[While every effort is made to ensure the accuracy of the information available at the time copy is prepared for this Bulletin, the University reserves the right to make changes at any time without prior notice.]

Stanford, California
### UNIVERSITY CALENDAR

#### AUTUMN QUARTER, 1978

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>Sept. 25-26</td>
<td>Monday-Tuesday, Registration</td>
</tr>
<tr>
<td>Sept. 27</td>
<td>Wednesday, Instruction begins</td>
</tr>
<tr>
<td>Sept. 28</td>
<td>Thursday, Conferring of degrees</td>
</tr>
<tr>
<td>Oct. 17</td>
<td>Tuesday, Last day for registration</td>
</tr>
<tr>
<td>Oct. 24</td>
<td>Tuesday, Last day for filing advanced degree applications;</td>
</tr>
<tr>
<td></td>
<td>A.M., M.S., M.F.A., Engineer for April conferral;</td>
</tr>
<tr>
<td></td>
<td>D.M.A., Ph.D. for June</td>
</tr>
<tr>
<td>Nov. 23-26</td>
<td>Thursday-Sunday, Thanksgiving Recess</td>
</tr>
<tr>
<td>Dec. 1</td>
<td>Thursday, Last day for filing A.B. and B.S. applications for</td>
</tr>
<tr>
<td></td>
<td>January conferral</td>
</tr>
<tr>
<td>Dec. 11</td>
<td>Monday, Last day for filing A.M., M.S., Engineer Theses,</td>
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<tr>
<td></td>
<td>and Ph.D. Dissertations</td>
</tr>
<tr>
<td>Dec. 11-15</td>
<td>Monday-Friday, End-quarter examinations</td>
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#### WINTER QUARTER, 1979

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<th>Date</th>
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<tr>
<td>Jan. 3</td>
<td>Wednesday, Registration</td>
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<tr>
<td>Jan. 4</td>
<td>Thursday, Instruction begins</td>
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<tr>
<td>Jan. 4</td>
<td>Thursday, Conferring of degrees</td>
</tr>
<tr>
<td>Jan. 15</td>
<td>Monday, Last day for filing Fellowship and Graduate Scholarship</td>
</tr>
<tr>
<td>Jan. 24</td>
<td>Wednesday, Last day for registration</td>
</tr>
<tr>
<td>Jan. 31</td>
<td>Wednesday, Last day for filing A.B. and B.S. application for</td>
</tr>
<tr>
<td></td>
<td>April and June conferral</td>
</tr>
<tr>
<td>Jan. 31</td>
<td>Wednesday, Last day for filing advanced degree applications;</td>
</tr>
<tr>
<td></td>
<td>A.M., M.S., M.F.A., Engineer for June conferral;</td>
</tr>
<tr>
<td></td>
<td>D.M.A., Ph.D. for September</td>
</tr>
<tr>
<td>Feb. 19</td>
<td>Monday, Observance of Washington’s Birthday (Holiday)</td>
</tr>
<tr>
<td>March 11</td>
<td>Sunday, Observance of Founders’ Day</td>
</tr>
<tr>
<td>March 19</td>
<td>Monday, Last day for filing A.M., M.S., Engineer Theses,</td>
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<tr>
<td></td>
<td>and Ph.D. Dissertations</td>
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<tr>
<td>March 19-23</td>
<td>Monday-Friday, End-quarter examinations</td>
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#### SPRING QUARTER, 1979

<table>
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<tbody>
<tr>
<td>April 2</td>
<td>Monday, Registration</td>
</tr>
<tr>
<td>April 3</td>
<td>Tuesday, Instruction begins</td>
</tr>
<tr>
<td>April 5</td>
<td>Thursday, Conferring of degrees</td>
</tr>
<tr>
<td>April 16</td>
<td>Monday, Last day for filing Undergraduate Scholarship applications,</td>
</tr>
<tr>
<td></td>
<td>matriculated undergraduates</td>
</tr>
<tr>
<td>April 23</td>
<td>Monday, Last day for registration</td>
</tr>
<tr>
<td>April 30</td>
<td>Monday, Last day for filing advanced degree applications;</td>
</tr>
<tr>
<td></td>
<td>A.M., M.S., M.F.A., Engineer for September conferral;</td>
</tr>
<tr>
<td></td>
<td>D.M.A., Ph.D. for January</td>
</tr>
<tr>
<td>May 28</td>
<td>Monday, Observance of Memorial Day (Holiday)</td>
</tr>
<tr>
<td>June 6</td>
<td>Wednesday, Last day for filing A.M., M.S., Engineer Theses,</td>
</tr>
<tr>
<td></td>
<td>Ph.D. Dissertations</td>
</tr>
<tr>
<td>June 8-13</td>
<td>Friday-Wednesday, End-quarter examinations</td>
</tr>
<tr>
<td>June 16</td>
<td>Saturday, Senior Class Day</td>
</tr>
<tr>
<td>June 17</td>
<td>Sunday, Commencement</td>
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<table>
<thead>
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<tbody>
<tr>
<td>June 25</td>
<td>Monday, Registration</td>
</tr>
<tr>
<td>June 26</td>
<td>Tuesday, Instruction begins</td>
</tr>
<tr>
<td>July 4</td>
<td>Wednesday, Independence Day (Holiday)</td>
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<tr>
<td>Aug. 17-18</td>
<td>Friday-Saturday, Eight-week term examinations</td>
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<tr>
<td>Aug. 18</td>
<td>Saturday, Eight-week term closes</td>
</tr>
<tr>
<td>Sept. 3</td>
<td>Monday, Labor Day (Holiday)</td>
</tr>
<tr>
<td>Sept. 4</td>
<td>Tuesday, Quarter closes</td>
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<table>
<thead>
<tr>
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<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
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<tr>
<td>Sept. 24-25</td>
<td>Sept. 24-25</td>
<td>Jan. 7</td>
<td>March 31</td>
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<tr>
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<td>Dec. 14</td>
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HISTORY OF THE UNIVERSITY

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 Indiana University, 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.

The University opened October 1, 1891, with dedication ceremonies in the Inner Quad. There were 559 in the first student body, many more than had been expected, and the original faculty of 17 was expanded to 29 for the second year. From the beginning, Stanford was coeducational and, like Johns Hopkins and Cornell, followed the German model of providing graduate as well as undergraduate instruction and stressing research along with teaching. Dr. Jordan installed the major subject system at the outset, and English was the only required entrance subject.

By 1916 the 125 Academic Council members were organized into 26 departments, each independent of the others. Ray Lyman Wilbur, who became the University's third President, undertook the arduous, ten-year job of organizing the departments into schools. Several regroupings occurred thereafter, but since 1948 the School organization has been as follows: Earth Sciences, Education, Engineering, Graduate School of Business, Humanities and Sciences, Law, and Medicine.

Within the seven Schools there are approximately 70 departments. In addition there are institutes, centers, programs, and laboratories that are not organized within the Schools. Some of the major ones are the Hoover Institution on War, Revolution, and Peace, the Center for Research in International Studies, the W. W. Hansen Laboratories of Physics, and the Stanford Linear Accelerator Center.

The University does not use any racial, religious, ethnic, geographic, or sex-related quotas in admissions. Enrollment in 1977-78 totaled approximately 11,700, of whom 6,400 were undergraduates and 5,300 graduates. The University awarded 4,063 degrees during 1976-77, of which 1,652 were baccalaureate and 2,411 advanced.

Stanford early acquired a reputation as a strong regional institution, especially at the undergraduate level, but it was not until the mid-1950's, during the administration of President J. E. Wallace Sterling, that national and international status as a major teaching 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 1977 it was 450.

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, engineering, and medical schools were each ranked among the top three nationally in a 1974 survey of deans. Stanford consis-
tently ranks second only to MIT as the choice of National Science Foundation scholars.

A measure of undergraduate distinction is found in the increase in applicants, now running at about seven applicants for each one admitted to the freshman class. Forty-four Stanford students have been elected Rhodes Scholars since World War II. Less than one half of 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 1,100 faculty members who make up the Academic Council there are eight Nobel laureates, ten winners of the National Medal of Science, 62 members of the National Academy of Sciences, 95 members of the American Academy of Arts and Sciences, 24 members of the National Academy of Engineering, and seven 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.
DEGREES

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

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

To supplement information found in Courses and Degrees, readers are referred to Information, the Stanford University Bulletin published each January and available, without charge, from the Office of the Registrar, Old Union Lobby. Information details Stanford University policies and practices regarding such matters as registration, tuition and fees, leaves of absence, academic standing, the Fundamental Standard and Honor Code, and student services.

UNDERGRADUATE STUDY AT STANFORD

A LIBERAL EDUCATION

Like all distinguished universities and most undergraduate colleges, Stanford provides the means for its undergraduates to acquire a liberal education: an education which broadens the student’s knowledge and awareness in each of the major areas of human knowledge; significantly deepens it in one or two; and prepares him or her for a lifetime of continual learning in the varied and changing application of knowledge to career and personal life. The distinguishing mark of the University is that its faculty are engaged in discovering and creating knowledge as well as in disseminating it; thus it offers students an unusually rich and varied set of opportunities to gain a liberal education.

The undergraduate curriculum at Stanford allows considerable flexibility. It permits each student to plan an individual program of study that takes into account personal educational goals consistent with particular interests, prior experience, and future aims. In most cases, however, a liberal education is not preparation for a particular career or profession. Rather, a liberal education equips the graduate for pursuing a richer personal and professional life through the enlargement of mind and spirit. It also develops the rigor of mind needed for professional training.

There is no single liberal education, and the purposes served by the study programs pursued by undergraduates are, quite properly, many and diverse. A governing principle, however, is that all programs of study should achieve some balance between depth of knowledge acquired in specialization and breadth of knowledge acquired through exploration. Guidance as to the limits within which that balance ought to be struck is provided by the University’s Distribution Requirements and by the requirements set for major fields of study.

These educational goals are achieved through study in individual “courses” which bring together groups of students examining a topic or subject under the supervision of scholars. Courses are assigned credit units. To earn a Bachelor’s degree, the student must complete at least 180 units and, in so doing, also complete the Writing Requirement, the Distribution Requirements, and the requirements of a major.

The purpose of the Writing Requirement is to promote effective communication by ensuring that every undergraduate can write clear and effective English prose. Words are the vehicles for thought, and clear thinking requires facility in writing and speech.

The Distribution Requirements provide guidance toward the attainment of breadth and stipulate that a significant share of a student’s work must lie outside of an area of specialization. These Requirements ensure that every student is exposed to different ideas and different ways of thinking. They enable the student to approach and to understand the important “ways of knowing”—to assess their strengths and limitations, their uniqueness, and, no less importantly, what they have in common.

Depth, the intensive study of one subject or area, is provided through specialization in a major field of study. The major relates more specifically to a student’s personal goals and interests than do the general requirements outlined above. Stanford’s curriculum provides a wide range of standard majors through its discipline-oriented departments, a number of interdisciplinary majors in addition to departmental offerings, and the opportunity for students to design their own major programs.
Elective courses, which are not taken to satisfy requirements, play a special role in tailoring the student’s program to individual needs. For most students, such courses form a large segment of the work offered for a degree. Within the limitations of requirements, students may freely choose any course which previous studies have prepared them to undertake.

Following are more detailed descriptions of these various Requirements and the rationales upon which they are based.

THE WRITING REQUIREMENT

All instructors expect that students will express themselves effectively in speech and writing. The Writing Requirement is designed to enable students to satisfy that expectation.

Each candidate for the Bachelor's degree must, therefore, complete two quarters of instruction in written composition or an equivalent. Students should fulfill this Requirement in the first year at Stanford so that its benefits may be fully realized during the rest of their formal education. The Requirement is usually met by taking two quarters' worth of courses certified to fulfill it; a list of these courses is available at the Academic Information Center and is distributed to entering undergraduates.

Students scoring 4 or 5 on the CEEB Advanced Placement Test in English are automatically exempted from the Writing Requirement. Students demonstrating sufficient skill in writing in the first quarter may be exempted from the second quarter upon certification by the instructor. These exemptions apply only to freshmen; transfer students are individually informed at matriculation of their status vis-à-vis the Requirement.

Courses available to fulfill the Writing Requirement are designated (DR:W) in this book.

THE DISTRIBUTION REQUIREMENTS

The Distribution Requirements have been revised for undergraduates entering Stanford in September, 1976, and thereafter. Students who matriculated before Autumn, 1976, have the option of choosing courses to satisfy the old Requirements. Following are a set of general remarks which apply to both the old and the new Requirements. Then the new and old Requirements are stated separately.

I. Information applicable to both old and new Distribution Requirements:

The Distribution Requirements are an integral part of undergraduate education at Stanford, and students should treat them as an important means toward attaining a liberal education. Students should exercise care in selecting the courses they wish to offer for the Requirements. By relating courses in each of the areas to a common theme, they will increase the benefit to be gained from each course. An important responsibility of advisors is to help students make this choice cogently, and students should seek their counsel. There are separate requirements in the three areas of Humanities, Social Sciences, and Natural Science/Mathematics/Technology.

The Dean of Undergraduate Studies certifies courses which will fulfill the Distribution Requirements in the three required areas of study according to the guidelines established by the Committee on Undergraduate Studies. Specific and current information is always available at the Academic Information Center.

It is the responsibility of each student to see that he or she has fulfilled the Requirements by checking with the Academic Information Center. This check should be made at least two or three quarters before graduation. Specific details about course options are available at the Center and are provided to each new student; final choices should be made only after reviewing those details. It should be noted, however, that certain general classes of work and courses may not be applied toward the Distribution Requirements:

a. Units granted for advanced placement work done in high school.

b. "Extradepartmental" courses, e.g., Undergraduate Specials, SWOPSI, SCIRE, Learning Assistance Center, Urban Studies.

c. Directed Reading.

d. Individual Work or Individual Study.

e. Courses used to fulfill the Writing Requirement.

Students should also be aware that certain other courses, even though taught within a department, do not fulfill any part of the Distribution Requirements; specific details may be obtained at the AIC. Finally, note that the Requirements are measured in courses, not units.

II. Distribution Requirements for students matriculating at Stanford in Autumn, 1976, and thereafter:

A. The Humanities Distribution Requirement

The purpose of this Requirement is to introduce students to a university-level study of:
1) Works of creative imagination and their cultural and historical context;
2) Problems of ethics, philosophy, or belief within a cultural context;
3) The approaches, methods, achievements and limitations of humanistic scholarship.

The Requirement

1) The Distribution Requirement in the Humanities will be three courses of at least three units each, chosen from those declared suitable.
2) Each course or sequence offered in fulfillment of the Requirement will include 1) or 2), both, of the the rationale listed above.
3) The following courses, while highly valuable on other grounds, do not fulfill the rationale:
   a) first-year language courses
   b) writing courses
   c) courses in creative and performing arts.

Each course offered to fulfill the Humanities Distribution Requirement will deal with the approaches, methods, achievements, and limitations of humanistic scholarship, i.e., part three of the statement of purpose given above. In addition, each course, group, or sequence will include the study of those facets cited in part one or part two, or both, of the statement of purpose.

The Humanities Distribution Requirement is preferably met in the freshman year, and it should be fulfilled by the end of the sophomore year.

To encourage coherence in a student’s program, departments have suggested sequences of three Humanities courses that may be applied toward the Distribution Requirement. These sequences are particularly suitable for introductory purposes. It is recommended that students complete a suggested sequence of courses, rather than individual, unrelated courses, if possible. Suggested sequences are listed below:

Art 1, 2 and 3.
Art 1, 5 and 10.
Anthropology 1, 2 and 8 or 10.
Anthropology 1, 152 and 153.
Asian Languages 91, 92 and 93.
Asian Languages 91 and any two of 138, 151, 152, 176, or 182.
Classics: A wide selection of approved courses is available allowing the student to select a special area of interest.
Communication 101, 141, 180.
Communication 101, 141, and 210A, B, or C.
Drama 1, 2 and 30.
English 10, 11, and 12.
English 30, 40, and 50.
English 113, 115, and 117.
English 119, 122, and 125.
French 22, 23, and 24.
French 102, 105, 107, 110, or 114 (any three).
German 51 plus any two of the 150-series.
German 160-series—any three.
German 170-series—any three.
History 1, 2 and 3.
History 91, 92, and 93.
Humanities 61, 62 and 63.
Humanites 91, 92 and 93.
Italian 51, 52 and 53.
Italian 120, 121 and 122.
Italian 130, 131 and 133.
Linguistics 10, 180 and 230.
Linguistics 10, 65 and 240.
Music 1 and any two of 2A,B or C.
Music 1 and any two of 4A,B or C.
Music 21, 22 and 23.
Philosophy 1, 2 and 3.
Philosophy 4, 5, 6.
Philosophy 100, 101 and 102.
Religious Studies 1A,B,C,D and E (any three).
Religious Studies 11-29 (any three).
Religious Studies 111-129 (any three).
Slavic Languages and Literatures 145, 146 and 147.
Slavic Languages and Literatures 51, 52 and 53.
Spanish and Portuguese 4, 5 and 6.
Spanish and Portuguese 130, 131, and 132.
Spanish 151 and any two of 152, 161 and 162.
Values, Technology and Society 101, 151 and 105.
Values, Technology and Society 101, 165 and 178 or 151.
Values, Technology and Society 101, 178 and 122 or 151.

B. THE SOCIAL SCIENCE DISTRIBUTION REQUIREMENT

The purpose of this Requirement is to introduce students to a university-level study of:

1) society and social institutions and their historical development;
2) human behavior and development;
3) the approaches, methods, achievements, and limitations of research in the social sciences;
4) The implications of this subject area in human affairs.

The Distribution Requirement in the Social Sciences is three courses of at least three units each (chosen from those declared suitable) in at least two different departments. Each course offered in fulfillment of the Requirement will meet some aspects of the statement of purpose given above. The Requirement is preferably met by a selection of courses related by a common theme, problem, or topic.
C. THE DISTRIBUTION REQUIREMENT IN NATURAL SCIENCES/ MATHEMATICS/TECHNOLOGY

The purpose of this Requirement is to introduce students to a university-level study of:

1) natural phenomena and processes;
2) technology;
3) mathematical sciences;
4) the approaches, methods, achievements and limitations of scientific research;
5) the implications of this subject area in human affairs.

The Distribution Requirement in Natural Sciences/Mathematics/Technology is three courses of at least three units each. At least one of the courses used by a student to fulfill this Requirement must be from an area other than the mathematical sciences.

Caution: the following symbols are valid only for students entering Stanford in 1976–77 and thereafter.

Courses shown in this book are annotated to show how they may be applied to the Writing and Distribution Requirements by means of the following symbols:

(DR:W) = Course applicable only to Writing Requirement.
(DR:H) = Course applicable only to Humanities Requirement.
(DR:S) = Course applicable only to Social Sciences Requirement.
(DR:T) = Course applicable only to Natural Sciences/Mathematics/Technology (NS/M/T) Requirement.
(DR:X) = Course applicable to NO part of Writing or Distribution Requirements.
(DR:A) = Course applicable to either Humanities Requirement or Social Sciences Requirement, at student’s option.
(DR:B) = Course applicable to either Humanities Requirement or NS/M/T requirement, at student’s option.
(DR:C) = Course applicable to either Social Sciences Requirement or NS/M/T Requirement, at student’s option.
(DR:D) = Course applicable to either Humanities Requirement or Social Sciences Requirement or NS/M/T Requirement, at student’s option.

No course may be applied toward more than one area of the Requirements.

If an individual course is not annotated, a more general statement regarding courses in that department or program and their application to the Writing and Distribution Requirements will be found elsewhere in its section.

Annotations will be repeated in the Time Schedule for each quarter, and students should confirm them by checking it. In the event of a discrepancy, the Time Schedule should be taken as the correct reference.

III. Distribution Requirements for students matriculating at Stanford before Autumn Quarter, 1976.

Each candidate for the Bachelor’s degree must complete at least three courses of at least three units each in each of the following broad areas:

a. Humanities and Fine Arts
b. Social Sciences
c. Natural Sciences/Mathematics/Technology

Some courses may be used toward satisfying the Requirements in more than one area, and it is the student’s responsibility to obtain such information in advance from the Academic Information Center as it affects his or her program. The (DR) notations in this book do not refer to these requirements.

THE MAJOR

A variety of major fields of study is available, and within most of them there is considerable latitude for students to attain individual goals. Honors programs, permitting individualized study for the qualified student, are offered in a number of departments and cooperatively among several departments. Students whose educational goals cannot be met in an existing degree program may propose an individually designed major (see below). Undergraduates may select a major at any time and must do so by the time they achieve junior status (85 units completed). All undergraduate major programs listed in Courses and Degrees are open to all students except for certain honors degree programs which require application and admission in advance. Students may change their major at any time upon request; in some fields, though, a late change could easily result in extending the period of undergraduate study.

The fields of study for which degrees may be awarded are listed in Courses and Degrees in the section, “Courses of Instruction.” Check individual departmental or program listings for the undergraduate degrees offered and for specific major requirements. If no baccalaureate degree is listed for a field of study, it cannot be offered as a regular undergraduate major.

The minimum requirements for each major field of study are set by the faculty teaching in
the subject area. Those requirements usually allow latitude for tailoring a major program to a student's specific educational goals. The responsibility for developing a major program within departmental or program requirements lies ultimately with the individual student, working in consultation with his or her major advisor. The following paragraphs provide general guidance to the purpose, structure, and limits of the major.

**PURPOSE OF THE MAJOR**

A primary purpose of the major is to enable a student to plumb a subject area to considerable depth. This study in depth contrasts with the breadth of study promoted by the Distribution Requirements and, in many cases, by the student's choice of electives. Work in depth permits practice in critical analysis and the solving of problems. Because of its depth, such study also provides a sense of how knowledge grows and evolves, how it is shaped by time and circumstances, and, hence, of its complexity and limitations as well as its power.

A second purpose of the major is to provide a considerable mastery of a subject area or group of subjects. The sense of mastery is fullest when work in the major leads to a culminating and synthesizing experience such as a senior seminar, an undergraduate thesis, or a senior project.

Given the purposes of the major, objectives which emphasize depth and mastery, it is unusual for a student successfully to undertake more than one major. However, provision is made for the exceptional undergraduate. Students interested in pursuing more than a single major should consult with the Academic Information Center.

**STRUCTURE OF THE MAJOR**

The structure of a major should be a coherent reflection of the logic of the discipline it represents. Ideally, the student should be introduced to the subject area through a course providing a general overview. Upper-division courses should build upon lower-division courses. The course of study should, if feasible, aim at giving the student the opportunity and responsibility of doing original, creative work in the major subject as a culmination to the program of study.

**LIMITS ON REQUIREMENTS FOR MAJORS**

In order to achieve the values of study in depth, a well-structured major should occupy no less than approximately one-third of a student's program (55–65 units).

Similarly, it would be difficult to achieve the values of breadth and exploration if that program occupied more than about two-thirds of a student's program (115–125 units).

Finally, to avoid intellectual parochialism, a major program should not require a student to take more than about one-third of his or her courses from within a single department.

Major requirements in cognate subjects which are essential to the structure of a given major should be counted as part of the major program in applying these guidelines. Departmental or school requirements designed to provide extra-disciplinary breadth should not be counted.

The guidelines set forth here are deliberately general. Detailed implementation needs to take into account the specific needs of a student's program and the nature of the discipline or disciplines involved. The exercise of responsibility in achieving the desired educational balance belongs first with the student who, after all, has the strongest interest in the value of his or her education. It belongs secondarily to departments and major programs which must set the requirements of competence in the many majors offered.

**PROGRAM FOR INDIVIDUALLY DESIGNED MAJORS**

This program is intended for students who are interested in pursuing an area of scholarly inquiry which falls outside the purview of an established academic department or program of the university. For details concerning this program refer to the "Other Departments, Institutes, and Programs" section of this bulletin.

**UNDERGRADUATE ACADEMIC ADVISING**

The long-range objective of the advising program is to assist the student in assuming maximum responsibility for his or her academic program and in setting and achieving academic and postgraduate goals. The two major components of the program are 1) the relationship between the student and advisor and 2) the Academic Information Center. The Center provides and coordinates information and services which will help the student and advisor to work together toward the establishment and accomplishment of the student's goals.

Freshmen are assigned to general academic advisors according to their residence and the primary academic interest which they have indicated. Each residence where freshmen live
offers them the services of a group of advisors representing the major academic disciplines. While freshmen are assigned to one specific advisor, they have easy access to all members of the advising group. Each freshman advisor works with advisees each quarter to plan academic programs; the advisor must sign study-list cards for each quarter of the student’s freshman year. Many instructors of Freshman Seminars based in residences serve as academic advisors to students in the seminars, integrating even more fully the academic and residential aspects of undergraduate education.

Sophomores who are undecided about their major usually continue to work with the advisor with whom they were associated as freshmen, and that advisor continues to sign the student’s study-list. By the time junior status is achieved, undergraduates must declare a major, at which time they are assigned to an advisor from the faculty of the major department or program. Sophomores, juniors, and seniors should continue to consult their advisors for planning of programs every quarter. Signatures of advisors on study-list cards are required each quarter for those undergraduates without majors and for undergraduate majors in Engineering and Music.

The Academic Information Center (AIC), located on the third floor of the Old Union, is an integral part of the advising program and of the Office of the Dean of Undergraduate Studies. Basically, the AIC is the place where advisors and students will be given an answer—or assistance in finding one—to all questions relating to academic matters. Included in the information available are announcements of fellowships, assistantships, scholarships, and special study programs available at other schools; a complete collection of graduate and undergraduate catalogs from other institutions in the United States and Canada; specifics on all degrees offered at Stanford along with concise listings of requirements for undergraduate degrees; guides to graduate and professional schools; and many other printed references. In addition, all undergraduates should consult the AIC for declaring a major, changing a major, requesting reassignment to a new general advisor, and inquiring about fulfillment of Writing and Distribution Requirements.

The AIC also coordinates a preprofessional advising program to provide guidance for students interested in further study in business, dentistry, education, law or medicine.

Location: 306 Old Union
Hours: Monday through Friday, 8:00–12:00 and 1:00–5:00
Phone: 497-2426.

The Learning Assistance Center (LAC) provides counseling on a wide range of efficient learning techniques, study skills and effective reading strategies. It helps students obtain tutoring in courses where they need individual assistance and trains other undergraduates to become effective tutors. The LAC also sponsors special lectures and academic courses dealing with learning, reading, and tutoring skills. It is the accrediting agency for all Stanford peer counseling courses, and it sponsors the Undergraduate Research Opportunities Clearing House. The LAC is sponsored by the Office of the Dean of Undergraduate Studies. Further information and course listings are in the Undergraduate Programs section of Courses and Degrees.

Location: Meyer Library, Room 123
Hours: Monday–Friday, 9:00–5:00
Phone: 497-2207.

UNDERGRADUATE DEGREES

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 applied in advance for graduation and fulfilled the following requirements: (See deadlines in Time Schedule calendar.)

1) Completed 180 (quarter) units of University work.
2) Completed Writing and Distribution Requirements.
3) Completed curricular requirements of the major department or program and received the recommendation of the department. (Curricula and other special requirements are listed under each department in Courses and Degrees.)
4) 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.)
5) Completed three quarters of study in residence.

Entering students 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 Place-
ment Examinations, subject to University and departmental approval.

With certain limited exceptions, no more than 90 quarter units of credit for work done elsewhere may be counted toward the bachelor's degree at Stanford. (See section on Transfer Credit, Information.)

An undergraduate is limited to a total of twelve (12) courses or thirty-six (36) units, whichever is greater, to be counted toward graduation from the following five extradepartmental programs combined (extradepartmental courses under the jurisdiction of the Office of the Dean of Undergraduate Studies): the Learning Assistance Center (LAC), the Student Center for Innovation in Research and Education (SCIRE), Stanford Workshops on Political and Social Issues (SWOPSIS), Undergraduate Specials, and the Program in Urban Studies. Furthermore, not more than twenty-seven (27) units may be from any one of these programs. There is, however, no limit on the number of courses or units which may be taken from these programs in any given 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 the Program in Mathematical Sciences, or Medical Microbiology 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 for 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 undergraduates. Specific requirements may be obtained at the Registrar's Office.

COTERMINAL A.B. AND B.S. DEGREE PROGRAMS

A Stanford undergraduate may work simultaneously 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 eleventh quarter. This statement should be in the form of a petition and should have the favorable recommendation of the appropriate representatives of the two departments in which the student expects to receive degrees.

In order to qualify for both degrees a student must (1) complete the stated University requirements and the departmental requirements for each degree; and (2) complete 15 full-time quarters, or three full-time quarters (45 units) after completing 180 units.

COTERMINAL BACHELOR'S AND MASTER'S DEGREES

The coterminal degree plan permits a Stanford undergraduate to be admitted to a graduate program as early as the ninth quarter (or upon completion of 105 units) and to study for both Bachelor's and Master's degrees simultaneously in the same, or in some cases, different departments.

The Coterminal student must complete 15 full-time quarters or three full-time quarters after completing 180 units. In addition to the 180 units required for the Bachelor's degree, the student must complete the number of units shown on the formal application for Master's candidacy (not fewer than 36).

Each degree is applied for separately by the deadline given on the University Time Schedules and calendars. The Bachelor's degree may not be conferred after the Master's.

University graduate fellowships or assistantships are rarely available to students in this program. Most private and federal graduate fellowships require the applicant to have received the baccalaureate degree.

Information and Petitions for Admission to the coterminal degree program are available in the Graduate Program Office or (if the graduate degree is to be in the School of Engineering) in the pertinent graduate department.

Petitions to enter the program should be submitted to the Graduate Program Office, Building 590, Room 104, unless one of the
graduate degrees falls in the School of Engineering. In such cases the petition is submitted to the pertinent graduate department. The student does not apply through the Graduate Admissions Office.

ADVANCED DEGREES

General University requirements for advanced 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 minimum requirement of work as a graduate student at Stanford. This minimum is listed under each degree. The final units of credit toward any advanced degree are expected to be earned at Stanford.

Specific departmental requirements for advanced degrees are listed in the appropriate sections in this bulletin. Doctoral study involving more than one department is described under Graduate Division Special Programs.

CANDIDACY

Candidacy for A.M., M.S., M.F.A., Engineer, D.M.A., and Ph.D. degrees must be approved by the University 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). Candidacy may be renewed by the approval of a new application, or extended upon the recommendation 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 Program Office, Building 590, Room 104, Stanford University, Stanford, California 94305.

In addition to conventional registration for half or full tuition, three other forms of registration are open to eligible graduate students:

1. **Advanced Graduate Registration (AGR):** If the student has been admitted to candidacy, registered for all required courses and satisfied the residence requirement, but wishes to use University services (faculty advising, health, university housing, etc.), he or she will register in Advanced Graduate Registration (AGR) status for the equivalent of nine units for each of three quarters.

2. **Terminal Graduate Registration (TGR):** for University services only with no course credit, at much reduced tuition—is open to students who have been admitted to candidacy, completed their coursework and residence requirement and fulfilled the three quarters of AGR status.

3. **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 Program 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 three quarters of work as a graduate student at the University and fulfilled such other requirements as may be prescribed by the school or department concerned. Note: A longer period will be necessary for students who are inadequately prepared or who do not enroll fulltime.

For a second Stanford Master’s degree an additional three quarters of residence (full tuition or the equivalent in partial registrations) and an additional unduplicated program of total units of course work normal to that department will be required.

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 and the number of units allowed at Stanford for the course. The method of validation should be indicated, e.g., transcript information or examination. However, the minimum residence requirement for the A.M. and M.S. remains unchanged. Note: In the Summer Quarter when tuition payment is permitted on a unit basis, 15 units are required for the equivalent of a full tuition quarter.

For admission to candidacy, see Candidacy under ‘Advanced Degrees’ above.
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 Program Office on or before the last day of instruction in the final quarter of candidacy. Directions for the preparation and submission of theses are available in the Graduate Program Office, Building 590, Room 104.

