or ability to score in the 60's for nine holes on a regulation length course.

1 to 2 units, Aut, Win, Spr (Diaz) MTWTh 2:15


1 unit, Aut, Win, Spr (Diaz) MTWTh 1:15 or 2:15

49. Equitation: Intermediate — Continued development of skill in English (forward seat) riding. Prerequisites: ability to walk, trot, and canter securely and knowledge of leads and diagonals.

1 unit, Aut, Win, Spr (Melville) MTWTh 3:15 or 4:15

102. Conditioning: Individual Programs—Conditioning through aerobic techniques. Prerequisite: experience in conditioning programs.

1 unit, Aut, Win, Spr (Staff) by arrangement

104. Apparatus Gymnastics: Advanced — See Physical Education (Encina Gym.)


1 unit, Win, Spr (Blankenhorn)

110. Badminton: Advanced—Refinement of strokes and utilization of strategy in game playing. Prerequisite: promoted from 11 or extensive experience which has resulted in above average ability.

1 unit, Aut, Win, Spr (Schoof) TTh 1–2

112. Fencing: Advanced — Concentration on practice of attacks. Regular lessons and some competition. Prerequisite: promoted from 13 or equivalent.

1 unit, Aut, Win, Spr (Helliwell) TTh 10 and T 7 p.m.

115. Tennis: Advanced — Refinement of strokes and utilization of strategy in game playing. Prerequisite: promoted from 16 or extensive experience which has resulted in above average ability in all strokes.

1 unit, Aut, Spr (Neal) MW 9 or 11 or 2:15 each with an additional hour

Win (Neal) MW 11–12 or 2:15 plus an additional hour

120. Basketball: Advanced — Prerequisite: promoted from 21 or equivalent.

1 unit, Win (Schoof) TTh 3:15 and an additional hour

144. Golf: Advanced—This course focuses upon understanding and refining the golf swing as well as increasing power and distance. Prerequisites: ability to hit the ball with relative accuracy and to play on a full 18-hole course with an average score of 115 or better.

1 unit, Aut, Win, Spr (Diaz) TTh 1:15 and by arrangement

148. Equitation: Jumping—Introduction to and development of jumping skill using low single fences, higher fences, combinations, and courses. Prerequisite: promoted from 49 or equivalent.

1 unit, Aut, Win, Spr (Melville) MTWTh 10:00

AQUATIC ACTIVITY AND THEORY

All courses are coeducational.

30. Swimming I—For those unable to swim at all or who feel unsafe in deep water. Concern with physical and mental adjustment to the water, buoyancy and body position, propulsion, personal safety skills, elementary rescue skills and the fundamentals of swimming on front and back.

1 unit, Aut, Spr (Weeks, Staff) MW 2:15
31. Swimming II—Continued work on personal safety skills, elementary rescues and fundamentals of crawl and elementary back stroke. Introduction to side stroke, breaststroke and back crawl; to defense techniques and to conditioning. Prerequisite: promotion from 30 or equivalent.

1 unit, Aut, Win, Spr (Weeks, Staff)
MWF 11

32. Swimming III—Particular attention to refinements in crawl, elementary back stroke, side stroke, breaststroke and back crawl. Continued development of personal safety, elementary rescues and conditioning. Prerequisite: promotion from 31 or equivalent.

1 unit, Aut, Win, Spr (Weeks, Staff)
MWF 11

130. Swimming IV—Review and refinement of the five basic strokes and all safety skills. Introduction to five new strokes (including the butterfly) and racing starts and turns. Extensive conditioning. Prerequisite: promotion from 32 or equivalent.

1 unit, Win, Spr (Staff)
TTh 2:15 and by arrangement

134. Lifesaving—The American Red Cross Lifesaving course which focuses upon increasing awareness of water hazards, the avoidance of accidents, prevention of accidents to self and others, and utilization of appropriate rescue techniques. Prerequisites: promotion from MPE 20A or WPE 130 and ability to swim 440 yards continuously.

2 units, Aut, Win (Weeks) MWF 2:15

135. WSI—The American Red Cross Water Safety Instructor course. Enroll in MPE 46.

230. Aquatics Seminar—In depth analysis of aquatic skills and exploration of various teaching methods, class organization patterns, evaluative techniques and pool management. Prerequisites: current WSI certification and consent of instructor.

3 units, Aut, Win, Spr (Strathairn) by arrangement

DANCE ACTIVITY AND THEORY

Although Stanford does not offer a Bachelor of Arts degree in Dance, a wise selection from among the following courses will fulfill most of the prerequisites for admission to and completion of the A.M. degree in Education with a Dance Specialization.

Men and women students should declare their intent early in their undergraduate career and confer with the dance advisers. All courses except as indicated are coeducational.


1 unit, Spr (Miller) MW 7:30-9 p.m.


1 unit, Aut, Win (Miller) MW 7:30-9 p.m.

59. Dance for Men—Beginning approaches to the study of modern dance designed especially for men. Emphasis is given to increasing range of movement, with technical problems geared to strength potential. Some concern for improvisation and creative problems.

1 unit, Aut (Cashion) MW 9 plus an additional hour
Win (Staff) TTh 9 plus an additional hour

60. Dance I—Analysis and performance of basic movement skills applicable to all dance. Development of simple rhythms and musical form with practical experience in simple drumming.

1 unit, Aut (Valenzuela, Staff) TTh 9 plus an additional hour
Win (Staff) TTh 9 plus an additional hour

61. Introduction to Basic Ballet and Preparatory Techniques for Dance—Basic classical and modern exercises for correct alignment and body placement, aiming for control and flexibility of movement. Elementary barre and center combinations introduce the beginning dance student to terminology of steps and concepts of line in relation to balance. Prerequisite: 60.

1 unit, Aut (Staff) TTh 10
Win (Staff) MWF 10

62. Modern Dance I—Development of flexibility, coordination, motor skills and modern dance techniques. Prerequisite: 60.

1 unit, Aut (Staff) MWF 3:15
Win (Staff) MWF 3:15
Spr (Staff) MWF 9 or 3:15

63. Modern Dance II—The extension of modern dance fundamentals to a clearly de-
fined use of techniques and qualities based on the elements of movement in regard to rhythmic, directional, and dynamic changes in movements. Intermediate level.

1 unit, Aut (Cashion, Weiss) TTh 11-12:50, also 2:15-3:30
Win, Spr (Weiss) TTh 2:15-3:30


1 unit, Aut, Win (Weiss) W 11-12:50

65. Modern Dance III — Course material based on a progressive upper intermediate level. Prerequisite: 63 or equivalent.

1 unit, Win (Cashion) TTh 1-2:05 plus an additional hour
Spr (Cashion) MWF 10 and M 11

72. Folk Dance I—Selection of dances from many countries with emphasis on traditional and foundation folk dance steps.

1 unit, Aut (Staff) MWF 1:15 or 2:15
Win, Spr (Staff) MWF 1:15

73. Folk Dance II—Continued presentation of dances from many countries with definite emphasis on foot and body skills necessary for the styling related to specific countries. Prerequisites: ability to perform basic and traditional folk dance steps; 72 or equivalent.

1 unit, Aut (Staff) TTh 1-2:05 plus an additional hour
Win, Spr (Staff) MWF 2:15

74. Folk Dance III—Dances from selected countries with concentration on foot and body skills necessary for the styling related to those countries. Opportunity for occasional community performances. Prerequisite: 73 or equivalent.

1 unit, Win (Lidster) TTh 10 plus an additional hour
Spr (Staff) TTh 1-2:05 plus an additional hour

75. Ethnic Dance: Styles and Techniques—Mexican—Selected regional dances of Mexico to be taught for technical and cultural understanding.

1 unit, Aut (Cashion) TTh 1-2:05
Spr (Cashion) MWF 1:15


77. Ethnic Dance: Styles and Techniques—Balkan—Selected dances of the Balkan with a concentration on styles, music and costume.

1 unit, Spr (Staff) TTh 11-12:50


1 unit, Win (Staff) TTh 11-12:50


1 unit, Win, Spr (Staff)

160. Modern Dance Technique: Advanced—Development of versatile dance techniques and disciplines for strong control and expressive use of movement. Prerequisite: consent of instructor.

1 to 3 units, Aut (Weiss) MF 4:15-6

161. Contemporary Dance Forms I — Sequences for manipulation of movement and advanced techniques. Prerequisite: consent of instructor.

1 to 3 units, Win (Weiss) MF 4:15-6

162. Contemporary Dance Forms II—This class is an extension of 161, for more advanced performance.

1 to 3 units, Spr (Weiss) MW 4:15-6

163. Choreography I—Compositional problems in Modern Dance based on traditional approaches in handling form and design, time and rhythm, energy flow and force as they relate to dance as an art form. Prerequisite: 61, 62, or intermediate skill.

3 units, Aut (Cashion) TTh 7-9:45 p.m.
Spr (Cashion) WF 11-12:50

164. Choreography Workshop—A continuation of the compositional elements of modern dance. Prerequisite: 163.

3 units, Win (Cashion) Th 7-9:45 p.m. and by arrangement

165. Contemporary Dance Workshop—Emphasis on new approaches in design and improvisation, involving exploration of movement and the study and manipulation of creative concepts for dance composition and choreography. Solo and group forms. Prerequisite: consent of instructor.

2 to 4 units, Aut (Weiss) W 4:15-6 and by arrangement

166. Performance Workshop—Preparation of choreographies for performance. Prereq-
PHYSICAL EDUCATION AND ATHLETICS

uisite: consent of instructor or by audition.
3 units, Spr (Cashion) Th 7–9:45 p.m. and F 4:15–6

168. Labanotation I—The Laban method of notating, with symbols, dance and other forms of movement.
3 units, Aut (Cashion) M 1–3 and W 1–2:05

4 units, Aut (Lidster) TTh 11–12:50

172A,B,C. Folk Dance: Advanced — This three quarter series focuses on dances with complex patterns and intricate steps. Emphasis on styling and footwork. Opportunity to work with guest teachers. Prerequisite: 74 or equivalent.
172A. 1 to 3 units, Aut (Lidster) Th 4:30–5:45 and M 7:30–9:45 p.m.
172B. 1 to 3 units, Win (Lidster) Th 4:30–5:45 and M 7:30–9:45 p.m.
172C. 1 to 3 units, Spr (Lidster) Th 4:30–5:45 and M 7:30–9:45 p.m.

173A,B. Folk Dance Exhibition: International—A two quarter series of advanced and exhibition dances mastered in order to participate in dance concerts, demonstrations, exhibitions, and festivals. Prerequisite: consent of instructor.
3 units, Win, Spr (Lidster, Staff) W 7–9:45 p.m.

175. Folk Dance Exhibition: Mexican — Further understanding of Mexican dance and its relation to the culture with an emphasis on technique and style for presentation of exhibitions. Prerequisite: 75 and/or consent of instructor.
3 units, Win (Cashion) T 7–9:45 p.m. and by arrangement

178. Survey of the Regional Dances of Hungary—The study of the language and cultural areas of Hungary as they are expressed in music, dance and costume.
3 units, Win (Staff) T 4:15–6 and by arrangement

179. Survey of the Regional Dance of Mexico—A tracing of the historical roots of Mexican dance found in the Pre-Columbian indigenous contributions and the Spanish heritage; followed by a look at each region of Mexico, its dance forms and an understanding of how those forms were developed in relation to varying cultural influences.
3 units, Spr (Cashion) T 7–9:45 p.m.