MASTER OF FINE ARTS

General Regulations—Upon recommendation to the Senate of the Academic Council by the faculty of the Art 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 three quarters of graduate work at this University and fulfilled such other requirements as may be prescribed by the Art Department.

Details of additional requirements are available in the Art section of this bulletin. For candidacy, see Candidacy under “Advanced Degrees” above.

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 satisfactorily completed 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 and 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 will be necessary for students who are inadequately prepared or who do not enroll fulltime.

Admission to Candidacy—See Candidacy under “Advanced Degrees” above.

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 Program Office on or before the last day of instruction in the final quarter of candidacy.

The candidate will be charged a fee for binding three copies of the thesis. Upon acceptance, two copies are sent to the University Library and one to the major department. Directions for the preparation and submission of theses are available in the Graduate Program Office, Building 590, Room 104.

MASTER OF LEGAL STUDIES

Admission to candidacy for the Master of Legal Studies degree (M.L.S.), a nonprofessional degree, is granted to not more than six students a year who hold the Doctor of Philosophy degree (Ph.D.) or other non-law doctoral degree, or who have been admitted to a non-law doctoral program and have completed a program of study amounting to 45 quarter-units or 30 term-units of work toward the doctorate and who meet an admission standard equivalent to that required of candidates for the Doctor of Jurisprudence degree.

The degree of Master of Legal Studies is conferred upon applicants so admitted to candidacy who, in not fewer than two academic terms in residence and in not more than two consecutive academic years, successfully complete 30 term-units of work in the School of Law, including three first-year courses in the first Autumn term and at least one course or seminar requiring a research paper. All work shall conform to the rules and regulations of the University and of the School of Law.

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 readmission 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 two copies of the dissertation and two copies of an approved abstract of the dissertation (maximum length 600 words). The candidate will be charged a fee to cover the cost of microfilming the dissertation, binding the copies 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.

(Further information concerning these requirements will be found in the Education section of this bulletin and may also be secured from the School of Education Doctoral Study Office, Room e28.)

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.

Information on the different requirements of the D.M.A. and the Ph.D. in Music may be found in the Music section of this bulletin. 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.

Admission to Candidacy— See Candidacy under "Advanced Degrees" above.

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.

Candidacy is limited to students of exceptional distinction and promise. (Full particulars concerning requirements may be found in the bulletin of the Stanford Law School.)

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

Academic 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.

Residence Requirements

Each candidate is required to complete three years of graduate residence (9 full tuition quarters or the equivalent in partial tuition quarters).

Acceptable work completed elsewhere as a graduate may be applied to this requirement to a maximum of three quarters. A doctoral program may include Master's and/or Engineer's courses but must show a minimum of 36 unduplicated units for each such degree.

A Stanford graduate student who has already received three quarters of residence credit under these rules may request as much as three additional residence quarters for work to be done at another institution. This work must have prior approval of the department and the Graduate Division. The amount of credit to be earned must be determined before the student begins the course of study.

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 Program Office, Building 590, Room 104, 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.

Teaching Requirement

A number of departments have a specific requirement for one or more quarters of teaching for the Ph.D. degree. Detailed information is available in the program descriptions in this bulletin.

FOREIGN LANGUAGE REQUIREMENT

The requirement of a reading knowledge of one or more foreign languages is left to the option of individual departments or schools. Fulfillment of the requirement to the satisfaction of the department is shown by appropriate departmental signatures on the back of the Ph.D. Application for Candidacy form or by the chairman's signature on the Foreign Language Report form. These forms are submitted to the Graduate Program 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 a capacity for independent investigation to the satisfaction of the schools or departments concerned, the University oral examination may then be arranged through the Graduate Program Office. 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 and Oral Examination Form must be submitted to the Graduate Program Office 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 the fields of study and to confirm fitness for scholarly pursuits. The examining committee is to be composed of (x) 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

A requirement for the Ph.D. is acceptance by the University of a dissertation that is the result of independent advanced research. The dissertation must first be approved on behalf of the major school or department by a reading committee consisting of the candidate's principal advisor and two other members. At least one member of the committee must be from the major department. (For regulations governing membership on dissertation committees, consult the Graduate Program Office.) In most departments, well before the University Oral Examination, the department chairman will ap-
point this reading committee, using the Appointment of a Ph.D. Dissertation Reading Committee form. Each member of this committee will certify by signature on the final copies of the dissertation that he or she has read the work and believes it to be of acceptable scope and quality.

One member of the committee will read the dissertation in its final submitted form and so certify on Form G82.

Three copies of the dissertation must be submitted to the Graduate Program 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 Program Office. A negative microfilm copy of the dissertation will be kept on file by University Microfilms, Ann Arbor, Michigan, from whom positive microfilm copies may be ordered. When bound, two copies will be sent to the Stanford University Library, and one copy to the major department. Any extra copies may be submitted with the three required.

Directions regarding the preparation of the dissertation, title and signature pages, and the abstract may be obtained from the Graduate Program Office, Building 590, Room 104. The candidate will be charged a fee to cover the cost of microfilming the dissertation, binding three copies of the dissertation, plus any extra copies, 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.
COURSES OF INSTRUCTION
1978-79

Note—Unless otherwise specified, courses numbered from 10 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.

Courses in this book are marked to indicate their availability to fulfill undergraduate Writing and Distribution Requirements. Graduate students should ignore the assorted (DR:) markings since such requirements do not apply to them.

Amendments to course offerings announced in Courses and Degrees will be found in the Time Schedule, issued quarterly.

SUMMER SESSION

Summer Sessions are eight weeks in length, except in certain schools that offer ten-week courses.

This bulletin includes, for the Summer Session, only those courses that 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.
GRADUATE SCHOOL OF BUSINESS


(Professors)

Dean: Arjay Miller

Associate Deans: Robert K. Jaedicke, Samuel A. Pond, James C. Van Horne

Assistant Deans: David S. Gordon, Paul R. Johnson, William L. Lowe, Carol A. Marchick, Robert W. Simon, Gary G. Williams


Assistant Professors: John C. Cox, David M. Depue (Acting), George M. Feiger, Paul A. Griffin, Peter G. W. Keen, Joanne Martin, Jeffrey H. Moore, David S. P. Ng, James M. Patell, Jerry I. Porras, Adrian B. Ryans, Stephen M. Schaefer (Acting), Myra H. Strober, Dick Rm Wittink, Mark A. Wolfson, William F. Wright


Adjunct Professor: Henry E. Riggs

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.

The Stanford Sloan Program is an intensive one-year course of study for middle management executives leading to the degree of Master of Science in Management. Participants must be sponsored by their company and have demonstrated superior achievement.

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 the current bulletin.
SCHOOL OF EARTH SCIENCES

Dean: Richard H. Jahns
Associate Deans: Robert L. Kovach, Ernest I. Rich
Assistant Dean: Dolores Warrington

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 give students training 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

The undergraduate curricula offered by the School of Earth Sciences are designed to give broad training, with emphasis on fundamental science.

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

Graduate programs in the School give specialized training in the various fields of earth science leading 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. One requirement for admissions is submittal of scores on the verbal and quantitative parts of the Graduate Record Exam. Admission to one department of the School does not guarantee admission to other departments.

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 applications for admission or for information to the Chairman, Programs in Economic Geology, School of Earth Sciences, describing their interests as succinctly as possible.

PROGRAMS IN PETROLEUM EXPLORATION

An interdepartmental program is available for students who plan to specialize in some branch of the broad field of exploration for petroleum
and natural gas. Students interested in such a program should consult with the Coordinator for Petroleum Geology.

An undergraduate student in this program is normally expected to complete the Core Course Sequence of the Department of Geology, except for the courses in petrology (Geology 180 and 181). In addition he/she is advised to choose electives from the following list:

- Geol. 143. Principles of Paleontology
- Geol. 150. The Oceans
- Geol. 171. Introduction to Geochemistry
- Geol. 193. Geomathematics II: Introduction to Probability and Statistics in Geology
- Geophys. 150. Plate Tectonics
- Geophys. 180. Geologic Interpretation of Reflection Seismograms
- Geophys. 190. General Geophysics
- Geophys. 191. Geophysical field techniques
- AES 192. Geomathematics I: Computer Applications in Geology and Applied Earth Sciences
- PE 103. Survey of Energy Industries
- PE 150A. Formation Evaluation
- PE 150B. Formation Evaluation
- PE 151A. Underground Earth Fluids
- PE 151B. Underground Fluid Behavior

For graduate work in petroleum exploration, students are advised to include courses from the above list and the following list in their programs:

- Geol. 210. Physical Processes of Geology
- Geol. 211. Regional Structural Geology
- Geol. 221. Photogeology
- Geol. 241. Introduction to Micropaleontology
- Geol. 245. Introduction to Palynology
- Geol. 250. Marine Geology, Ocean Basins
- Geol. 251. Marine Geology, Continental Margins
- Geol. 253. Sedimentary Petrology
- Geol. 255. Sedimentary Basins
- Geophys. 280. Data Analysis
- Geophys. 284. Reflection Seismology
- AES 251. Oil Field Exploration and Development
- AES 296. Airborne Exploration: Structural Mapping

AES 388. Offshore Exploration Seminar
PE 267. Evaluation and Appraisal of Oil and Gas Properties

**APPLIED EARTH SCIENCES**

Emeriti: Evan Just, Fredrick C. Kruger, Charles F. Park, Jr. (Professors)

Chairman: Irwin Remson

Associate Chairman: George A. Parks


Associate Professor: Marco T. Einaudi*

Senior Lecturer: George Mader

Assistant Professor: Bernard Hallet*, André Journel (Visiting)

Affiliated Faculty:

Professor: Frank W. Dickson


The Department of Applied Earth Sciences offers the following programs and options:

**Undergraduate**

Environmental Earth Sciences
Land Resources Planning
Metallurgy
Ore Deposits

**Graduate**

Applied Geomathematics
Applied Hydrogeology
Engineering Geology
Environmental Earth Sciences
Extractive Metallurgy and Materials Processing
Mineral Economics (offered as an option in other programs)
Ore Deposits and Exploration
Petroleum Exploration
Remote Sensing—Airborne Exploration (offered as an option in other programs)
Special Applied Earth Sciences Program

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, etc. At the graduate level, the Department welcomes applicants from any scientific or engineering discipline who are interested in using their training in Applied Earth Sciences.

* Joint appointment with Geology
** Joint appointment with Civil Engineering
## Undergraduate Programs of Study

### Courses Taken by All Undergraduates

<table>
<thead>
<tr>
<th>University Requirements</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing Requirement</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>Mathematics, natural sciences, and technology (satisfied by Departmental requirements below)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></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. A careful choice of electives will enable the student to develop expertise in at least one area of environmental interest.

<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>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 (to be discussed with advisor)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Chem. 31. Chemical Principles</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Chem. 135. Physical Chemical Principles</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>(A Civ. Engr. course in Water Quality may replace Chem. 135)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civ. Engr. 170. Man and His Environment</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Civ. Engr. 171. Environmental Planning</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Comp. Sci. 105. Introduction to Computing</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Econ. I. Elementary Economics</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Food Research Inst. 135. Population Problems</td>
<td>5</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>4</td>
<td></td>
</tr>
<tr>
<td>Geol. 102. Introduction to Field Geology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 121. Surface of the Earth</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Biol. Sci. 1. Introductory Biology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>(Human Biology 2A, 2B may be substituted)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math. 10 and 11. Analytic Geometry and Calculus</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Stat. 60. Introduction to Statistical Methods</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>180</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Land Resources Planning

The undergraduate program of study in Land Resources Planning is designed to prepare students for graduate study in city and regional planning, conservation, landscape architecture, law, resource management, and allied programs. It is not designed for students intending to enter graduate study in engineering or science. A careful choice of electives will enable the student to develop expertise in at least one area of environmental interest.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>University requirements</td>
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<td></td>
</tr>
<tr>
<td>A.E.S. 130, 131, 132, Environmental Earth Sciences</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 133. Measurement of the Environment-Remote Sensing</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Art 176. American Architecture and Urbanism</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>C.E. 133. Introduction to Urban Planning</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 170. Man and His Environment</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C.E. 171. Environmental Planning</td>
<td>3</td>
<td></td>
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<tr>
<td>Comp. Sci. 105. Introduction to Computing</td>
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<td>Econ. I. Elementary Economics</td>
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<tr>
<td>Food Research Inst. 135. Population Problems</td>
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<td>Geol. 1. Interpreting the Earth</td>
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<td>Geol. 102. Introduction to Field Geology</td>
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<td>Geol. 121. Surface of the Earth</td>
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<td>Biol. Sci. 1. Introductory Biology</td>
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<td>(Human Biology 2A, 2B may be substituted)</td>
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<td>Math. 10 and 11. Analytic Geometry and Calculus</td>
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<td>Stat. 60. Introduction to Statistical Methods</td>
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<td></td>
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<tr>
<td>Electives</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>180</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Metallurgy

Undergraduates desiring to specialize in Metallurgy may follow a curriculum that includes required courses in the School of Earth Sciences and the School of Engineering.

### Ore Deposits

The undergraduate program in Ore Deposits is designed to prepare the B.S. graduate for professional experience and also is designed as a starting point for other graduate programs in the School. Course requirements are available from the Department Office.

### 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 Material 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.

Candidates for the degree of Doctor of Philosophy in Applied Earth Sciences are normally those preparing for careers in education or basic 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) unless specified in a curriculum.

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 advisor. Special core curricula must be approved by the Curriculum Committee of the Department.


CURRICULA RECOMMENDED FOR THE MASTER’S DEGREE

GROUP A

Applied Geomatics

All students in this program are expected to be familiar with differential and integral calculus and have an undergraduate background in geology or a related field in the earth sciences.

Course No.  Subject Units
A.E.S. 192. Geomatics I: Computer Applications in Geology and Applied Earth Sciences 4
Geol. 193. Geomatics II: Introduction to Probability and Statistics in Geology 3
A.E.S. 194. Geomatics III: Numerical Methods for Geologists 3
Geophysics 280. Geomatics IV: Data Analysis 3
Geol. 293 Geomatics V: Application of Probability and Statistics in Geology 3
Math. 130. Ordinary Differential Equations 3
Computer Sci. 135. Numerical Methods 3
Total ........................................... 25

Additional course work should be selected from the offerings of the School of Earth Sciences. In addition to course work, M.S. candidates will prepare a report discussing mathematical or statistical applications to a substantive problem in earth sciences.

Applied Hydrogeology

All students in the Applied Hydrogeology Program are expected to have completed a prior degree in one of the science or engineering disciplines, including courses in elementary chemistry, and physics, fluid mechanics, analytic geometry and calculus, computer science and geology. Students in Option 1, Applied Chemical Hydrogeology, are expected to have in addition to the above, course work in mineralogy, petrology, field geology and physical chemistry. The degree specification for each option will be simply "Applied Hydrogeology."

Requirements for all students in Applied Hydrogeology:

Course No.  Subject Units
C.E. 266. Engineering Hydrology 4
Geol. 230. Hydrogeology 5
Option 1. Applied Chemical Hydrogeology
Additional Requirements:
A.E.S. 225. Surfaces and Interfaces 3
A.E.S. 277A. Problems in Applied Aqueous Thermodynamics 3

THE HONORS COOPERATIVE PROGRAM

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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) unless specified in a curriculum.

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 advisor. Special core curricula must be approved by the Curriculum Committee of the Department.


CURRICULA RECOMMENDED FOR THE MASTER’S DEGREE

GROUP A

Applied Geomatics

All students in this program are expected to be familiar with differential and integral calculus and have an undergraduate background in geology or a related field in the earth sciences.

Course No.  Subject Units
A.E.S. 192. Geomatics I: Computer Applications in Geology and Applied Earth Sciences 4
Geol. 193. Geomatics II: Introduction to Probability and Statistics in Geology 3
A.E.S. 194. Geomatics III: Numerical Methods for Geologists 3
Geophysics 280. Geomatics IV: Data Analysis 3
Geol. 293 Geomatics V: Application of Probability and Statistics in Geology 3
Math. 130. Ordinary Differential Equations 3
Computer Sci. 135. Numerical Methods 3
Total ........................................... 25

Additional course work should be selected from the offerings of the School of Earth Sciences. In addition to course work, M.S. candidates will prepare a report discussing mathematical or statistical applications to a substantive problem in earth sciences.

Applied Hydrogeology

All students in the Applied Hydrogeology Program are expected to have completed a prior degree in one of the science or engineering disciplines, including courses in elementary chemistry, and physics, fluid mechanics, analytic geometry and calculus, computer science and geology. Students in Option 1, Applied Chemical Hydrogeology, are expected to have in addition to the above, course work in mineralogy, petrology, field geology and physical chemistry. The degree specification for each option will be simply "Applied Hydrogeology."

Requirements for all students in Applied Hydrogeology:

Course No.  Subject Units
C.E. 266. Engineering Hydrology 4
Geol. 230. Hydrogeology 5
Option 1. Applied Chemical Hydrogeology
Additional Requirements:
A.E.S. 225. Surfaces and Interfaces 3
A.E.S. 277A. Problems in Applied Aqueous Thermodynamics 3
C.E. 273. Water Chemistry  
C.E. 273A. Water Chemistry Laboratory or equiv.  
C.E. 274 Water Microbiology  
Total ........................................ 26

Option 2. Applied Physical Hydrogeology  
Additional Requirements:  
C.E. 267. Advanced Hydrology  
Geol. 232. Numerical Methods in Hydrology  
C.E. 226. Optimization Techniques in Civil Engineering  
C.E. 239. Seminar in Water Resources Planning  
Total ........................................ 26

Engineering Geology  
The graduate program in Engineering Geology is a two-year program firmly based on an understanding of fundamental processes and of geotechnical considerations relevant to the field. A Master’s thesis is required.  
All students in the Engineering Geology Program are generally expected to have taken courses approximately equivalent to those of the Stanford Undergraduate Core sequence in Geology, as well as an introductory geomorphology class (Geol. 121), General Geophysics (Geophys. 190), and either Physical Processes in Geology (Geol. 210) or applied Mechanics: Stress Analysis (Engr. 11).

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.</td>
<td>Engineering Geology (A)</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 285.</td>
<td>Geotechnical Practice (W)</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 286.</td>
<td>Engineering Geologic Mapping (Spr)</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 386A, B.C.</td>
<td>Seminars in Engineering Geology (A, W,Spr)</td>
<td></td>
</tr>
<tr>
<td>Geol. 221.</td>
<td>Photogeology (A)</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 230.</td>
<td>Hydrogeology (W)</td>
<td>5</td>
</tr>
<tr>
<td>C.E. 190.</td>
<td>Geotechnical Engineering (A)</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 290.</td>
<td>Soil Mechanics (W)</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 191.</td>
<td>Geophysical Field Techniques (Spr)</td>
<td>4</td>
</tr>
<tr>
<td>Geophys. 270.</td>
<td>Engineering Seismology (W)</td>
<td></td>
</tr>
<tr>
<td>or C.E. 282B.</td>
<td>Earthquake Engineering II (Spr)</td>
<td>3</td>
</tr>
<tr>
<td>Total units required .................................. 35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Students are urged to take or audit additional relevant courses either in the Earth Sciences or in Civil Engineering. The following courses are particularly well suited for engineering geologists:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 222.</td>
<td>Intermediate Geomorphology</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 135.</td>
<td>Soil Science</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 283.</td>
<td>Permafrost and Related Engineering Problems</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 291.</td>
<td>Foundation Engineering</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 292.</td>
<td>Earth Structures</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 293.</td>
<td>Experimental Soil Mechanics</td>
<td>2</td>
</tr>
<tr>
<td>C.E. 294.</td>
<td>Theoretical Soil Mechanics</td>
<td>2</td>
</tr>
<tr>
<td>Geol. 192.</td>
<td>Igneous and Metamorphic Rocks</td>
<td>4</td>
</tr>
</tbody>
</table>

Environmental Earth Sciences  
All students in the Environmental Earth Sciences Program are expected to have completed a prior degree in science or engineering, including courses in elementary biology, chemistry, physics, calculus, computer science, probability and statistics, geology and field geology. 

Requirements for all students in Environmental Earth Sciences:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 130, 131, 132.</td>
<td>Environmental Earth Sciences</td>
<td>9</td>
</tr>
<tr>
<td>Geol. 221.</td>
<td>Photogeology</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 121.</td>
<td>The Surface of the Earth</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 270.</td>
<td>Water Quality in Water Resources Development</td>
<td></td>
</tr>
<tr>
<td>Total ........................................ 19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Option 1. Special Program in Environmental Earth Sciences  
A program comprising 26 additional units of graduate-level courses may be used to design a substantive, coherent program to meet individual interests and career objectives.

Option 2. Aqueous Geochemistry and the Environment  
Additional requirements:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 227A.</td>
<td>Problems in Applied Aqueous Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 228.</td>
<td>Environmental Planning</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 273.</td>
<td>Water Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>C.E. 274.</td>
<td>Water Microbiology</td>
<td>2</td>
</tr>
<tr>
<td>Geol. 171.</td>
<td>Introduction to Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Total ........................................ 45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Option 3. Geomorphology and the Environment  
Additional requirements:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 135.</td>
<td>Soil Science</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S 283.</td>
<td>Permafrost and related Engineering Problems</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 284.</td>
<td>Engineering Geology</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 222.</td>
<td>Intermediate Geomorphology</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 325.</td>
<td>Seminar in Fluvial Geomorphology</td>
<td>2</td>
</tr>
<tr>
<td>Geol. 326.</td>
<td>Seminar in Glacial and Periglacial Geology</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Total ........................................ 45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Option 4. Hydrology and the Environment  
Additional requirements:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.E. 266.</td>
<td>Engineering Hydrology</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 267.</td>
<td>Advanced Hydrology</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 230.</td>
<td>Hydrogeology</td>
<td>5</td>
</tr>
<tr>
<td>Geol. 232.</td>
<td>Numerical Methods in Hydrology</td>
<td>2</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Total ........................................ 45</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Option 5. Planning and the Environment  
Additional requirements:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.E. 227.</td>
<td>Economics and Engineering Planning</td>
<td>3</td>
</tr>
</tbody>
</table>
Research in Wilderness Areas

Students in the Environmental Earth Sciences Program have the possibility of doing their research in nearby wilderness areas in the Santa Cruz Mountains or in the Palo Alto Baylands.

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

Students with prior degrees in these areas who wish to broaden their backgrounds in Extractive Metallurgy, environmental control, geochemistry, or economic geology are encouraged to enroll in the Extractive Metallurgy and Materials Processing Program. Specialized programs are encouraged.

Pyrometallurgy

High temperature extrative 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.

Core Courses for all Metallurgy and Materials Processing Options:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 105</td>
<td>Extractive Process Metallurgy</td>
<td>2-3</td>
</tr>
<tr>
<td>A.E.S. 150</td>
<td>Introduction to Mineral Extraction Processes</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 207</td>
<td>Metal Refining and the Nature of Liquid Metals</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 228</td>
<td>Extractive Metallurgy Seminar</td>
<td>2-3</td>
</tr>
<tr>
<td>Mat. Sci. 181</td>
<td>Thermodynamics and Phase Equilibria</td>
<td>4</td>
</tr>
<tr>
<td>Mat. Sci. 182</td>
<td>Rate Processes in Materials</td>
<td>3</td>
</tr>
<tr>
<td>Mat. Sci. 185</td>
<td>Mechanical Behavior of Solids</td>
<td>3</td>
</tr>
<tr>
<td>Ch.E. 120</td>
<td>Separation Processes, or Ch.E. 160.</td>
<td>Chemical Engineering Plant Design, or Ch.E. 205.</td>
</tr>
<tr>
<td>Subtotal</td>
<td>24-26</td>
<td></td>
</tr>
</tbody>
</table>

Additional units (making a total of 30) must consist of advanced level courses selected by the student in conjunction with his or her advisor.

The remaining 15 required units are taken under either the Research-Technical Option or the Management Option described under Group B.

Mineral Economics

Students may specify a Mineral Economics Option while enrolling in one of the Applied Sciences core curricula (generally Environmental Earth Sciences, Extractive Metallurgy and Materials Processing, Ore Deposits and Exploration, or Petroleum Exploration). The Mineral Economics Option is available only for the M.S. degree.

Ore Deposits and Exploration

This program is flexible, and students who wish to make substitution for core requirements may petition the faculty with a statement of the justifications.

All students in the program leading to the M.S. (including co-terminal) and Ph.D. degrees are required to complete the following core course sequence.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 201</td>
<td>Fall Field Geology (A)</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 172</td>
<td>Geological Thermodynamics and Phase Equilibria or Geol. 272. Advanced General Geochemistry or Mat. Sci. 181. Thermodynamics and Phase Equilibria (W)</td>
<td>3-4</td>
</tr>
<tr>
<td>A.E.S. 277</td>
<td>Field Mapping of Mineral Deposits (Spr. vac &amp; Spr. qtr.)</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 220A,B</td>
<td>Advanced Ore Deposits (Win, Spr)</td>
<td>8</td>
</tr>
<tr>
<td>Geophys. 191</td>
<td>Geophysical Field Techniques (Spr)</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>22-23</td>
<td></td>
</tr>
</tbody>
</table>

In addition to these core courses, the degree candidate will be expected to have taken the following courses (or their equivalents); core courses assume the student has the knowledge provided by this background, and the equivalent of a summer field mapping course.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 163</td>
<td>Optical Microscopy (A)</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 171</td>
<td>Introduction to Geochemistry (A)</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 120</td>
<td>Introduction to Ore Deposits (A)</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 192</td>
<td>Geomathematics I: Computer Applications in Geology and Applied Earth Sciences or Comp. Sci. 106. Introduction to Computing (A)</td>
<td>3-4</td>
</tr>
<tr>
<td>Geophys. 190</td>
<td>General Geophysics (A)</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 151</td>
<td>Sedimentary Geology (W)</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 180</td>
<td>Petrology I (W)</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 193</td>
<td>Geomathematics II: Introduction to Probability and Statistics in Geology (W)</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 181</td>
<td>Petrology II (Spr)</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>22-23</td>
<td></td>
</tr>
</tbody>
</table>

Petroleum Exploration

The student should select courses from the list below to aggregate at least 35 units. Students in the Petroleum Exploration Program are expected to have completed a prior degree in
either geology, geophysics or petroleum engineering.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 145</td>
<td>Mineral Economics</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 192</td>
<td>Geomathematics I: Computer Applications in Geology and Applied Earth Sciences</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 250</td>
<td>Probabilistic Methods of Decision Analysis in Petroleum Exploration</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 251</td>
<td>Petroleum Exploration and Oil Field Development</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 388</td>
<td>Offshore Exploration Seminar</td>
<td>2</td>
</tr>
<tr>
<td>A.E.S. 390</td>
<td>Geology of Energy Sources</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 180</td>
<td>Geologic Interpretation of Reflection Seismograms</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 190</td>
<td>General Geophysics</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 230</td>
<td>Hydrogeology</td>
<td>5</td>
</tr>
<tr>
<td>Geol. 255</td>
<td>Sedimentary Basins</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 278</td>
<td>Organic Geochemistry and the Geochemical Environment of Life</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. 151A</td>
<td>Underground Earth Fluids</td>
<td>3</td>
</tr>
<tr>
<td>Pet. Engr. 151B</td>
<td>Underground Fluids Behavior</td>
<td>3</td>
</tr>
<tr>
<td>Pet. Engr. 170</td>
<td>Elements of Reservoir Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

**Remote Sensing-Airborne Exploration**

Most students interested in remote sensing enroll in one of the Applied Earth Sciences core curricula (e.g., Ore Deposits and Exploration). If this core is not appropriate, the student and the advisor may develop a Special Applied Earth Sciences Program (such as Remote Sensing-Geomorphology or Geobotany) for departmental approval. Failing this, suitable advanced courses may be selected from the following list, for substitution by Faculty petition within the core.

All graduate students are urged to take the Short "Quickie" Courses which are offered by the Computer Sciences Department each quarter, in a variety of aspects of the use of the SCIP system. Following (or possibly concurrently, with) this introduction, then A.E.S. 192 should be taken.

The following courses are recommended for use in Special Programs or for approval substitution in a basic (Ore Deposits and Exploration) curriculum.

For those interested in Geobotany:
Biol. 178. Biology Natural Populations, S., (10), Jasper Ridge

For those interested in Statistics and Spatial Aspects of Remote Sensing Data:
Stat. 119. Statistical Inferences: 119 W., (4); 120 Sp., (4)
Geophys. 280. Data Analysis, Sp., (3)
Math. 130. Ordinary Differential Equations, A., W., Su., (3)
Math. 113. Linear Algebra and Matrix Theory, A., W., Sp., Su., (3)


For those interested in Hydrological Applications:
Geol. 222. Intermediate Geomorphology, W (3)

**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 (A.E.S. 300). These courses should amplify the academic base from which research is done and provide experience with the practice and techniques of research.

**Management Option**

Select a minimum of 15 units from the following courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus. 200-01. Economic Analysis and Policy</td>
<td>8</td>
</tr>
<tr>
<td>Bus. 210-11. Management Accounting or Indus. Engr. 133. Industrial Accounting</td>
<td>4-8</td>
</tr>
<tr>
<td>Bus. 220-21E. Business Finance</td>
<td>8</td>
</tr>
<tr>
<td>Bus. 261-62. Decision Analysis</td>
<td>8</td>
</tr>
<tr>
<td>Bus. 270. Organizational Behavior or Indus. Engr. 100. Theory and Management</td>
<td>4-6</td>
</tr>
<tr>
<td>Bus. 301. International Economics</td>
<td>4</td>
</tr>
<tr>
<td>Bus. 303. Economic Forecasting</td>
<td>4</td>
</tr>
<tr>
<td>C.E. 145. Construction Equipment and Methods</td>
<td>3</td>
</tr>
<tr>
<td>I.E. 234. Research and Development Management</td>
<td>3</td>
</tr>
<tr>
<td>Engr.-Econ. Sys. 231. Decision Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Indus. Engr. 229. Engineering Economy</td>
<td>3</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. 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.

Graduate students are admitted with a degree goal: M.S., Eng., or Ph.D. An approved petition is required to change goals. Those with a Ph.D. goal initiate qualifying procedures after earning faculty recommendation, at the end of the first year. 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 take a series of courses approved by his or her Program Committee.

Departmental 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

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: Basic chemistry, physical chemistry, desirable. (DR:T if 3 units.)

2 or 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. (DR:T if 3 units.)

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

120. Introduction to Ore Deposits—A survey course emphasizing the geological environment of ore deposits. Topics include evolution through geologic time: Petro-tectonic setting, morphology and structure; mineral associations. Laboratory study includes hand lens inspection of rock suites and discussions with some sessions on interrelationship of plans and cross-sections in visualizing three dimensional aspects of ore bodies, alteration patterns and structure. Prerequisite: Geol. 161 or equivalent. (DR:T)

4 units, Aut (Einaudi) MWF 10; lab. M 1:15-4:05

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
135. Soil Science—A survey of principal soil properties and processes, including soil interfaces; physical chemical and microbiological processes, soil genesis and classification. The course is designed for seniors and graduate students majoring in earth sciences and engineering. Prerequisites: freshman calculus, chemistry and physics. (DR:T)

4 units, Win (Rubin) TTh 3:15-5:05; Alternate years, given 1979–80

145. Mineral Economics—Lectures and discussions on the relationship between minerals and the economy and decision making in the mineral industry. Included in the course are elements of commodity analysis, economic feasibility studies and the influence of government policies, national and international, on these evaluations. Case studies methods for minerals, metals and the fossil fuels will be used. (Graduate students enroll in 215.) (DR:S)

3 units, Win (Douglas) MF 11-12:30

150. Introduction to Mineral Extraction Process—A survey of mineral and metal production technology emphasizing underlying principles and preliminary process selection and appraisal. Opportunities and limitations offered or imposed by the character of the ore and the process, and by the desired products and environmental protection will be considered. Elementary knowledge of mineralogy, chemistry and physics will be assumed. (DR:T)

3 units, Aut (Parks) MWF 8
geology would be helpful as background, but is not a prerequisite. Students should anticipate spending an aggregate of about five days in the field, principally on weekends. Most of the travel costs will be shared by students. (DR:T)

5 units, Spr (Harbaugh, Jackson, Rick)
TTh 3:15-5:05; field trips by arrangement

192. Geomathematics I: Computer Applications 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. Various topics are introduced, including elementary matrix algebra, least-squares surface fitting, machine contouring, information storage and retrieval, and numerical solution of differential equations in finite-difference form. Applications touched upon include ore deposits, petroleum geology, palaeontology, structural geology, and flow of fluids. Work in the course consists mostly of developing and using computer programs. Toward the end of the course, each student develops a programming application in his own field of interest. Prerequisite: an introductory course in calculus. This course may be followed by Geomathematics II or Geomathematics III, or both. (DR:T)

4 units, Aut (Harbaugh) MWF 11 plus 1 hour to be arranged. Given 1979–80

194. Geomathematics III: Numerical Methods for Geologists—A course intended for students in all fields of the earth sciences. Topics covered include an introduction to numerical, finite element, linear programming and matrix methods in earth sciences. The emphasis is on application to mathematical models. Prerequisite: Introductory calculus. (DR:T)

3 units, Spr (Remson) MWF 9

199. Special Problems in Applied Earth Sciences for Undergraduates—Guided research or reading on special problems. (DR:X)

Any quarter (Staff) by arrangement

GRADUATE COURSES

All courses are DR:X

201. Principles and Methods of Crystal Growth—(Enroll in Materials Science and Engineering 201.)

3 units, Spr (Tiller) TTh 2:15-3:30

206. Separation Processes—(Enroll in Ch.E. 120).

3 units, Spr (Staff) TTh 2:15-3:30

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 effectively 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) MW 2:15

215. Mineral Economics—For graduate students. Lectures the same as 145.

3 units, Win (Douglas) MF 11-12:30

220A,B. Advanced Ore Deposits—Lectures, seminars, extending through Winter and Spring quarters, designed to integrate field, theoretical, and laboratory data on the geology of the major types of ore deposits and application to exploration concepts. Emphasis is placed on empirical and theoretical development of genetic models of magmatic, hydrothermal and sedimentary processes. Laboratory consists of an introduction to the reflected light microscope, followed by advanced study of rock suites from district collections by hand lens, polished thin section microscopy, X-ray diffraction, electron microprobe and other techniques; emphasis on characterization of whole-rock mineral assemblages and parageneses, and on genetic interpretation. Individual projects, reports, and class presentations. Prerequisites: Geol. 163, 171, 812, A.E.S. 120.

4 units each quarter, Win, Spr (Einaudi)

TTh 11; one lab 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, and adsorption on solids. 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

227A. Problems in Applied Aqueous Thermodynamics—A systematic in-depth lecture and self-study review of the ideas and principles needed for solving quantitative problems in applied aqueous geochemistry or hydrometallurgy and a series of applied problems which test your understanding of principle and your ability to use it. There will be two weekly class meetings. Intended for those who have had some exposure to aqueous thermodynamics. Prerequisite: Geology 271 or equivalent, Geol. 272
or Mat. Sci. 181 recommended (may be taken concurrently).

3 units, Win (Parks) by arrangement

277B. Workshop in Aqueous Thermodynamics—Intensive study and experience in about eight topics including: analysis of problems; temperature, pressure, and ionic strength effects on equilibria; estimation and critical appraisal of thermodynamic data; computer models; and topics selected by the class. There are two 1.5 hour sessions per week, one lecture and one workshop. You will be expected to submit at least two written papers based on analysis of a problem of your choice in terms of the topics covered in the course. Prerequisites: Geol. 171 and Civ. Eng. 273A, Geol. 172 or Mat. Sci. 181, and A.E.S. 227A, A.E.S 225 is recommended.

2 units, Win (Parks) by arrangement

229. 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) MWF 2:15


3 units, Spr (Schwaar) MF 1:15-3:05

250. Probabilistic Methods of Decision Analysis in Petroleum Exploration—An introduction to probabilistic decision making in exploration for petroleum. Stress is placed on objective methods of estimating outcome probabilities in exploration, and their incorporation in modern methods of financial analysis. Topics include the use of frequency distribution of estimate outcome probabilities on a regional basis. Monte Carlo methods of combining frequency distribution, methods of statistically assessing exploration map reliability, Bayes' theorem, and the various forms of "conditional" analysis useful in estimating outcome probabilities on a prospect-by-prospect basis. Other topics include alternative exploration search strategies, including the use of maturely explored "training" areas to make statistical predictions in less mature "target" areas. Financial topics include preparation of cash-flow forecasts, expected monetary value analysis, devising and using utility functions, and decision-tree analysis. Part of the work in the course is centered around use of a series of problem sets that provide extensive practice in the methods. Although the problem sets pertain directly to petroleum exploration, the illustrate principles that also may be applied in exploration for ore deposits.

3 units, Spr (Harbaugh) TTh 11

251. Oil Field Exploration and Development—Course combines a seminar and directed laboratory work. The objective is to analyze specific actual oil exploration ventures from a geological, engineering, and financial standpoint, and to prepare a comprehensive series of recommendations. It is possible that one or more wells will be drilled during the quarter on the basis of the recommendations. Topics treated include interpretation of subsurface geology using information from well logs, preparation of well drilling and completion program specifications, preparation of cash flow forecasts, lease acquisitions, methods of funding of oil exploration ventures, and legal aspects of drilling ventures. Some of the topics involve guest speakers.

3 units, Spr (Harbaugh, Kourt) W 2:15-4:40

255. Introduction to Solute Transport—A study of processes influencing transport of solutes through porous media; description of solute transport and numerical methods for their solution. The course emphasizes physically simple systems and ways of including several types of chemical controls in the analysis. Prerequisites: freshman calculus, chemistry and physics; Fortran and experience in computer programming. Previous knowledge of numerical methods is unnecessary. (DR:X)

2 units, Win (Rubin) Th 3:15-5:05; alternate years, give 1978–79

257. Hydrogeology in Engineering Practice—Groundwater exploration, siting and design of wells, rehabilitation of wells, water quality, water law, and water resources.

2 units, Spr (Gilman) by arrangement

277. Field Mapping of Mineral Deposits—A seven-day field trip to a specific mineral district in California or Nevada, emphasizing detailed mapping of outcrops, 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. Prerequisite: A.E.S. 120.

3 units, Spr vacation (Einaudi); register Spring Qtr

283. Permafrost and Related Engineering Problems—A review of the physical and chemical properties of permafrost and their relation to engineering problems characteristic of areas
where the ground is seasonally or permanently frozen. The lectures will include discussions of frost heaving, icing, thaw consolidation and liquefaction, and their cumulative effects on roads, hot pipe lines, reservoirs, structure foundations and other engineering works. The susceptibility of permafrost to thermal disturbances, especially those caused by the activities of man, will also be discussed.

3 units, Spr (Hallet) MWF 9; alternate years, given 1979–80

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 (Johns) TTh 10; field trips and seminars by arrangement

285. Geotechnical Practice—Survey of current case histories in professional practice of engineering geology, environmental geology and soil engineering. Includes discussions of planning and management of projects, of data presentation and analysis, and of basic operations and skills such as field exploration and soil classification. Also includes several hours of individual internship on project work in the field and in a consulting office. Course is taught by geologists and engineer from a consulting firm, Earth Sciences Associates.

3 units, Win (Meehan) MWF 8:00

286. Engineering Geologic Mapping—Detailed field work and preparation of an engineering-geologic map and a stability-analysis 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 (Staff) by arrangement

295A,B,C. Seminar: Remote Sensing in Exploration—Weekly two-hour for discussion of recent advances covering all aspects of remote sensing, especially those which may be applied to mineral exploration. No prerequisites. Open to all interested participants, who will be expected to cover some pertinent aspect of the field for review and presentation. Pass-Fail grading. Sequence may be repeated.

1 unit, Aut, Win, Spr (Lyon) Fri. 12-2

296. Airborne Exploration: Structural Mapping—Advanced photographic and radar interpretation of larger-scale features, for rapid reconnaissance, as in the initial search for mineral districts. The effect on geological interpretation, with varying sun angles and radar look-directions, of flight altitudes, scales and seasons will be evaluated. Includes laboratory photogeological and radar analysis of imagery (satellite and aircraft) designed to extract the maximum of structural information from an area. Field analysis of low-sun-angle photography and radar imagery. Prerequisite: Geology 221, A.E.S 133, or equivalent.

3 units, Spr (Lyon) TTh 1:15; lab. TTh 2:15-4:05; alternate years, given 1979–80

297. Airborne Exploration: Lithologic Mapping—A course covering the physics and methodologies of the multi-spectral and multi-temporal response of terrain (rock, soil, vegetation and water) to various parts of the electromagnetic spectrum, from ultraviolet to infrared and microwave, principally for use as an exploration tool. Spectral and temporal signatures will be stressed as means of determining rock lithologies directly. Time-dependent responses (thermal interia or rock and soil, seasonal vigor of vegetation, etc.) will be discussed in detail. Geobotanical and biogeobotanical aspects will be covered. Laboratory work will deal with LANDSAT (ERTS) imagery and digital tape enhancement, by use of a computer, together with radar and thermal infrared imagery. Labs will be supported by field measurements and data analysis. Prerequisite: Geology 221, AES 133 or equivalent.

3 units, Spr (Lyon) TTh 1:15; lab. TTh 2:15-4:05; alternate years, given 1979–80

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

320. Research Seminar in Ore Genesis—Discussion of classic ideas and current research on the genesis of ore deposits. Students will prepare papers and make oral presentations. Topics will be selected mainly on the basis of participant interest and timeliness. Prerequisite: A.E.S. 220 or consent of instructor.

2 units, Aut (Einaudi) by arrangement

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 (Staff) by arrangement
386A,B,C. Seminars in Engineering Geology.
1 unit, Aut (Hallet)
Win (Staff)
Spr (Jahns) 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) TTh 1

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 11; W 1

393. Transport in Reacting Systems—(Enroll in Ch. E. 205).
3 units, Aut (Mason) TTh 2:15-3:30

GEOLGY
Emeriti: A. Myra Keen, Konrad B. Krauskopf, Benjamin M. Page, Charles F. Park, Jr. (Professors)
Chairman: Frank W. Dickson
Associate Chairman: William R. Evitt

Assistant Professor: Elizabeth L. Miller
Affiliated Faculty:
Professors: Alan Cox, Irwin Remson
Associate Professor: Marco T. Einaudi
Assistant Professor: Bernard Hallet

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 or her undergraduate program. The required courses for a student majoring in geology can be grouped into three categories: (1) core 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. Letter grades are required in geology core courses and in chemistry, physics, and mathematics, but in special cases exceptions may be granted by petition. 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>
</tr>
</thead>
<tbody>
<tr>
<td>1. Interpeting the Earth</td>
<td>Aut, Win, Spr</td>
<td>5</td>
</tr>
<tr>
<td>2. Earth History</td>
<td>Spr</td>
<td>5</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 Paleocology</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>
</tr>
</tbody>
</table>

In addition to the courses noted above, the student is required to take one of the following courses of his or her choosing:

<table>
<thead>
<tr>
<th>Courses</th>
<th>Quarter</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>143. Principles of Paleontology</td>
<td>Win</td>
<td>5</td>
</tr>
<tr>
<td>163. Optical Microscopy</td>
<td>Aut</td>
<td>4</td>
</tr>
<tr>
<td>171. Introduction to Geochemistry</td>
<td>Aut</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 190. General Geophysics</td>
<td>Aut</td>
<td>3</td>
</tr>
</tbody>
</table>

Total core course units

Max. 58
Min. 56

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 se-
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. The following course sequences describe alternative ways of meeting the minimum requirements:

**Mathematics**

1. For students entering Stanford with only high school algebra and trigonometry: Mathematics 10, 11, 21, 22, and 23 or Mathematics 41, 42, 43 (Analytic 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, Chemistry 31 (Chemical Principles) and Chemistry 135 (Physical Chemical Principles) 7
2. In some instances the following sequence may be substituted for Chemistry 31 and 135 with consent of the advisor: Chemistry 31 (Chemical Principles) and Chemistry 33 (Structure and Reactivity; organic chemistry) 8

Maximum possible required units in mathematics, physics, and chemistry 35
Minimum possible required units in mathematics, physics, and chemistry 27

**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 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 advisor. 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 commonly exceeds the number of elective units available to a student.

**CO-TERMINAL 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
- Geochemistry Mineralogy Petrology
- Mathematical Geology
- Ore Genesis

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.

Graduate core programs in the following subjects are listed under the Department of Applied Earth Sciences in this bulletin:
- Engineering Geology
- Petroleum Exploration
- Exploration
- Ore Deposits
- Environmental Geochemistry

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 several purposes of the Master's program in geology are to train professional geologists, to continue a student's training in general geology, and to help in formulating a Ph.D. program.

Procedures—A written Counseling Questionnaire will be given during the week prior to initial registration, in order to ascertain the student's background in geology and the supporting basic sciences and mathematics. The purpose of this questionnaire is to provide a basis for appropriate counseling of the student's 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 Master's 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 Questionnaire. 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 should include either one of the sequences of M.S. courses established by faculty Core Groups, or 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 advisor. Each ad hoc Core Group and course sequence must be approved by the Graduate Committee of the Department.
3. The student must complete a thesis describing his or her research before the end of the sixth quarter of graduate work at Stanford. The thesis normally is expected to be based on 10 to 15 units of research. The research and thesis 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 thesis is acceptable for the M.S. degree in the Department of Geology. The group will notify the Department Graduate Committee of their decision. A copy of the thesis is to be placed in the student's file.
GEOLOGY

Schedule—The recommended schedule of events in the Master's program is:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counseling Questionnaire</td>
<td>Upon arrival</td>
</tr>
<tr>
<td>Selection of Academic Advisor</td>
<td>by end of 1st Qtr.</td>
</tr>
<tr>
<td>Selection of Core Program and Research Advisor</td>
<td>1-2</td>
</tr>
<tr>
<td>Certification by Core Group and petition to Graduate Studies Office for M.S. program</td>
<td>2-3</td>
</tr>
<tr>
<td>Presentation of complete draft of M.S. thesis to Advisor and members of the Core Group</td>
<td>3-5</td>
</tr>
<tr>
<td>Completion of M.S. thesis and public presentation of results of research</td>
<td>5-6</td>
</tr>
</tbody>
</table>

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.

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. Marine geologic research is pursued in a global context with a special focus on the Pacific basin. 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.

Upon entering Stanford, a Ph.D. student is to take the Counseling Questionnaire 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.

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 Advisory Committee is to be selected by a student in consultation with his or her research advisor. The committee is to be made up for three to five members, at least two of whom must be geology faculty including the Research Advisor. The primary responsibility of the Research Advisory Committee is to aid in establishing and accomplishing the research program of the student.

The Department qualifying procedures for Ph.D. candidacy involve five steps: completing the Core Course sequence, establishing the Research Advisory Committee, preparing the Ph.D. research proposal, 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.

Schedule—The recommended schedule of events in the Ph.D. program is:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counseling questionnaire</td>
<td>upon arrival</td>
</tr>
<tr>
<td>Selection of Academic Advisor</td>
<td>by end of 1st Qtr.</td>
</tr>
<tr>
<td>Selection of a Core Program</td>
<td>1-3</td>
</tr>
<tr>
<td>Selection of Research Advisory Committee including the Research Advisor</td>
<td>1-3</td>
</tr>
<tr>
<td>Preparation of Research Proposal</td>
<td>2-5</td>
</tr>
<tr>
<td>Certification and Petition for the Ph.D. Program</td>
<td>2-5</td>
</tr>
<tr>
<td>Departmental Examination</td>
<td>2-6</td>
</tr>
<tr>
<td>Admission to Candidacy for Ph.D.</td>
<td>before 7</td>
</tr>
</tbody>
</table>

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 candidate 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 include 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 to 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. (DR:T)

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

2. Earth History—Evolution of the major features of the earth, including plate tectonics, the surface environment of the earth and the evolution of life. Topics include the history of oceans, continents and mountain belts as they relate to current theories of continental drift and plate tectonics; the evolution and role of life on earth as related to the physical, chemical, climatic and oceanographic history of the earth; earth resources and earth history, directions of current research in the history of the earth. Lectures and laboratory sessions; discussion sessions of relevant research topics including original papers. Prerequisite: 1 or consent of instructor (DR:T)

5 units, Spr (van Andel) MWF 9; laboratory and discussion sessions 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 discussions 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. (DR:X)

2 units, Spr (Jahns) 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 used 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. (DR:T)

4 units, Spr (Rich 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 geologic maps and sections 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 interval 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. (DR:T)

3 units, Sum (Dickinson) Sept. 7-22

103A.B. Advanced Field Geology—This course provides an opportunity of 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). (DR:X)

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 15-July 27

103B. Preparation of comprehensive geologic report on field area studied during 103A; work done on campus.

4 units (Staff) July 30-Aug. 10

105. Geologic Problems—Supervised reading, field and/or laboratory work, written reports thereon. (DR:T) if taken for three or more units.

1 to 10 units, any quarter (Staff) by arrangement

110. Structural Geology—Introduction to geometric analysis of structures. Emphasis is on use of stereographic projections, descriptive geometry and plane-table surveying in order to develop three-dimensional views of structures. One hour per week devoted to case studies of structures. Two problem sessions per week deal with geometric methods. Several homework problems assigned each session. One day per week spent in field, mapping structures at Moss Beach. Prerequisite: 1 or 101. Recommended: 102. (DR:T)

5 units Spr (Miller) MWF 9

plus field lab.

121. The Surface of the Earth: an Introduction to Geomorphology—An introduction to the geologic character and genesis of the principal landforms, and to the processes that modify them. Case studies of environmental signifi-
cance will be considered in the course, to pro-
vide a basis for evaluating the effects of humans
on the landscape. There will be one two-day
field trip to the Sierra Nevada, one to the nor-
thern Coast Range, and a couple of local one-day
trips. A written report based on field observa-
tions combined with literature studies will be
expected. Prerequisite: 1. (DR:T)
4 units, Aut (Hallet) TTh 10-11:30,
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; impor-
tant fossils preserved in unusual ways; micro-
scopic fossils; conspicuous evolutionary succes-
ses; coral and other reefs during the last 600
million years; products of ancient life in the
service of man. Term report. No prerequisites.
(DR:T)
3 units, Spr (Evitt) MWF 11;
alternate years, given 1979–80

142. Vertebrates of the Past—A survey for
nonspecialists, exploring through readings and
illustrated lectures the distinctive characters,
specializations for particular modes of life, evolu-
tionary history and distribution in space and
time of major vertebrate groups. Term report.
No prerequisites. (DR:T)
4 units, Aut (Evitt) MTWTh 11;
alternate years, given 1979–80

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. Lab-
oratory introduction to several major groups of
fossil organisms. Term project or report. Pre-
rerequisite: 2 or consent of instructor. (DR:T)
5 units, Win (Evitt) MWF 10;
lab. TTh 1:15–4:05

150. The Oceans: An Introduction to the Ma-
rine Environment—The course provides an in-
sight into the science of oceanography including
the nature of sea water, the interplay between
circulation of the oceans and atmosphere, the
nature of sea water, the interplay between
coring the interface between continents and
atmosphere; important marine resources together with attendant
and biologic productivity. Lectures, occasional laboratory

demonstrations and one coastside field trip re-
quired. A term paper on a marine topic is also
required. (DR:T)
4 units, Win (Ingle) MWF 11; laboratory
demonstrations, research conferences,
and field trips by arrangement;
alternate years, given 1978–79

151. Sedimentary Geology—Inquiry into de-
positional systems and origins of sedimentary
rocks. Topics explored include provenance and
weathering, sediment transport and sediment-
ary structures, and lithification of sediments;
but main emphasis is placed upon the interplay
of processes that control the operation of various
deposystems in different sedimentary environ-
ments. Prerequisites: 1, 2, 101 and 102. (DR:T)
4 units, Win (Dickinson) MWF 9;
lab. W or Th 1:15–5:05;
optional field trips by arrangement

152. Stratigraphic Geology and Paleo-
ecology—Rudiments of interpreting sedimen-
tary rocks with emphasis placed on the utility of
integrating paleontologic, sedimentologic, and
geochemical evidence to reconstruct paleoenvi-
nvironments. Characteristic variations of modern
and ancient bioclasts 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 level, the population level, and the
community level. An independent investigation
of a stratigraphic problem serves as a basis for a
required term paper. Lectures and discussions
are supplemented by extensive reading from
classic and current scientific literature. Pre-
rerequisites: 1, 2, 101 and 102. (DR:T)
4 units, Spr (Ingle) MWF 10; one three-
day field trip is required; additional field
trips and research conferences
by arrangement

154. Topical Deposystems—Field and lab-
oratory investigation of Cenozoic deposystems.
Focus will be entirely on a single example of
some type of depositional packet of subunit
within a local formation selected by the instruc-
tor. Work will include field work on weekend
days and analysis of the data obtained in a semi-
nar format. Open only to those registered con-
currently in Geology 151. (DR:X)
1 unit, Win (Dickinson), by arrangement

161. Crystal Chemistry and Mineralogy—In-
troduction to the crystallographic groups and
the theory of x-ray diffraction. Principles of crys-
tal chemistry. Factors affecting the stability of
minerals and the solid contaminants of our envi-
nvironment. Systematic examination of the struc-
tures, 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 mineral-
ogy including hand specimen, optical and x-ray
methods. One field trip. Prerequisites: 1, 101, 102 and Chemistry 31 (may be taken concurrently). (DR:T)

5 units, Aut (Brown) MWF 10;
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. (DR:T)

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

171. Introduction to Geochemistry—A lecture survey of elementary geochemistry for Senior level students, suitable for graduate students, plus choice of either a laboratory or a review of thermodynamics. The distributions, migration modes and storage mechanisms of elements during the geochemical cycle. Laws governing the partitioning of elements among natural materials. Prerequisites: 1, 161, Thermodynamics, either Chemistry 135, or Materials Science 181, or 1 unit Thermodynamic option below, may be taken concurrently. (DR:T)

4 units, Aut (Dickson) MWF 9; Choice of one 3 hour lab. (1 unit) or 2 hrs of elementary thermodynamics (1 unit) per week, by arrangement.

172. Geologic Phase Equilibria—Three lectures per week on thermodynamics and properties of phase diagrams and application to phase equilibria. Considerations on crustal processes, including igneous, metamorphic, sedimentary and hydrothermal. Topics include equilibrium, metastability, fractional crystallization, partial melting, metamorphic reactions and replacement. Emphasis to be placed on the relation of phase diagrams to experiments and to geological problems. One laboratory exercise on the determination of phase equilibria, 3 hours per week. Prerequisite: 171 or consent of instructor. (DR:T)

3 units, Win (Luth) MWF 9

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 of common metamorphic rocks. Two one-day field trips to local areas that display rocks of special interest. Prerequisite: 180 or consent of instructor. (DR:T)

3 units, Spr (Staff) 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. (DR:X)

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

193. Geomathematics II: 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. This course may be followed by Geomathematics V or the Geomathematics Seminar. Prerequisite: Introductory calculus. (DR:X)

3 units, Win (Switzer) TTh 11:00-12:15

201. Fall Field Petrology—A course for students wishing to study petrologic 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 undergraduates desiring an extension of field geology beyond 103B, and graduates in Earth Sciences desiring enhanced training in field geology. Prerequisite: consent of instructor. Generally some experience in field geology will be required. (DR:X)

3 units, Aut (Dickson) Th 8;
one day per week in field,
alternate years, given 1979–80
213. Treatment of Continuum Properties in Geology—Introductory course to provide familiarity with common vector and tensor operations and subscript notation by considering problems of geological interest. Lectures and discussions will be centered on problems dealing with topics ranging from stress tensor transformations, to crystal symmetry, material properties of anisotropic rocks, rock failure analysis, and flow laws. Prerequisite: 210 or consent of instructor. (DR:X)
3 units, Win (Hallet) TTh 9; alternate years, given 1978–79

214. 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: 192 and 110 or equivalent. (DR:X)
3 units, Spr (Compton) W 11; lab. MW 1:15-4:05; alternate years, given 1979–80

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: 121 or equivalent; 222 recommended but not required, or consent of instructor. (DR:X)
3 units, Aut (Rich) TTh 1:15-4:05

222. Intermediate Geomorphology—A review of the principles of geomorphology using specific regional systems and quantitative evaluation of the principal processes that modify the land surface. Some of the principles of fluid flow and theories of sediment transport are used to analyze the origin and evolution of a wide variety of destructive and constructive landforms. Topics may include, but are not limited to, river and glacier mechanics, dynamic equilibrium theories, movement and deposition of sediment by water, ice and wind. Classroom discussions will be augmented by a review of actual field observations. Prerequisites: 121 or consent of instructors. (DR:X)
3 units, Win (Rich and Hallet) MWF 10

230. Hydrogeology—Theory of underground water, analysis of field data and pumping tests, geologic groundwater environments, solution of problems. Prerequisites: elementary calculus and physics. (DR:X)
5 units, Win (Remson) MWF 9; seminar M 2:15-4:05; lab. by arrangement

232. Numerical Methods in Hydrology—Supervised self study of numerical methods with illustrative examples chosen from hydrology. Prerequisite: consent of instructor. (DR:X)
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 and 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. (DR:T)
5 units, Aut (Ingle) MWF 11; two lab. discussion periods by arrangement, alternate years, given 1979–80

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. (DR:X)
5 units, Spr (Evitt) 3 lecs., 2 labs, by arrangement, alternate years, given 1979–80

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. (DR:X)
Aut (Evitt) units and hours by arrangement, alternate years, given 1979–80

244. Advanced Micropaleontology—Discussion and practice in use of marine microfossils (mainly benthonic and planktonic foraminifera) to solve fundamental geologic and oceanographic problems of geochronology, correlation, paleoecology, and paleoceanography. Individual analyses of a series of unknown samples provide an intensive laboratory experience in applying basic concepts of biostratigraphy and paleoenvironmental analysis to interpretation of Paleozoic, Mesozoic, and Cenozoic microfossil assemblages. Lectures focus on classic and cur-
rent examples of research in this field. Pre-
requisite: 241. (DR:X)
3 units, Win (Ingle), T 11;
lab. TTh 1:15-4:05 or by arrangement;
alternate years, given 1979–80

250. Marine Geology—Ocean Basins—Physiography, tectonics and sedimentation of the modern and ancient ocean. Survey of the field with emphasis on familiarization with the current main geological literature and with directions of advanced research in marine geology and marine geophysics. Topics include the morphology, tectonics and volcanism of the deep-sea, processes of deep-sea sedimentation, the carbonate and silica cycles, sedimentary history of the deep ocean, Cenozoic and Mesozoic paleoceanography. Course restricted to the geology of the deep-sea; the geology of the ocean margins is treated in G-251. A term project (research proposal) is required. Prerequisites: 150, 151 or consent of the instructor. (DR:T)
4 units, Aut (van Andel) MWF 9;
alternate years, given 1978–79

251. Marine Geology—Continental Margins—An overview of the current knowledge of continental margins past and present. Emphasis is on the structure and the sedimentary history and facies of the margins of the world and present nearshore and shelf sedimentation processes are treated only in this light. Topics include morphology and structure, sediment facies patterns and sediment petrology of coastal, shelf and slope sediments; origin of passive and active continental margins; causes and effects and the role of transgressions and regressions in geological history; petroleum geology of the continental margin; problems in the utilization of continental margins; politics and management of continental margin research, exploration and exploitation. Seismic reflection studies on the continental margin. A term project is required. Prerequisites: 150, 151 or consent of the instructor. 255 recommended. (DR:T)
4 units, Aut (van Andel) MTW 9;
alternate years, given 1979–80

253. Sedimentary Petrology—Examination and interpretation of sediments and sedimentary rocks. Aspects of provenance, texture, composition, diageneis, and incipient metamorphism are treated. Laboratory stresses work with the petrographic microscope but includes sieving and settling procedures, sectioning and staining techniques, separation and mounting of heavy minerals, and modal pointcounting. Emphasis is placed on sandstones of all kinds including calcarenites, but limited study of volcanioclastic rocks, lutites and cherts, phosphorites, ironstones, evapo-rites, and carbonate rocks is included. Pre-
requisites: 163, or 161 and 180. (DR:X)
4 units, Spr (Dickinson) TTh 9;
lab. TTh 1:15-4:05;
optional field trips by arrangement

254. Sedimentary Basins—Analysis of the de-
positional 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, and synthesis of basin development through time in terms of depositional systems and tectonic settings. A term paper is required. (DR:T)
5 units, Aut (Dickinson) MTWTh 1:15;
optional field trips by arrangement

255. Sedimentary Sequences—Library review and field examination of clastic and carbonate sequences in the Death Valley region, with attention to sedimentary petrology, depositional structures, environments of deposition, paleogeography, and tectonic setting. Work will include an extended field trip (nearly a week long), preparatory lectures, library research, and seminar discussions. Open only to those registered concurrently in Geology 253. (DR:X)
2 units, Spr (Dickinson), by arrangement

256. Structural Mineralogy and Crystal Chemistry—Matrix-algebraic development of the crystallographic groups. Introduction to x-ray crystallography including powder and single-crystal diffraction techniques and elements of crystal structure analysis and refinement. Geologic applications. Crystal chemical principles and current theories of chemical bonding as applied to minerals. Spectroscopic properties of minerals. Factors affecting trace element distributions in minerals. (DR:T)
3 units, Win (Brown) MWF 11;
alternate years, given 1979–80
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 equivalent experience with chemical thermodynamics. (DR:T)

3 units, Aut (Leckie) TTh 9, F 2:15

272. Advanced General Geochemistry—This course is designed to acquaint students with modern approaches in geochemistry. Topics will include geochemical balances of elements, trace element distributions, isotope, regional compositional trends, and related experimental approaches. Prerequisites: 172 or consent of instructor. (DR:X)

3 units, Spr (Dickson) MWF 9

278. Organic Geochemistry and the Geoenvironment 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. (DR:X)

2 units, Win (Koenwolden) TTh 4:15

279. Microprobe and X-ray Fluorescence 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. Discussion of geologic applications, laboratory use of the microprobe to develop sufficient skills for independent operation. (DR:X)

4 units, Spr (Brown and Taylor) two lecs., 1 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 1978–79

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. Prerequisites: 172 or 182 or consent of instructor. (DR:X)

4 units, Spr (Liou) 2 lecs., 1 lab by arrangement; alternate years, given 1979–80

293. Geomathematics V: 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 statistical usage. Prerequisite: 193 or consent of instructor.