260. Contemporary Dance Practicum — Teaching Assignments. Prerequisite: consent of instructor.
2 units, Aut (Weiss) F 11–1

261. Contemporary Dance Practicum and Research—Exploration and study of potential resources for creative design in the teaching of Dance. Ideas and assignments for improvisation, composition, music for dance and concepts for performance and dance for children. Prerequisite: consent of instructor.
4 units, Spr (Weiss) W 11–1 and by arrangement

262. Seminar in Dance Styles — Focus on the changing aims and expressions of a time and its artists as reflected by various techniques and styles of dance. Evaluation of different emphasis and points of view and study of traditional and experimental procedures in dance. Master lessons and lectures by visiting guest artists included.
2 to 4 units, Win (Weiss) 4:15–6:00 and by arrangement

263. Dance Thesis: Contemporary — Individual development of thematic material for a creative project leading toward completion of the A.M. degree in Dance.
5 units, Aut, Win, Spr (Weiss) TTh 3:30

265. Fundamentals of Modern Dance — This course involves analytical study of movement vocabulary and techniques as well as methods of presentation, rhythmic accompaniment with percussion instruments and basic concepts for structural development of movement as a creative experience and dance as a performing art. Prerequisites: advanced level students and consent of instructor.
1 to 3 units, Spr (Weiss) F 11:12–50

266. Dance Repertory — Dance sequences, phrases and contrasting progressions, emphasizing fluency of movement, accuracy of timing, and clarity of form. Study of theme and variations. Prerequisite: consent of instructor.
1 to 3 units, Win (Weiss) F 11–12:50
268. Labanotation II—Continued application of Labanotation skills. Must be taken concurrently with 262 and/or 272 for materials for notation. Prerequisite: 168 or equivalent and consent of instructor.

   2 units, Win (Cashion) by arrangement

270. Folk Dance Practicum—Analysis and development of instructional materials for an elementary folk dance class with teaching assignments. Prerequisite: 172 series or equivalent and consent of instructor.

   2 units, Aut, Win (Lidster) by arrangement

271. Folk Dance Practicum—Analysis and development of instructional materials for an intermediate or advanced folk dance class and for community recreation with teaching assignments. Prerequisite: 172 series or equivalent and consent of instructor.

   2 units, Win, Spr (Lidster) by arrangement

272. Seminar in Folk/Ethnic Dance — A relating of folk-ethnic dance forms to their respective cultures. Selected dances from Europe, Asia, Africa, and Latin America. Prerequisite: 160, 172 or their equivalent.

   5 units, Win (Lidster, Cashion) MW 11–12:50 and M 7:30–9:45 p.m.

273. Dance Thesis: Folk/Ethnic — Individual development of folk/ethnic material for a creative project leading toward completion of the A.M. degree in Dance.

   5 units, Aut, Win, Spr (Lidster) by arrangement

PHYSICAL EDUCATION AND SPORTS

INTERCOLLEGIATE ATHLETICS

113. Fencing: Varsity—Men’s and women’s teams. Prerequisite: consent of instructor.

   2 units, Aut, Win, Spr (Helliwell) TTh 9 and T 7-9:45 p.m.

124. Field Hockey: Varsity—Women only. Prerequisite: consent of instructor.

   2 units, Aut (Schoof) MTWTh 3:15–5:00

132. Swimming Varsity — Conference competition during Autumn Quarter. Winter enrollment for national competition requires team membership during the immediately preceding Autumn quarter. Women only. Prerequisite: consent of instructor.

   1 to 2 units, Aut, Win (Weeks) MTWThF 3:15–5

145. Golf: Varsity—Women only. Prerequisite: average scores under 100 for a regulation length 18-hole course.

   1 unit, Aut, Win, Spr (Díaz) TTh 1:15 and by arrangement

121. Basketball Varsity—Women only. Prerequisite: consent of instructor.

   2 units, Win (Schoof) MTWTh 4:15–6:00

124. Field Hockey: Varsity—Women only. Prerequisite: consent of instructor.

   2 units, Aut (Schoof) MTWTh 3:15–5:00

116. Tennis: Varsity—Women only. Prerequisite: consent of instructor.

   1 to 2 units, Spr, Aut, Win (Neal) MTWTh 3:15–5:00

180. Basketball Officiating—Emphasis upon the principles and techniques of officiating which requires a thorough knowledge of and ability to apply the rules of basketball for girls and women. Prerequisite: above average playing ability or two seasons of playing experience.

   2 units, Aut (Schoof) MW 1–2:05

181. Golf Officiating and Tournament Organization—This course focuses upon planning
various types of golf tournaments according to USGA rules, with main emphasis on collegiate events.

2 units, Aut, Win, Spr (Diaz) by arrangement

182. Tennis Officiating and Tournament Organization—This course focuses upon understanding the principles and mechanics of organizing and conducting a variety of tennis tournaments and upon developing the knowledge and ability to become USLTA rated tennis officials.

2 units, Spr (Neal) by arrangement

183. Fencing Officiating and Tournament Organization—Students learn how to conduct fencing meets and develop competency in directing, judging, and time keeping for fencing competitions.

2 units, Aut, Win, Spr (Helliwell) by arrangement

184. Swimming Meet Officiating and Organization—Principles and mechanics of organizing swimming meets and developing skills in duties of all officials. Practical experience provided. Written and practical exam may be taken to become a rated official.

2 units, Aut, Win (Strathairn) by arrangement

187. Field Hockey Officiating—The principles and techniques of officiating field hockey games.

2 units, Spr (Schoof) TTh 3:15-5

208. Martial Arts: Theory and Technique—Prerequisite: consent of instructor.

2 units, Aut, Win, Spr (Blankenhorn) by arrangement

210. Badminton Theory and Technique—Prerequisite: consent of instructor.

2 units, Aut, Win, Spr (Diaz, Schoof) by arrangement

211. Badminton Practicum—Teaching assignment. Prerequisites: advanced level ability and consent of instructor.

2 units, Aut, Win, Spr (Diaz, Schoof) by arrangement

212. Fencing Theory and Technique—Analysis of the various moves used in fencing and of learning sequences. Prerequisite: consent of instructor.

2 units, Aut, Win, Spr (Helliwell) by arrangement

214. Fencing Practicum—Teaching assignment. Prerequisites: advanced level ability and consent of instructor.

2 units, Aut, Win, Spr (Helliwell) by arrangement

215. Tennis Theory and Technique—Analysis of the strokes and strategies of tennis with emphasis on understanding learning progressions. Prerequisite: consent of instructor.

2 units, Aut, Win (Neal) by arrangement

216. Tennis Practicum—Teaching assignment. Prerequisites: advanced level ability and consent of instructor.

2 units, Win, Spr (Neal) by arrangement

244. Golf Theory and Technique—Analysis of golf skills with emphasis on learning progressions for groups and individuals. Prerequisite: consent of instructor.

2 units, Aut, Win, Spr (Diaz) by arrangement

245. Golf Practicum—Teaching assignment. Prerequisite: advanced level ability and consent of instructor.

2 units, Win, Spr (Diaz) by arrangement
SPECIAL OPPORTUNITIES IN GRADUATE STUDY

INSTITUTE FOR PLASMA RESEARCH

Executive Committee: Peter A. Sturrock (Chairman), Daniel Bershader, Oscar Buneman, I-Dee Chang, Marvin Chodorow, Frederick W. Crawford, Robert H. Eustis, Charles H. Kruger, Morton Mitchner, Vahe Petrosian, Sidney A. Self, Arthur B. C. Walker, John M. Wilcox

The Institute is an interdepartmental organization coordinating teaching and research in plasma physics at Stanford and incorporates seven specialized research groups.

The Aerophysics Group (Baganoff, Bershader, Chang) conducts experimental and theoretical research on plasma and plasma flow at high density and moderate temperature, using shock tubes and advanced interferometric and spectroscopic equipment.

The Gas Kinetics Group (Kuotsyamnis) is engaged in theoretical studies (kinetic theory, spectroscopy, discharge theory) and experimental studies related to the interaction of plasma and radiation.

The High-Temperature Gasdynamics Group (Eustis, Kruger, Mitchner, Self) concentrates on experimental and theoretical research on flowing, high temperature gases related to such applications as magnetohydrodynamic energy conversion, air pollution, chemical kinetics, and lasers, and includes studies of diagnostic techniques and calculations of non-equilibrium properties.

The Experimental Plasma Physics Group (Crawford, Self) carries out experimental research, with supporting theoretical studies, on waves and instabilities, beam-plasma interactions, and nonlinear processes such as wave-wave and wave-particle interactions.

The Space Science and Astrophysics Group (Petrosian, Sturrock, Walker) is engaged in both theoretical and experimental studies: the experimental work is concerned primarily with x-ray spectroscopic observations of the solar corona, super-nova remnants, x-ray stars and the interstellar medium; the theoretical program is concerned with solar structure and solar activity, pulsars, radio galaxies, quasars and cosmology.

The Theoretical Plasma Physics Group (Buneman) concentrates on computer simulation and stability calculations as related to plasma containment for fusion, and to extraterrestrial plasmas.

The facilities of the Institute are available to any interested and qualified student, who must be admitted by and registered in a department. The Departments of Aeronautics and Astronautics, Electrical Engineering, Mechanical Engineering, and Applied Physics provide opportunities leading to an M.S. or Ph.D. degree for work in plasma physics. A number of plasma courses are listed by these departments and by the School of Engineering.

Further information is available from members of each group and from the Chairman of the Executive Committee.

SPACE SCIENCE AND RELATED PROGRAMS


Space science, which is the study of natural phenomena by observations from space vehicles, is actively pursued by many groups at Stanford. Experimental research in progress includes development of experimental packages to be carried by rockets, satellites, and space probes for studies including: radio emission in the magnetosphere; radio measurements of the interplanetary medium and of planetary atmospheres; plasma waves in space; infrared and radar sensing of planetary surfaces; X-ray emission from the sun and other astronomical objects; and gravitation.

Related observations by means of ground-
based equipment are made at the Radio-science Laboratory (ionospheric and magnetospheric structure and radio properties); the Radio Astronomy Institute (the sun and other radio sources); the Center for Radar Astronomy (magnetospheric and cislunar media, sun and moon), operated jointly with Stanford Research Institute; and the Institute for Plasma Research.

The experimental work is supported by theoretical studies and by a program of laboratory simulation of space plasma wave and instability phenomena.

A program in theoretical astrophysics provides for study and research over a wide range of topics including solar physics, solar-terrestrial relations, and nonthermal phenomena related to pulsars, radio galaxies, quasars and cosmic rays.

Stanford is a member of the Universities Space Research Association, a consortium of universities which operates the Lunar Science Institute in Houston, Texas. Opportunities and financial support for graduate students interested in advanced lunar research are available.

Courses related to many of the above topics are listed below. The descriptions of these courses will be found listed under Aeronautics and Astronautics, Applied Mechanics, Electrical Engineering, Geophysics, and Applied Physics, and also under the Astronomy Course Program.

The Space Science and Related Programs are available to any interested and qualified graduate student, who must be admitted by and registered in a department. The Departments of Aeronautics and Astronautics, Applied Mechanics, Electrical Engineering, Geophysics, and Applied Physics provide opportunities leading to a Ph.D. degree for work in space science, astronomy, or astrophysics.

In case a study program is not appropriate to any one department, a student has the privilege, under the general provisions of the Graduate Division Special Programs, of proposing a special program leading to a Ph.D. degree on a topic such as space science, astronomy, or astrophysics.

Further information is available from the Chairman of the Committee in Charge.

15. The Nature of the Universe—(Enroll in Applied Physics 15.)

3 units, Aut (Petrosian) MWF 11


3 units, Aut (Walker) TTh 2:15–3:30

102A,B,C. Astronomy Laboratory—(Enroll in Astronomy 102A,B,C.)

102A. 1 unit, Aut (Walker) by arrangement

102B. 1 unit, Win (Walker) by arrangement

102C. 1 unit, Spr (Walker) by arrangement

103. Stellar and Galactic Astronomy—(Enroll in Applied Physics 103.)

3 units, Win (Staff) TTh 2:15–3:30

105. High-Energy Astronomy — (Enroll in Applied Physics 105.)

3 units, Spr (Petrosian) TTh 2:15–3:30

211B. Physical Gas Dynamics—(Enroll in Aeronautics and Astronautics 211B.)

3 units, Spr (Bershader)

222. Optical Methods in Engineering Science—(Enroll in Aeronautics and Astronautics 222.)

3 units, Aut (Bershader) alternate years, given 1974–75

240. Space Physics—(Enroll in Applied Mechanics 240.)

3 units, Win, alternate years, given 1975–76

295. Physics of Planetary Interiors—(Enroll in Geophysics 295.)

3 units, Aut (Kovach) MWF 10

348. Ionospheric Processes—(Enroll in Electrical Engineering 348.)

3 units, Spr (Staff) alternate years, given 1975–76

350. Radioscience Seminar—(Enroll in Electrical Engineering 350.)

1 unit, Aut, Win, Spr (Staff) by arrangement

351. Plasma Wave Theory—(Enroll in Electrical Engineering 351.)

3 units, Spr (Crawford) alternate years, given 1975–76

352. Wave Propagation in the Ionosphere and Magnetosphere—(Enroll in Electrical Engineering 352.)

3 units, Spr (Helliwell) alternate years, given 1974–75
353. Radiometry and Interferometry—(Enroll in Electrical Engineering 353.)
   3 units, Aut (Bracewell)

354F. Theory and Application of Radio Wave Scattering—(Enroll in Electrical Engineering 354F.)
   3 units, Aut, alternate years, given 1975–76

360. Solar Terrestrial Relations—(Enroll in Applied Physics 360.)
   3 units, Aut (Sturrock) MWF 9,
   alternate years, given 1974–75

361. The Sun and Solar Activity—(Enroll in Applied Physics 361.)
   3 units, Win (Sturrock) MWF 9,
   alternate years, given 1974–75

   3 units, Win (Petrosian) MWF 11,
   alternate years, given 1974–75

363. Seminar in Astrophysics—(Enroll in Applied Physics 363.)
   3 units, Spr (Sturrock) by arrangement
   [May be repeated for credit]

364. Radiation from Plasmas—(Enroll in Applied Physics 364.)
   3 units, Aut, alternate years,
   given 1975–76

STANFORD LINEAR ACCELERATOR CENTER

Director: Wolfgang K. H. Panofsky
Deputy Director: Sidney D. Drell
Associate Directors: Joseph Ballam (Research Division); Robert H. Moulton, Jr. (Administrative Services Division); Richard B. Neal (Technical Division); Frederick V. L. Pindar (Business Services Division)


Assistant Professors: Robert K. Carnegie, Harvey L. Lynch


The Stanford Linear Accelerator Center (SLAC) is devoted to experimental and theoretical research in elementary particle physics and to the development of new techniques in high energy accelerators and elementary particle detectors. The Center is located on 480 acres of Stanford property west of the main campus, parallel to and south of Sand Hill Road and is operated under a contract with the United States Atomic Energy Commission. The major experimental facility of the Center is a two-mile-long linear electron accelerator.

The accelerator, which began operations for physics research during 1966, can provide an electron beam at energies up to 22 BeV and at beam intensities up to 30 microamperes average current. Positrons can also be accelerated to a maximum energy of about 14 BeV, at average beam currents up to about one microampere. A "switchyard" of magnetic elements at the end of the accelerator can direct the beams to any of several experimental areas. A large number of secondary beams of special character, including pion, kaon, muon, and photon beams, are available. A complement of large research instruments available for use with the accelerator includes three magnetic spectrometers capable of analyzing momenta up to 1.6, 8, and 20 BeV/c; two bubble chambers, a 40-inch diameter, cylindrical chamber built at SLAC and a 14-inch rapid-cycling bubble chamber that operates in a hybrid mode with triggering counters; two large-volume magnets, with pole diameters of 54 inches and 80 inches, used in spark-chamber and streamer-chamber experiments. A variety of general purpose apparatus is also available. An electron-positron storage ring facility (SPEAR) has recently been constructed and is now engaged in a full research program with colliding beams each of 2.5 BeV energy. During the coming year its energy will be increased to about 4.2 BeV for each beam. A large-aperture superconducting solenoid (LASS) system is nearing the end of construction and will begin a study of multi-hadron events this year.

The Center is operated by Stanford as a
national facility so that qualified scientists from universities and research centers throughout the country and world, as well as those at Stanford, may participate in the high energy physics research program of the Center. As of January 1974, physicists from 50 other institutions have had research programs accepted for execution at the Center. The faculty of the Center leads a group of some 80 physicists in research programs on theoretical and experimental particle physics. In addition, the faculty offers lecture series on various aspects of high energy physics, and conducts seminars on topics of current interest.

The experimental research program at SLAC deals with almost all areas of elementary particle physics at high energies. To name but a few, experiments are in progress on high energy elastic and inelastic electron scattering, the study of high energy photon and hadron interactions both with bubble chamber and electronic techniques, studies of decay properties of weakly interacting particles, and the study of electron-positron annihilation to form hadrons, leptons, and photons. The work in theoretical physics deals with all phases of elementary particle theory.

Stanford graduate students may, with the approval of their departments, carry out research for the Ph.D. degree with members of the SLAC faculty. (Graduate students from other universities also participate in the research programs of visiting groups.)

Research assistantships are available for qualified students by arrangement with individual faculty members. There are also opportunities for summer employment in the research groups at the Center. Interested students should apply to the Office of the Director.

UNDERGRADUATE PROGRAMS

Engineering and Society

Relations between society, engineering, and technology are studied in various courses and programs:

SCHOOL OF ENGINEERING PROGRAM

A program entitled “Engineering and Society” is available to undergraduate students in the School of Engineering. (See the “School of Engineering” section of this Bulletin.) It gives the interested student the opportunity to explore the interfaces between engineering, technology, and society in some depth. Adequate technical courses are included so that understanding of technology can be acquired. Flexibility exists in the program so that the student may tailor the coursework to his or her own career goals and interests.

TECHNOLOGY AND SOCIETY COURSES

A list of courses specifically dealing with the interaction of Technology and Society is available in the Office of the Dean of Engineering. This list was assembled for the use of engineering students in fulfilling the Technology and Society requirement in the undergraduate engineering curriculum, but it contains many courses open to all students, regardless of major.

ENGINEERING COURSES OF GENERAL INTEREST

The following courses are of general interest to both engineering and non-engineering students. They are taken by students from diverse departments and have no prerequisites:

- Engr. 1. The Engineer in Modern Society
- Engr. 3, 4, 5. Applied Mechanics I, II, III
- Engr. 7. Energy, From Nature to Man
- Engr. 10. Aeronautics and Astronautics
- Engr. 44. Basic Electronics
- Engr. 50. Introductory Science of Materials
- Engr. 102. Optimization
- Engr. 161. Engineering Economy
- Chem.E. 20. Introduction to Chemical Engineering
- C.E. 40. Elementary Surveying
- C.E. 130. Transportation
- C.E. 150. Introduction to Urban Planning
- C.E. 170. Man and His Environment
- C.E. 171. Environmental Planning
- E.E. 181. Introduction to Computer Organization, Machine and Assembly Languages
- I.E. 50. Human Values in a Technological Society
- I.E. 100. Organizations: Theory and Management
- I.E. 133. Industrial Accounting
- M.E. 101. Visual Thinking
- M.E. 102a, b. Design Communication Workshop
Human Biology
(Program in)

Committee in Charge: Donald Kennedy (Biological Sciences), Chairman; Sanford M. Dornbusch (Sociology); Paul R. Ehrlich (Biological Sciences); David A. Hamburg (Reed-Hodgson Professor of Human Biology and Psychiatry—on leave 1974-75); Albert Hastorf (Psychology); Joshua Lederberg (Genetics); Colin S. Pittendrigh (Bing Professor of Human Biology and Biology—on leave 1974-75); James L. Gibbs, ex officio (Dean of Undergraduate Studies)

Faculty: Albert J. Ammerman (Genetics); Jack D. Barchas (Psychiatry); Philip A. Berger, (Psychiatry); Merton R. Bernfield (Pediatrics); Luigi L. Cavalli-Sforza (Genetics); Garth Collier (Civil Engineering); Peter Corning (Political Science); Carl Djerassi (Chemistry); Burr S. Eichelman, Jr. (Psychiatry); Walter P. Falcon (Food Research); John W. Farquhar (Medicine); Shirley Feldman (Psychology); Jane van Lawick-Goodall (Psychiatry); John G. Gurley (Economics); Herant Katchadourian (Psychiatry—on leave 1974-75); Sidney Liebes, Jr. (Genetics); Donald T. Lunde (Psychiatry—on leave 1974-75); Albert A. Siegel (Psychiatry); Keith B. Taylor (Medicine); C. Peter Timmer (Food Research)

Student Members: Donna Anderson, Cynthia Clinkingbeard, Robert Kaplan, Kathryn E. McLane, Anne M. Murphy, Emily A. Polis, Richard S. Strauss, Patricia C. Tobin, Elizabeth Vazquez, Wanda B. Weaver, Wendy L. Wornham

Program Coordinator: Sophia C. Alway

STATEMENT OF PURPOSE

This Program is an undergraduate major designed to encourage the convergence of natural and social science in the study of man. The Program is an interschool, interdepartmental major, utilizing not only those faculty and courses particularly created for the major, but also pertinent areas of instruction available throughout the University. It also is concerned with man as an organism, his adaptation to other men and to nature, his ability to control and to live with the environment, and the mechanism by which these factors relate to his biological and behavioral evolution.

This Program is a response to the need for knowledge of the complex relationship of man with nature, exemplified by the dilemmas of social policy in health and education, population problems, pollution of the environment, and conservation and development of resources. The Program is designed for the general education of policy makers and citizens. It is also a route to advanced study in the established natural and social sciences and related professions.

OFFERINGS AND FACILITIES

The Program is funded by a grant from the Ford Foundation and leads to an A.B. in Human Biology. The curriculum is designed for those students who desire a knowledge of biology, particularly of man, linked with knowledge of the behavioral sciences. The Program predominantly involves faculty from the School of Humanities and Sciences and the Medical School. Representatives from other Schools will also participate in the Program.