3 units, Spr (Switzer) TTh 11:00-12:15; alternate years, given 1978–79

299. Geomathematics VI: Geomathematics Seminar—Geostatistics, probability models and simulation, sampling theory, and other topics chosen according to the interests of the participants. Prerequisite: consent of instructor. (DR:X)

3 units, Spr (Switzer) TTh 11:00-12:15; alternate years, given 1979–80

314. Research Seminar in Structural Geology—Discussion of the literature and current research by graduate students and staff on topics of special interest. Topics include: Rheological properties of rock; effect of stress on transformations in rock; deformation mechanisms in crystals and rock; structures and mechanics of folded mountains. The format will range from lectures to group discussion, depending upon the nature of the subject and the interest of the students. In some cases students will carry out small research projects. (DR:X)

2 units, Win (Hallet) by arrangement
320. Introduction to Glaciology—Review of the nature and behavior of temperate and polar glaciers. Emphasis will be placed on recent research on surging phenomena, basal sliding, hydrology, chemistry and structure of glaciers. Prerequisite: 210 or consent of instructor. (DR:X)
3 units, Spr (Hallet) by arrangement

325. Seminar in Fluvial Geomorphology—Analysis of current problems, concepts, and research in fluvial geomorphology and related fields, with emphasis on newly available data. Topics for discussion will vary from year to year. Course will include some lectures supplemented by literature review. (DR:X)
2 units, Win (Rich) by arrangement; alternate years, given 1979–80

326. Seminar on Glacial and Periglacial Geology—Principal geomorphic processes active in glacial and periglacial environments. The content of the seminar will vary according to student interest, but likely topics will include: The relation between glacial erosion and deposition and the sliding of glaciers; the role of freezing porewaters on frost-shattering and solifluctions; lenses, wedges and layers of ice in permafrost. Prerequisites: 222 or 320, or consent of instructor.
3 units, Spr (Hallet) by arrangement; alternate years, given 1978–79

327. Quarternary Geology—Various aspects of Quarternary stratigraphy, methods of chronostatigraphic correlations of Quarternary deposits, climatic fluctuations and associated depositional or erosional landforms, and literature review of Quarternary geology of selected areas in California and the Great Basin will form the basis of the course. Lecture-seminar format. Field trips will be included if feasible.
3 units, Spr (Rich) by arrangement; alternate years, given 1978–79

351. Seminar in Marine Geology and Geophysics—Advanced level discussion of current research problems in the geophysics, tectonics, sedimentation and history of the ocean basins. Emphasis will be on new data or unsolved problems; occasionally, data sets may be available that have not yet been used and that permit original research in a tectonic or sedimentary problem. Topics for discussion will be selected where possible with the advice of prospective participants. Prerequisite: consent of the instructor. (DR:X)
2 units, Spr (van Andel) 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. (DR:X)
2 units, Win (Jahns) by arrangement

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: consent of instructor. (DR:X)
2 units, Spr (Liou) by arrangement; alternate years, given 1978–79

Problems in Various Fields of Geology—Units, quarter, and time by arrangement (Staff). All courses (DR:X).

309. Problems in General Geology.
319. Problems in Structural Geology.
329. Problems in Geomorphology and Photogeology.
339. Problems in Environmental Earth Sciences and Hydrogeology.
349. Problems in Paleontology, Palynology, and Paleoecology.
355. Problems in Oceanography.
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). All courses (DR:X).

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

Chairman: George A. Thompson
Associate Chairman: Allan V. Cox
Professors: Jon F. Claerbout, Allan V. Cox, Robert L. Kovach, George A. Thompson. Affiliated: Tjeerd H. van Andel
Associate Professor: Amos M. Nur
Assistant Professors: David M. Boore, Robert J. Geller
Visiting Professor: Fabio Rocca
Visiting Associate Professor: William Mac Donald
Consulting Professor: Thomas Cantwell, Francis Muir
Research Associates: Lori Dengler, Gerald M. Mavko, Michael O. McWilliams, Eve S. Sprunt

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) a background of fundamentals in science and (2) courses in geophysics to coordinate the fundamentals with principles of geophysics. The program leading to the Bachelor of Science in Geophysics permits many electives and a high degree of flexibility for each individual student. Graduate programs give specialized training for professional work in exploration, in research, and in education. The Department of Geophysics is housed in the Ruth Wattis Mitchell Earth Sciences Building and the Salvatori Laboratory of Geophysics. The Department has a number of research facilities among which are a seismic observatory, a rock-magnetism laboratory, minicomputers, a high pressure and temperature rock deformation laboratory, and various instruments for field measurements. Current research activities in the Department include earthquake prediction studies, studies of geothermal areas, application of seismology to study of present-day tectonics, near field seismology, geophysical monitoring of the San Andreas fault, paleomagnetic investigations, free oscillation and surface wave studies, and a major research program in data analysis techniques as applied to geophysical exploration. Graduate programs lead to the degree of Master of Sciences 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. A written report on original research is also required. Normally, this will be undertaken as part of the student’s participation in three quarters of Research Seminar (Geophysics 185, Section A, B, C, D, E, F, or G) 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 31</td>
<td>Chemical Principles</td>
<td>Aut</td>
<td>4</td>
</tr>
<tr>
<td>Chemistry 135</td>
<td>Physical Chemical Principles, or Physics 170, 171, Thermodynamics</td>
<td>Win</td>
<td>3</td>
</tr>
<tr>
<td>Electrical Engineering 141</td>
<td>Electromagnetic Fundamentals or Physics 120. Electricity and Magnetism</td>
<td>Aut, Win</td>
<td>3</td>
</tr>
<tr>
<td>Geology 101</td>
<td>Framework of Geology</td>
<td>Spr</td>
<td>4</td>
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<tr>
<td>Geology 102</td>
<td>Introduction to Field Geology</td>
<td>Sum</td>
<td>3</td>
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<tr>
<td>Geology 110</td>
<td>Structural Geology</td>
<td>Spr</td>
<td>5</td>
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<tr>
<td>Geology 161</td>
<td>Mineralogy</td>
<td>Aut</td>
<td>4</td>
</tr>
<tr>
<td>Geophysics 185 (A, B, C, D, E, F, or G) Research Seminar</td>
<td>Aut, Win, Spr</td>
<td>6</td>
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</tr>
<tr>
<td>Geophysics 190</td>
<td>Elementary Geophysics</td>
<td>Aut</td>
<td>4</td>
</tr>
<tr>
<td>Math. 10, 11, 21, 22, 23 and 44 or 41, 42, 43 and 44.</td>
<td>Analytical Geometry and Calculus</td>
<td>Any</td>
<td>18</td>
</tr>
</tbody>
</table>

As electives in the Geophysics Curriculum the following courses are recommended: Geophysics 102, 150, 174, 175, 180, 191, 195, Geology 163A and B or 201, Geology 181, Physics 57, 58, 100, 101, 121 or Electrical Engineering 142. Mathematics 131, 132, Engineering 44, and Chemical Engineering 140, 150.

MASTER OF SCIENCE

General Program

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.
GEOPHYSICS

2. Complete 45 units with at least a B average. At least 6 of these units must be independent work on a research problem, resulting in a written report accepted by the candidate's faculty advisor. 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, F, or G).

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.

**Exploration Program**

Objectives—To provide the theoretical background needed for a career in geophysical exploration, with emphasis on techniques used in the search for new petroleum energy resources. The program is designed for graduates with B.S. in physics, engineering, mathematics, geophysics, or geology. The program is not intended as an intermediate step to the Ph.D. degree, although admission to the Ph.D. program will be considered after the student has gained at least one year's on-the-job experience subsequent to obtaining the M.S. degree.

The program will normally take four quarters, beginning and ending in the Autumn quarter. In addition, short courses offered for two weeks immediately prior to both Autumn quarters are required of students with no prior training in geology. A background in mathematics through differential equations is required to enter the program. A summer internship in industry or government research is an integral part of the program. Although a formal M.S. thesis is not required, the student will present an oral and written interpretation of geophysical data as part of the Geophysics 380 seminar in the final Autumn quarter.

Requirements for the Degree—A total of 45 units is required for the degree and the normal course load is 12 to 15 units per quarter. The required courses for the degree are listed in the following model schedule.

### First Year

<table>
<thead>
<tr>
<th>Autumn Quarter</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geophysics 190. General Geophysics</td>
<td>4</td>
</tr>
<tr>
<td>Geophysics 397. Contemporary Geophysics Seminar</td>
<td>1</td>
</tr>
<tr>
<td>Geology 255. Sedimentary Basins</td>
<td>5</td>
</tr>
</tbody>
</table>

2. Complete 45 units with at least a B average. At least 6 of these units must be independent work on a research problem, resulting in a written report accepted by the candidate’s faculty advisor. 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, F, or G).

### Second Year

<table>
<thead>
<tr>
<th>Winter Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geophysics 174. Seismology</td>
</tr>
<tr>
<td>Geophysics 175. Seismology Laboratory</td>
</tr>
<tr>
<td>Geophysics 180. Geologic Interpretation of Reflection Seismograms</td>
</tr>
<tr>
<td>Geophysics 282. Rock Physics</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Spring Quarter</th>
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</thead>
<tbody>
<tr>
<td>Geophysics 150. Plate Tectonics</td>
</tr>
<tr>
<td>Geophysics 191A. Geophysical Field Techniques</td>
</tr>
<tr>
<td>Geophysics 280. Data Analysis</td>
</tr>
</tbody>
</table>

### Third Year

<table>
<thead>
<tr>
<th>Summer Session (Final two weeks only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology 102. Introduction to Field Geology</td>
</tr>
</tbody>
</table>

### 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, F, or G). Ph.D. candidates in Geophysics are required to complete Physics 121 or Electrical Engineering 142, Electrical Engineering 261, and Physics 210, 211, or 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, Civil Engineering, Chemical Engineering, 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. 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. Experience as a teaching assistant (quarter-time for at least one academic quarter) is required for the Ph.D. degree. 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 reapply for admission to candidacy and retake the Departmental and the University oral examinations. They will be given an additional one year in which to submit their dissertations.

**COURSES**

All courses DR:T if taken for 3 or more units.

51. Earth Physics—This course is an introduction to geophysics for students with no prior knowledge of earth sciences. The subjects covered include earthquakes, geothermal processes, volcanism, shifts of the earth's rotation axis, continental drift, geomagnetism, gravity, changes in climate, and geophysical techniques used in the search for petroleum. The central theme of the course is the new theory of plate tectonics. Prerequisite: Mathematics 41 or 11 and enrollment in Mathematics 42 or 21.

4 units, Win (Cox) MWF 10; four 3-hour labs by arrangement


3 units, Aut (Cox) MWF 9; offered alternate years, given 1978–79

150. Plate Tectonics—Measurement and description of movements between lithospheric plates as determined from geologic and geophysical data. Topics include: determination of relative velocities between plates; analysis of magnetic anomalies to determine age of sea floor; interpretation of paleomagnetic data; geologic processes at rises, trenches, and transforms; and cause of plate motions. Prerequisites: geometry; and introductory geology.

3 units, Spr (Cox) MWF 1:15

174. Seismology—Introduction to earthquakes and seismic wave propagation. 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, determination of earthquake source mechanisms, earthquake prediction. Prerequisites: some knowledge of waves and Fourier transforms (check with instructor if in doubt).

3 units, Win (Geller)

175. Seismology Laboratory—Practical exercises in seismology using records from local and teleseismic events. Required for those taking Geophysics 174.

2 units, Win (Geller)

180. Geologic Interpretation of Reflection Seismograms—Elementary principles of reflection seismology, seismic data processing, and field operations, including field trip to an operating crew. Geology of petroleum; source rocks, migration and accumulation, structural and stratigraphic traps. Workshops in stratigraphic and structural interpretation of seismic sections and well logs, utilizing data from various oceans and continents.

3 units, Win (Claerbout, Crandall, Thompson) TTh 11 and lab. W 1:15–4:00

185A,B,C,D,E,F,G. 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: Reflection Seismology—Departmental research in reflection seismology and petroleum prospecting.

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

185F. Research Seminar: Strong Motion Seismology—Current research concerning near field wave propagation, studies of source models, interpretation of strong motion data.
2 units, Aut, Win, Spr (Boore) by arrangement

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

191A. Geophysical Field Techniques—Field investigations as in Geophysics 191 supplemented with lectures and classroom exercises on the quantitative interpretation and inversion of electrical and electromagnetic prospecting data. Prerequisite: Physics 120 or Electrical Engineering 141.
6 units, Spr (Kovach) by arrangement

195. Physics of Earth's Interior—A study of the available data of seismology, volcanology, 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. This course is open to undergraduate seniors majoring in geophysics.
3 units, Win (Kovach)

200. Geophysical Continuum Mechanics—Mechanics of elastic solids, inelastic solids and viscous fluids applied to important problems of the crust and upper mantle of the earth such as wave propagation, faulting and crack problems, relaxation phenomena, wave attenuation, flow in porous media. Emphasis on intuitive approaches to problem solving, using symmetry, scaling, and conservation laws to estimate results without complete analysis. Useful theorems and techniques for solving boundary value problems. Prerequisites: knowledge of calculus and partial differential equations.
3 units, Aut (Mavko and Nur) MWF 1:15

260. Tectonophysics—Topics selected from theories of elasticity, viscoelasticity, friction and fracture as related to geotectonic processes. Transport theories and related phenomena in geophysical processes. Fluid, electrical, and thermal flow of rocks, with particular emphasis on the mechanics of fluid flow in porous, deformable solids. Discussion of effective stress laws, dilatancy, and role of fluids in earthquakes, aftershocks, creep, and time dependent strain in the crust. Application of dislocation theory to crustal and mantle deformation, faulting and creep. Application to earthquake prediction and fault studies. Content varies from year to year.
3 units, Spr (Nur) MWF 10

262. Rock Physics—Properties of and processes in rocks as related to geophysical exploration, crustal studies and tectonic processes. Emphasis on (1) wave velocities and attenuation in rocks as a function of stress, pore pressure, time and temperature; (2) hydraulic permeability; and (3) electrical resistivity. Application to in situ velocity, attenuation, resistivity and fluid flow problems, using laboratory data, theoretical results and symmetry considerations.
3 units, Win (Nur) MWF 10

and engineering. Prerequisite: consent of instructor.

3 units. Spr (Boore) T 3:45-5:00; F 2:45-4:00; offered alternate years, given 1979–80

276A,B. Advanced Seismology—Basic results for body waves, surface waves, free oscillations and earthquake source theory studied theoretically and applied to data. Topics covered include dispersion and excitation of free oscillations, use of free oscillations and surface waves to determine earthquake source parameters, inversion of dispersion data to determine earth structure, physical dispersion due to anelasticity, Cagniard-de Hoop and reflectivity methods for body-wave synthesis and crack theory models of the earthquake source. Prerequisites: Geophysics 174, 175; knowledge of contour integration and boundary value problems in mathematical physics; Fortran programming.

276A. 3 units, Spr (Getter) by arrangement
276B. 3 units, Aut (Getter), given 1979–80


3 units, Spr (Claerbout) MWF 9


3 units, Aut (Claerbout) MWF 10

301. Problems in Geophysics.

Any quarter (Staff) by arrangement

380. Seminar: Professional Presentation of Geophysical Data and Conclusions—This seminar 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: Reflection Seismology—Departmental research in reflection seismology and petroleum prospecting.

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

385F. Research Seminar: Strong Motion Seismology—Current research concerning near field wave propagation, studies of source models, interpretation of strong motion data.

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


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

397. Introduction to Contemporary Geophysics—Seminar on current topics of interest in geophysics with particular emphasis on active
398. Seminar; Advanced Marine Geophysics.
2 units, Spr (van Andel)
by arrangement

399. Teaching Experience in Geophysics—
The purpose of this course is to provide on-the-job training in the teaching of geophysics. The student will have an opportunity to develop problem sets and laboratory exercises, grade papers, and give occasional lectures under the supervision of the regular instructor of a geophysics course. Regular conferences with the instructor and with students in the class will provide the student-teacher with feedback about his effectiveness in teaching.
2-4 units, any quarter (Staff)
by arrangement

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

PETROLEUM ENGINEERING
Emeritus: Frank G. Miller (Professor)
Chairman: Henry J. Ramey, Jr.
Professors: William E. Brigham (on leave), Sullivan S. Marsden, Jr., Henry J. Ramey, Jr.
Assistant Professor: Herber Cinco-L, D. O. Shah
Consulting Professors: Herman Dykstra, Alvah J. Horn, Subir K. Sanyal, Marshall B. Standing

OFFERINGS
The study programs of the Department of Petroleum Engineering are designed to train graduates competent in the engineering technology of water, 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:
Drilling Technology
Production Technology
Well and Property Valuation
Pressure Transient Analysis
Reservoir Engineering
Well Test Analysis
Well Logging and Log Analysis
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 fluid production industries require professionals of unusual versatility interested in wide-ranging technological, sociological, and geographical subjects. Qualified students are encouraged to take graduate study because typical assignments often lead to responsible positions in industrial management and research. Graduate research is conducted in specialties such as geothermal engineering, improved oil recovery, water production and reclamation, well log analysis, well bore heat and fluid flow, pressure transient analysis, flow of non-Newtonian fluids in porous media, in-situ shale gasification, solution mining, natural gas engineering and 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 and for certain graduate students. Employment opportunities are extraordinary at all degree levels, and command the highest starting salaries of all scientific degrees. 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 machine shop, an analytical laboratory, the main office for the Stanford University Petroleum Research Institute (SUPRI), faculty offices, 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 is 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 inspections 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. The last three years, Petroleum Engineers have received higher average starting salaries, and more job offers per student than other baccalaureate degree recipients. 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 (min)</td>
</tr>
<tr>
<td>Science</td>
<td>24 (min)</td>
</tr>
<tr>
<td>Engineering breadth</td>
<td>30 (min)</td>
</tr>
<tr>
<td>Engineering depth</td>
<td>36 (min)</td>
</tr>
<tr>
<td>Technical electives</td>
<td>12</td>
</tr>
<tr>
<td>Free electives</td>
<td>33</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
</tr>
</tbody>
</table>

GRADUATE DEGREES

The energy industries are 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 permits more extensive course work than the Master's degree with an emphasis on professional practice.

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 the 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, well log analysis, natural gas engineering and energy industry management, pipeline transportation, and certain groundwater hydrology and environmental problems.

Courses Suggested for the Master's Degree

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering 200A. Mathematical Methods in Mechanical Engineering*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 200B. Mathematical Methods in Mechanical Engineering*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineering 200C. Mathematical Methods in Mechanical Engineering*</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pet.E. 270A. Advanced Reservoir Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pet.E. 270B. Advanced Reservoir Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pet.E. 270C. Advanced Reservoir Engineering</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Pet.E. 274. Introduction to Research Methods 3
Pet.E. 275A. Fundamentals of Well Test Analysis 3
Pet.E. 275B. Advanced Well Test Analysis 3
Electives† 12
Total 45

* The series of courses consisting of Mathematics.
  131. Partial Differential Equations I, Mathematics
  110. Statistical Methods in Engineering may be used to substitute for the series M.D. 200A,B,C.

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 broaden 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. The student must have a B average in courses given by the School of Earth Sciences. The student 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. Ordinarily the student is expected 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. 106. Introduction to Theory of Functions of a Complex Variable 3
Math. 113. Linear Algebra and Matrix Theory 3
Math. 114. Linear Algebra and Matrix Theory 3
Math. 115. Fundamental Concepts of Analysis 3

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. 210-211. Accounting I and II 4 ea.
Bus. 220. Business Finance 4
Bus. 240. Marketing Management 4
Bus. 303. Economic Forecasting 4
Bus. 321. Investment Management 4
Bus. 366. Information Systems Survey 4
Ind. Eng. 229. Engineering Economy 3
Ind. Eng. 230. Capital Budgeting 3
Oper. Res. 252. Operations Research 4

Additional units needed to make up the required 90 may be electives selected with the consent of the student's advisor. The student must secure at least "Pass" grades in Graduate School of Business courses. In all other courses the student must maintain a B average. The student 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.
Math. 131. Partial Differential Equations 3
Math. 132. Partial Differential Equations 3
Mechanical Engineering 200A, B, and C.
  Mathematical Methods in Mechanical Engineering 3 ea.
Stat. 110. Statistical Methods in Engineering and Physical Sciences 4
Comp. Sci. 106. Introduction to Computing 3
Comp. Sci. 135. Numerical Methods 3
Comp. Sci. 137A and B. Numerical Analysis 3
Comp. Sci. 234. Numerical Methods of Optimization 3
Aero. & Astro. 192. Vector Analysis and Cartesian Tensors 3
Aero. & Astro. 291A and B. Linear Transforms and Their Applications to Engineering Problems I and II 3 ea.

Science
App. Earth Sci. 225. Surfaces and Interfaces 3
Geol. 230. Hydrology 5
Geol. 231. Groundwater Resources 3
Geol. 278. Organic Geochemistry and the Geophysical Environment of Life 2
Geophys. 190. General Geophysics 4

Engineering
Chem. E. 140. Fluid Dynamics 3
Civil Engr. 201. Environmental Field Mechanics I, II 4 ea.
Engr. 296A and B. Engineering Teaching 1 ea.
Engr. 299. Fluid Mechanics 1
Ind. Engr. 229. Engineering Economy 3
Mech. E. 250A. Heat Transfer 3

General
Appl. Earth Sci. 278. Minerals, Politics, and Economics 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. Experience as a teaching assistant (quarter-time for at least one academic quarter) is required for the Ph. D. degree. During the second and third years, the student also acquires 25 units of research. The student begins the research work by making a literature survey and by formalizing research objectives. The fourth year the student spends full time completing research and writing the dissertation, 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.

The student’s record must indicate outstanding scholarship. The student 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. The student 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. Requirements of the minor department are optional. 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.

COURSES
All courses (DR:X) except 103.

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; oil shales; tar sands; coal; and solar energy. (DR:T) 3 units, Aut, Spr (Horn) MWF 11

150. Introductory Well Log Analysis—An interdisciplinary course for all earth scientists and engineers. The main objective is development of a practical understanding of the interpretation of well logs by use of real field examples. Lectures, problems. Methods for evaluating commercial significance of rock formations penetrated in exploratory drilling. Drilling muds, core analysis, mud logging, electric logging. 4 units, Aut (Sanyal) by arrangement
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 (Staff) T 9, Th 9 and 10


3 units, Win (Staff) MWF 10


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

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

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

151E. Core Analysis Laboratory—Porosity, permeability, capillary pressure, irreducible saturations imbibition rates, formation resistivity factor. Prerequisite: 151B (may be taken concurrently).

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

152A. Drilling Technology—A course designed to provide a comprehensive picture of modern drilling operations, practices, and equipment both onshore and offshore. Lectures, visual aids, field trips, problems.

3 units, Win (Horn) MWF 10

152B. Production Technology—Course designed to provide a survey of production operations, practices, and equipment. Lectures, demonstrations, field trips.

3 units, Spr (Horn) T 10 and 11, Th 11


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 (Standing) MWF 9


3 units, Aut (Ramey) MWF 10

173. Special Topics in Energy and Mineral Fluids—Lectures, problems. Any quarter (Staff) by arrangement

250. Advanced Formation Evaluation—Lectures, problems. Advanced logging systems, planning and computer aided interpretation. Proper combinations of wellbore logs with computer analysis of digitized data provided a more detailed inspection of formations. Prerequisites: 150 or consent of instructor.

3 units, Spr (Sanyal) by arrangement

267. Engineering Valuation and Appraisal of Oil and Gas Wells, Facilities, and Properties—Seminar, problems. Methods in appraising new well and remedial work from oil lands; estimation of productive capacity, reserves; operating costs, depletion and depreciation; value of future profits, tax returns, fair market value. Prerequisite: consent of instructor.

3 units, Win (Horn) F 11, S 10-12, or by arrangement

268. Seminar in Petroleum Engineering. Any quarter (Staff) by arrangement

269. Geothermal Engineering—Steam well deliverability measurement, forecasting, and steam reserves determination and forecasting. Vapor and liquid-dominated systems. Wellbore heat transmission, static and flowing pressures in wells, flow metering. Field problems and examples.

3 units, Win (Ramey) MWF 10


3 units, Aut (Cinco) MWF 9


3 units, Win (Cinco) MWF 9
270C. Advanced Reservoir Engineering—Continuation of 270B. Lectures and problems.  
3 units, Spr (Cinco) T 9; Th 9-11

270D. Simulation Reservoir—Lectures, seminar. Advanced group study of reservoir simulation. Applications of electronic computing machinery to reservoir problems. Prerequisite: 270B.  
3 units, Spr (Cinco) by arrangement

3 units, Spr (Ramey) MWF 10

Any quarter (Staff) by arrangement

3 units, Aut (Marsden) MWF 10

3 units, Win (Standing) M 2:15-5:05

3 units, Spr (Ramey) MWF by arrangement

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 (Dykstra) MWF 8

280B. Modern Fluid Injection—Continuation of 280A.  
3 units, Win (Staff) MWF 11

281. Applied Mathematics in Reservoir Engineering—Lectures, problems. Philosophy of solution of engineering problems, solution of partial differential equations, operational calculus, numerical integration, application of statistics to petroleum engineering. Prerequisites: Mechanical Engineering 200A or Mathematics 131, and consent of instructor.  
3 units, Spr (Staff) 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, Spr (Marsden) MWF 9

Any quarter (Marsden, Sanyal, Cinco, Miller, Ramey) by arrangement
SCHOOL OF EDUCATION


Dean: Arthur Coladarci

Associate Deans: Robert C. Calfee (Research and Development), Richard C. Still (Business Affairs)

Assistant Dean: Janet K. Weston

Assistant to Dean: Valerie Familant


Visiting Professor of Education, Psychiatry and Behavioral Sciences, Emeritus: Bruno Bettelheim

Associate Professors: Edmundo Fuenzalida, Michael W. Kirst, Miriam B. Lidster (by courtesy), Denis C. Phillips, Wesley K. Ruff, Helen W. Schrader (by courtesy), Pamela L. Strathairn (by courtesy), Decker F. Walker, Hans N. Weiler


Lecturers: Guy H. Browning, B. Roberto Cruz, Ronald B. Herring, Richard N. Jacks, Helen B. Krumoltz, Herman Ohme, Carolyn Walker (by courtesy)

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. Five degrees with specialization in education are granted by the University: Master of Arts, Master of Arts in Teaching, Educational Specialist, Doctor of Education, and Doctor of Philosophy. The Master of Arts in Teaching degree is offered jointly with several academic departments. Teaching and educational service credentials are issued by state departments of education upon certification by the School of Education that properly accredited work has been completed by the student. The School recommends to the California Commission for Teacher Preparation and Licensing that credentials be granted to those students completing one of the Commission-approved credential programs.

Students who qualify for a Preliminary Teaching Credential in California but who need a fifth year of study and a University recommendation for the clear teaching credential in California may satisfy this state requirement in one of the University's degree programs. The student requiring this University recommendation must contact the Credential Administrator in the School of Education during his/her first quarter of study.

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.)

Students who wish to be candidates for graduate 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. The Graduate Record Examination (Aptitude Test) is required for all graduate admissions.

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

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 advisors 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.

**MASTER OF ARTS**

The degree of Master of Arts in Education is offered in the following fields:
- Administration
- Cultural Pluralism
- Curriculum and Teacher Education (with specializations in the following areas):
  - Art Education
  - Bilingual/Bicultural Education
  - Design and Evaluation of Educational Programs (General Curriculum, Curriculum Evaluation, Elementary Education, Teacher Education)
  - Foreign Language Education (Second Language Learning)
  - Language Arts or English
  - Mathematics Education
  - Physical Education
  - Physical education with Specialization in Dance
  - Social Studies Education
  - Early Childhood Education
  - International Development Education
  - Mathematical Methods in Educational Research
  - Social Foundations of Education
  - Stanford Teacher Education Program*

Other program areas may be arranged for individual 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 practice, or have one year or more of teaching experience before entering the A.M. program.

More detailed information about the Master of Arts programs and requirements in specific areas may be obtained from the Master of Arts Administrator, 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 and the candidate must achieve at least a B average. Eighteen (18) 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. 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."

Only one quarter of nonmatriculated study may be counted toward the residency requirement for this degree.

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 conferral of the master’s degree should be obtained from the Master of Arts Administrator, School of Education, during registration in the first quarter of residence.

NOTE: Application for candidacy for the A.M. degree must be filed with the Master of Arts Administrator no later than the first two weeks of the quarter preceding the quarter in which degree conferral is expected.

* A program for candidates who are seeking initial preparation for the Single Subject Teaching Credential (Secondary) as well as for the master’s degree. See "Teaching Credential" for pertinent information.
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, Classics, Drama, English, French and Italian, German, History, Latin American Studies, Linguistics, Mathematics, Music, Political Science, Slavic Languages and Literature, and Sociology. 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 the student 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.

3. Three quarters of full-time residence (or equivalent) are a requirement for this degree. This may be satisfied in many cases by the candidate's attending a series of summer quarters when appropriate courses are available.

4. A minimum of 45 quarter units of graduate study is required. At least 36 of these units must be completed at Stanford. 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." Only one quarter of nonmatriculated study may be counted toward the residency requirement for this degree.

5. A minimum of 25 units of the courses taken for the M.A.T. must be in the teaching field of concentration.

6. At least 12 units of the M.A.T. 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 course 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 advisor 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.

NOTE: Application for candidacy for the M.A.T. degree must be filed with the Master of Arts Administrator no later than the first two weeks of the quarter preceding the quarter in which degree conferral is expected.

EDUCATION SPECIALIST DEGREE

The degree of Educational Specialist (Ed.S) is intended for experienced educators who already have completed a master's degree or its equivalent, and is offered only to students in the Instructional Leadership Program (ILP). This degree will provide an intermediate program of specialized training in education between the master's degree and the doctorate. The ILP is designed for educators who desire new skills and knowledge in general areas of leadership as well as subject matter specialties. Candidates

† The degree of Master of Arts in Teaching is 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 details.
for the Ed.S. degree in the Instructional Leadership Program should have a deep commitment to excellence in teaching and a continued interest in working in school settings. This degree program is not appropriate for individuals interested in becoming researchers, educational administrators, or university teachers.

The Ed.S. degree can be completed with a minimum of three quarters of coursework beyond the master's (or its equivalent) and an accumulation of 45 quarter units. While students may choose from a variety of course offerings, course work must be completed in a subject matter field in addition to course work in a leadership specialty area. There are five leadership specialty areas: 1. Alternatives in Education, 2. Classroom Management/School Discipline, 3. Curriculum Improvement, 4. Multicultural Education, and 5. Adolescent Development. The students in this program must also participate in at least two Professional Development Seminars in Educational Leadership and complete a field-based project in which they demonstrate leadership abilities.

The minimum residence requirement for the Ed.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."

Further information describing possible courses of study for the Instructional Leadership Program and the Educational Specialist Degree is available from the School of Education Admissions Office. Other inquiries should be directed to the Director of the Instructional Leadership Program.

NOTE: Application for candidacy for the Ed.S. Degree must be filed with the Master of Arts Administrator no later than the first two weeks of the quarter preceding the quarter in which degree conferral is expected.

**DOCTORAL DEGREES**

Students admitted to study 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 advisor, to emphasize certain aspects of the work, depending on particular interests and objectives. A faculty advisor from the student's program area will 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 the Doctor of Philosophy degrees are listed below.

**Administration and Policy Analysis**
- Curriculum and Teacher Education, with concentrations in any of the following fields:
  - Art
  - Bilingual (Bidialectal)/Bicultural Education
  - Design and Evaluation of Educational Programs (General Curriculum, Curriculum Evaluation, Elementary Education, Teacher Education)
  - Foreign Language Teaching and Second Language Learning
  - Language Arts or English
  - Mathematics
  - Music
  - Physical Education
  - Social Studies

**International Development Education**

**Mathematical Methods in Educational Research**

**Psychological Studies in Education**
- Child Development and Early Education
- Counseling Psychology
- Educational Psychology

**Social Sciences in Education**
- Anthropology of Education
- Economic Studies in Education
- History of Education
- Philosophy of Education
- Political Studies in Education
- Sociology of Education
- Social Sciences in Education (interdisciplinary)

**For each of the six general program areas there is a corresponding Area Committee.**

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

Application for formal admission to candidacy for the Ph.D. degree 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).

A timetable for the student's expected progress toward the Ed.D. or Ph.D. degree is available for each program area. In general the timetable is as follows:
First year: Selection of program area and advisor; development of program plan; course work; preliminary review (qualifying examination in some areas).
Second year: Continuation of course work; qualifying examination or review; admission to candidacy; dissertation planning and proposal; oral examination (proposal option).
Third year: Work on dissertation; completion of course work.
Fourth year: Completion of dissertation; oral examination (defense of dissertation).