The core of the Program for majors in Human Biology is the Fundamental Program. It consists of eight one-quarter courses required of all majors. The objective of these courses is to present a broad but rigorous overview of the biology and behavior of man in society. The core is the necessary academic basis for the more specialized and advanced offerings of the Program.

There is no graduate program in Human Biology, but students will be prepared for advanced training in biology, the behavioral and social sciences, medicine, law, or education, depending on their choice of advanced courses following the Fundamental Program.
The Office of the Program in Human Biology is located in Building 80 of the Inner Quad.

PROGRAM OF STUDY

BACHELOR OF ARTS

The degree of Bachelor of Arts in Human Biology will require approximately 60 to 65 units in the major. The Fundamental Program will consist of 33 units and will satisfy the University Distribution Requirements in the social sciences and the natural sciences. It is expected that, in addition, at least six advanced courses will be taken in fields related to the biological, social, or physical aspects of Human Biology. Detailed guidance should be sought at the office of the Program in Human Biology so that the program for the individual student can be designed to fit his or her particular needs and career goals.

The Honors Program provides qualified majors with an opportunity to do research and write a thesis on a subject of individual interest, for which up to 15 units of credit can be given in the honors candidate's senior year. These units (see Human Biology 198 under "Courses") will be in addition to the 30 upper division units ordinarily required for an A.B. in Human Biology.

Application for admission to the Honors Program should be made by the third quarter of the junior year. Applicants must have completed the Human Biology "core" requirements including the Workshop. The submission of the Honors thesis is expected by the beginning of the spring quarter of the year of graduation.

COURSES

Note: Students who have elected a major in Human Biology will be expected to take courses 1 through 6 in the Fundamental or "Core" Program. These courses must be taken for a grade by majors with the exception of the workshop. It is advised that the sequence be initiated in Spring Quarter of the Freshman year. Courses 1 through 4 are open to non-majors; however, the A and B Series must be taken concurrently and in sequence by all students.

FUNDAMENTAL PROGRAM

1. Evolution of Life and Emergence of Man — The question "what is life?" leads to a discussion of the nature of organisms, of organization in general, its dependence on information, and the central position of genetic and evolutionary theory in all biological sciences. A beginning is made in developing an understanding of the role of natural selection in molding the character of organisms and societies as self-reproducing entities adapted to the conditions in which they exist.

A major section of this course is a substantial treatment of Mendelian and population genetics. The nature/nurture problem is introduced as one of the most important contributions which the biologists as such can make to an understanding of man and political issues that beset him.

Metabolism in general, with principal emphasis on the energetics of the organism and traffic with the environment in material constituents, is given only brief treatment. The cell is studied as the simplest unit of living organization. The structure of its organelles is considered in terms of the functions they serve, especially in terms of the energy relations.

This introductory course is primarily concerned with broad outlines of the origin and history of life, with special emphasis on the evolution of the vertebrates and the primates. The quarter will close with a discussion of the biological uniqueness of man and his origins from the Australopithecines.

5 units, Spr (Staff) MTWThF 10

2A. Cells, Organisms, and Societies — The structural and functional prerequisites for life at various levels of organization are treated in this quarter in greater depth, i.e., cellular structure, molecular architecture, and the energetics of living systems. The character of intercellular communication in multicellular organisms, leading to the neural and endocrine mechanisms underlying behavior; will provide the major theme for the course. Prerequisite: 1 or Biological Sciences 1; must be taken concurrently with 2B.

4 units, Aut (Barchas, Bernfield, Kennedy) MWF 9

2B. Evolution of Human Behavior — This course views man as an organism with a long evolutionary history that has significance for understanding the behavior of contemporary man. Over millions of years, behavior patterns have evolved in relation to meeting sur-
vival requirements: food, shelter, defense, reproduction, preparation of offspring to cope with environmental conditions. Such adaptive patterns will be examined in different eras of human evolution: in nonhuman primates; in hunting-and-gathering societies; in agricultural societies. Attention will be given to: subsistence patterns; interpersonal and intergroup relations; sources of conflict and modes of conflict resolution.

4 units, Aut (Goodall, Staff) MWF 10

3A. The Human Organism — This course will build on the material in 2A, emphasizing issues in physiological control and development. Particular emphasis will be placed upon (1) adaptation and homeostatic capacity; (2) coordinating mechanisms that underlie these abilities and (3) human performance under environmental extremes. Prerequisites: Human Biology 2A and 2B; must be taken concurrently with 3B.

4 units, Win (Kennedy, Barchas, Bernfield) MWF 9

3B. The Person in the Social Structure—This course will explore the development and functioning of the person in a social and institutional context. We shall look at individual development within the setting of family, school and work. Those social-psychological processes will be emphasized which are relevant to the understanding of social interaction and human organization. Stress will be placed upon the influence of both the person and the institutional setting in determining belief systems and behavior. Prerequisites: Human Biology 2A and 2B; must be taken concurrently with 3A.

4 units, Win (Siegel, Hastorf, Dornbusch) MWF 10

4A. Biology of Populations—The course will present an overview of populations as biological units, emphasizing their genetics, dynamics, and the interactions of populations in ecosystems. Illustrative material will be drawn largely from human populations and those of organisms which interact closely with man. Subjects discussed will include race, human population growth, resource depletion, and man’s impact on the environment. Prerequisites: Human Biology 3A and 3B; must be taken concurrently with 4B. Some background in statistics desirable.

4 units, Spr (Ehrlich, Staff) MWF 9

4B. Human Institutions—This course will present selected economic and political principles relevant to contemporary problems of human biology. Certain data and concepts of the social sciences will be considered, and their significance explored in relation to some aspects of health, disease, and other areas where biology and the social sciences interact.

4 units, Spr (Gurley, Corning) MWF 10

6. Workshop in Human Biology — This workshop, required of all Program majors, offers the student the opportunity to augment his formal course work with a supervised field, community, or laboratory project of his own choosing. To be arranged in advance and to be initiated at least three quarters prior to graduation. Limited to majors in Human Biology. Course graded pass/no credit exclusively.

4 units (Liebes) by arrangement

10. Human Sexuality—Human sexual function and behavior will be reviewed from biological, psychological, and cultural perspectives. In the first part, the anatomy, physiology, and endocrinology of sexual and reproductive functions are examined. The second part deals with psycho-sexual development and patterns of sexual behavior. In the final portion of the course, erotic themes in literature and art are reviewed, and legal and moral aspects of human sexuality examined. The emphasis in the course is on information, not advice.

4 unit, Spr (Katchadourian, Lunde, Staff) MWF 11, given 1975-76

ADVANCED COURSES

Note: A major in Human Biology is expected to take 30 units of upper division credits in fields related to the natural or physical and the social or behavioral aspects of Human Biology. The courses may be selected from the upper division offerings of the Program, or any appropriate department on the campus. The student must balance the advanced courses so that two-thirds of the units are in either the natural or the social sciences, while one-third are in the other—i.e., two-thirds social and one-third natural; or two-thirds natural and one-third social. The upper division courses should reflect a unity directed toward the ultimate goal of
the student. The student's individual design of an advanced program must have approval from a Program adviser and the Committee on the Major. At the student's discretion one half of the upper division courses (15 units) may be taken for pass/no credit.

Students who plan to pursue graduate work in the sciences or social sciences should be aware of admissions requirements for graduate programs and the necessity for early planning of their programs, in order to satisfy the requirements of both the Program and graduate schools.

Advanced courses presented by the Program in Human Biology are open to non-majors with the proper prerequisites. Human Biology majors will have preference where the number of students must be restricted.

102. Health as Human Ecology—The interplay of environmental, genetic, and social factors that influence health outcomes. Historical epidemiology, contemporary environmental hazards, the evolution of parasites and human hosts, the challenges of health research and of preventive medicine, and the dilemmas of value choices involving life and health will be reviewed. (Students interested in the sociology and economics of medical services should see CPM 200.) Prerequisites: Human Biology core or 20 units of Biological Sciences.

4 units, Win (Lederberg) MWF 11

106. Man-Made Environment —A course consisting of lectures, discussions, and readings reviewing man's role in shaping his environment. Emphasis will be placed upon the planning factors and processes which act to determine the nature of our cities and communities. The class is limited to 40 students with preference given to Human Biology majors.

3 units, Spr (Collier) Th 2:05-4:15

110. Introduction to Biological Chemistry—This elective course is designed for students who cannot take courses offered by the Departments of Chemistry and Biochemistry. Major topics include biologically important principles of physical chemistry, characteristics of enzymes and other molecules of biological interest, biochemical pathways and genetic errors of metabolism.

3 units, Spr (Staff) TTh 4:15

120. Human Nutrition—An introduction to human nutrition including the metabolic basis of nutritional requirements, dietary requirements, biogeographic aspects, socioeconomic determinants of dietary problems, specific deficiency diseases, and global aspects of malnutrition. Prerequisite: Human Biology core or consent of instructor.

4 units, Win (Taylor, Farquhar, Timmer) MWF 4:15

121. The World Food Economy—(Same as Food Research 103 and Economics 106.) This course will examine the individual components essential to a macro-perspective of the world food economy. The biological and economic principles of food production will be used to explain the potential for food supplies. Next, attention will be devoted to nutritional, social and economic factors that influence the consumption of major food groups. Techniques for measuring and evaluating nutritional wellbeing will be discussed briefly. The last part of the course will examine the world food economy in global perspective.

3 units, Spr (Timmer) MWF 11

128. Seminar in Comparative Survival Strategies — (Same as Political Science 128C.) A systematic comparison of how different human societies go about meeting their basic survival and reproductive needs. The overall configuration of survival strategies and behaviors will be considered, and students will be required to take a holistic approach, drawing upon data and research from a variety of disciplines. Emphasis will be placed on the interaction between biological and cultural processes.

5 units, Spr (Corning) T 2:15-4:05

130. Human Genetics—This course will include the following: molecular aspects of human variation, genetics of disease and of continuous traits including behavioral attributes; population aspects; dynamics of change and equilibria under mutation, selection, drift, migration and population structure models; social aspects of human genetics. Prerequisite: Human Biology core or consent of instructor.

4 units, Aut (Cavalli-Sforza) MWF 2:15

131. Human Evolution—Early and recent human evolution and differentiation in the light of modern evolutionary theories as revealed by a multidisciplinary approach (archeology, paleoanthropology, paleoecology, geology, population biology and genetics).
Attention will be paid to both cultural and biological adaptations and the nature of their interplay over the course of human evolution. Special topics will be developed in greater depth in the seminar in Human Evolution (Human Biology 132) which is run concurrently.

3 units, Win (Ammerman, Cavalli-Sforza) TTh 4:15

132. Seminar in Human Evolution—Discussion of selected topics to be chosen among those presented in the course on Human Evolution. Examples of areas that may be examined would include: adaptations to changing environments during the Pleistocene, anatomical changes in the genus Homo, patterns of cultural change and regional differentiation at various points during the course of human evolution, origins of agriculture and related cultural and biological implications. The selection of topics will be based in part on the background and interests of those taking the course. Prerequisite: to be taken concurrently with Human Biology 131 or consent of the instructor.