**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. This degree is intended to meet the needs of those who wish a comprehensive professional understanding of and competence in dealing with educational problems met by administrators, supervisors, guidance workers, and curriculum specialists, or those who wish a scholarly preparation for teaching Education in colleges or universities.

**Residence**—Nine full quarters of graduate registration (or part-time registration equivalent thereto) beyond the baccalaureate degree are required for the doctorate. Evaluation of residence is based on tuition payments. Graduate registration at other institutions may be included in the fulfillment of this requirement. (See sections on Degrees and on Nonmatriculated Graduate Study in this bulletin.) Candidates for the degree will be expected during the course of work to register at Stanford for a minimum of two academic years (six full quarters or partial registration equivalent thereto). 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.

**Units**—A minimum of 108 quarter units must be completed. Unit requirements are evaluated on the basis of graduate units taken beyond the baccalaureate degree including relevant and acceptable work taken elsewhere up to a maximum of 36 quarter units.

Graduate course work taken seven or more years ago ordinarily will not be included in the doctoral program.

Organization of Program—The student will organize a program in conference with an advisor relevant to the selected field of concentration. This advisor will also make recommendations to the Area Committee concerning the student’s application for candidacy for the degree and will usually function as advisor on research for the dissertation. The advisor will be aided by other members of the faculty in the direction of the research program. All programs require the approval of the relevant School of Education Area Committee and the Committee for Academic Affairs.

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

**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 to direct research work in public school systems or in specialized institutions, or to conduct research as faculty members of colleges or universities.

**Residence**—Nine full quarters of graduate registration (or part-time registration equivalent thereto) beyond the baccalaureate degree are required for the doctorate. Evaluation of residence is based on tuition payments. Graduate registration at other institutions may be included in the fulfillment of this requirement. (See sections on Degrees and on Nonmatriculated Graduate Study in this bulletin.) Candidates for the degree will be expected during the course of work to register at Stanford for a minimum of two academic years (six full quarters or partial registration equivalent thereto). 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.

**Units**—A minimum of 108 quarter units must be completed. A minor field of study must be included if the candidate does not hold an acceptable Master’s degree outside the field of education. Unit requirements are evaluated on the basis of graduate units taken beyond the baccalaureate degree, including relevant and acceptable work taken elsewhere up to a maximum of 36 quarter units. Graduate course work taken seven or more years ago ordinarily will not 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 advisors relevant to the field of concentration. All programs require the approval of the candidate’s 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.

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

**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.

**Administrative Services Credential**

The Stanford School of Education is authorized to recommend students for the Services Credential with Specialization in Administrative Services. Students must be admitted to a degree program in the School of Education as well as to the Administrative Services Credential Program. Applications for the Credential Program are available from the Credential Administrator in the School of Education. Students must hold a valid California teaching credential based on a baccalaureate degree or a pupil personnel services credential; have three years of successful, full-time experience (either teaching or in the field of pupil personnel services); and complete Stanford’s approved program. Information about current advisors, programs of study, and application procedures should be obtained from the Credential Administrator in the School of Education 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.

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**Teaching Credentials**

The School of Education is authorized to recommend those students who complete the Stanford Teacher Education Program (STEP) for the California Single Subject Teaching Credential. Programs of study and order of procedure should be obtained from the Credential Administrator in the School of Education on registration day in the first quarter of residence.

Students who have completed their professional preparation (teacher training) elsewhere and who qualify for a Preliminary Teaching Credential (either Multiple Subject or Single Subject) will need a University recommendation for a clear credential upon completion of a fifth year of study. These students must contact the credential Administrator at the beginning of the first quarter of study at Stanford in order to plan the credential requirements to be completed concurrently with degree requirements. If this is not done, the student will be unable to receive Stanford’s recommendation for the credential.

**Stanford Teacher Education Program (Internship)**

The Stanford Teacher Education Program is a twelve-month, fifth-year program which leads to a California Single Subject Teaching Credential and the Master 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. Stanford offers training for the credential in the following areas only: English, Music, Physical Education, and Social Science.

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 Stanford 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

* Stanford does not offer training for a teaching credential at the elementary level (Multiple Subject Credential) at this time.*
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 Admissions 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 February 15. Applications for admission will be accepted after March 1 only as space is available.

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

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

   Every effort is made to secure placement for a candidate that reflects the student's preference and that provides an income. However, no guarantee is made that a salaried internship position can be provided.

5. Requirements: To complete the program for the clear Single Subject Teaching Credential, the candidate must satisfy the following requirements.
   a) A baccalaureate or higher degree from an approved institution (except in professional education).
   b) A teaching major consisting of a minimum of 36 quarter units (24 semester units) of upper division or graduate courses.
   c) The approved fifth year of study program of professional preparation which includes work in the academic area, in professional education, and in practical teaching experiences. A minimum of 45 units of graduate study is required, and at least 36 of these units must be completed at Stanford.
   d) Fulfillment of the U.S. Constitution requirement either by taking satisfactory course work or by passing an examination.
   e) The course in reading instruction.
   f) The course in health education.
   g) Subject matter competence verification in order to establish a teaching authorization in the student's area of admission. This must be done by one of the following two methods:
      1. Passage of a subject matter examination (currently one of the Single Subject examinations of the National Teachers Examinations) or,
      2. Completion of a Commission approved subject matter waiver program in a California institution.

   An intern teacher must be credentialed during the STEP training year. Therefore, the teaching authorization should be verified by one of the above methods before starting an internship in September.

   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, reading, and health and adolescence.

   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 and curriculum and instruction and 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

   All courses are DRX

   The School of Education is primarily a professional graduate school. However, upper division undergraduates are welcome in many courses. They 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 in numerical order and indexed by professional program areas.

   105. American Education and Public Policy—Drawing on history and political science, this course treats policy issues in education. Who influences schooling and how? How have American schools responded to human diversity? What consequences does schooling have? What are the prospects for reform in public education? Issues analyzed in lectures and in small group discussions. (SSE)

   3 units, Aut (Kirst, Tyack) WF 10-11
109. Cultural Pluralism: Classroom and Curricular Strategies—Multidisciplinary theoretical concepts used to examine diversity in American schools. Classroom problems, the role of the teacher, curriculum and research will be stressed. Promising instructional and curricular strategies will be tested and critiqued. Prerequisites: previous classroom teaching, advanced graduate standing. (CTE)

3 to 4 units, Aut (Reeves)
M 4:15-6:05, W 4:15-5:05

110. Introduction to Models in Social Science—(Same as Sociology 171 and Political Science 105.) Models of choice, exchange, adaptation, diffusion, and structure are used to predict and interpret human behavior. Emphasis is placed on the invention and application of models more than the testing of them. (APA, SSE)

4 units, Aut (March), given 1979-80

120. Organizational Decision Making—(Same as Sociology 163 and Political Science 107.) Decision making in complex organizations, such as universities, schools, hospitals, business firms and public bureaucracies. Information, power, resources, organizational structure, and the environment. Alternative models of choice and their implications. (SSE)

4 units, Win (March) Given 1979-80

130. Counseling and Therapy: An Introduction—(Same as Psychology 144.) Some major approaches to counseling and psychotherapy. Primary emphasis on social learning strategies as to key concepts, and clinical techniques. Study number of case studies on variety of personal, social, academic problems. Psychology 1 recommended as prerequisite. (PSE)

3 units, Spr (Staff) M 3:15-5:05
and by arrangement

136. Behavior Modification: Introduction—(Same as Psychology 139.) Rationale, concepts and issues in application in educational settings. Implementations of behavior change program. (PSE)

3 units, Win (J. Krumboltz) M 3:15-5:05
and by arrangement

139. Recent Developments in Pre-College Mathematics Education—Purpose and programs of mathematics in elementary and secondary schools; teaching materials and methods. Major emphasis will be on results of recent research. Open to upper division undergraduates. (CTE)

3 units, Win (Pence) by arrangement

142. Practical Inquiry in Education—An introduction to the spirit and basic techniques of systematic inquiry that is directed toward the resolution of practical educational problems, as contrasted with research on basic processes or foundations. Attention will be given to empirical/experimental approaches as well as to conceptual/discursive/interpretive ones. It is intended for first-year doctoral students in Curriculum and Teacher Education and other areas who have little or no background in research and to those whose background is narrowly specialized to one sort of research. A major aim of the course is to enable students to choose more wisely in subsequent quarters among the many courses in methods of inquiry available in the University. (CTE)

3 units, Spr (Walker) MW 11-12:30

154. Psychology of Reading—(Same as Psychology 143.) Survey of literature on the reading process, and acquisition of reading. Review of experiments on reading and reading instruction. (PSE)

3 units, Aut (Calfee) MWF 8

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. (CTE)

3 units, Spr (Nixon) MWF 10

161. Introduction to Teaching and Learning in Asia—Preparation for transcultural living and teaching experiences. Emphasis on knowledge of (1) Asian history and culture; (2) skills required for living in an Asian community; and (3) role played by American culture in shaping one's own attitudes, values and behavior. Prerequisite: consent of instructor. (IDE)

4 to 5 units, Spr (Herring) by arrangement

165. Teaching Music in the Elementary School—(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. (CTE)

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

167. Movement for Educators—(Same as Physical Education 167.) Exploring at an elementary educational level the concepts and relationships that exist between academic, art, music and dance (physical) areas of education. Broadening the teaching concept of self-education and promoting the enjoyment of self-awareness and self-expression through these areas. Having students become aware of the inter-relationships existing in all areas of learning. Prerequisite: Interest. Dance training not necessary. Class will be movement oriented and combined with writing, lectures and discussion. (CTE)

2 units, Win, Spr (Valenzuela) MWF 2:15
170. Sex and Education—This course examines sex as a critical variable in educational institutions. Dichotomizing educational experience by sex—as by class or race—reveals much more about the lives of individuals and the nature of the organizations they inhabit. This course takes a cross-disciplinary approach to issues such as distribution of power in schools, the relative payoff of schooling for women and men, the causes of differential behavior and treatment between the sexes in the school setting, and legal redress of inequities. The primary approaches will be sociological and historical, but professors of psychology, economics and law will also take part in the analysis. Small discussion groups will focus on issues raised in lectures, readings and films. (SSE)

4 units, Aut, Spr (H. Krumboltz) TTh 2:15-4:05

171. Women's Self-Directed Re-Education—In this cross-disciplinary seminar, students examine female role behaviors and apply research-based psychological techniques to strengthen or change self-selected socialized responses. Coping skills, utilizing self-management principles from cognitive and social learning are designed to help students learn effective and positive ways to exert more control over their own environments. No prerequisites. (SSE)

3 units, Spr (Cohen, Tyack) TTh 9-10 and one hour by arrangement

172. Status Attainment: Education and Work—(Same as Sociology 147.) Examines classical theories of social stratification as representing alternative conceptions of the roles of work and education in determining individual success. Reviews research on educational, occupational, and income-attainment processes in the U.S. tradition and considers additional research paradigms focused on class-formation. Issues addressed include: the role of educational institutions in challenging and reinforcing social inequities (including micro-level focus on differential class access and attainment and micro-level focus on the implications of testing practices and stratification in the schools), factors influencing individual mobility (considering ascribed statuses, achieved statuses, labor-market and work-organization factors), and the links between standards of success, cultural values, and educational/workplace policy. (SSE)

4 units, Aut, Spr (H. Krumboltz) TTh 2:15-4:05

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

3 units, Win (Ruff) TTh 8:30-10

180. Directed Reading in Education—For Master's degree students. (All Areas)

Any quarter (Staff) by arrangement

190. Directed Research in Education—For Master's degree students. (All Areas)

Any quarter (Staff) by arrangement

200. History of Education—(Same as History 103.) 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. (SSE)

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

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. (SSE)

3 units, Spr (Tyack) WF 10 and one hour by arrangement

203. Models of the Child in Contemporary Educational Thought—Introductory course 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. (SSE)

4 units, Aut (Phillips) MW 1:15-3:05

204A. Introduction to Philosophy of Education—Introductory course focusing on critical analysis of current generative themes in education. Students develop skills in conceptual analysis through small group discussion and the writing of several short philosophical papers. Readings include Plato, John Dewey, B. F. Skinner and Paulo Freire. (SSE)

4 units, Aut (Pacheco) MW 10-12

204B. Introduction to Philosophy of Education—Aims at introducing current approaches and techniques in philosophy of education, but material has been selected also for its general relevance to students of education; the introductory philosophical material will be presented in the context of issues concerning the curriculum. (SSE)

4 units, Win (Phillips) MW 9-11

205. Comparative Ideologies and Education—Introductory course focusing on philosophical analysis of the concept of ideology through comparative examination of relationship of ideology to schooling in several contexts: the U.S.A., Soviet Union, China, Cuba, and Tanzania. Related concepts such as indoctrination, socialization, and cultural transmission are also examined, with special attention paid to relationship between theory and practice. (SSE)

4 units, Win (Pacheco) MW 10-12
206A,B,C,D. Workshop on Problems of Development Education—This course is designed as a core workshop throughout the year for M.A. students in SIDEC and, with the consent of the instructor, other interested students. 206A required for all first year IDE students. (IDE)

206A,B. 3-5 units, Aut, Win (Weiler, Fuenzalida, Vettoso) M 12-2 and by arrangement
206C. 3-5 units, Spr (Weiler, Fuenzalida) M 12-2 and by arrangement
206D. 3 units, Sum (IDE Staff) M 12-2 and by arrangement

208. Personality and Social Structure—(Same as Sociology 103.) An interdisciplinary approach to the interrelations of personality and social structure: how the personal qualities of individuals influence social systems and institutions, and how the social order of a group or society shapes the personality of the individual. Among the issues examined: suicide; juvenile delinquency and mental illness; recruitment to and performance in occupational roles; the character of groups and nations; political behavior and political extremism; child socialization. Recommended prerequisite: background in personality theory or sociology. Enrollment limited to 65. (IDE, SSE)

3 to 5 units, Spr (Inkeles) TTh 9-11

210. Sociology of Education—(Students planning to take this course during the Autumn will meet with Education 310; see description under Education 310.) 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. (SSE)

4 units, Aut (Cohen) MW 9-11
Sum (Talbert) TTh 2:15-4:05

211. Sociology in Action: The Classroom and the School—Course designed for classroom teachers: examines teacher’s role as change agent; multicultural climate of school; principles of group work and classroom social structure; consequences of evaluation and reward structure for students and teachers; changing conditions for learning for the unsuccessful student. Course is team taught and is planned especially for teachers in training. (SSE)

3 units, Win (Reeves) M 4:15-5:05,
W 4:15-6:05

212. The Politics of Educational Planning: Comparative Perspectives—Focus of course: political assumptions and decisions in designing, implementing and evaluating plans for educational development and reform; case material from European and Third World countries reviewed in class and individually. (IDE, SSE)

3 units, Win (Weiler) M 4:15-6:05
and by arrangement

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. (CTE)

4 units, Aut (Esiner) MW 3:15-5:05

214. Evaluative Research Methods for Mass Media Projects in Developing Countries—(Same as Communications 253.) 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: Basic statistics, Communications 207 (or equivalents), Communications 256. (IDE)

3 to 5 units, Spr (Staff) TTh 10-12
and by arrangement

215. Psychological Foundations of Education—(Same as Psychology 145.) Introductory course in application of psychological principles to educational practices. Prerequisite: Psychology 1 or equivalent. (CTE, PSE)

4 units, Aut (Gage) MW 4:15-6:05
Sum (Gage) MW 1:15-3:05

216. Cultural Pluralism and American Educational Policy—Review of theories affecting educational policy with regard to cultural differences in language, heritage, values, motivation and cognition. (SSE)

3 units, Aut (Castaneda) MW 11:00-12:30

217S. Teaching a Global Perspective: Cross-Cultural Approaches—An overview of current research and practice in the field of global education in the American schools. Emphasis will be on cross-cultural approaches to teaching a global perspective. Research on how children acquire a world view will be surveyed. Models and promising practices will be critically reviewed—including curricula developed by the Stanford Program on International and Cross-Cultural Education. Recommended for STEP interns and others who are interested in classroom teaching and/or in-service education, as well as doctoral students planning research in this field. (CTE, IDE)

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

220A,B,C. The Social Sciences and Educational Analysis—Relationships among eco-
nomics, political science, and sociology and their applications to education in the United States. Required of students in the program in Administration and Policy Analysis and open to all students. Each quarter emphasizes the contribution of a particular social science, but also stresses the interrelationships among the social sciences.

220A. The Social Sciences and Educational Analysis: Introduction to the Economics of Education—Overview of the relationship between education and economic analysis—investment and consumption theories of education—financing of education. Topics include effects of education on economic growth and distribution of income—taxation for educational purposes. Students who lack training in elementary economics required to enroll in a parallel course in economic analysis for one additional unit of credit. (APA, SSE)
4 to 5 units, Aut (Levin) TTh 1:15-3:05 and by arrangement

220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education—Overview of relationships between political analysis and policy formulation in education; focus on alternative models of the political process, the nature of interest groups, political strategies, community power, the external environment of organizations and the implementations of policy. Applications to educational settings and problems emphasized. (APA, SSE)
4 units, Win (Kirst) MW 11-12:30; F 11-12:30 by arrangement

220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education—Effects of schools and schooling on individuals, the stratification system, and society. Education as socializing individuals and as legitimizing social institutions—social and individual factors affecting the expansion of schooling, individual educational attainment, organizational structure of schools. (APA, SSE)
4 units, Spr (Meyer) MWF 10-11 and by arrangement

221A,B,C. Administration and Organization of Educational Institutions in Context—Context within which educational institutions function, issues they face and how they are organized, governed and administered. Required for all programs in Administration and Policy Analysis; open to other students in Stanford University.

221A. Administration and Organization of Educational Institutions in Context: Administration and Organization of Public and Private Schools—Focuses on the individual, group and institutional determinants of organizational behavior in educational settings. (APA, SSE)
4 units, Win (Talbert) MW 1:15-3:05

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. (APA, SSE)
4 units, Aut (Mayhew) MW 1:15-3:05

221C. Administration and Organization of Educational Institutions in Context: American Educational Institutions—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. (APA)
4 units, Spr (Hatton) MW 3:15-5:05

222A,B,C. Decision Analysis in Education—A three-quarter sequence in the application of quantitative reasoning and decision making in education.

222A. Decision Analysis in Education I—An introduction to the use of statistics to summarize data and to decision making in the face of uncertainty. Topics include elementary probability theory, sampling methods, descriptive statistics, inferences about populations, the value of uncertain outcomes, statistical decision theory, risk, and utility. Assignments will involve actual data and cases, and students will use the computer where appropriate. Intended for educational administrators and policy analysts who must consider and act upon limited or uncertain information. (APA, SSE)
5 units, Aut (Jackson) MWF 9-10:30

222B. Decision Analysis in Education II—Considers problems of optimization and design and evaluation of decision experience. Marginal analysis, cost-benefit accounting, constrained maximization, mathematical modeling, program evaluation. Introduction to linear models for large-scale data analysis provided. Particular attention paid to sensitivity of implications to model assumptions. (APA, SSE)
4 units, Win (Levin) TTh 1:15-3:05

222C. Decision Analysis in Education III—Application of simple quantitative models to administrative problems through structured computer-based simulations of educational processes, procedures, and institutions. Introduces Markov models, queuing theory, and elementary difference equations. Participants will work briefly with existing simulation models and then spend much of the quarter con-
structing, programming, and testing small-scale computer simulators. No previous computer experience is necessary, but Education 222A and 222B or their equivalents are prerequisite: (APA, SSE)

4 Units, Spr (Jackson) T 9-10; Th 9-11 and by arrangement

224. Current Issues in Pre-School, Elementary, Secondary, or Community College Educational Institutions—Examination of selected contemporary concerns for organization and administration of pre-school, elementary, secondary or community college institutions. 1978–79 foci include study of school district merger and cooperative plans and impact of pre-school and early childhood programs on public school organization. (APA)

4 units, Win (Hatton) Th 4:15-6:05

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. Attention to issues of community control, citizen participation in educational decision making and alternative proposals for community schools or districts, and participation approaches. (APA)

4 units, Aut (Hatton) MW 3:15-5:05

232. Science and Research in Counseling Psychology—(Same as Psychology 253.) Examines assumptions of empirical-experimental research in applied human sciences. Critical analysis of relationship between theoretical rationales, research questions, designs, data analyses and conclusions. Enrollment limited. (PSE)

3 units, Aut (Staff) M 4:14-6:05

and by arrangement

233. Intensive Experimental Research—(Same as Psychology 247.) Introduction to single (or few subjects) time series designs in education, psychology, and clinical medicine settings. Examine research design and analysis methods along with philosophy of science issues. Intended primarily for students interested in doing observational and experimental studies in applied settings. (PSE)

4 units, Win (Staff) T 2:15-4:05

and by arrangement

234. Individual Counseling Psychology Methods—(Same as Psychology 250.) Techniques for helping individual clients learn successful procedures for coping with problems such as shyness, depression, anxiety, obesity and aggression. (PSE)

3 units, Aut (J. Krumboltz) T 2:15-4:05

and by arrangement

238A,B,C. Counseling Psychology: Supervised Applications—Supervised counseling in interventions at Stanford Institute for Stanford Counseling Institute and in selected field settings. Sequence must begin in Autumn quarter. For doctoral students in Counseling. Consent of instructor. (PSE)

4 units, Aut, Win, Spr (J. Krumboltz, Staff) M 9-10:50 and by arrangement

239A,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. (CTE)

2 to 4 units, Aut, Win, Spring (Browning and C. Walker)

by arrangement

240. Health and Adolescence—An orientation to the American Secondary School. (CTE)

2 units, Sum (Duke) TTh 1:15-2:05

241X. Issues in Teacher Professional Development—Covers the development of in-service education, teacher unions and associations, and the role of the teacher. Legal aspects of teaching, including teacher rights. Important issues in the professionalization of teaching, including feminization, accountability, and new staffing patterns. (CTE)

3 units, Spr (Duke) T 6:15-9 p.m.

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. (CTE)

3 units, Sum (Castañeda) WF 11:00-12:30


3 units, Sum (Duke) TTh 4:15-5:45

244. Issues in Early Childhood Education—(Same as Psychology 243.) Provides opportunities for graduate students to review critically and discuss issues relating to child development and educational settings and programs for young children. Topics vary from year to year. Focus on the application of present

*This course requirement may be waived at the discretion of the instructor.
knowledge base to early childhood education.
Prerequisite:
Consent of instructor. (PSE)
3 units, Win (Staff) Th 10-12
and by arrangement

246A. Secondary Teaching Practicum—Training and practice in specific skills in teaching. (CTE)
1 to 15 units, Sum (Staff) by arrangement

246B.C,D. Internship in Teaching and Student 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. (CTE)
246B. 1 to 15 units, Aut (Staff) by arrangement
246C. 1 to 15 units, Win (Staff) by arrangement
246D. 1 to 15 units, Spr (Staff) by arrangement

247. Affective Education: Research and Practice—Examination of models of evaluation, moral education, citizenship, and the relation of logical development to affect; competing models of affective education and methods of evaluation in the field. (CTE)
3 to 4 units, Spr (Noddings) TTh 4:15-6:05

249. Curriculum and Instruction in Higher Education—Examines the developmental needs of college students and appropriate curricular and instructional means to meet the needs. Considerable stress placed on social-psychological research relevant to curricular concerns. (APA, CTE)
3 units, Win (Mayhew) M 1:15-4:05

5 units, Aut, Spr (Staff) MTWThF 1:15
Sum (Staff) by arrangement

250A.B. Statistical Analysis in Educational Research I—This two-quarter sequence is designed for graduate students who expect to use statistical methods in their research. Foundations of statistical inference. Prerequisite: Education 250, or special permission of the instructor. (MME)
4 units, Win, Spr (Olkin) MWF 11-12:30

250C.D. Statistical Analysis in Educational Research II—Continuation of Education 250B: These two courses may be taken independently of each other. Prerequisites: 250B or equivalent and consent of instructor. For scheduling information see specific course descriptions for 250C and 250D.

250C. Statistical Analysis in Educational Research II—This course emphasizes multivariate analysis and applications. Topics include multivariate normal distribution, multiple regression, partial and multiple correlations: linear and non-linear models, advanced analysis of variance, analysis of co-variance. (MME)
4 units, Aut (Sitgreaves) MWF 11-12:30

250D. Statistical Analysis in Educational Research II: Experimental Design—This two-quarter sequence deals with the analysis of variance and design of experiments. Topics include factorial, blocked and fractional designs, linear contrasts, and repeated-measures designs; applications of BMD and SPSS computer packages will be covered. (MME)
2 units, Win, Spr (Calfee) MW 8
and by arrangement

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. (PSE)
3 units, Aut (Corno) MWF 9

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. (PSE)
3 to 4 units, Aut (Cronbach) MW 2:15-4:05

253. Early Education Programs—An overview of the historical and psychological bases for early education programs including the following topics: Montessori Schools, Head Start, British Infant Schools, Behavior Analysis, Piagetian Influences, Follow-Through, Infant Programs and Day Care. (PSE)
3 units, Aut (Staff) T 2:15-4:05
and by arrangement

254. Anthropological Research Methods with Implications for Education—(Same as Anthropology 192.) Seminar and practicum in anthropological approaches to educational process. Coverage includes ethnological and hologetic approaches, but emphasizes ethno-
graphic techniques such as collecting genealogies and life histories, doing semi-structured participant and non-participant observation, and interviewing key informants. Articulation between ethnographic and more structured approaches is examined. Role playing in simulated field situations attempts to develop empathy and sensitivity to feedback. Students are encouraged to collect and analyze their own field data. (IDE, SSE)

4 to 5 units, Win (Textor) Th 7-10 p.m.

and by arrangement

255. Human Abilities—(Same as Psychology 155.) The nature, development and measurement of intellectual abilities. Prerequisites: Psychology 1 and Education 250 or Psychology 60, or equivalent. (PSE)

3 units, Spr (Snow) MWF 10

257. Introduction to Curriculum Problems—This course presents an overview of the phenomena and problems associated with the curriculum in programs of mass general education, and introduces some of the major ideas and techniques that have been developed to address these problems and to manage and interpret these phenomena. Evening sessions will consist of real or simulated encounters with curricular problems and situations. The course is intended for masters and doctoral students from all areas of concentration. (CTE)

3 units, Win (Walker) MW 11:00-12:30

and by arrangement

262B. A. Curriculum and Instruction in English—Evaluation of conflicting views or 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 reading and various types of literature. (CTE)

2 units, Win (Staff) T 4:15-6:05

262A. 2 units, Sum (Staff) T 3:15-5:05

265B. C. Curriculum and Instruction in Music—Theory and practice of vocal and instrumental instruction. (CTE)

2 units, Aut (Kuhn) T 4:15-6:05

265C. 2 units, Win (Kuhn) T 4:15-6:05

266C. A. 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. (CTE)

2 units, Win (Staff) F 8-10

266A. 2 units, Sum (Staff) MTWTh 9

268B. A. 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. (CTE)

268B. 2 units, Win (Gross) T 4:15-6:05

268A. 2 units, Sum (Gross) TTh 3:15-5:05

269A, B. Professional Development Seminar in Instructional Leadership—Designed for students in the Instructional Leadership Program and other graduate students concerned with issues in professional development, in-service training, and school improvement. Covers research on new roles for teachers, teacher involvement in educational policy making, and strategies for improving teacher effectiveness. Oriented toward those who work in school settings. ILP students must complete a local leadership project. (CTE)

3-6 units, Win (Duke)

269A. 3-6 units, Win (Duke)

W 6:05-9:00 and by arrangement

269B. 3-6 units, Sum (Duke) TTh 8:30-10:00

and by arrangement

270. Alternative Schools and Educational Change in the United States—An examination of teacher preparation for elementary and secondary school problems with current practices, and possible new directions. (CTE)

3 units, Win (Duke)

alternate years, given 1979-80

272. Classroom Observation—Students observe classrooms containing substantial numbers of minority students. Attention focused on: (1) A variety of curricular materials; inter-ethnic reading, mathematics, and English-language arts materials; (2) Teaching strategies for certain cultural and ethnic groups; (3) Exemplary classroom programs; (4) Classroom dynamics of ethnicity, and culture. Limited to Secondary Interns. (CTE)

1 unit, Aut, Win, Spring (Noddings)

by arrangement

273. Education as a Social Science: Problems and Perspectives—The focus of the course will be the examination of educational issues from the perspective of various social science methodologies, with specific attention to the limitations and difficulties inherent in each approach. This introductory course is intended primarily for new students enrolled in the Social Science Area of the School of Education. (SSE)

2 units, Aut (Phillips) T 7-9 p.m.

is designed to be appropriate to both foreign and American students and may be taken for only one quarter or as a three-quarter sequence. Interdisciplinary: faculty from Engineering, Political Science, Economics, Education, Anthropology; encourages convergence of engineering and natural sciences with the social and behavioral sciences in the study of development processes and the ethics implicit in development choices. By making underlying values explicit development options can be tested for appropriateness. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures are analyzed in terms of appropriateness to development in both less developed and industrialized societies. Present systems and planning processes will be examined in terms of their present day inequities as well as their consequences for future generations. Autumn: Major world trends—population, food, energy, technology, life-styles. Development examined in terms of relative satisfaction of human needs. Lectures, discussions, work-groups. Winter: Alternative development strategies—country case studies. Lectures, discussions, work-groups. Spring: The individual and social change; the engineer, political scientist, education, etc., as designer of alternatives and as policy and decision-maker. Work-groups only. 2 unit: pass/no credit. 3-5 units: pass/no credit or grade, small discussion groups and workshops, limited enrollment. (IDE)

274A, B, C. 2-5 units, Aut, Win, Spr (Cooper, Fagen, Lusignan, McWhorter, Siegel, Textor, Weiler) M 7:30-9:30 p.m. and by arrangement

276S. Education in the People's Republic of China—This course will investigate the problems of educational reform and planning in a post-revolutionary socialist society. The course will probe the problems of introducing an educational system congruent with the development of "socialist man." While the course will thus focus on the post-1949 transformation of the educational system, education in pre-revolutionary China will be introduced for comparative purposes. In this context, the relationship between education and social, economic and political structures will be raised. Open to undergraduates. No prerequisites. (IDE)

4 units, Win (Grossman) TTh 4:15-6:05

282. Linguistics and the Teaching of English as a Foreign/Second Language—(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. (CTE)

3 units, Aut (F. Politzer) MW 4:15-5:30

283S. Science and Mathematics in the Elementary School—This course is intended for those who may do research using science or mathematics as a subject matter vehicle in elementary schools. Curriculum frameworks: formal, intuitive, and hierarchical; instructional modes: CAI, continuous progress, individualized instruction; teacher responsibility and requisite training for various programs; political and social aspects of programs. (CTE)

4 units, Spr (Noddings) MW 1:15-3:05

285. Approaches to Evaluation—This course is designed to introduce different conceptual approaches to planning evaluations including: evaluation as research, the decision-theoretic approach, cost-effectiveness and cost-benefit analysis, educational connoisseurship, and the adversary model. The strengths, limitations and applications of each approach will be explored. This will include a discussion of field problems and the relation between evaluation and social policy. Course material will be illustrated with examples from evaluation of educational programs. (PSE)

3 units, Spr (Ambron) T 2:15-4:05

and by arrangement

286S. Instructional Innovation and the Problem of Change: A Sociological Analysis—Focus is on innovation in instructional practice and social change. The course examines the unanticipated consequences of the social organization of the school and social relations in the classroom as contexts for learning. Particular attention is given to ways students and teachers work together to produce school failure despite their best intentions to the contrary. The sociological task is to examine the intellectual assumptions underlying particular theories that prevail in the field and which support particular patterns of innovation. Concept: instructional innovation; school failure; organizational inertia; and relationships between research and practice. (SSE)

3 units, Spr (Reeves)

M 4:15-6:05; W 4:15-5:05

287. Cultural Approaches to Alternative Futures—(Same as Anthropology 269.) Seminar exploring alternative middle-range futures from an anthropological perspective. Stress is laid upon developing ability to read the futures literature critically, and upon developing skills in
forecasting, scenario-building, and ethnographic interviewing. In the context of global ecological and social imperatives, particular cultures and subcultures are examined in terms of their adaptive capacity or lack thereof. Relevant educational and other policy implications are addressed. (IDE)

5 units, Win (Textor) M 2:15-5:05

291. Methods of Teaching German—(Same as German Studies 302.) (CTE)
2 units, Spr (Lohnes) MWF 11

293. Methods of Teaching French—(Same as French 289.) Analysis and discussion of classroom practices and related pedagogical material in the context of the rationalist direct method of teaching French language. (CTE)
4 units, Aut (Hester) W 10-11 and by arrangement

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. (CTE)
3 units, Spr (Metcalfe) MWF 1:15-2:05

297. 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 teaching credential candidates.) (CTE)
5 units, Sum (Staff) MW 4:15-6:05 and by arrangement

301. Colloquium on the Historiography of American Education—(Same as History 301.) Analysis of the literature of American education 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. (SSE)
4 to 5 units, Aut (Tyack) Th 10-12 and two hours by arrangement

302. Colloquium on the History of American Urban Education—(Same as History 302.) 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. (SSE)
4 to 5 units, Sum (Tyack) TTh 9-11

303A. Philosophical Analysis: Cultural Pluralism—Critical analysis of concept of cultural pluralism and related notions such as biculturalism, marginality, assimilation, acculturation, and cultural domination and dependence, with special reference to education and schooling. Theoretical models of society that purport to explain pluralism are also critically examined. (SSE)
4 units, Spr (Pacheco) MW 10-12 and one hour by arrangement

304B. Aspects of Explanation in Social Science—(Same as Philosophy 216B.) 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, organicism, structuralism, and Gestalt versus atomistic psychology). (SSE)
4 units, Win (Phillips) MW 1:15-3:05

305. Philosophy and Empirical Research—Problems of relevance to the researcher will be explored from the point of view of philosophers of science such as Karl Popper and Carl Hempel, but much of the material dealt with will have been written by researchers themselves. (SSE)
4 units, Spr (Phillips) MW 1:15-3:05

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. (IDE, SSE)
5 units, Aut (Velloso) TTh 2:15-4:05 and by arrangement

306B. Education and Political Development—(Same as Political Science 221.) Introduction to analysis of relations between educational and political systems from a comparative perspective. Special emphases include: political socialization, international elements in educational development, politics of educational innovation and evaluation. Course consists of lectures, discussion sections and individual projects. (IDE, SSE)
5 units, Win (Weiler) TTh 2:15-4:05 and by arrangement

306C. Education and Sociocultural Change—(Same as Anthropology 238.) Examines the role of education in modernization, within a
context of interdependency and ecology, from a cultural and social-structural perspective. Relies on theories and models of change and on case studies from modernizing areas. Examines ethnocentric and ethical implications of “development.” Experiential techniques complement a lecture-and-discussion format. (IDE, SSE)

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

310. Sociology of Education—(Same as Sociology 241.) For doctoral and master’s students. Provides acquaintance with selected sociological concepts, theories, and their application to applied problems in sociology of education. Emphasis on learning suitable conceptualization and methodology of applied research. Strong cross-cultural emphasis. (SSE)

4 to 6 units, Aut (Cohen) MW 9-11 and by arrangement

311. Socialization and Social Institutions—(Same as Psychology 245.) Students in this course will examine the role of the family and the school as socializing institutions. Particular attention will be given to the influence of family structure and environment upon educational achievement and to social class and cultural variation in family interaction. (PSE)

3 units, Win (Hess) T 9-10, Th 9-11

312A. The Low Status Student: Race and Social Class—(Same as Sociology 242A.) Sociological treatment of contemporary problems in education. Covers relevant sociological theory and research literature from stratification, socialization and race relations. Relationship of research to policy formation stressed. Prerequisite: Education 310 or equivalent. (SSE)

4 units, Win (Cohen) MW 2:15-4:05

312B. Interaction Processes in Education—(Same as Sociology 242B.) Educational applications of sociological/social psychological theory and research in small group settings. Topics include social processes of influence, role differentiation and evaluation. Methods in interaction study and some field work included. Prerequisite: Education 310 or equivalent. (SSE)

4 units, Spr (Cohen), given 1979-80

313A,B. Economics of Education—Major attention devoted to the “production,” distribution, and financing of education; contribution of education to economic growth; education and the distribution of income; role of educational characteristics in labor markets. Prerequisites: economic theory and quantitative methods and consent of instructor. (SSE)

3 units, Win, Spr (Carnoy, Levin) Given 1979-80

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. (CTE)

3 to 4 units, Aut (Gross) TTh 1:15-3:05

315. Cultural Transmission—(Same as Anthropology 286.) 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. (SSE)

5 units, Win (G. Spindler, L. Spindler) T 7:00-10:00 and by arrangement


3 units, Spr (Calfee) TTh 4:15-5:30

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

4 units, Win (Gage) MW 4:15-6:05

321. Organization, Administration, and Governance of Pre-School, Elementary, Secondary or Community College Institutions at the District and Building Levels—Systematic study of administrative process focusing on problems of administrative activities. Administration treated as synonymous with management but larger than subject matter of organizational behavior. Administration viewed from vantage points of the school chief executive at both district and building levels. (APA)

4 units, Win (Hatton) MW 3:15-5:05

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 of coalitions. (APA)

3 units, Win (Kirst) MW 3:15-5:05; F 3:15-5:05 by arrangement

323C. Education and Public Policy: The Governance and Reform of Education—Political behavior of key actors at the state and local
levels, including the overall political setting. Stresses impact of teacher organizations and research approaches. (APA)

3 units, Spr (Kirst) MF 11:00-12:30

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. (APA)

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

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. (APA)

4 units, Win (Levin) TTh 3:15-5:05

327. Research Practicum: Social Sciences in Education—(Same as Sociology 286.) Seminar designed to assist students in developing their dissertation proposals. Intended for doctoral students who have identified a dissertation problem area and are prepared to begin work on a proposal draft. Issues relevant to stages of research design are addressed: conceptualizing a research problem and developing hypotheses, choosing a research strategy, identifying and selecting cases, measuring variables and producing data, and strategies for analyzing the data. Course structure facilitates the decision-making process and the writing of the proposal and provides feedback to individuals at each stage of the proposal’s development. (SSE)

4 units, Win (Talbert) Th 1:15-4:05

331. Financing Higher Education—Addresses the financing of higher education from the perspectives of government, students, higher educational institutions and the broader society. Components of the course include the development of conceptual frameworks for financing higher education, descriptions and analyses of current support patterns and consequences, and evaluations of alternative proposals for change. Prerequisite: Education 220A or equivalent. (APA)

4 units, Spr (Jackson, Levin)
TTh 3:15-5:05

333. Leadership in Organizations—(Same as Sociology 162 and Political Science 108.) 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. (APA)

4 units, Win (March) TTh 8-10

335X. Instructional Theory and Research—The course is intended for graduate students in education seeking a detailed overview of the body of literature known as instructional theory and research. This literature has as a focus the study and design of systematic instructional materials, which include psychological principles of learning in the presentation of generic and curriculum-specific lesson content. Instructional theory involves also the study of adaptive instruction; that is, methods for adapting students to various modes of instruction. Particular attention will be paid to implications for classroom instruction, teacher training, and curriculum development. (CTE)

4 units, Sum (Corno) MW 10:00-12:00

338A,B,C. Internship in Counseling Psychology—Intensive supervised field experience in local schools or social agencies. For doctoral students in Counseling. (PSE)

338A. 1-6 units, Aut (J. Krumboltz, Staff) by arrangement

338B. 1-6 units, Win (J. Krumboltz) by arrangement

338C. 1-6 units, Spr (J. Krumboltz, Staff) by arrangement

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. (CTE)

4 units, Aut (Eisner) TTh 3:15-5:05

342A,B. Curriculum Construction—A practicum in 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: Education 340, consent of Instructor. (CTE)

342A, 4 units, Win (Walker) T 7-10 p.m.
and one hour by arrangement

342B, 3 units, Spr (Walker) T 7-10 p.m.

343X. Motivational Processes in Education—The course is intended primarily for psychological studies students, interested in problems of motivation and perception in achievement-related situations. Course content includes the study of traditional theories of motivation and related research, an in-depth examination of re-
cent reconceptualizations of traditional theories of motivation in information processing terms, motivational development in children, including home and school influences; and educational outcomes. Particular attention is given to implications for classroom instruction, teacher training, and curriculum development. (PSE)

3 units, Win (Corno) MW 3:15-5:05

344. Alternative Models of Elementary Curriculum—General model of elementary education and their associated curriculum models: Summerhill; "back to basics"; open education/inquiry; behavior modification; "little red schoolhouse." Examination of philosophical and psychological bases of particular curricula, e.g., Taba, SAPA, DISTAR. (CTE)
4 units, Win (Noddings) MW 1:15-3:05

4 units, Spr (Duke) TTh 12-2

348. Educational Connoisseurship and Educational Criticism—This course introduces students to literature dealing with forms of educational evaluation employing artistic and qualitative rather than scientific and quantitative procedures. It provides students with opportunities to develop high levels of educational connoisseurship. It fosters the development of writing skills in a critical mode. It is expected that students will write, present, and compare educational criticism. (CTE)
4 units, Spr (Eisner) M 9-11

349. Professional Education of Teachers—The course is intended to provide for students of teacher education and teaching (a) an historical overview of American teacher education from 1960 to the present, which lead to (b) a systematic framework for teacher training (particularly in-service) based on an adaptive conception of the teaching-learning process, and (c) exemplary training content material for use within the framework. Developed at the Center for Educational Research at Stanford, the "Systematic Teacher Training Model" represents a set of recommendations for research and practice. Students will learn the theoretical and research bases of the model, experiment with various content material at each stage, and apply the model to specific training needs in actual or hypothetical training situations. (CTE)
3 units, Win (Corno) MW 10:00-11:30

350A,B. Psychological Studies in Education—Introduction to psychological studies in education. Required of first-year doctoral students in Psychological Studies. Others by consent of instructor. (PSE)
2 units, Aut (Snow) TTh 4:15-6:05
Win (Calfee) TTh 4:15-6:05

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. (PSE)
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. (PSE)
3 to 4 units, Win (Cronbach) MWF 10:00-11:30

356. Seminar in Physical Education Research—Critique of selected recent literature and research. (CTE)
3 units, Win (Nixon) M 8-10; F 8-9

357. Seminar in Physical Education Curriculum—Research in physical education curriculum and instruction. (CTE)
3 to 4 units, Spr (Nixon) M 8-10; F 8-9

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. (CTE)
3 units, Win (Nixon) W 8-10; F 9-10

360X. Assessment and Measurement of Language Competencies—Problems in evaluating growth in learning English. Testing procedures, approaches to measuring oral language proficiency, writing abilities, communicative competence, and social uses of language. Focus also on assessment issues affecting minority students, including second dialect (Black English) speakers and bilingual pupils. (CTE)
3 units, Win (Ramirez) T 2:15-4:05 and by arrangement
364. Collective Bargaining—Collective bargaining both as a national and state level policy issue in education. Topics include the development and current status of employee bargaining groups in education: 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. (APA)

4 units, Win (Fuenzalida) TTh 10-12

365. Seminar: Planning Policy-Oriented Research—A working seminar for doctoral students who plan to carry out policy studies, emphasizing the careful translation of policy concerns into researchable questions. Topics include the use of existing literature and of peer reviews to guide research design, the choice of research procedures, the susceptibility of designs and procedures to overt and inadvertent biases, and the ethical and substantive criteria which should guide policy research. The seminar will emphasize and provide exercise in clear, cogent writing and persuasive argument. Students will prepare, exchange, criticize, defend, and revise research proposals, which will in turn underlie much of the substantive discussion. Intended for students approaching the dissertation. First-year students must secure the instructor’s consent to enroll. (APA)

3 units, Win (Jackson) T 4:15-6:05 and by arrangement

372. Linguistic Analysis of the Teaching Process—Study of linguistic phenomena in the classroom; teachers’ use of language; variation of pupils’ language behavior; analysis of linguistic factors influencing pupils’ performance. Systems for analyzing classroom discourse will be examined. Consent of instructor. (CTE)

4 units, Spr (Ramirez) TTh 2:15-4:05

373X. Higher Education Institutions in Developing Countries I—This course analyzes the extent to which present higher education institutions in developing countries contribute to self-centered development or to socio-cultural incorporation of these countries into the world economic system, at a general-theoretical level and with emphasis on familiarization with current literature. (IDE)

4-5 units, Win (Fuenzalida) by arrangement

374X. Higher Education Institutions in Developing Countries II—Content same as in 373X, but with a discussion of country case studies on the basis of research conducted by the instructor. 373X is not a prerequisite for 374X, even though it is desirable to take the two courses in sequence. (IDE)

4-5 units, Spr (Fuenzalida) by arrangement

378X. Sociology of Development and Education—This course offers a systematic comparison between modernization and dependence approaches to development, emphasizing the different treatment education receives in each of them, and the consequent different approach toward educational reforms in developing countries. (IDE, SSE)

4-5 units, Aut (Fuenzalida) by arrangement

380. Curriculum Development in the Visual Arts—This course is 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. (CTE)

4 units, Spr (Eisner) W 7-10 p.m.

381. Practicum in Cultural Pluralism—Includes lectures, visits to schools and organizations with multicultural programs and development of a project designed and implemented by the student. (SSE)

3 units, Aut, Win, Sum (Castañeda) Th 7-10 p.m.

382. Current Practices in Bilingual-Bicultural Education—An examination of current teaching methodologies for elementary and secondary bilingual-bicultural education. Special emphasis on testing, evaluation and curriculum. Projects involving practical issues will be described and discussed by professional educators of the Bay Area Bilingual Education League. (CTE)

2 units, Win (Cruz) Th 12-2

383. Recent Developments in Foreign Language Education—Second Language Teaching in the context of Bilingual Education and Cultural Pluralism. Concerns with student variables and problems of individualization of instruction. Description and evaluation of linguistic and cultural objectives. (CTE)

4 units, Spr (R. Politzer) MW 4:15-6:05

385. The Role of Non-Standard Dialects in Education—Differences between standard and non-standard dialects with special reference to social dialects and Black English. Instruction in a second dialect. Non-standard dialects and literacy. Prerequisite: an introductory course in linguistics and/or a course in Methodology of Teaching Language. (CTE)

4 units, Win (R. Politzer) TTh 4:15-6:05

386. Linguistic Theories of Language Acquisition and Language Teaching—Theories of language acquisition, psycholinguistics, contrastive analysis and error analysis and their relation to the teaching of a second language. Prerequisite: at least one graduate course in linguistics and/or psycholinguistics (CTE)

4 units, Win (R. Politzer) MW 4:15-6:05
388. Foreign Language Education and Bilingual Education in the Elementary school—
Discussion of foreign language instruction and bilingual education in the elementary school. Problems of organization of bilingual curricula. Sociological and psychological variables affecting bilingual education. (CTE)
   4 units, Aut (R. Politzer) MW 1:15-3:05

393S. Cognitivist Influences on Curriculum Construction—An examination of cognitivism as a school of psychological thought, its major subschools and conflicts, and the influence of certain cognitive premises on curriculum builders. (CTE)
   4 units, Win (Noddings) MW 3:15-5:05

   2 to 4 units, Aut (Gross) given 1979-80

397. Elementary School Social Studies—
Analysis of theories, trends, issues of elementary school social studies curriculum. For experienced teachers, supervisors, administrators. (CTE)
   2 to 4 units, Aut (Gross) given 1979-80

398. Social Structure of World Society—(Same as Sociology 220.) This seminar pursues a sociological analysis of society on a worldwide basis, that is, all the people inhabiting the earth and the institutions through which their lives are organized, are treated as participants in one global social system. Competing models of the emerging world order will be reviewed and compared. Among the topics to be covered will be worldwide population dynamics, the nature of the world economy, communication of persons on a global scale, socio-economic stratification of the world population and education, science and technology as global systems. The seminar will utilize a mixed lecture-discussion format, and each student will be expected to write several brief research papers. Enrollment limited. (IDE)
   4-5 units, Spr (Inkeles) W 3:15-5:05

400. Seminar in History of Education—A seminar examining selected issues, topics, and sources in the history of education outside the United States. (SSE)
   3 units, Win (Gross), given 1979-80

404. Seminar in the Philosophy of Education—A topical seminar designed for doctoral students in philosophy of education; others admitted with consent of the instructor. (SSE)
   4 units, Win (Phillips) Given 1979-80

405. Philosophy and Social Theory—(Same as Philosophy 215.) Advanced seminar focusing on philosophy of social science, including examination of bases for social science in the philosophical tradition. Readings include works of Plato, Marx, Weber, and Durkheim, and recent writings on positivism by philosophers of the Frankford School. Prerequisite: consent of instructor required. (SSE)
   4 units, Win (Pacheco) T 7-10 p.m.
   and one hour by arrangement

408. Research Seminar on the Comparative Study of Politics of Education—(Same as Political Science 323.) Seminar oriented towards theoretical and methodological problems involved in studying various aspects of the politics of education; political socialization, interest group politics in education, politics of resource allocation, etc. Prior course work in appropriate fields of political science; facility in handling empirical data required. (IDE)
   5 units, Spr (Weiler) T 4:15-6:05
   and by arrangement

411A. Seminar in Child Development and Early Education: Research Instrumentation—This seminar is devoted to the critical examination of instruments most frequently used in early education research. Opportunity is provided for administering selected instruments and examining their usefulness from the standpoint of validity, reliability, and quality of data obtained. Consent of instructor required. (PSE)
   1 to 3 units, Aut (Hess) Th 2:15-4:05
   and by arrangement

411B. Seminar in Child Development and Early Education: Dissertation Proposals—
Dissertation research and proposals and other research activities of students in early education will be discussed. The design, problems and issues unique to research in early education will be of special interest. (PSE)
   1 to 3 units, Win (Hess) Th 2:15-4:05
   and by arrangement

411C. Seminar in Child Development and Early Education: Field Work and Implementation of Research Plans—Continuation of discussions of student research, with special attention to the problems of data gathering, field contacts, ethics of research and of research reporting, and effect of field conditions on quality of data. (PSE)
   1 to 3 units, Spr (Ambron, Hess)
   Th 2:15-4:05 and by arrangement

415. Seminar in Educational Psychology—Topical seminar for advanced students. Admission by consent of instructor. (PSE)
   2 units, Aut (Cronbach) M 10-12
415A. Seminar in Educational Psychology: Assessment of Young Children—This course is designed to give students an overview of major tests for young children. This includes examining selected instruments in detail to determine the basis of the test and how to interpret test results. Students will also gain experience testing young children. We will explore in detail issues in testing young children including establishing rapport, validity of procedures, and stability of scores. (PSE)

3 units, Spr (Ambron) F 10-12

and by arrangement

416. Seminar on Aptitude—Study of individual differences in learning, cognitive and motivational processes related to education. Limited to advanced doctoral students in educational research. Prerequisites: Education 250A, B, Education 255, or equivalent, and consent of instructor. (PSE)

3 units, Sum (Snow) TTh 1:15-3:05.

Given alternate years

417. Seminar in Observational Research Methods—This course is designed to give students an overview of the literature on observational measures, to examine examples of observational measures used in educational settings, to address conceptual and methodological problems in observational measures and to develop an observational measure. Permission of the instructor is required. (PSE)

3 units, Spr (Ambron), given 1979–80

422A,B,C. Internship in Educational Administration—A seminar especially designed for students in educational administration program holding field internships. Involves reading the theoretical discussions on administration; lectures by practicing administrators. (APA)

422A. 1 to 5 units, Aut, Win
(Mayhew, Ohme)

422B. 1 to 5 units, Spr (Staff)

by arrangement

424. Structure and Functioning of Institutions of Higher Education—Examination and critique of existing and emerging forms of administration, organization and governance of institutions of higher education—advanced seminar for second and third year students. Designed for administrative majors—appropriate for other students interested in understanding how collegiate institutions operate. (APA)

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

431. Doctoral Seminar in Counseling Psychology—Designed for all doctoral candidates in counseling psychology and related areas. Analysis of professional problems. May be repeated for credit. Prerequisite: consent of instructor. (PSE)

1 unit, Aut. Win, Spr (J. Krumboltz, Staff) T 7:30-9:30 p.m., biweekly

440. Seminar in Bilingual-Bicultural Education, Research, Fieldwork and Implementation—A seminar examining selected issues, topics and sources in bicultural forms of education. Prerequisite: Education 382. (CTE)

3 units, Spr (Cruz) Th 12-2

453. Doctoral Dissertation. (All Areas)

Any quarter (Staff) by arrangement

459. Seminar on Physical Education Issues — Selected issues and problems in physical education. (CTE)

3 to 4 units, Spr (Nixon) W 8-10; F 9-10

461. 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. Consent of instructor required. (CTE)

2 to 4 units, Win (Eisner) T 7-10

463. Seminar for Doctoral Students in the Design and Evaluation of Educational Programs—This seminar is intended for doctoral students in the Design and Evaluation of Educational Programs. The seminar will focus on the problem or theme of special interest to the staff responsible. (CTE)

2 to 4 units, Aut (Walker) T 4:15-6:05

465. Research Seminar in the Teaching and Learning of English—An examination of recent research studies in various areas of English (Language arts) Education—composition, language development, literature, and reading. Students will formulate researchable problems and develop appropriate designs for conducting the research. Consent of instructor required. (CTE)

3 units, Win (Ramirez) Th 2:15-4:05

and by arrangement

470. Practicum—For advanced graduate students. (All Areas)

By Arrangement

470E. Practicum in Evaluation—Topics of current interest in the area of educational evaluation will be discussed. Restricted to student members of the Evaluation Consortium. (All Areas)

0 to 4 units, Aut, Win, Spr (Staff) Th 10-12

and by arrangement

480. Directed Reading—For advanced graduate students. (All Areas)

By Arrangement

correlates of second language acquisition and bilingualism. (CTE)

4 units, Spr (R. Politizer) TTh 4:15-6:05

490. Directed Research—For advanced graduate students. (All Areas)
by arrangement

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

493B. Practicum in Consulting on Methodological Problems in Educational Research. (MME)
1 to 3 units, Aut, Win (Olkin, Sitgreaves) Th 11-1 and by arrangement
1 to 3 units, Spr (Olkin) Th 11-1
and by arrangement

Administration and Policy Analysis (APA)

Basic and advanced courses are offered in the administration and organization of pre-collegiate educational institutions and other educationally related organizations and bureaucracies. These courses will meet requirements for administration credentials in California.

110. Introduction to Models in Social Science (Same as Sociology 171 and Political Science 105.)

120. Organizational Decision Making (Same as Sociology 163 and Political Science 107.)

220A. The Social Sciences and Educational Analysis: Introduction to the Economics of Education
220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education
220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education

221A. Administration and Organization of Educational Institutions in Context: Administration and Organization of Public and Private Schools
221B. Administration and Organization of Educational Institutions in Context: Administration and Organization of Post-Secondary Institutions
221C. Administration and Organization of Educational Institutions in Context: American Educational Institutions

222A. Decision Analysis in Education I
222B. Decision Analysis in Education II
222C. Decision Analysis in Education III
224. Current Issues in Pre-School, Elementary, Secondary, or Community College Educational Institutions

227. Schools and Community

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

251. Organization, Administration, and Governance of Pre-School, Elementary, Secondary or Community College Institutions at the District and Building Levels

252A. Education and Public Policy: Federal Education Policy and Administration
252B. Education and Public Policy: The Governance and Reform of Education

255A. Planning in Educational Administration
256A. Topics in Financing Education

331. Financing Higher Education
333. Leadership in Organizations (Same as Sociology 162 and Political Science 102.)

496. Seminar in Social Studies Education—
A seminar in social studies education for advanced degree candidates. A comprehensive analysis of social studies education for the purpose of identifying researchable problems and appropriate designs. Attention also to the analysis of the social curricular, and instructional theories of the various contemporary schools of thought in the social studies. (CTE)
2 to 4 units, Aut (Gross) W 7-10
and one hour by arrangement

364. Collective Bargaining

366. Seminar: Planning Policy-Oriented Research

422A,B. Internship in Educational Administration
424. Structure and Functioning of Institutions of Higher Education
470E. Practicum in Evaluation (See Psychological Studies in Education.)

Curriculum and Teacher Education (CTE)

109. Cultural Pluralism: Classroom and Curricular Strategies

139. Recent Developments in Pre-College Mathematics Education

142. Practical Inquiry in Education

156. Foundations of Physical Education

165. Teaching Music in the Elementary School (Same as Music 282.)

167. Movement for Educators (Same as Physical Education 167.)

177. Physiology of Exercise

213. Foundations of Aesthetic Education

215. Psychological Foundations of Education (Same as Psychology 145.)

217S. Teaching a Global Perspective: Cross-Cultural Approaches

239A,B. Observation and Directed Teaching of Study Skills and Developmental Reading in College

240. Health and Adolescence

241X. Issues in Teacher Professional Development

242. Bicultural Processes in Education

243. Student Behavior and School Discipline: Problems, Perspectives and Proposals

246A. Secondary Teaching Practicum

246B,C,D. Internship in Teaching and Student Teaching

247. Affective Education: Research and Practice

249. Curriculum and Instruction in Higher Education

257. Introduction to Curriculum Problems

262B,A. Curriculum and Instruction in English

265B,C. Curriculum and Instruction in Music
215. Psychological Foundations of Education (Same as Psychology 145.)
232. Science and Research in Counseling Psychology (Same as Psychology 293.)
233. Intensive Experimental Research (Same as Psychology 247.)
234. Individual Counseling Psychology Methods (Same as Psychology 250.)
238A,B,C. Counseling Psychology: Supervised Applications
244. Issues in Early Childhood Education (Same as Psychology 243.)
251. Laboratory Methods in Educational Research (Same as Psychology 248.)
253. Early Education Programs
255. Human Abilities (Same as Psychology 155.)
255. Approaches to Evaluation
311. Socialization and Social Institutions (Same as Psychology 245.)
315. Cognitive Psychology of Education
317. Introduction to Research on Teaching
338A,B,C. Internship in Counseling Psychology
343X. Motivational Processes in Education
350A, B. Psychological Studies in Education
353. Problems in Measurement (Same as Psychology 249.)
354. Planning Educational Evaluations
408. Research Seminar on the Comparative Study of Politics of Education (Same as Political Science 323.)
411A. Seminar in Child Development and Early Education: Research Instrumentation
411B. Seminar in Child Development and Early Education: Dissertation Proposals
411C. Seminar in Child Development and Early Education: Field Work and Implementation of Research Plans
415. Seminar in Educational Psychology
415A. Seminar in Educational Psychology: Assessment of Young Children
416. Seminar on Aptitude
417. Seminar in Observational Research Methods
431. Doctoral Seminar in Counseling Psychology
470E. Practicum in Evaluation

Committee on Social Sciences in Education (SSE)

105. American Education and Public Policy
109. Cultural Pluralism: Classroom and Curricular Strategies
110. Introduction to Models in Social Science (Same as Sociology 171.)
120. Organizational Decision Making (Same as Sociology 163 and Political Science 107.)
170. Sex and Education
171. Women's Self-Directed Re-Education
172. Status Attainment: Education and Work (Same as Sociology 147.)
200. History of Education (Same as History 103.)
201. History of Education in the United States (Same as History 158.)
203. Models of the Child in Contemporary Educational Thought
204A. Introduction to Philosophy of Education
204B. Introduction to Philosophy of Education
205. Comparative Ideologies and Education
208. Personality and Social Structure (Same as Sociology 103.)
210. Sociology of Education (Same as Sociology 241.)
211. Sociology in Action: The Classroom and the School
212. The Politics of Educational Planning: Comparability
216. Cultural Pluralism and American Educational Policy
220A. The Social Sciences and Educational Analysis: Introduction to the Economics of Education
220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education
220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education
221A. Administration and Organization of Educational Institutions in Context: Administration and Organization of Public and Private Schools
221B. Administration and Organization of Educational Institutions in Context: Administration and Organization of Post-Secondary Institutions
221C. Administration and Organization of Educational Institutions in Context: American Educational Institutions
222A. Decision Analysis in Education I
222B. Decision Analysis in Education II
222C. Decision Analysis in Education III
254. Anthropological Research Methods with Implications for Education (Same as Anthropology 192.)
273. Education as a Social Science: Problems and Perspectives
286X. Instructional Innovation and the Problem of Change: A Sociological Analysis
301. Colloquium on the Historiography of American Education (Same as History 301.)
302. Colloquium on the History of American Urban Education (Same as History 302.)
303A. Philosophical Analysis: Cultural Pluralism
304B. Aspects of Explanation in Social Science (Same as Philosophy 216B.)
305. Philosophy and Empirical Research
306A. Education and Economic Development
306B. Education and Political Development (Same as Political Science 116.)
306C. Education and Sociocultural Change (Same as Anthropology 238.)
310. Sociology of Education (Same as Sociology 241.)
312A. The Low Status Student: Race and Social Class (Same as Sociology 242A)
312B. Interaction Processes in Education (Same as Sociology 242B.)
313A,B. Economics of Education
315. Cultural Transmission (Same as Anthropology 266.)
327. Research Practicum: Social Science in Education (Same as Sociology 286.)
378X. Sociology of Development and Education
381. Practicum in Cultural Pluralism
400. Seminar in History of Education
404. Seminar in the Philosophy of Education
405. Philosophy and Social Theory (Same as Philosophy 215.)
470E. Practicum in Evaluation (See Psychological Studies in Education.)

Special Courses, Independent Study, Directed Reading, Practica, Research, Dissertation

150. Directed Reading in Education—For Master’s degree students. Any Quarter (Staff) by arrangement
190. Directed Research in Education—Master’s degree students. Any Quarter (Staff) by arrangement
453. Doctoral Dissertation. Any quarter (Staff) by arrangement
470. Practicum—For advanced graduate students. Not for STEP students. By arrangement
450. 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: James L. Adams (Academic Affairs), John G. Linvill, L. Farrell McGhie, Robert L. Street (Research), Lauress L. Wise (Student Relations)

Assistant Deans: Kenneth S. Down, Madelyn M. Hunt, Edwin F. Laak

Consulting Professor of Engineering: Hans M. Mark, Chauncey Starr

The School of Engineering offers four-year undergraduate programs leading to the degree of Bachelor of Science; 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; dual degree programs with certain other colleges; and graduate curricula leading to the degrees of Master of Science, Engineer, and Doctor of Philosophy.

The School includes nine academic departments: Aeronautics and Astronautics, Chemical Engineering, Civil Engineering, Electrical Engineering, Engineering-Economic Systems, Industrial Engineering and Engineering Management, 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. Petroleum Engineering is offered through the School of Earth Sciences.

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 may declare a 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 plan to enter as freshmen intending to major in engineering should take mathematics in high school to as high a level as is offered. (See Mathematics Department (School of Humanities and Sciences) for information on advanced placement in mathematics.) 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 due 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 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 advisor. 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 in Society, Mathematics, Science, Engineering Breadth, Engineering Depth, Free Electives, and the requirement of “Functional Balance” (see part 8 of this section).

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.

Engineering students are subject to the University requirements outlined in the first pages of this bulletin. (The requirement in the area of mathematics, natural sciences, and technology will be satisfied automatically by the engineering program.) Students who qualify for advanced placement will receive credit toward fulfillment of the Engineering mathematics and science requirement.

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 of at least 3 units each are required by the University for graduation (see the first section of this bulletin for details).

Social Sciences

Three courses of at least 3 units each (chosen from those declared suitable) in at least two different departments 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 & Fine Arts and Social Sciences units be at least 23.