3 units, Win (Ammerman) by arrangement

140. Energy and Society — (Same as Mechanical Engineering 180.) A unified analysis of the effects on man’s environment of the production, distribution, and consumption of energy. Treatment will include: the kinds and magnitude of energy resources; the various technologies for conversion to electric energy and other consumer forms; priorities and strategies for future development; the social conflicts between growing demands and environmental degradation; technological assessment; the legal and economic framework of the energy industry. Presentation of technical information will be in terms understandable to the non-engineering student. Prerequisites: high school physics and junior standing or consent of instructor.

3 units, Spr (Connolly, Liebes) TTh 1:15-2:30

145. Research Seminar on the Origins and Evolution of Politics—(Same as Political Science 145C.) A reconsideration of the origins of politics and the “state” and the role of politics in the evolution of human societies in light of recent research in a variety of disciplines, ranging from paleoanthropology and primatology to political anthropology and political science. Because of the interdisciplinary and exploratory nature of the course, original student research will be emphasized. Topics will include: defining politics; precursors and parallels in animal societies; precursors among Pleistocene hominids; evidence from the Paleolithic and Neolithic; theories of cultural evolution; “stages” of political evolution; theories of the emergence of the state; government in primitive societies; kinship systems, stratification and politics; force, violence and politics; the future of politics. Restricted to advanced human biology, political science and anthropology students by permission of the instructor.

5 units, Win (Corning) given 1975–76

150. Biosocial Aspects of Birth Control — (Same as Chemistry 130.) The problems of introducing a new, practical birth control agent or procedure involve legal, political, cultural and economic factors in addition to purely biological ones. The course will deal with a critical evaluation of the logistic aspects of practical human fertility control. Groups of 5 to 8 students of diverse backgrounds will develop a series of position papers dealing with new birth control procedures suitable for populations of different cultural and socioeconomic backgrounds. The selection of students admitted to this class will be based in part on the desire to create a multi-disciplinary student group so that each position paper will be prepared by task forces consisting of participants with different undergraduate backgrounds (e.g., Pre-medicine, Pre-law, Biological Sciences, Anthropology, Chemistry, etc.) who will focus on specific logistic aspects of a common topic in the birth control field. Limited to 40 students. Pre-registration during fall quarter essential. Prerequisite: at least junior standing and completion of pre-registration questionnaire available from Human Biology Office.

5 units, Win (Djerassi) M 2:15–4:05; W 2:15–4:05, alternate years, given 1975–76

152. Biosocial Aspects of Pest Control—This course will focus on policy issues in the management of pests in agriculture and public health. Among the topics considered will be the following: biological basis of contemporary control techniques and the major alternatives; the properties of agroecosystems and the biology of pest organisms; economic
and political factors that motivate pest-control practices; measuring the costs and benefits of chemical control; impact of regulation on the development of new technology in private and public sectors. The first part of the course will consist of lectures on these and other biological and institutional features of the problem. In the second part, teams of 6–8 students will investigate a particular application, in most cases a local one that may be examined at first hand, and formulate a set of policy recommendations. Limited to 40 students, who must preregister for course during the winter quarter.

5 units, Spr (Kennedy) MW 2:15–4:05
given 1975–76

153. U.S. Agriculture: Interaction of Biology and Economics—(Same as Food Research 145.) The development of agriculture in the United States has been profoundly shaped by biological and by economic influences; sound policy determination usually requires an understanding of the roles of both. This course is devoted to the interaction of these influences. It will consider (a) the biological basis of agricultural practice, including the major groups of cultivated plants, soil and water relations, growth physiology, genetics and plant breeding, agroecosystems and pest control; (b) basic agricultural economics, including the micro-economic basis of production, the supply of agricultural products, technological change, the demand for farm products, and the influence of federal farm programs on agricultural incomes, output, and international trade. In the last part of the course, the scientific and institutional components of selected policy issues in agriculture will be considered.

3 units, Spr (Falcon, Kennedy) MWF 11

160. Primate Behavior — This course will study in detail the research literature on behavior of higher primates in natural habitats. Special attention will be given to chimpanzee behavior, but material on other species of great apes and Old World monkeys will be considered. Some evidence will be included on experimental analysis of questions arising from observation in natural habitats. Prerequisites: Human Biology 2A and 2B.

3 units, Spr (Goodall, Staff) by arrangement

161. Primate Behavior Workshop—An African elective; minimum 2 quarters. Prerequisite: Human Biology 160; limited to 8 Human Biology majors per year.

15 units, Aut, Win, Spr, Sum (Goodall) by arrangement

163. Topics in Psychobiology—This course will focus on recent developments in psychopharmacology, as they relate to the study of human mood disorders and schizophrenia. Current theories regarding the etiology of mental illness will be discussed. The relationship between hormones and human behavior will be examined. Emphasis in the course will be on student participation, using a seminar format. Limited to 24 students. Prerequisite: Human Biology core.

3 units, Aut (Berger) T 3:15–5:05

164. Human Aggressiveness — This course, taught in seminar format, will review data and theory concerning biological, psychological and social aspects of human aggressive behavior. Biological aspects will include instinct theories, genetic variables, hormonal contributions, evidence from the study of nonhuman primates, and brain mechanisms. From a psychological viewpoint, links between frustration and aggression, as well as social learning of aggressive behavior will be reviewed. Social factors will include effects of crowding, stranger contact, status conflicts, and inter-group competition. An effort will be made to integrate information and ideas from biological and psychosocial perspectives. Limited to 20 students. Prerequisite: completion of Human Biology core program.

3 units, Win (Eichelman) W 1:15–4:05
given 1975–76

198. Honors Program—This establishes an opportunity for in-depth research on an appropriate issue or problem by the student. It is necessary to choose a faculty sponsor who will be the adviser to the project and a faculty consultant who will act as second reader of the thesis; at least one of these two must be a member of the Human Biology faculty.

Minimum requirement for the Honors program work and the resultant thesis is the equivalent of 10 units of work; a maximum of 15 units may be awarded. Limited to majors in the Program in Human Biology who have completed the "core" courses including the workshop. Interested candidates should consult with advisers in the Program
in Human Biology for explicit requirements for the Honors Program.

(Staff) by arrangement

199. Directed Reading/Special Projects — Independent study undertaken with faculty in the Program in Human Biology. Course graded pass/no credit exclusively.

Any quarter (Staff) by arrangement

Individually Designed Majors

This program is intended for students who are interested in pursuing in depth an area of scholarly inquiry which falls outside the purview of a single, established, academic department or program of the university. What is envisioned are intellectually coherent majors designed by the students themselves with the assistance of faculty members of their choice. The Interdepartmental Major Program is not an honors program, and an honors grade point average is not a requisite. Any student in good academic standing is invited to participate.

In designing a major, the student will consult with at least three faculty members from at least two separate departments or programs of the University; one of the faculty members will be selected as the student’s “primary” adviser. In helping the student design the major and in signing the proposal requesting approval from the Dean’s Advisory Committee on Individually Designed Majors, the faculty members are committing themselves to act as a regular academic advisory group for the student until graduation. The Committee will not consider proposals (or changes in previously approved proposals) unless the student has the approval of the faculty advisory group.

The proposal should begin with a statement which describes the major, articulates the motivation for, and the justification and ultimate goal of, the major, and shows how the courses listed relate to and fulfill the major’s goal. This statement should be followed by a list of the proposed core courses to be counted toward the major and, as far as possible, the sequence in which they are to be taken. The total proposal must be signed by at least three faculty members; their signatures certify that they approve of the major as described in the proposal and agree to serve as the student’s permanent advisory group. All members of the student’s advisory group must be members of the Academic Council at Stanford; this requirement will help ensure that they will be available throughout the student’s program.

The “Committee in Charge”

The Program for Individually Designed Majors is administered by the (Undergraduate Studies) Dean’s Advisory Committee on Individually Designed Majors. The Committee is composed of both faculty and student members, with representatives from the Office of the Dean of Undergraduate Studies serving in ex officio positions.

The Committee acts in lieu of a regular department of the University. This role involves certifying the scholarly merit of the program and includes the obligation to consider, approve, and recommend changes in each proposed major. Because the Committee works closely with the Office of the Dean of Undergraduate Studies, and especially the Academic Information Center, it can facilitate access to the full range of resources available to the student.

In carrying out its role, the Committee reserves the right to reject proposals which in its opinion lack scholarly merit or which are not clearly interdisciplinary. Occasionally, the Committee must reject a proposal which, though of considerable academic merit, requires resources which are not available at Stanford. The Committee also reserves the right to recommend additions to each student’s faculty advisory group.

The Proposal

The proposal should begin with a statement which describes the major, articulates the motivation for, and the justification and ultimate goal of, the major, and shows how the courses listed relate to and fulfill the major’s goal. This statement should be followed by a list of the proposed core courses to be counted toward the major and, as far as possible, the sequence in which they are to be taken. The total proposal must be signed by at least three faculty members; their signatures certify that they approve of the major as described in the proposal and agree to serve as the student’s permanent advisory group. The proposal must also be accompanied by a statement from the primary adviser, giving his or her frank appraisal of the academic viability of the proposed major.

All members of the student’s advisory group must be members of the Academic Council at Stanford; this requirement will help ensure that they will be available throughout the student’s program.

The Guidelines

To defend the program for Individually Designed Majors as being fully equivalent to a Stanford Bachelor of Arts or Bachelor of Science degree in an established department or program, the Senate of the Academic Council originally established these requirements:

1) Each major shall consist of at least sixty
(60) units, all in courses at or above the 100 level (or equivalent);
2) A maximum of fifteen (15) of these sixty (60) may be taken on a pass/no-credit basis;
3) A maximum of five (5) units of these sixty (60) may be taken in individual study or directed reading.
4) Students proposing an individually designed major must have at least two quarters' undergraduate work remaining at Stanford after the date on which the proposal is to be discussed by the Committee.

Since each proposal is considered individually, the student and the faculty advisory group may request exception to these guidelines.

Further information on the program may be obtained at the Academic Information Center.

LEARNING ASSISTANCE CENTER

Director: Michael McHargue

The Learning Assistance Center (LAC) is designed to improve the learning environment at Stanford. It has helped several departments develop expanded tutoring programs and has worked to improve the teaching, advising and counseling services available to students.

The LAC provides four direct services to students:
A. Course Tutoring — Students who need extra help in their courses (that cannot be provided by professors, TA's or departmental tutoring programs) may come to the LAC and obtain the names of tutors from our files.
B. Study Skills Improvement — The LAC offers individual counseling and tutoring, workshops, and courses in effective learning and study skills. A broad range of topics are covered, including: (1) self-management skills; (2) study and time management; (3) major course-related skills (including study-reading, exam techniques, and responsive listening and note-taking); (4) auxiliary course skills (like research and communication skills);
(5) attitudes and interests that affect learning.
C. Reading Improvement—Counseling, the LAC Learning Lab, and an academic course are all designed to help students become more efficient, flexible, sophisticated readers.
D. Tutor Training—Courses and workshops train students to become effective academic tutors.

All LAC courses are pass/no credit and they can all be taken for fewer than the listed number of units by consent of the instructor. All LAC services are free. You are invited to visit the Center at Meyer Library 123, or call us at ext. 7-2207. We are open Monday through Friday, 9–5 and some evenings.