Technology in Society

Every engineer should have an appreciation of the role of technology in society in order to make the value judgments he or she 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 in this category is available from the office of the Dean of Engineering. See also the “Technology and Society Courses” section. (Note that not all Values, Technology, and Society courses satisfy this requirement.)

Mathematics and Science (45 units minimum with at least 21 units of each)

Engineering students need a solid foundation in the calculus of continuous functions, an introduction to discrete mathematics, and understanding of statistics or probability theory. The minimum preparation should normally include work to the level of Mathematics 43. Knowledge of ordinary differential equations and matrices is important in many areas of engineering, and students are encouraged to select additional courses in these topics. A list of courses appropriate for satisfying the Engineering mathematics requirement is available in the office of the Dean of Engineering.

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 beginning with Physics 51 normally is chosen by engineering students. These courses are aimed at giving the student contact with engineering during the first year. A list of courses appropriate for satisfying the Engineering science requirement is available in the office of the Dean of Engineering.

Engineering Breadth (30 units minimum)

Every undergraduate engineering program includes coursework selected from a variety of engineering disciplines. Accordingly, each student chooses a minimum of 30 units of courses from at least five of the eight categories listed below. Three of the categories selected should not be directly related to the student's engineering major. No more than 10 units in any one category can be counted toward satisfaction of the breadth requirement. On recommendation from his/her advisor, a student may request substitutions to this list by submitting a petition to the Special Programs Committee of the Engineering Undergraduate Council.
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. 3</td>
<td>Applied Mechanics: Statics</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 11</td>
<td>Applied Mechanics: Stress Analysis</td>
<td>4</td>
</tr>
<tr>
<td>Engr. 12</td>
<td>Applied Mechanics: Dynamics</td>
<td>4</td>
</tr>
<tr>
<td>Engr. 21</td>
<td>Mechanics of Fluids</td>
<td>4</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>
</tr>
<tr>
<td>Physics 110</td>
<td>Intermediate Mechanics</td>
<td>3</td>
</tr>
</tbody>
</table>

More Advanced Courses

Civil Engr. 107. Mechanics of Fluids
Civil Engr. 114. Mechanics of Materials
Mech. Engr. 131A. Thermosciences
Physics 111. Intermediate Mechanics

2. ELECTROMAGNETISM, ELECTRIC CIRCUITS, AND DEVICES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. 41</td>
<td>Circuits</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 42</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>
</tr>
</tbody>
</table>

More Advanced Courses

Elec. Engr. 101. Circuits I
Elec. Engr. 111. Electronics
Elec. Engr. 141. Electromagnetic Fundamentals
Physics 120. Intermediate Electricity and Magnetism

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>Chem. 135</td>
<td>Physical Chemical Principles</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 171</td>
<td>Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Mat. Sci. 181</td>
<td>Thermodynamics and Phase Equilibria</td>
<td>4</td>
</tr>
<tr>
<td>Physics 170</td>
<td>Thermodynamics, Kinetic Theory, and Statistical Mechanics</td>
<td>3</td>
</tr>
</tbody>
</table>

More Advanced Courses

Chem. Engr. 110. Equilibrium in Thermodynamic Systems
Mech. Engr. 131C. Thermosciences

4. MATERIALS SCIENCE AND PROPERTIES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. 50</td>
<td>Introductory Science of Materials</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 170</td>
<td>An Introduction to Polymeric Materials</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 51</td>
<td>Materials Technology for Structural Applications</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 52</td>
<td>Electronic Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>Mat. Sci. 180</td>
<td>Atomic Arrangements in Solids</td>
<td>4</td>
</tr>
</tbody>
</table>

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 and Engineering
Mat. Sci. 192. Biomaterials

5. LOGIC AND COMPUTER SYSTEMS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp. Sci. 106</td>
<td>Introduction to Computing</td>
<td>4</td>
</tr>
<tr>
<td>Phil. 57</td>
<td>Introduction to Logic</td>
<td>5</td>
</tr>
<tr>
<td>Phil. 160A</td>
<td>Symbolic Logic</td>
<td>3</td>
</tr>
</tbody>
</table>

More Advanced Courses

Comp. Sci. 103. Programming in Fortran
Comp. Sci. 104. Programming in Algol W
Comp. Sci. 107. Programming Methods
Comp. Sci. 111. Introduction to Computer Organization, Machine and Assembly Languages
Comp. Sci. 140A,B. Systems Programming
Comp. Sci. 156. 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. ANALYSIS AND CONTROL OF DYNAMIC SYSTEMS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. 104</td>
<td>Dynamic Response</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 105</td>
<td>Control System Analysis and Design</td>
<td>3</td>
</tr>
</tbody>
</table>

More Advanced Courses

Engr. 206. Control Systems Design and Simulation
Engr.-Econ. Sys. 201A,B Dynamic Systems

7. MASS AND ENERGY TRANSFER

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. Engr. 20</td>
<td>Introduction to Chemical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 120</td>
<td>Separations Processes</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 120L</td>
<td>Separations Processes 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>Mat. Sci. 182</td>
<td>Rate Processes in Materials</td>
<td>3</td>
</tr>
<tr>
<td>Mech. Engr. 131A</td>
<td>Thermosciences</td>
<td>5</td>
</tr>
</tbody>
</table>

More Advanced Courses

EE. 293. Energy Processes
Engr. 161. Engineering Economy
Indus. Engr. 108. Work Systems Design and Measurement
Mech. Engr. 102. Design Communication
Mech. Engr. 103. Manufacturing Technology
Oper. Res. 151. Introduction to Operations Research I 3
Oper. Res. 152. Introduction to Operations Research I 4
Oper. Res. 153. Introduction to Operations Research II 4

More Advanced Courses
Engr. 235A,B Engineering Systems Design 3-5, 3-5
Indus. Engr. 160. Analysis of Production Systems 3
Indus. Engr. 164. Production Engineering Problems 3
Indus. Engr. 208. Man-Made Systems 3
Mech Engr. 115A. Introduction to Product Design 3

Engineering Depth (36 units minimum)
The depth requirement is satisfied in one of three ways.

Departmental Majors. The student completes the sequence of courses recommended by one of the engineering departments (Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering and Engineering Management, Materials Science and Engineering, and Mechanical Engineering.) Interdisciplinary Majors (General Engineering). The student completes the sequence of courses recommended for one of the following programs: Aeronautics and Astronautics, Environmental Engineering, and Product Design.

Innovative Majors (General Engineering). Any student, aided by an advisor, may propose unique curriculum to attain 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 and experimentation. Analysis is concerned with the formulation and solving of mathematical models, primarily by use of deductive reasoning, and optimization. Synthesis emphasizes problem definition, ideation, and inductive reasoning. Experimentation involves the innovative applications of experimental equipment and techniques to discover relations and to answer questions. 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 of synthesis 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/her curriculum. A list of courses and their unit content of synthesis and-or experimentation is available from the office of the Dean of Engineering.

Accreditation
The Engineers Council for Professional Development (ECPD) 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 Dean of Engineering.

The following undergraduate curricula are accredited: Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering and Engineering Management, Mechanical Engineering, and Petroleum Engineering (School of Earth Sciences). The Aeronautics and Astronautics curriculum is accredited at the Master's degree level.

ENGINEERING MAJORS

1. Departmental 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. Sample programs for departmental majors are available from the office of the Dean of Engineering.
Chemical Engineering

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 130.</td>
<td>Theory and Practice of Identification</td>
<td>3</td>
</tr>
<tr>
<td>Chem. 131.</td>
<td>Organic Polyfunctional Compounds</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. 120.</td>
<td>Separations Processes</td>
<td>3</td>
</tr>
<tr>
<td>Chem. Engr. 130.</td>
<td>Chemical Kinetics: Theory with Applications for Reactor Design</td>
<td>3</td>
</tr>
</tbody>
</table>
| Chem. Engr. 180. | Chemical Engineering Laboratory | 6 

Civil Engineering

| C.E. 107. | Mechanics of Fluids | 3 |
| C.E. 114. | Mechanics of Materials | 4 |
| 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 | 3 |
| C.E. 180. | Elementary Structural Analysis | 4 |
| C.E. 190. | Geotechnical Engineering | 4 |

| At least one of the following: | |
| C.E. 196. | Engineering Practice | 2 |
| C.E. 197. | Engineering Synthesis | 4 |
| C.E. 198. | Senior Report | 1 |
| At least one of the following: | |
| Geol. 101. | Framework of Geology | 4 |
| Geophys. 51. | Earth Physics | 4 |
| C.E. 40. | Elementary Surveying | 5 |
| C.E. 116. | Plain Concrete | 3 |

| At least one of the following: | |
| C.E. 133. | Introduction to Urban Planning | 3 |
| C.E. 171. | Environmental Planning | 3 |
| C.E. 181. | Design of Steel Structures | 4 |
| C.E. 182. | Design of Reinforced Concrete Structures | 4 |

Special Requirement:

Any student who has not had exposure to drafting, either in high school or through work experience, should include ME 102 in his or her program.

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Electrical Engineering

| E.E. 101, 102, 103. | Circuits and Networks | 9 |
| E.E. 111, 112, 113. | Electronics | 9 |
| E.E. 121, 122 | Laboratory | 6 |
| E.E. 141. | Electromagnetic Fundamentals | 3 |
| E.E. 181 or 182. | (See Descriptions) | 3 |
| E.E. 139 or 274. | Laboratory | 3 |
| Restricted Electives (any Elec. Engr. courses) | 3 |

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Electrical Engineering-Computers

| E.E. 101, 102, 104 | 9 |
| E.E. 111, 112, 113 | 9 |
| E.E. 121, 122 | 6 |
| E.E. 180, 181, 182 | 9 |
| E.E. 183 or E.E. 274 | 3 |

36

Industrial Engineering and Engineering Management

| I.E. 100. | Organizations: Theory and Management | 4 |
| I.E. 120. | Quality Assurance | 3 |
| I.E. 133. | Industrial Accounting | 4 |
| I.E. 141. | Utilization of Computers | 3 |
| I.E. 144. | Computer Simulation | 3 |
| I.E. 160. | Analysis of Production Systems I | 3 |
| I.E. 164. | Production Engineering Problems | 3 |
| I.E. 261. | Analysis of Production Systems II | 3 |
| Engr. 161. | Engineering Economy | 3 |
| Stat. 110. | Statistical Methods in Engineering and the Physical Sciences | 4 |

36

Materials Science and Engineering

| M.S. & E. 180. | Atomic Arrangements in Solids | 4 |
| M.S. & E. 181. | Thermodynamics and Phase Equilibria | 4 |
| M.S. & E. 182. | Rate Processes in Materials | 3 |
| M.S. & E. 185. | Mechanical Behavior of Solids | 3 |
| M.S. & E. 188. | Electrical, Optical and Magnetic Properties of Materials | 3 |
| M.S. & E. 202A,B,C. | Experimental Methods in Materials Science (Previous on concurrent registration in M.S. & E. 180 series or equivalent) | 6 |
| Phys. 56. (Concurrent with Phys. 55) | 1 |
| Stat. 110. | 4 |
| Restricted Electives: (science or engineering courses approved by M.S. & E.) | 8 |

36

Mechanical Engineering

| M.E. 101. | Visual Thinking | 3 |
| M.E. 103. | Manufacturing Technology | 4 |
| M.E. 111. | Stress, Strain and Strength | 3 |
| M.E. 112. | Mechanical Systems | 3 |
| M.E. 113. | Engineering Design | 3 |
| M.E. 131A,B,C. | Thermosciences | 14 |
| Engr. 104. | Dynamic Response or M.E. 161. Engineering Vibration | 3 |
| M.E. 161. | Engineering Vibration or Engr. 104. Dynamic Response | 3 |
| Any M.E. course in the 100 or 200 series | 3 |

36

II. Interdisciplinary Majors

General Engineering

General Engineering programs must be approved by the Special Programs Committee of the Engineering Undergraduate Council. Petitions for approval of special programs should be submitted during the junior year and should include a statement that describes a well-defined educational objective. General engineering programs must meet University (Writing and Distribution) and School (Mathematics, Science, Technology in Society, Breadth, Depth, and Functional Balance) requirements. To fulfill the engineering Depth
requirement, General Engineering programs should include at least 18 units of courses within the School of Engineering. These courses should represent a coherent package and should correspond in academic rigor to departmental depth sequences. Additional information and sample programs regarding these majors may be obtained from the office of the Dean of Engineering.

Aeronautics and Astronautics

Engr. 104. Dynamic Response 3
A.A. 100. Introduction to Aeronautics and Astronautics 3
A.A. 131. Experimentation in Aeronautics and Astronautics 3
Civil Engr. 114. Mechanics of Materials 4
Mech. Engr. 113C. Thermosciences Thermodynamics 4
A.A. 200A. Engineering Analysis of Flight Vehicles 3
A.A. 192. Vector Analysis and Cartesian Tensors 3
Math. 130. Ordinary Differential Equations Flow 3
Restricted Electives 7

Environmental Engineering

An environmental engineering education stresses interdisciplinary work in social sciences such as economics, political science, and sociology as well as in the natural sciences, particularly biology and engineering. Students in this program are encouraged to seek a strong fundamental background, to become knowledgeable about a wide range of environmental issues, and to pursue knowledge in depth in areas which are most compatible with their future interests.

(36 units from the following:)
C.E. 107. Fluid Mechanics 3
C.E. 130. Transportation 3
C.E. 133. Urban Planning 3
C.E. 160. Water-Resources Engr. 4
C.E. 170. Environment 3
C.E. 171. Environmental Planning 3
C.E. 176. Small Scale Energy Systems 3
C.E. 270. Water Quality 3
C.E. 276C. Environ. Radioactivity 3
Chem. Engr. 20. Introduction 3
A.E.S. 130,131,132. Environ. Earth Sciences 5,5,5
A.E.S. 144. Minerals, Politics, and Economics 3
M.E. 137. Air Pollution 3
M.E. 138. Noise Pollution 3
M.E. 180. Energy and Society 3
Mech. Engr. 103. Manufacturing Technology 4
Mech. Engr. 112. Mechanical Systems 3
Mech. Engr. 115A. Human Values in Design 3

III. Innovative Majors
(General Engineering)

General Engineering programs must be approved by the Special Programs Committee of the Engineering Undergraduate Council. A coordinated sequence of courses that provides mastery of the important principles and techniques in a well-defined field will ordinarily be approved. Petitions for approval of special programs should be submitted during the junior year and should include a statement that describes a well-defined educational objective. General Engineering programs must meet University (Writing and Distribution) and School (Mathematics, Science, Technology in Society, Breadth, Depth, and Functional Balance) requirements. To fulfill the Engineering Depth requirement, General Engineering programs should include at least 18 units of courses within the School of Engineering. These courses should represent a coherent package and should correspond in academic rigor to departmental depth sequences. Programs such as Bio- or Premedical-Engineering, Urban Planning, and Ocean Engineering may be developed within the framework of the innovative major. For further information consult the office of the Dean of Engineering.

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.

CO-TERMINAL DEGREE PROGRAMS

A Stanford undergraduate may work simultaneously toward Bachelor’s and Master’s 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 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.

Admission to the co-terminal program requires admission to graduate status by the pertinent department. Admission criteria varies from department to department.

3. Procedure for Applying for Admission to the Co-terminal Degree Programs. 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 a graduate degree in engineering will apply to the pertinent department.

DUAL DEGREE PROGRAMS

Stanford University cooperates with certain liberal arts college (presently Centenary College, Claremont Men's College, the College of Idaho, Knox College, Mills College, Pacific Lutheran College, Scripps College, Westmont College, 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".

GRADUATE ADMISSION

Application for admission with graduate standing in the School should be made to the Director of Graduate 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. Advisor 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
Aeroelasticity
Aerophysics
Aerospace Structures
Aerospace Systems Synthesis and Design
Analytical and Experimental Methods in Solid and Fluid Mechanics
Biomedical Solid and Fluid Mechanics
Energy Systems Studies
Flight Mechanics
Gaskinetics
SCHOOL OF ENGINEERING

Guidance and Control
Physical Gasdynamics
Propulsion
Transportation
Waves and Vibrations

ENGINEERING
Interdisciplinary Programs
Interdepartmental Programs

ENGINEERING IN BIOLOGY AND MEDICINE
Biomaterials
Biomechanics
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
Suspension Rheology
Hydrodynamic Stability
Electrochemical Energy Conversion
Applied Chemical Kinetics
Surface Reactivity
Adsorption and Catalysis
Bioengineering
Polymer Science
Membrane Separation Processes

CIVIL ENGINEERING
Construction Engineering and Management
Infrastructure Management
Infrastructure Planning
Structural and Geotechnical Engineering
Earthquake Engineering
Foundation Engineering
Reliability and Risk Analysis
Soil Mechanics
Soil-Structure Interaction
Structural Engineering
Structural Mechanics
Environmental and Water Studies
Environmental Engineering
Hydrology
Hydromechanics
Nuclear Civil Engineering
Water Resources Engineering

ELECTRICAL ENGINEERING
Bioelectronics
Communications and Information Theory
Computer Applications
Computer Systems
Electromagnetic Theory and Microwaves
Electronic Circuits and Devices
Information Processing
Integrated Circuits
Modern Optics and Optical Devices
Network Theory
Plasmas
Quantum Theory and Applications
Radioscience
Solid State Materials and Properties
Systems and Control Theory

ENGINEERING-ECONOMIC SYSTEMS
Decision Analysis
System Analysis
Applied Economics
Long Range Planning
Public Policy Analysis

HYDROLOGY
See "Committee on Hydrology," in "Other Departments, Institutes, and Programs" section of this bulletin.

INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT
Production Systems
Engineering Economy
Engineering Management
Systems Analysis and Synthesis
Transportation Systems
Man-Machine Systems

MATERIALS SCIENCE AND ENGINEERING
Biomaterials
Electrical and Optical Behavior of Solids
Fracture
Imperfections in Crystals
Kinetics
Magnetic Behavior of Solids
Materials Synthesis and Processing
Mechanical Behavior of Solids
Phase Transformations
Physical Ceramics
Physical Metallurgy
Polymers
Solid State Chemistry
Structural Analysis
Thermodynamics
MECHANICAL ENGINEERING

Air Pollution
Biomechanics
Combustion
Composites, Fracture of Solids
Continuum Mechanics
Controls
Dynamics
Energy Conversion
Engineering Design
Environmental Measurements
Experimental Mechanics
Fluid Mechanics
Heat Transfer
High Temperature Gasdynamics
Kinematics
Nuclear Engineering
Optimization
Product Design
Solar Energy
Thermodynamics
Transport Processes
Turbulence

OPERATIONS RESEARCH

Applied Probability and Queueing
Dynamic Programming
Inventory Theory
Reliability Theory
Mathematical Programming
Networks and Combinatorics
Energy and Economic Modeling

SPACE SCIENCE

See the "Space Science and Related Programs" section in this bulletin.

For further details about the above programs, 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 advisors, 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. 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 with 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 advisor from the department in which the student wishes to study. Further information may be obtained from the department in which the student is interested.

MASTER OF SCIENCE IN ENGINEERING

The degree of Master of Science in Engineering 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.

There are three School requirements for the M.S. degree in Engineering: (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. These programs are administered by the departments and of course must meet the standard of quality of the departments.

Applications for admission to the Engineering program 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.
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 closely related 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 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 for the Doctor of Philosophy are given in the section "Degrees" in this bulletin. Further information will be found in the departmental listings.

**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. These include Petroleum Engineering which is in the School of Earth Sciences and Computer Science and Statistics which are in the School of Humanities and Sciences. The HCP is 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 Stanford Instructional Television Network [(415)497-3616].

**ENGINEERING**


**Associate Professors:** C. Thomas Bowman, Bruce B. Lusignan, J. David Powell

**Adjunct Professor:** Sotiris P. Koutsoyannis

**Assistant Professor:** Robert Sinclair

**Lecturer:** Ellen Nold, Gerd Wallenstein

The "Engineering" courses deal with subject areas within engineering which are, in their essential nature, broader than the confines of any particular branch of engineering. These courses are taught by professors from the several departments of the School of Engineering, under the supervision of those listed above.

Of the courses described in this section, many are of general interest to both engineering and non-engineering students. In addition, certain departmental courses are of general interest and without prerequisites.

Students interested in the interactions between technology and society should also consult the "Values, Technology, and Society" section of this bulletin.

**COURSES OF INTEREST PRIMARILY TO UNDERGRADUATES**

All courses (DR:T) unless otherwise noted.

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 (Adams) TTH 11 and T 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. The methods used in the course are experiential. 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. (DR:X)

2 units, Aut, Win, Spr (Roth, Wilde)
W 1:15-5:05

3. Applied Mechanics: Statics—Equilibrium of particles; moments, couples; equilibrium of rigid bodies; analysis of trusses, frames, machines, vehicles; dry friction; hydrostatic forces; stability of equilibrium. Vectors and vector algebra are introduced and used in the course. Prerequisites: high school algebra and trigonometry.

3 units, Aut (Bryson) MWF 11
Winter (Staff) MWF 9

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 physics in high school.

3 units, Spr (Vincenti) 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, Math 21 or 42.

4 units, Win (Ashley) MWF 9;
problem sessions by arrangement
Spr (Staff) MWF 8

12. Intermediate Dynamics—Review of first and second order linear dynamic systems; damping, resonance, instability, characteristic equations. Rigid body dynamics; gyroscopes; balancing rotating machinery; vibrations, and dynamic response of simple mechanical systems. Writing dynamic system equations of motion, their solution and interpretation. Prerequisites: Math 23 or 43 and Physics 51.

4 units, Win (Bershader) MWF 8 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. Prerequisites: 12, Math 23 or 43, or consent of instructor.

4 units, Aut (Hsu) MWF 10;
lab. M or T 1:15-4:05
Spr (Hsu) 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 (Bowman) MWF 8
Win (Eustis) MWF 10

41. Circuits—Introduction to electrical signals, circuits, and analytical techniques. Circuit principles, natural and forced response, a-c Circuits, network theorems, block diagrams, and feedback. Prerequisites: Physics 53 and Math 43.

3 units, Aut (Manning) MWF 8
Win (Crawford) MWF 10
Aut (Helliwell) MWF 11

42. Electronics—Electronic devices and circuits; linear and non-linear applications. Digital devices and logic circuits; circuits, microprocessors; power, small-signal, and operational amplifiers. Prerequisite: 41 or equivalent.

4 units, Win (Manning) MWF 9
Win (Smith) MWF 11
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: 41 or equivalent.

3 units, Win (Helliwell) TTh 11-12:15
Spr (Crawford) TTh 10;
one 3-hour lab. weekly
by arrangement

44. Basic Electronics—Electronics for the nonspecialist. Electrical quantities and circuit laws; electron ballistics and the CRO; semiconductor diodes and transistors; integrated circuits; digital devices, logic circuits, microprocessors; signal wave-forms and ac circuits; power, small-signal, and feedback amplifiers; operational amplifiers; modulation; instrumentation. Lectures and laboratory work. Not in-
tended for those who take 41. Prerequisite: calculus and college physics.

5 units, Aut (Smith) MWF 11-12:10
one 3-hour lab. weekly by arrangement

3 units, Aut (Nix) MWF 11
Win (Sherby) MWF 11
Spr (Sinclair) MWF 11

51. 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: 50.
3 units, Win (Shyne) MWF 1:15

52. Electronic Properties of Materials—Description of the electrical, optical and magnetic properties of solids with emphasis on the relationships between these properties in crystalline and amorphous materials. Elementary treatment of electrons in solids, the relationship between basic materials properties and electronic behavior, and survey of electronic devices. Prerequisite: 50.
3 units, Spr (Staff) TTh 11-12:15

60. Mathematical Methods in Engineering—An introduction to the theory and application of ordinary and partial differential equations, matrix algebra, La Place transforms, and numerical methods in engineering. Mathematical models are derived from various physical principles. Solutions are obtained by use of listed techniques. Prerequisites: Mathematics 43 and Computer Science 105 or 106, or equivalent experience, or consent of instructor. Enrollment limited to 30 undergraduates.
3 units, Spr (Street) MWF 11:00

101. Teaching Technical and Expository Writing—Theory of composition; practice in composition; theory of teaching; practice in tutoring. Students who successfully pass this course may become paid tutors. (DR:X)
3 to 4 units, Win (Nold) Monday evenings

102. Directed Writing—A tutorial course. Students will work on their own projects, including preparation of papers for the University and practice in forms of writing in business and industry. (DR:X)
1 to 5 units, Aut, Win, Spr and Sum (Staff) by arrangement

103. Public Speaking—Principles of and practice in impromptu and extemporaneous speaking in situations that approximate those of University orals and presentations in business and industry. (DR:X)
1 to 5 units, Aut, Win, Spr and Sum (Staff) by arrangement

3 units, Aut (Koutsoyannis) MWF 11

3 units, Aut (Powell) MWF 9
Win (Staff) TTh 8-9:15

161. Engineering Economy—Economic analysis for decision making among alternative courses of action in engineering, business, government and personal finance. Use of compound interest calculations to compare the consequences of different alternative decisions is stressed. Effects of depreciation accounting methods, national and state income taxes, simple risk and uncertainty, and the selection of appropriate minimum attractive rates of return are considered in problems relating to multiple alternatives, sunk cost, incremental cost, replacement, resource allocation and publicly financed projects. May be taken by freshmen, but recommended for second year or higher students. Two lectures plus one small
3 units, Aut (Ireson) TTh 10; one hour by arrangement
Spr (Ireson) TTh 11; one hour by arrangement
Sum (Staff) MTWTh 10

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 (P. Kruger) MWF 11

199. Special Studies in Engineering—Special studies, laboratory work, or reading under the direction of a faculty member. Often research experience opportunities exist in ongoing research projects. Interested students are invited to make arrangements with individual faculty. By consent only. (DR:X)

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

COURSES OF INTEREST PRIMARILY TO GRADUATE STUDENTS

All courses (DR:X) unless otherwise noted.

205. International Telecommunication Agreements—Examination of the International Telecommunication Union (ITU) as a model for worldwide collaboration in resource allocation, standardization, and planning of services. Interdisciplinary focus on outcomes achieved by voluntary agreement. Case studies of ITU action, particularly in satellite communication. Lectures and study projects. (Same as Communications 230.)

3 units, Spr (Wallenstein) F 11-12:15

206. Control System Design and Simulation—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 (Staff) MWF 1:15; lab. by arrangement

207. Digital Control I—Study of the digital computer in feedback control. Sampling, z-transforms, digital filters, discretization of continuous compensation, design, quantization errors, state variable design of digital controllers and observers. Laboratory experiments on a mini-computer/analogue computer system. Limited enrollment. Prerequisite: 105.

4 units, Win (Powell) TTh 11-12:15; lab by arrangement
Spr (Franklin) TTh 11:00-12:15; 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 experiments on a mini-computer/analogue computer system. Prerequisite: 207.

3 units, Spr (Powell) MW 10; lab. by arrangement


3 units, Spr (DeBra) MWF 8

221. The Social Impact of Technology—The functions of science and technology in various cultures; historical development; underlying patterns and concepts. Unifying frameworks to enable simultaneous consideration of technical factors, human needs and ecological requirements. The adequacy of "traditional" and "scientific" philosophies as criteria for judging the satisfying of these needs. Systems, system methods, and their limits; the role of disciplines. For graduate students in engineering and science; run conjointly with VTS 106.

4 units, Spr (Kline) T 1:15-2:05, Th 1:15-3:05

235A,B. Engineering Systems Design—This course brings students and faculty together to work on a highly interdisciplinary systems design project. In 1978–79 one team of approximately thirty students from engineering, science, business, political science, law, etc., prepared a preliminary design of a complex energy system. Past energy projects have included an integrated system for conversion of garbage to energy and a study of the biomass energy options for Hawaii, and a study of "soft" energy paths. The student-faculty group will be assisted by a high-level advisory group of "Stakeholders" in the study, which will be sponsored by the Institute for Energy Studies. In-
interested students should inquire at the Energy Information Center by November 15. Both courses (DR:T)

235A. 3-5 units, Win (Staff) hours by arrangement
235B. 3-5 units Spr (Staff) hours by arrangement

287. 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 practice teaching with videotape recording. Available to advanced graduate students from all disciplines with an interest in a college teaching career.

3 units, Win (Chilton) by arrangement

290. Technology in History—In the past thousand years the material base and cultural forms of western civilization have been fundamentally modified by the development of technology. How did this come about? The course addresses this important question through reading and informal discussion of books by several historians. The resulting insights help to understand the social role of technology and the cultural background and problems of engineering. For graduate students only; enrollment limited to 15; pass/no credit only.

3 units, Win (Vincenti) T 7:15-9:15 p.m.

297A,B,C. Ethics of Development in a Global Environment (EDGE): Cross Discipline Seminar—(Same as Education 274A,B,C, Political Science 140A,B,C, Social Thought and Institutions 197A,B,C, Anthropology 133A,B,C, Graduate Special 297A,B,C.) Theory and practice of development in a global setting. Open to graduates and undergraduates, course is designed to be appropriate to both foreign and American students and may be taken for only one quarter or as a three-quarter sequence. Interdisciplinary: faculty from Engineering, Political Science, Economics, Education, Anthropology; encourages convergence of engineering and natural sciences with the social and behavioral sciences in the study of development processes and the ethics implicit in development choices. By making underlying values explicit development options can be tested for appropriateness. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures are analyzed in terms of appropriateness to development in both less developed and industrialized societies. Present systems and planning processes will be examined in terms of their present day inequities as well as their consequences for future generations. Autumn: Major world trends—population, food, energy technology, life-styles. Development examined in terms of relative satisfaction of human needs. Lectures, discussions, work-groups. Winter: Alternative development strategies—country case studies. Lectures, discussions, work-groups. Spring: The individual and social change; the engineer, political scientist, educator etc., as designer of alternatives and as policy and decision-maker.

Work-groups only. 2 units: pass/no credit. 3-5 units: pass/no credit or grade, small discussion groups and workshops, limited enrollment.

297A,B,C. 2-5 units, Aut, Win, Spr (Cooper, Fagen, Lusignan, McWhorter, Siegel, Textor, Weiler) M 7:30-9:30 p.m. and by arrangement.

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

School of Engineering Advisory Committee on Engineering in Biology and Medicine: Robert L. Piziali, Mechanical Engineering (Chairman); I-Dee Chang, Aeronautics and Astronautics; L. J. Leifer, Mechanical Engineering, J. D. Meindl, Electrical Engineering; Alan S. Michaels, Chemical Engineering; T. S. Nelson, Surgery; C. R. Robertson, Chemical Engineering; W. A. Tiller, Materials Science and Engineering; R. L. White, Electrical Engineering.

Though Stanford does not have a formal department of bioengineering, there are approxi-
mately ten faculty in the School of Engineering whose primary research activities are in the general area of bioengineering. Thus, the study of Bioengineering at Stanford is most appropriate at the Ph.D. level. The faculty working in bioengineering are spread throughout the various departments of the School of Engineering, and a list of their names, together with a summary of their research interest, 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. Their applications are judged on substantially the same ground as other applicants to the 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, and bone elasticity, cardiovascular dynamics and haemodynamics in the Mechanical Engineering and Aeronautics and Astronautics 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 Dopplershift 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. These research projects have carried out in collaboration with faculty of the Medical School or 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. Prior courses in Biology, Chemistry, etc., are beneficial, but students are admitted and advanced on their engineering abilities. Advanced courses in physiology are generally taken only by Ph.D. students. Bioengineering courses exist at the M.S. level and students can take these as electives. The student's advisor 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. While the degrees of Master of Science in Engineering and Master of Science in Engineering in Biology and Medicine are available, there is no prescribed program and working toward these degrees is not encouraged. 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.

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. 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.