COURSES

1. Effective Learning Skills—Teaches self-management and study skills. Lectures, discussions, assignments, and individual counseling are designed to encourage students to practice new techniques on other coursework.
   2 units, Aut, Win, Spr, Sum (McHargue, Adams and Staff)

10. Effective Reading Skills—Small sections designed to improve reading skills including vocabulary building, critical and analytical reading of college-level materials, study reading, and rate improvement.
   4 units, Aut, Win, Spr, Sum (Walker and Staff)

101. Tutoring Practicum—Weekly seminar/workshop provides the tutoring and counseling skills required for students to successfully tutor other students in lower division coursework. Consultation with faculty, and actual tutoring done by arrangement. Course may be repeated for credit. Prerequisites: At least a B grade in subject to be tutored and consent of instructor.
   1 to 3 units, Aut, Win, Spr, Sum (McHargue and Staff)

Mathematical Sciences (Program in)

Committee in Charge: Sidney I. Resnick (Statistics), Chairman; Paul W. Berg
(Mathematics), John G. Herriot (Computer Science), Arthur F. Veinott, Jr. (Operations Research)

**STATEMENT OF PURPOSE**

This interdepartmental, interschool undergraduate program is designed as a major for students interested in the mathematical sciences or in the use of mathematical ideas and analysis in problems in the social or management sciences. It provides a core of mathematics basic to all of the mathematical sciences, and an introduction to the concepts and techniques of automatic computation, optimal decision making, probabilistic modeling, and statistical inference; it also provides an opportunity to undertake elective work in any of the mathematical science disciplines at Stanford.

The program utilizes the faculty and courses of the Departments of Computer Science, Mathematics, Operations Research, and Statistics. It is intended to prepare students for graduate study or employment in the mathematical sciences or in those areas of applied mathematics which center around the use of high-speed computers and are concerned with the problems of the social and management sciences.

**PROGRAM OF STUDY**

**BACHELOR OF SCIENCE**

The requirement for the Bachelor's degree, beyond the University's basic requirement, is an approved course program of 71 to 75 units, distributed as follows:

1. Mathematics (33 units): Calculus and Analytic Geometry through Mathematics 43 or 23, or equivalent; Advanced Calculus (44, 45); Linear Algebra (113); Fundamental Concepts of Analysis (115); Modern Algebra (120); Differential Equations (130). Mathematics 54, 55 (8 units) may be substituted for Mathematics 44, 45, and 115.

2. Computer Science (9 units): Introduction to Computing (105 or 106); Numerical Analysis (137A,B).

3. Operations Research (6-9 units): Introduction to Operations Research (152, 153) or Linear Programming (240) and Models in Operations Research (250, 251).

4. Statistics (11-12 units): Theory of Probability (116 or Mathematics 123); Statistical Inference (119, 120).

5. Electives (12 units): Twelve units of courses in the Mathematical Sciences of which six (6) must be chosen from Mathematics 114, Mathematics 116 (or Mathematics 56), Computer Science 111, Computer Science 155 (or Computer Science 150 or Operations Research 245), Statistics 217 (or Mathematics 124). The choice of electives will be determined by the student's interest. In particular, students planning graduate study in Operations Research are advised to take Mathematics 114 and 116.

**Seminars for Entering Students**

*Dean's Advisory Committee in Charge: Marvin Chodorow (Director of the Program), Thomas A. Bowers, George Collier, Karel de Leeuw, Lynn Eddy, Roger Gray, David Kennedy, Lisa Lang, Ronald Rebholz, Ann Snow, Mason Yearian (ex officio)*

The seminars for entering students, with course topics covering a great variety of fields, are especially designed to provide small group learning experiences. The seminars allow you to explore a subject of particular interest, working closely with a professor, lecturer, or advanced graduate student.

There are anywhere from six to twelve students in a seminar. Since approximately 1,800 entering students are eligible for some 96 seminars, everyone cannot be placed in his or her first choice, and some students who apply may not be placed in a seminar at all.

The seminars are for three, four, or five units of credit per quarter. The two-quarter seminars are continuing courses, and students are expected to complete both quarters. Some seminars fulfill part or all of the Writing Requirement and some can count toward the University's distribution requirement.

**APPLICATION AND ADMISSION PROCEDURES**

All students who accept admission to Stanford University receive in June a copy of *Approaching Stanford* which includes de-
scriptions of the seminar offerings for the following academic year. Applications for the seminars are received and processed in late summer and students are notified of their acceptance into the particular seminars upon arrival at Stanford.

Correspondence regarding the program should be addressed to the Office of the Dean of Undergraduate Studies, Building 1, Room 1-C, Stanford University, Stanford, California 94305.

Stanford Workshops on Political and Social Issues (SWOPSI)

Stanford Workshops on Political and Social Issues (SWOPSI) is a student-initiated program organized in an effort to provide within Stanford's curriculum more practical and direct involvement in the search for solutions to urgent social and political problems. It is based on the assumption that one of the major responsibilities of the university in such times of concern and urgency is to help cultivate a community in which concern with respect to social problems is found in knowledge and understanding of the facts, and in which the translation of a sense of urgency into action is thoughtfully directed.

SWOPSI was organized during the summer of 1969, and began the following autumn quarter with an offering of 10 workshops on such topics as: air pollution in the Bay Area, California logging policy, the delivery of health services, University research policy, and disarmament negotiations. The program has expanded since then and has now involved over 3,000 students in over 150 workshops. In the future SWOPSI will offer for credit an average of 20 to 25 workshops per quarter.

The basic objective of all SWOPSI workshops is to develop new insights into contemporary issues of political and social consequence; and, ultimately, to affect more people than are actually members of the workshop. This might be done through informing the community of their conclusions in publications or public forums, or by using the results to form the basis of concrete legal, political or community action.

Workshops are generally concerned with issues which are of interest to Stanford students and faculty, but workshops may also be initiated by concerned members of the outside community. Since each problem may require a different approach, the specific structure of a workshop is determined by the instructors and students who are involved in it.

Workshops are open to both undergraduates and graduates, as well as other interested members of the Stanford community. There are occasionally prerequisites for a workshop, but past experience has indicated that a diversity of backgrounds enhances the possibility of a more perceptive analysis and more imaginative solutions. In general, the workshops meet weekly, but the largest part of the work is done through individual research, interviews, and other kinds of field work. Credit is available for the workshops, primarily on a pass/no credit basis.

Each workshop is provided with a small amount of financial support for operating expenses.

Further information and the specific workshop offerings for any quarter may be found in the SWOPSI catalogue distributed each registration day. There is no pre-registration for workshops, and enrollment limits are determined by the instructor.

Any person interested in organizing, running, or participating in a workshop on a particular issue should contact the SWOPSI office at Ext. 7-4305.

The Student Center for Innovation in Research and Education (SCIRE)

The Student Center for Innovation in Research and Education (SCIRE) is a student-initiated, extradepartmental program. The program's overall objective is to support the educational needs of undergraduate students. This is accomplished through assistance to individual students and by work done to improve the general state of undergraduate education.

Best known among SCIRE's activities is its support of individual or small group student-initiated projects. SCIRE facilitates these
projects in several ways. The staff works with interested students, developing and refining project ideas. Members of the academic community and other qualified individuals with interests similar to the students’ are sought out by the staff and students jointly. Academic credit is then granted to those project proposals which receive the approval of the SCIRE Policy Board which consists of six students and five faculty members.

SCIRE projects allow undergraduates to directly affect their education by giving them the opportunity to experiment with new subject matter, creative research and learning approaches, and unique field experiences. The number of units granted for a project may range from 1 to 15 per quarter. This flexibility enables students to test initial interest in a new field through small introductory projects or to engage in intensive study in an area to which the student is already committed.

In addition to encouraging increased student responsibility for their academic programs, SCIRE is currently working in some new areas relevant to undergraduate education. Policy Board members have identified a number of educational problem areas and task forces are being organized to work on ways to resolve these.

SCIRE will use the support of students and other University community members in this endeavor, both in identifying problems and working toward their resolution.

Another area of emphasis at SCIRE is the stimulation of opportunities for students to work and learn off campus. SCIRE is in the process of developing a file of off-campus learning resources. Plans are also under way to increasingly serve as a clearing house for off-campus learning opportunities by stimulating better coordination among the various agencies and groups in this field. Eventually SCIRE would like to serve as a catalyst for the development of a coherent approach to educational opportunities in the local community.

In past years, SCIRE has provided sponsorship and support for a number of exciting projects which have improved undergraduate education at Stanford. Projects such as the Urban Studies Program, the Undergraduate Program in the School of Education (UPSE) and the Optical Observatory were all inaugurated with SCIRE sponsorship. Current SCIRE activities continue to support such projects. The program has developed an innovation fund which will be used to make grants of “seed money” to support exciting educational projects developed by students. The stress of the fund will be upon ideas which are likely to have a positive impact upon undergraduate education.

Students with academic project ideas, an interest in task forces, a desire to work and learn off campus, and with innovation fund proposals should come by the SCIRE office, 590-A Old Union, or call extension 74504. The office is open Monday through Friday from 8 to 5.

Undergraduate Special Courses

Undergraduate Special Courses are sponsored by the Office of the Dean of Undergraduate Studies. They widen the range of options open to undergraduate students by drawing upon the educational resources of the entire university community, including some parts which customarily have not participated in undergraduate work. Members of the faculties of the graduate professional schools may offer such courses. These are not intended to introduce the technical content of the professional schools into the undergraduate curriculum, but rather are to be general in character. Undergraduate Special Courses may be taught, under suitable arrangements, by persons who are not members of the Academic Council, under the sponsorship of a Council member. The administrative structure of this program of courses is intended to encourage innovation, the introduction of experimental and interdisciplinary courses, and other types of offerings which for various reasons might not appear under the auspices of a particular department or school.

The maximum number of students who may enroll for credit in any Undergraduate Special Course in one quarter is 40. In some of these courses, the enrollment is limited to fewer students.

Grades in these courses are given in the normal manner, with the pass/no credit option available upon the instructor’s approval.

A student may take 12 Undergraduate Special courses, or 36 units of Undergraduate Specials, whichever is lower. Up to 27 of these units may be SCIRE (Student Center
for Innovation in Research and Education), SWOPSI (Stanford Workshops on Political and Social Issues), and/or Urban Studies.

The list of all Undergraduate Special courses to be offered in any given quarter is available to students in advance of registration in the separately published program catalog. Enrollment of individual students in all courses is determined by the Registrar’s class lists, with sign-ups handled in accord with the regular University system of alphabetical rotation, on regular advance registration or registration days, at the location established by the Registrar. Courses which are approved as part of a residence’s program of residential education may reserve no more than 75 percent of the total places available in the course for students who live in that residence. In such cases, the Registrar will maintain separate class lists for residents and for non-residents according to established procedures.

Prerequisites and other enrollment restrictions for Undergraduate Special courses must be approved by the Committee in Charge at the time the course proposal is reviewed. No restriction will be approved based on race, creed, sex, or national origin.

A proposal for an Undergraduate Special course may be initiated by a student, staff member, faculty member, or other member of the academic community. The proposed instructor—the person doing the actual teaching or presentation of course materials—should file with the Committee a form obtained from the Office of the Dean of Undergraduate Studies, indicating:

a) Course title and description, number of units. (The maximum number of credits offered is usually three.)

b) A description of the manner in which the course will be conducted, and a meeting schedule.

c) A reading list and course outline.

d) The name of the instructor and any others who will assist in teaching the course, and a statement of the qualifications of these individuals.

e) A statement assuming full academic responsibility for the course.

If the proposed instructor of the course is not a member of the Academic Council, he must be formally sponsored by a member of the Academic Council, who will be responsible to the Committee on Undergraduate Studies through the Office of the Dean of Undergraduate Special Courses for the quality of the course, the performance of the instructor, and the evaluation of individual student performance, in accord with the course description as approved by the Committee.

Academic credit is granted only if the course proposal receives a favorable evaluation from the standing committee, composed of faculty members and students. Undergraduate Special courses are administered through the Office of the Dean of Undergraduate Studies. Proposals are due by the fifth week of the quarter preceding the one in which the proposed course is to be offered.

Undergraduate specials satisfy neither the Writing nor the Distribution requirements.

Listings of courses available each quarter will be printed in the program catalog and at the Academic Information Center.

UNDERGRADUATE WRITING PROGRAM

Director: Ellen W. Nold

The Undergraduate Writing Program is funded through the office of the Dean of Undergraduate Studies. It has three main functions: to offer experimental courses fulfilling the Writing Requirement, to offer courses for upperclassmen who wish to continue improving their writing skills and to offer tutorial help in writing on a drop-in basis. The program is staffed by people especially skilled in teaching composition.

COURSES

1. Small Group/Tutorial Sessions in Writing—Each quarter of this course fulfills half of the Writing Requirement. Every student meets with a small group of ten to twelve students once a week for two hours and again individually with his or her instructor. The approach to the course varies with instructor, but in each section eighty to one hundred percent of student/teacher energy is spent on reading, writing and talking about compositions. Goals are individual-
ized as far as is possible under writing require-
ment guidelines.

3 units, Aut, Win, Spr (Staff)

2. Small Group/Tutorial Sessions in Writing for Second Language Speakers—Each quarter fulfills half of the Writing Requirement. The format is the same as for WP1, but the instructor is skilled in handling problems encountered by non-native speakers of English.

3 units, Aut, Win, Spr (Rossi)

3. Directed Writing—Fulfills half the Writing Requirement. Designed for those students who have already passed one quarter's work towards the requirement and who wish to design their own writing projects. Each student will meet with his or her instructor once a week.

3 units, Win, Spr (McMullen)

10. Writing about Political Science—Fulfills half of the Writing Requirement. Each student in this course must also take concurrently Professor Herbert Marshall's course, Major Issues in American Public Policy (Political Science 1). Writing will be based on the issues suggested by Political Science 1. The student may fulfill the second half of the Writing Requirement by taking another course in the Undergraduate Writing Program or by one quarter of a Writing Requirement course in the Freshman English or Freshman seminar program.

3 units, Aut (Staff)

11. Writing About History—Fulfills half of the Writing Requirement. Each student in this course must also take concurrently Modern Europe I. Writing will be based on the issues suggested by History I.

3 units, Aut (Trollman)

14. Writing about Psychology—Fulfills half of the Writing Requirement. Each student in this course must also take concurrently Psychology 1. Writing will be based on the issues suggested by Psychology 1.

3 units, Aut (Staff)

101. Small Group/Tutorial Sessions in Writing for Upperclassmen—Designed for those students who have fulfilled the writing requirement but wish to improve further their writing skills. The course is in the same for-
mat as WPI. Assignments and goals are individualized.

3 units, Aut, Win, Spr (Freedman, McMullen)

102. Small Group/Tutorial Sessions in Writing for Second Language Upperclassmen—Designed for non-native speakers of English who wish to improve further their writing skills. The course is in the same format as WP1, but it is taught by an instructor skilled in handling problems of those students for whom English is a second language.

3 units, Aut, Win, Spr (Rossi)

103. Directed Writing—Each student will meet with his or her instructor once a week. The student and his instructor will work out the student's goals and the means of reaching them.

1 to 5 units, Aut, Win, Spr (Staff)

THE PROGRAM ON URBAN STUDIES

The Committee on Urban Studies: Jonathan Casper, Assistant Professor of Political Science; Kirk Henckels, student member; Michael Kirst, Associate Professor of Education; Michael Levinthal, student member; John Mollenkopf, Assistant Professor of Urban Management; Richard Muth, Professor of Economics; Richard Pantell, Professor of Electrical Engineering; Hilary Bowen, student member; Nancy Tuma, Assistant Professor of Sociology; Paul Turner, Assistant Professor of Art. Ex Officio members: B. Michael Closson, Assistant Dean of Undergraduate Studies; Laurel Lunn, student member; Frederic Stout, Urban Studies Program Coordinator; Alice Supton, Urban Studies Program Secretary; Julie Williamson, student member.
GENERAL INFORMATION

The Program on Urban Studies is an undergraduate extradepartmental program concerned with cities and urban life in the local, regional, national and world contexts. The focus of the Program is broadly interdisciplinary and emphasizes the complex interaction of social, political, economic and cultural forces in the urban setting. The Program takes as an area of special concern the problems of urbanization as they affect the San Francisco Bay Region.

The Program is empowered by the Faculty Senate to coordinate offerings of regular Stanford departments and to offer fieldwork internships, group projects and adjunct courses taught both by Stanford faculty members and outside community experts. A supplemental catalog outlining the internships and adjunct courses is available prior to the beginning of each academic quarter at the Program offices, 590A Old Union, Ext. 7-3452.

Urban Studies courses and internships are open to all Stanford students. A student wishing to major in Urban Studies may do so by designing his or her own Interdepartmental Major through the offices of the Academic Information Center, Room 306, Old Union, Ext. 2426. The staff of the Program on Urban Studies will gladly assist any student in the design of an Interdepartmental Major in Urban Studies.

THE CORE CURRICULUM

The Committee on Urban Studies is currently designing a core curriculum which, when completed and approved, will constitute an Interdisciplinary Urban Studies major. That major will provide a strong central discipline, both in terms of content and methodology, by requiring a thorough grounding in the skills and concepts of a variety of urban-related fields. It will also encourage flexibility by allowing the student to pursue a specific area of concentration relating to his or her individual interests. Majors will be required to take the Junior Seminar in Urban Studies (which demonstrates the inter-connected nature of the major urban-oriented disciplines) and to complete a Senior Project (which may be either an exercise in pure research or an exercise combining research with fieldwork experience.)


VALUES, TECHNOLOGY, AND SOCIETY

Emeriti: Evan Just (Professor, Applied Earth Sciences), Philip H. Rhinelander (Professor, Philosophy and Humanities)

Chairman: To be designated

Coordinator: Robert E. McGinn

Professors: Clifford R. Barnett (Anthropology), Eric Hutchinson (Chemistry), Stephen J. Kline (Mechanical Engineering), William C. Reynolds (Mechanical Engineering), Nathan Rosenberg (Economics), Alberta E. Siegel (Psychiatry), David F. Tuttle (Electrical Engineering), Walter G. Vincenti (Aeronautics and Astronautics)

Associate Professor: Duncan K. Foley (Economics)

Assistant Professor: Robert E. McGinn (Humanities)

Lecturers: Eric D. Fenster, William R. Kincheloe (Electrical Engineering), Robert A. Kreiss

STATEMENT OF PURPOSE

Values, Technology, and Society (VTS) is a multi-disciplinary program focusing on technology and its interactions with various other aspects of life in contemporary industrial society. The purpose of the Program is two-fold: (1) to provide students with materials and opportunities for synthesis, enabling them to realize more adequately the
central goal of general education: broad understanding of man, society, and nature, including their interactions in the contemporary world; (2) to develop a program of courses providing the basis for an innovative form of broad undergraduate education particularly appropriate for students planning study in graduate professional schools (e.g., law, business, or education) or in fields leading to careers in sociotechnical assessment, urban policy science, engineering-economic systems, public policy analysis, environmental planning, etc.

VTS gives due recognition to the importance of technology as a force affecting every individual and every aspect of modern life. However, VTS believes that for the study of technology and its ramifications to be fruitful it must be informed with historical and cross-cultural perspective and coupled with an emphasis on the importance of human values. VTS thus hopes to generate in prospective professionals and citizens a keen, operational awareness of the need for viewing complex problems in technological society from a more comprehensive and integrated perspective.

Offerings and Facilities

At present there is no standard B.A. or B.S. major in VTS. However, a student may choose to design his or her own special Interschool Major in VTS, in consultation with Program faculty, the Office of the Dean of Undergraduate Studies, and the Academic Information Center. A minor in VTS is also available. An integrated sequence of VTS courses may be used as part of the student-designed concentration component required of majors in the Department of Humanities Special Programs. VTS courses may also be used in fulfilling the Technology and Society requirement in the School of Engineering. Finally, many VTS courses may be applied toward the fulfillment of the University Distribution Requirement in any one of the two or three areas to which a given VTS course applies. For information on which distribution area(s) a particular VTS course satisfies, inquire at the VTS Office (Room 372, Outer Quad; Ext. 7-2565) or at the Academic Information Center.

VTS courses will be particularly valuable for undergraduates planning further study in graduate professional schools (e.g., business, education, engineering, law, and medicine) as well as for those students wishing to relate the more specialized knowledge of their major fields to broader problems of life in contemporary technological society.

Admission to Program Offerings

VTS courses are designed primarily for undergraduates. Several have enrollments that are limited either in number and/or with respect to the distribution of student majors. Students are urged to consult course abstracts in the Academic Information Center or the VTS office for details on individual courses.

Fundamental Courses

101. Man in Contemporary Technological Society — The nature, significance, problems, and potentials of contemporary technological society, with special reference to America in 1974. Five approaches to the study of contemporary society will be employed: anthropological, philosophical, legal, literary, and historical. Topics include: technology and the transformation of cultures (e.g., American Indian, Australian Aboriginal, Arctic Lapp); evaluative frameworks with which to assess social changes arising out of technological innovations (e.g., the status of friendship and of the aged in contemporary American society; the impact of urban environments on mental health in contemporary society); the impact of science and technology on the way in which man experiences or conceives of his relation to the cosmos; the character and texture of daily life in contemporary American society contrasted with that in pre- and early-industrial England (e.g., contrasting scales of life and modes of work and leisure in these societies); and ethical aspects and current legal status of selected problems in technological innovation (e.g., new biomedical and energy technologies).

4 units, Spr (McGinn) TTh 2:15-4:05 or 4:15-6:05

105. Human Values and Technological Society — Analysis and assessment of the status of perennial human values in contemporary Western society. A broad spectrum of such values will be considered in this connection: moral and aesthetic, individual and social,
spiritual and material. Topics include: alternative value systems and their relations to contemporary technological society; philosophical perspectives on concepts of art and work, love and friendship, modern spirituality and identity, individuality and sociality, man and nature, education and sensibility, efficiency and quality of human experience, culture and social structure—all in relation to life in contemporary technological society. Analysis of selected institutions and developments characteristic of technological society with a view toward illuminating their underlying philosophical principles and values. Readings drawn from Nietzsche, Marx, Rilke, Kafka, Seneca, Thoreau, Morris, and Zola; Mishan, Grant, Rieff, Hardin, and Dubos.

4 units, Aut (McGinn) MW 10
Section Th 2:15–4:05 or 7:15–9:05

106. Technology, Humanity, and Nature—Technology as a form of human activity shaping the society in which we live. Topics include: elaboration of the various categories of needs required for comprehending the interactions of technologies with social systems, human values, and ecologies; technology's relations to human functions and capacities; technology in historical and cross-cultural perspective; discussion of modern psychosocial theories and ecological concepts as the basis of "ideal" decision-making criteria for technological society; processes of change and development in ancient, transitional, and modern technologies; technology and current social problems and potentials; "alternative futures," not only in terms of economic growth but also in relation to potential limiting factors and problems of "saturation" in various areas of human concern.

4 units, Spr (Kline) TTh 10
Section W 2:15–4:05

107. Technology and Modern Industrial Society—This course deals with the genesis of modern industrial society. It is taken as axiomatic that a central thrust in the development of such societies has been the creation and introduction of new technologies. The course will examine the interrelationships between technological events and the nature and form of industrial societies, primarily over the past two centuries. It will explore the phenomenon of technological change as a socio-economic process, and will then attempt to illuminate the history of the past 200 years by relating it systematically to that process. This will include examination of (1) the factors that shape the rate and direction of technological change; (2) the speed with which new technologies (e.g., steam engine, metallurgical innovations, transportation) are diffused; (3) the implications of this diffusion for the structure of the economy and the growth of large-scale organizations (e.g., governments, corporations, universities); and (4) the broad impact of these events upon modern industrial man in his roles as both producer and consumer.

4 units, Win (Rosenberg) TTh 2:15–4:05

ADDITIONAL COURSES

115. Models and Modeling: Representations of Reality—Human thought and action are often guided not so much by reality as by simple representations thereof, known as models. Appropriate models vary in nature, validity, and utility from one discipline to another. The course examines this thesis by scrutinizing as wide a variety of models as possible: from humanities, from social sciences, from physical sciences and technology. For example: creation myths, metaphors, theoretical and practical scientific models, two-species interaction models (competition, commensalism, predation), and a model from the Forrester school (e.g., World Dynamics). The use of mathematics will be kept consonant with the class background.

3 units, Aut (Tuttle) MW 2:15–4:05

121. Technology and Society: Historical Perspective—This lecture-discussion course in the social history of technology examines the origins of contemporary industrialized civilization by surveying the interplay of technological change and societal development from ancient times until the beginning of the twentieth century. Among the topics are: Egyptian pyramids; Chinese and Islamic technology; technosocial influences of medieval Christianity; clocks and the concept of time; cannon, ships, and European expansion; origins and impact of the Industrial Revolution. The course, especially the discussion, is built on carefully chosen readings from the history of technology and from associated social and economic history. The lectures, illustrated by slides, serve to supplement and extend the readings. The course can be taken either with a final examina-
tion (4 units) or with a research paper (5 units).

4 to 5 units, Aut (Vincent) MW 3:15,
Section Th 9:00–10:50 or 2:15–4:05,
given 1975–76

125. Case Study in Socio-Technological History—This seminar (enrollment limited to 12) is devoted to an in-depth study of some historical case in the interaction of technology and society. Members will do research papers on different aspects of the topic (technological, social, political, economic, etc.); these will be discussed as they develop and finally be coordinated and assembled as chapters in a monograph. Prerequisite: 121 or consent of instructor.

5 units, Win (Vincent) TTh 2:15–4:05,
given 1975–76

131. The Professions—Study of the professions in contemporary technological society. Topics covered include: moral conflict and professional activity; social responsibility; conflicts with private life; impact of technological innovation on professional practice; personal satisfaction; role-behavior; professional activism. Through classroom interviews with practicing professional persons and by reading pertinent biographies, autobiographies, and modern novels, students examine the profession they think might befit their talents and fulfill their aspirations.

4 units, Spr (Siegel) MW 2:15–4:05

141. Energy: From Nature to Man—Nature provides an abundant supply of energy, mostly in forms not directly usable by man. The engineer has the problem of designing systems to convert this energy to usable forms, to transmit energy, and to use the energy in a socially responsible way. This course provides an introduction to the science of energy and to the technical aspects of energy supply. Open to all students who have taken some mathematics and science in high school. (Sophomore engineering students should take Engineering 32 instead.)

3 units, Win (Reynolds) MWF 11

1 to 2 additional units (term project)
by arrangement

142. Information: The Communications Revolution in Contemporary Society—The nature of the communications revolution and its impact on technological society, present and future. Topics covered include: fundamental concepts of communications and information theory; impact of communications technology on education (the future of books, libraries, teaching, etc.), participatory democracy, urban problems, human values (privacy, etc.); cable TV; society as an interactive organism; communications and ecology; communications and the nature of consciousness.

3 units, Aut (Kincheloe) TTh 2:15–4:05

143. Materials, Non-Renewable Earth Resources, and Man—Abundance, location, and elementary geology of non-renewable energy and mineral resources in the earth’s crust, including the probable extent of undiscovered deposits; patterns of usage, population trends, industrial development and future demand; limitations that specific resource scarcities will eventually impose on living standards; economic and environmental costs of extracting resources; recycle technology and ultimate recycle limits; international mineral trade; perspectives of developed resource-consuming countries and developing resource-supplying countries; the economics of conservation; non-renewable resource policy and population policy of the United States: actual and optimal.

3 units, Spr (Just) MWF 11

151. Science, Politics, and Public Policy—Survey of the historical development of legislation and public policies relating to science from the time of Jefferson to the present. Major legislation leading to the establishment of science-oriented government agencies such as the Federal Drug Administration and the National Science Foundation will be examined. The role of formal and informal avenues of scientific and technological advice to government will be discussed, as well as the methods and effects of government support of research and development in non-government institutions. A brief comparative study of British and American science policies will be presented. Case studies of a limited number of science policies will be undertaken in some detail, principally through guest lectures of members of the Stanford faculty who have served in government agencies dealing with science and technology.

3 units, Win (Hutchinson) W 2:15–4:05,
alternate years, given 1975–76

152. Implications of Genetic and Behavioral Technology—Study of techniques for human
genetic intervention and behavioral modification, available and imminent; their bearing on conceptions of human nature and goals, and notions of human dignity and identity; analysis and assessment of decision-making processes for implementing such technological innovations; cases studied include: "test-tube babies," gene manipulation, new beginnings of life (extra-uterine conception, cloning, etc.), retardation of aging, and chemical, surgical, and electrical modification of behavior; social dimensions of these issues: legal questions, responsibilities of scientists and physicians, legislation and international regulation, assessment of public resistance to and demand for such techniques; the ethics of experimentation and application, etc.

4 units, Aut (Fenster) given 1975–76

153. Ownership, Property, and Environment — Critical examination of possessory rights in land, water, air, and other resources, exploring the interactions of these rights with human values, social relationships, technological change, resource development, and pollution; the efficacy of various socio-political systems in relation to equitable distribution of benefits, efficient management of resources, and ecological viability. "Primitive," historical, and contemporary examples will be analyzed with particular attention given to future problems and alternatives.

4 units, Aut (Kreiss) TTh 4:15–6:05

154. Law, Morality, and Technology — Study of the legal instrumentalities used in encouraging, directing, controlling or restricting technological developments. In this connection attention will be devoted to the nature and function of legal and moral norms; the availability of legal mechanisms for influencing recent technological developments; the effects of constitutional and moral limitations on such developments. Case studies will be drawn from various areas including biomedical research and the control of genetic defects; urban growth; electronic surveillance; punishment, responsibility, and mental deficiency; transportation and communications.

4 units, Win (Rhinelander) MW 11

Section Th 2:15–4:05

160. Scriptorium: Calligraphy and Illumination — A course designed to illustrate the influence of certain aesthetic and technological factors, such as the development of pens, pigments, vellums, and papers, on the written word, which reached its aesthetic climax just prior to the invention of printing. The course has a considerable craft content, through which the above points are brought out by teaching the foundational and italic hands: the technical and craft aspects of calligraphy and illumination will be supplemented by analysis of some great manuscripts, old and new. All students will be required to produce samples of finished calligraphy for evaluation. Limited to 20 students per quarter.

3 units, Win (Hutchinson, Minto)

W 7:30–9:30 p.m.


3 to 5 units, Aut, Win, Spr (Staff)
by arrangement

199. Individual Work.

1 to 5 units, Aut, Win, Spr (Staff)
by arrangement

COURSES OFFERED OVERSEAS

128. Technology and Society in the British Industrial Revolution—(Taught at Stanford in Britain.)

4 units, Aut (Vincenti)

129. Urban and Technological Change in 19th Century Britain—(Taught at Stanford in Britain.)

5 units, Aut, Win (Vincenti)

130. Industrial Archaeology — (Taught at Stanford in Britain.)

5 units, Win (Vincenti)

UNIVERSITY PUBLICATIONS

These University Publications contain information of general interest. Many Schools and Departments publish pamphlets of a more specific nature, and should be contacted directly for a complete listing.

Aeronautics and Astronautics at Stanford — available at the Office of the School of Engineering.

Advisor's Handbook — available at Academic Information Center.

Approaching Stanford — available at the Dean of Undergraduate Studies Office.

Articles of Organization of the Faculty — Inquire at Academic Secretary's Office.
Asians at Stanford—available at Admissions Office.

Associated Students of Stanford University: Constitution and By-Laws — inquire at ASSU Office.

ASSU Course Review—(review of selected courses through tabulation of questionnaires) inquire at the ASSU Office.

Black Student, The — available at Admissions Office.

Charter of the Senate of the Academic Council of the Faculty of Stanford University—available at the Academic Secretary's Office.

Course Abstracts—(quarterly compilation of data about Undergraduate courses) available for consultation at the Academic Information Center.


Energy at Stanford—Office of School of Engineering.

Faculty/Staff Directory—on sale at Stanford Bookstore.


Founding Grant, The, with Amendments, Legislation and Court Decrees—(limited quantity) inquire at the Secretary to the University’s Office.

Native American student booklet—available at Admissions Office.


Information Bulletin—(general administrative procedures; rules governing withdrawal, leaves of absence; fee listings, etc) —available at Registrar’s Information Window.

Information for Prospective Undergraduate Applicants from Other Countries—available at Admissions Office.


Library guides (available at any major library):

Guide to Selected Reference Materials, Stanford University Libraries

Guide to Stanford University Libraries

Selected Facts: Stanford University Libraries

Graduate Study for Native American Students at Stanford — available at Admissions Office.

Pre-Law Handbook—available at Academic Information Center.


Senior Survey—available at Academic Information Center.

Senate Rules — available at the Academic Secretary's Office.


Stanford International Studies — available from the Center for Research in International Studies.

Stanford Legislative and Judicial System — available at the Office of the President.


Stanford Memorial Church—booklet on sale at Stanford Bookstore, Visitor Information Office, and Tresidder Union Store.


Stanford Para Mi? ¡Seguro Que Si! — available at the Admissions Office.

Stanford Residences, 1974-75: A Descriptive Guide to the 1974 Undergraduate Spring Housing Draw — available for consultation at the Dean of Student Affairs Office.

Stanford University Bulletins:

Available at the Registrar’s Information Window:

Information
Summer Session
Courses and Degrees
Available at the School or Department:
Hopkins Marine Station
School of Law
Graduate School of Business
School of Medicine

Student Directory — on sale at the Stanford Bookstore.

Time Schedule—distributed to faculty and students by the Registrar’s Office.


Women in Engineering — Inquire at the School of Engineering Office.
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