### AERONAUTICS AND ASTRONAUTICS

**Emeriti:** Nicholas J. Hoff (Professor)
**Chairman:** Arthur E. Bryson
**Associate Chairman:** Daniel Bershader


**Associate Professor:** J. David Powell

**Adjunct Professors:** Sotiris P. Koutsoyannis, Richard S. Shevell

**Lecturers:** John Billingham, D. DeVincenzi, Danielle Coldwater, Richard D. Johnson, Harvard Lomax, Philip R. Nachtsheim, Jiro Oyama, Joan Vernikos-Danellis, Donald R. Young, Fredric H. Schmitz
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. Courses in the teaching program lead to the degrees of Master of Science, Engineer, and Doctor of Philosophy. 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. 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.

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. Cryogenic gyro test facilities are available in the nearby Varian Physics Building, and Electrical Engineering's Integrated Circuit Fabrication Facility is adjacent. Computer-aided engine test facilities are available in the Mechanical Engineering Laboratories and are an integral part of the Guidance and Control research program.

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 does tuned-laser experiments on resonant refractivity in gas flows. Interferometric techniques are also in use to study free convection problems of combined heat and mass transfer. 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. A continuous low-speed wind tunnel with an 18" x 18" working section and speeds to 200 feet per sec. is available for use in instructional laboratories and research.

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 tuneable laser for the study of molecular kinetics.

Included among the facilities in the building are structural laboratories for demonstrating and studying the behavior of small-scale structures. For the purpose of conducting structural tests of large-scale prototype structures in static, dynamic, and thermal environments, a new central laboratory for the School of Engineering has recently been constructed. Specific facilities include a static/dynamic testing bed; a programmable horizontal crash simulator; and high-load rate, materials test systems.

Service facilities in the building include a full machine shop, standards laboratory, chemistry laboratory, an 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 in the Terman building across the street which is readily available to Department researchers and students. Terminals in the facility provide for individual on-line, time-shared computation with the campus facility IBM 370-168. There are also terminals for the campus academic computer system (LOTS), which are available to all students at no cost for their course work or unsponsored research. Three digital minicomputers and several analog computers are also located in this 2,500 square foot area. Interfacing equipment permits combining the computers as hybrid facilities or running independently. The instructional facilities for courses such as E206, E207, and E208 are closely integrated with the equipment used for research activities.

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.

**M.S. DEGREE IN AERONAUTICS AND ASTRONAUTICS (45 QUARTER UNITS)**

**COURSE REQUIREMENTS**

All candidates for this degree selecting either the Engineering or Science curriculum are expected to meet the Basic Courses (Category A) requirements, provided they have not already taken substantially equivalent material in fluid mechanics, structural mechanics, guidance control, propulsion, and experimentation in
aeronautics and astronautics. In those cases where Category A course requirements are believed to have been satisfied previously, waivers must be obtained and documented through the procedure outlined in the subsection “Waivers and Transfer Credits.” In those cases where basic course requirements have been satisfied previously, courses in the form of electives may be substituted. It is expected, also, that students who have not taken the mathematics (Category B) and depth (Category C) courses of the M.S. degree curricula will rectify any deficiencies either prior to, or as soon as feasible after, enrollment in the M.S. degree program. The fundamental mathematics prerequisites are calculus, ordinary differential equations, and vector analysis.

Basic courses (Category A) for which prerequisites exist are designated with the superscript 1. Courses not listed in Category A which are taken either to rectify deficiencies or to satisfy a prerequisite in Category A can be used for credit toward the M.S. degree requirements only in Category D (OTHER ELECTIVES).

A. BASIC COURSES—Candidates will select eight courses as indicated.

- AA200\(^1\)
- AA210A\(^1\) or AA206A (ME258A)
- AA240A\(^1\) and AA240B or AA245A\(^1\) and AA245B (ME238A and ME238B)
- or AA247\(^1\) and AA248 (ME241B and ME241C)
- or AA249A\(^1\) and AA249B (ME242A and ME242B)
- AA242\(^1\)
- AA271A\(^1\) or AA279A
- AA280A\(^1\) or AA283\(^1\)
- AA131

B. MATHEMATICS COURSES—Each candidate is expected to develop a competence in the applied mathematics methods pertinent to his or her major field. This requirement can be met either (1) formally, through a minimum of six units in applied mathematics taken from ME200A or Math 113 (linear algebra), ME200B or Math 131 and Math 132 (partial differential equations), ME201 or Math 106 (complex variables), CS135 (computer science), and Stat 116E (probability); or (2) informally, through matriculation in those basic (breadth) and technical electives (depth) courses which strongly emphasize methods of applied mathematics. Courses to be offered in informal fulfillment of the Category B requirement may appear in either or both of Categories A and C; however, they should not be considered as satisfying the mathematics requirement without obtaining the prior approval of the advisor. Note that the major-field Ph.D. qualifying examination provides for 25%-time devoted to pertinent mathematics. (See “INFORMATION ON Ph.D. QUALIFICATION” available from the Academic Secretary). Note, also, that when the mathematics requirement is being satisfied via the informal route, six units of additional course work must appear in Category C, TECHNICAL ELECTIVES.

C. TECHNICAL ELECTIVES—Candidates, in consultation with their advisors, will select at least four major-field courses (in addition to those taken under Category A) appropriate to either the Engineering or Science options from among the three-digit-series courses offered by the departments and divisions of the School of Engineering and the Department of Physics in the School of Humanities and Sciences. This requirement increases by two additional courses (taken from either the major or peripheral fields) when the mathematics requirement is being satisfied informally.

D. OTHER ELECTIVES—It is recommended that all candidates enroll in at least one humanities or social sciences course. Practicing courses in, for example, Art, Music, and Physical Education do not qualify in this category.

SCHOLARSHIP REQUIREMENTS

A minimum-grade-point average of 2.75 is required to fulfill the Department’s M.S. degree requirements and a 3.0 is the minimum required for eligibility to attempt the Ph.D. qualifying examination. Thus it is incumbent upon both M.S. degree and potential Ph.D. candidates to request letter grades in all courses except those which fall into the categories of colloquia and seminars (e.g., AA129, 295, 297, and 298). Insufficient grade points upon which to base the grade-point average may delay expected degree award or, if appropriate, result in refusal of permission from the Candidacy Committee to take the qualifying examinations. In any event, candidates with grade-point averages 3.0 through 3.2 must request the permission of the Candidacy Committee to attempt the qualifying examinations.

WAIVERS AND TRANSFER CREDITS

All students who receive faculty approved waivers of required courses for the M.S. (also, Engineer and Ph.D.) degree in Aeronautics and Astronautics by virtue of substantially equivalent and satisfactorily performed course work at other institutions should have such action documented in their record folders. A memorandum from the course instructor (or ad-
visor, if appropriate) to the Candidacy Committee via the Academic Secretary indicating (1) the Stanford University course number and title and (2) the institution and number(s) and title(s) of the course(s) wherein substantially equivalent material was treated will suffice. Compliance with this procedure will accelerate the approval and forwarding of degree candidacy forms to the Graduate Study Office.

A similar procedure should be followed with regard to transfer credits. Please note, however, that transfer credit is allowed only for courses in which equivalence to Stanford courses is established and a grade of B or better has been awarded. The number of transfer credits accepted for each degree (M.S., Engineer, and Ph.D.) is delineated in the "Advanced Degrees" section of Courses and Degrees.

M.S. DEGREE IN ENGINEERING OR ENGINEERING SCIENCE
(45 QUARTER UNITS)

For students who do not wish to meet the Department's specified requirements for the M.S. degree in Aeronautics and Astronautics, the opportunity is available to pursue programs to an M.S. degree in either Engineering or Engineering Science. These programs are described in the School of Engineering "Graduate Programs of Study" section of Courses and Degrees.

MASTER OF SCIENCE IN ENGINEERING OR ENGINEERING SCIENCE

As described under the School of Engineering section of this Bulletin, each department in the School of Engineering may sponsor students in the more general degrees, Master of Science in Engineering or Master of Science in Engineering Science. Sponsorship by the Aeronautics and Astronautics Department requires that the student file a petition for admission to a Registration Day; no more than 18 units used for the proposed program can have been previously completed. The proposed program must include at least 9 units of graduate level work in the department of Aeronautics and Astronautics. The petition must be accompanied by a statement explaining the objectives of the program, how it is coherent, contains depth and fulfills a well-defined career objective. The grade and unit requirements are the same as for the Master of Science in Aeronautical and Astronautical Engineering.

ENGINEER

The University's basic requirements for the Engineer degree are outlined in the section "Degrees" in this bulletin. The following are Department 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) Aerospace 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) Transportaion, (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.

Qualifications for candidacy for the Doctor's degree are 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 possessing a 3.2 or better grade-point average for graduate course work at Stanford, (c) the student's having completed three units of a directed research problem (Course AA290), and (d) in the second year of graduate study, the student's passing an oral examination given by the Department during the second 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. Normally, continued registration is expected for each quarter the student requires departmental consultation in completing thesis work.
Engineering Curriculum—The 45 course units beyond the Master's degree are chosen by the candidate and the advisor 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 advisor 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 each carries a grant of $8,000 or more for the nine-month academic year. Students who have demonstrated research capability are eligible for half-time research assistantships. The minimum stipend for half-time research assistants, on the basis of 20 hours of work per week, is $325 per month, plus tuition. Research assistants are normally given the opportunity of full-time summer employment at the minimum rate of $650 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

All courses (DR:X) unless noted otherwise.

10. Aeronautics and Astronautics—(Enroll in Engineering 10.) (DR:T)

100. Introduction to Aeronautics and Astronautics—Explanation of the principles of fluid flow, flight and propulsion; discussion of the creation of lift and drag, aerodynamic performance including take-off, climb, range and landing performance, structural concepts, propulsive systems, trajectories and orbits outside the atmosphere. Remarks on the history of aeronautics and astronautics. Prerequisites: Understanding of differential and integral calculus. (DR:T)

3 units, Aut (Shevell) TTh 11:00-12:15

104. Dynamic Response—(Enroll in Engineering 104.) (DR:T)

105. Control System Analysis and Design—(Enroll in Engineering 105.) (DR:T)

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. (DR:T)

3 units, Win (Billingham, DeVincenzi, Goldwater, Johnson, 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 2:15-5:05 or T 1:15-4:05

132. Optical Methods in Engineering Science—Introduction to nature of light, its propagation through various media and the design and analysis of optical systems for engineering studies and measurements. Comparison of special features of visible, ultra-violet and infra-red portions of the spectrum. Material will include fundamentals of laser action in gases, and such applications as interferometry, schlieren, holography, elements of spectroscopy. Raman and other laser methods for species identification and velocimetry.

3 units, Aut (Bershader) MW. 2:15-3:30, alternate years, given 1978-79

135. Introductory Acoustics—The objective of this course is to introduce the student to the basic concepts of acoustics and their applications, on the basis of one-dimensional acoustic motion. The presentation will consist of lectures with experimental demonstrations: one-dimensional acoustic motion of a homogeneous inviscid fluid; wave equation and its general solution; travelling plane sound waves; speed of sound in gases and liquids; sound energy den-
sity, flux, and intensity; intensity and pressure levels and the decibel scale; one-dimensional sound propagation in an elastic solid; monochromatic waves; frequency, wave length, wave number and phase speed; reflection and transmission of sound between different media; mass law of transmission through walls; acoustic impedance of surfaces and sound absorption; spherical and cylindrical waves; acoustic source and dipole radiators; analysis of acoustical systems—electrical and mechanical analogies; acoustic resistance, inductance, capacitance and impedance; combinations of various acoustic elements; filters and transformers; measurement of impedance and absorption coefficients; propagation through a rigid duct of varying cross-section; introduction to acoustical measurements; remarks on the effects of friction and heat-flow, and of motion of the medium on sound propagation.

3 units, Aut (Karamcheti) MWF 10:00

136. Introduction to Psychoacoustics—An introduction to quantitative relationships between auditory experience and the acoustic stimulus and the methods used to obtain such relationships.

A brief review of physical sound description and auditory system physics and physiology. Measurement of sensitivity and masking. Scaling of pitch and loudness. Applications in noise pollution, audio systems, and the perception of speech and music. Experiments will be demonstrated during the lectures. Prerequisites: Junior standing or consent of instructor. Open to graduate students.

3 units, Spr (Ahumada and Nagel) MWF 3:15

138. Noise Pollution—(Enroll in Mechanical Engineering 138.) (DR:T)

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


3 units, Win (Bryson) MWF 8

201A. Fundamentals of Acoustics—Acoustic equations for a stationary homogeneous fluid; wave equation; sound energy density, flux, intensity, and power; r.m.s. pressure; plane, spherical, and cylindrical waves; harmonic (monochromatic) waves; simple sound radiators; reflection and transmission of sound at interfaces between different media; multiple analysis of sound radiation—monopole, dipole, and quadrupole distributions; inhomogeneous wave equation; Kirchhoff integral representation; scattering and diffraction of sound; propagation through ducts—dispersion, attenuation, group velocity; sound in enclosed regions—reverberation; elements of sound propagation in an elastic solid. Prerequisite: first year graduate standing in Engineering, Mathematics, Sciences, or consent of instructor.

3 units, Win (Karamcheti) MWF 10:00

201B. Fundamentals of Acoustics—Continuation of 201A with emphasis on the acoustics of moving and inhomogeneous fields. Effects of friction and heat flow on sound propagation in a homogeneous fluid initially at rest—equations, and boundary conditions; energy considerations; simple examples of plane wave propagation—longitudinal and transversal waves; general considerations introducing the notions of dilatational and rotational waves; effects on propagation in ducts; comments on sound absorption and dispersion owing to relaxation processes; radiation from moving sources and dipoles; Doppler effect; propagation through a uniformly moving fluid—equations and energy relations; plane wave propagation in such a fluid; reflection and transmission at the interface of two differently moving fluids; radiation from a source in a uniformly moving fluid in a duct; acoustics of an inhomogeneous nonuniformly moving fluid; geometrical or ray acoustics; propagation in the atmosphere and the ocean. Prerequisite: 210A or equivalent or consent of instructor.

3 units, Win (Karamcheti) MWF 11:00

202. Acoustic Measurements Laboratory—Lecture/laboratory course dealing with fundamental concepts and laboratory techniques for the measurement of the physical properties of sound fields in fluids and the development of noise criteria and measurement practice; use of basic acoustic instrumentation such as mic-
rophones, audio-oscillators, sound level meters, acoustic spectrum analysers, and recorders. Experiments include: classification, calibration, and refrequency response of microphones; speed of sound in fluids and solids; reflection, refraction, and absorption coefficients; sound wave propagation in 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. Prerequisite: 135 or 201, or consent of instructor.

3 units, Spr (Koutsoyannis) MWF 9, plus lab. by arrangement

203. Aerodynamic and Hydrodynamic Noise —Lighthill’s formulation of the theory of generation of fluid mechanical noise; Lighthill’s equation; representation of solution in unbounded and bounded regions; monopole, dipole, and quadrupole radiations; some general results; consideration of stationary and moving surfaces and source distributions; problem of a systematic theory of generation and propagation of aerodynamic noise—recent approaches; generation of discrete frequency noise—vortex tones and different kinds of edgetones generated by shear layers such as jets, wakes, and separated boundary layers interacting with surfaces; noise generation by turbulence—relevant description of turbulent motion, analysis of the random noise field in terms of the characteristics of the turbulent field; subsonic and supersonic jet noise theory and comparison with experiments; current developments in jet noise theory; jet noise suppression; noise radiation from boundary layers on bodies and on duct walls; analysis of noise generated by propellers, helicopter rotor blades, and blades or rotating machinery; noise radiation from bodies in motion; airfoil and hydrofoil noise; noise from bodies such as those of aircraft shape; sonic boom; current topics in aerodynamic noise. Prerequisite: 201A and B or equivalent or consent of instructor.

3 units, Win (Chang, Karamcheti) MWF 2:15, alternate years, given 1978-79

204. Mechanics of Hearing—(Enroll in Mechanical Engineering 283.)

206A. Fluid Dynamics—(Enroll in Mechanical Engineering 258A.)

206B. Fluid Dynamics—(Enroll in Mechanical Engineering 258B.)

207. Mechanics of Viscous Flow—(Enroll in Mechanical Engineering 259.)


3 units, Aut (Chang) MWF 10, alternate years, given 1979-80

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. Emphasis is placed on the development of the full three-dimensional nonsteady field equations and the associated constitutive relations representing the working fluid. Examples are given for the specialized cases of flows in one and two dimensions; compressible Couette flow, normal shock wave, potential flow, linearized potential equation, lift and drag of thin airfoils, similarity rules for subsonic and supersonic flow, quasi-one-dimensional flow, conical flow, Prandtl-Meyer Flow. Prerequisite: 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. Review of solution methods for the linearized potential equation for supersonic flow and applications to thin wings, swept wings, drag of slender bodies, and lifting surface theory. Nonlinear solutions for constant area flow and introduction to the Riemann invariants. Elements of the theory of characteristics and method of solution for two-dimensional and axisymmetric flows; nozzle design; extension to nonisentropic flow. Analysis of Prandtl’s boundary layer equations, 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

211. Physical Gas Dynamics—(Enroll in Mechanical Engineering 262A.)

212. Introductory Aerothermodynamics—Dynamic and thermal phenomena in flows of
gases and mixtures over a wide range of velocities and altitudes. Review of high-temperature thermochemical equilibrium behavior is extended to rate process analysis for treating vibrational non-equilibrated or chemically-reacting flows. Effects of viscosity and heat conductivity are added to study drag, heat transfer and overall flow field environment around high-velocity flight vehicles. Familiarity with the elementary concepts of compressible flow is desirable as a prerequisite.

3 units, Win (Bershader) TTh 1:15-2:30, alternate years, given 1979-80

213. Atmospheric Entry—The total atmospheric entry problem is surveyed with emphasis on the physical phenomena that influence the heating to the vehicle. A general description of planetary atmospheres, orbital mechanics, and motion in the atmosphere identifies key factors that quantify the entry problem. The overall heating problem is studied by dividing the physical phenomena into three groups: (1) the aerothermodynamic environment which includes description of processes in bow shock such as dissociation, ionization, and both line and continuum radiation. The processes are atmospheric dependent but independent of the heat shield material; (2) material response which accounts for in-depth time dependent thermal response of the heat shield including chemical degradation and ablation. These processes are atmosphere independent; (3) the viscous gas-material interaction, including an account of the fluid dynamic processes of convective heating and diffusion of vaporized species into the boundary layer and the radiative transfer processes of absorption and re-radiation of the gas species. Applications to manned and unmanned vehicles and meteorites are examined and active areas of research involving gas-material interactions are identified.

2 units, Aut (Nachtsheim) MW 12

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. Spectral and pseudospectral methods are discussed along with the effects of aliasing errors. Accuracy, stability and programming complexity are considered.

2 units, Win (Lomax) TTh 9, alternate years, given 1978-79

217. Geophysical Fluid Dynamics—(Enroll in Mechanical Engineering 260.)

218. Similitude in Engineering Mechanics—(Enroll in Mechanical Engineering 206.)


224. Molecular Physics of Gas-Dynamic Flow—Selected topics on thermodynamic properties and statistical mechanics with emphasis on high temperature effects and rate processes in gas phase flow. Quantum modeling from an engineering viewpoint is developed to give approximations that are reasonable substitutions for more exact relations. Electron spin and nuclear spin effects on diatomic and triatomic energy states are treated, as well as the usual rotational, vibrational, and electronic modes. Chemical equilibrium and nonequilibrium, and the rates of rotational, vibrational, and electronic excitation are considered.

3 units, Spr (Hansen) 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; introduction to the statistical theory of turbulence.

3 units, Spr (Baganoff) MWF 1:15, alternate years, given in 1979-80

227. Atmospheric and 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, Aut (Spreiter) TTh 2:45-4:00, alternate years, given 1979-80


3 units, Aut (Chang) TTh 11:00-12:15, alternate years, given 1978-79

230. Aerodynamics of Rotary Wing Aircraft and Power Generators—Recent advances in rotary wing technology as applied to the helicopter and the VTOL aircraft and the windmill are highlighted. Fundamental aerodynamics of rotors are examined—including general momentum theory, blade element theory, and an introduction to vortex theory. Aerodynamic and mission performance of the modern helicopter and other VTOL aircraft are considered using simple preliminary design methods.

3 units, Aut (Schmitz) MWF 3:15, alternate years, given 1979-80

231. Dynamics and Control of VTOL Aircraft—The known methods of controlling the modern helicopter and other VTOL aircraft (tilt-rotor, tilt-wing, etc.,) are explored. Questions of control uniqueness and redundancy are considered. The VTOL aircraft as a dynamic body is considered using linearization techniques. La Place transform—root locus techniques are used to deduce the vehicle’s dynamic stability and response characteristics. These are related to ease of control by a human operator with and without feedback compensation. Primary emphasis is on a basic understanding of principles involved.

3 units, Aut (Schmitz) MWF 3:15


240A. Analysis of Structures—Elements of one- and two-dimensional linear and non-linear 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, Aut (Chao) MWF 10

240B. Analysis of Structures—Effects of deflectional, rotational, and extensional elastic restraint; introduction of Lagrangian multiplier, Dirac delta function, and Galerkin methods; bending/torsion of plates with non-uniform planforms; stress-functional variational princi-
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 (Breakwell) MWF 8:00

244A. Free and Forced Motion of Structures—Vibrations and forced response of linear systems with a finite number of degrees of freedom. Vibrations and forced response of continuous structures, developed in a framework of analytical dynamics; rods, beams, membranes and other elastic systems. Discussion of approximate methods for analyzing nonuniform and built-up structures. Finite-element methods presented in a dynamic context. Introduction to random responses and to nonlinear systems, with emphasis on stability. Prerequisites: 240C, 242, or equivalents.

3 units, Aut (Ashley) MWF 3:15

244B. Structural Dynamics and Aeroelasticity—Continuation of the 244A treatments of finite-element methods and vibration of continuous, two-dimensional structures. Introduction to aeroelasticity from a unified viewpoint applicable to flight vehicles, rotating machinery and other elastic systems. Introduction to aeroelastic operators and unsteady aerodynamics in two dimensions. Forced response, static and dynamic eigenvalues of a simplified system. Aeroelastic analysis of representative one-dimensional and two-dimensional systems. Prerequisite: 244A or equivalent.

3 units, Win (Ashley) MWF 3:15, alternate years, given 1978-79

244C. Aeroelasticity—Continuation of 244B. The unrestrained elastic flight vehicle. Modern unsteady aerodynamic theory, including transonic flow and numerical methods for three-dimensional surfaces. Review of experimental methods. Special topics of current interest, such as optimization, coupling between aeroelastic phenomena and automatic controls systems, and problems of power machinery, windmills, etc. Prerequisite: 244B.

3 units, Spr (Ashley) MWF 3:15, alternate years, given 1978-79

245A. Theory of Elasticity—(Enroll in Mechanical Engineering 238A.)

245B. Theory of Elasticity—(Enroll in Mechanical Engineering 238B.)

245C. Theory of Elasticity—(Enroll in Mechanical Engineering 238C.)

246. Theory of Plates—(Enroll in Mechanical Engineering 241A.)

247. Theory of Shells—(Enroll in Mechanical Engineering 241B.)

248. Thin Shell Analysis—(Enroll in Mechanical Engineering 241C.)

249A. Introduction to Nonlinear Continuum Mechanics—(Enroll in Mechanical Engineering 242A.)

249B. Introduction to Nonlinear Continuum Mechanics—(Enroll in Mechanical Engineering 242B.)

253A, B. Waves and Vibrations—(Enroll in Mechanical Engineering 236A, B)


3 units, Spr (Chao) TTh 2:45-4:00

270. Introduction to Linear System Theory—(Enroll in Electrical Engineering 363.)

271A. Stability and Control of Flight Vehicles—Rigid-body dynamics of spacecraft, fixed-wing aircraft, and rotary-wing aircraft. Stability and control of longitudinal and lateral modes of motion, with and without spin. Introduction to autopilot and autoland systems. Prerequisites: 242, 200, Engineering 105 or equivalents.

3 units, Spr (Bryson) TTh 9:30-10:45


3 units, Aut (Bryson, DeBra) MWF 8, alternate years, given 1979-80

flight testing techniques. Prerequisites: 242 and Engineering 104.
3 units, Win (DeBra) MWF 10, alternate years, given 1979-80

3 units, Spr (DeBra) MWF 8, alternate years, given 1979-80

273A. Digital Control I—(Enroll in Engineering 207.)
273B. Digital Control II—(Enroll in Engineering 208.)
275. Fluid Power Control—(Enroll in Mechanical Engineering 229.)
276. Control Systems Analysis and Design—(Enroll in Engineering 206.)
277. On-Off Control Logic—(Enroll in Engineering 209.)

3 units, Win (Breakwell) TTh 8

3 units, Spr (Bryson) TTh 8

3 units, Aut (Breakwell) MWF 11, alternate years, given 1978-79

279A. Space Mechanics—Orbits of near-earth satellites and interplanetary probes; transfer and rendezvous; decay of satellite orbits; influence of earth's oblateness; sun and moon effects on earth satellites.
3 units, Win (Powell) TTh 9:30-10:45

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 interplanetary 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 1978-79

280. 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 or consent of instructor.
3 units, Spr (Chang) TTh 11:00-12:15

283. Aircraft Propulsion—Aircraft characteristics which influence propulsion performance. Physical parameters of airbreathing propulsors, including ramjets, turbojets, and turbosfans. Supersonic inlet and nozzle design. Performance calculations of engines and review of selected items of current propulsion research literature. Prerequisite: Fundamental fluid mechanics or consent of instructor.
3 units, Win (Chang) TTh 11:00-12:15

286. Advanced Aircraft and Space Propulsion—Topics selected from supersonic and hypersonic propulsion, scramjets, rocket/airbreathing hybrids, variable cycle and variable engines, engine-airframe integration, propulsion system control and simulation, hybrid rockets, gas-particle flow, thrust vector control and basics of electric propulsion. Prerequisites: 280, 283 or consent of the instructor.
3 units, Aut (Chang) TTh 1:15-2:30; alternate years, given 1978-79

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, La Place, Hankel, Mellin transforms. Applications to
boundary and initial value problems in acoustics, waves in solid, vibration, random vibration, and heat conduction. Inverse transformation, contour integration. Methods of steepest descent and stationary phase. Group velocity for dispersive waves. Prerequisite: Mathematics 106 or its equivalent (may be taken concurrently).

3 units, Win (Chao) TTh 9:35-10:50, alternate years, given 1979-80

291B. Linear Transforms and Their Applications to Engineering Problems II—Continuation of 291A: Advanced techniques in integral transforms. Cagniard's method and its applications to seismology. Weiner-Hopf technique, defraction and scattering of waves by an obstacle. Prerequisite: 291A.

3 units, Spr (Chao) TTh 9:35-10:50, alternate years, given 1979-80

294A. Introduction to Nonlinear Continuum Mechanics—(Enroll in Mechanical Engineering 242A.)

294B. Introduction to Nonlinear Continuum Mechanics—(Enroll in Mechanical Engineering 242B.)

295. Seminar in Solid Mechanics—(Enroll in Mechanical Engineering 295.)

297. Seminar in Flight Mechanics and Control—Problems in all branches of vehicle control, guidance and instrumentation. The purpose of the seminar is to extend the subject matter of the classroom and 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. Graduate students with an interest in automatic control applications in flight mechanics, guidance, navigation and mechanical design of control systems 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 (Powell) 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

**CHEMICAL ENGINEERING**

*Chairman: Channing R. Robertson*

*Professors: Andreas Acrivos, Michel Boudart, Robert J. Madix, David M. Mason, Channing R. Robertson*

*Adjunct Professor: Alan S. Michaels*

*Consulting Professor: Richard F. Balzhiser*

*Associate Professors: Curtis W. Frank, George M. Homsy*

*Lecturer: Robert H. Schwaar*

*Affiliated Faculty:*

*Professors: Robert A. Huggins, William C. Reynolds, William E. Spicer, Milton D. Van Dyke*

**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, transport phenomena, and applied chemical kinetics. In addition, this program includes courses in physics, mathematics, chemistry, and basic engineering, and may be further supplemented by optional advanced chemical engineering courses in polymer science, plant design and selected courses from the graduate course offerings in chemical engineering. 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 advisors or the Dean's Office, School of Engineering. It is recommended that the student discuss his or her prospective program with an advisor, 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**

A Master of Science program comprising an academic year of appropriate course work is available to accommodate students wishing to

*The curriculum leading to the B.S. degree in Chemistry is described elsewhere in this bulletin.*
pursue professional chemical engineering work upon receiving the M.S. degree, including foreign students who plan on returning to their homeland. The M.S. degree is awarded without requiring a formal thesis after a minimum of 3 quarters of broad study subject to the following specifications:

Unit and Course Requirements—For those students terminating their graduate work with the M.S. degree in chemical engineering, a program consisting of 45 units of academic work is required, including at least 4 lecture courses selected from the Chemical Engineering 200-series. The remaining courses may be chosen from departmentally approved graduate or advanced undergraduate courses in basic or applied sciences and engineering according to the following guidelines: (1) Approved courses include (a) all graduate courses offered in the Departments of Aeronautics and Astronautics, Chemical Engineering, Civil Engineering, Electrical Engineering, Materials Science Engineering, Mechanical Engineering, Operations Research, Applied Physics, Biological Sciences, Chemistry, Computer Science, Mathematics, Physics, Statistics, and the School of Earth Sciences, and (b) all upper-division undergraduate courses in Biological Sciences, Computer Science, Mathematics, Physics, and Statistics. (2) None of the depth-sequence courses required for the B.S. degree in chemical engineering as listed on page 86 of this catalog may be counted as part of the 45-unit Master's program. Any departure from these guidelines is to be resolved by petition of the student to the chairman of the department of chemical engineering. Credit toward the M.S. degree will not be given for Chemical Engineering Special Topics courses numbered Ch. E. 270-277, or for the Colloquium, Ch. E. 300. Note that the student should register for Ch. E. 300 and attend the Colloquia. Students wishing to obtain research experience should choose an advisor and enroll in Chemical Engineering Research 290, for which up to 6 units may count toward the 45-unit requirement; Ch. E. 290 however, cannot be substituted for any of the required four lecture courses in the Chemical Engineering 200-series. A written report describing the results of this research must be submitted to and approved by the research advisor.

To insure that an appropriately balanced program is being taken by all M.S. candidates, the student's program must be approved by the graduate advisor, and a tentative program for the whole academic year should be worked out by the student and advisor at their first meeting of the academic year.

Minimum Grade Requirement—All courses must be taken for letter grades, if offered, with the minimum grade point average for students enrolled in the terminal master's program in chemical engineering being 3.00.

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 (excluding chemical engineering courses numbered 270-300) is required, with six courses being chosen from the Chemical Engineering 200-series. The remaining electives must be advanced technical courses chosen with the consent of the advisor according to the guidelines noted for the Master's degree in Chemical Engineering. All courses must be taken for a letter grade, if offered, with the minimum grade point average being 3.00. After completion of this series of courses and at least 3 quarters of residence (36 units or more of course work) the student will be eligible to apply for the M.S. degree in chemical engineering.

Thesis Requirement—The thesis must represent a substantial piece of research equivalent to nine months of full-time effort and must be approved by a reading committee consisting of two members of the chemical engineering faculty.

Qualification for the Ph.D. Program by Students Receiving the Degree of Engineer—Upon completion of all the requirements for the Engineer's degree, a student, if he/she so wishes, may be examined on his/her Engineer's research work for the purpose of qualifying for the Ph.D. The student's thesis must be available in its final form for inspection by the faculty and must have been approved by the Reading Committee at least two weeks prior to the scheduled date of the examination.

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, including six courses chosen from the Chemical Engineering 200 lecture series. After completion of this series of courses and at least 3 quarters of residence (36 units or more of course or research work) the student will be eligible to apply for the M.S. degree in chemical engineering. The remaining courses, to total 60 units, may be chosen from the basic sciences and engineering, including up to six units of Chemical Engineering 270 through 277. A few selected students may participate in a
research project during their first year. Following consultation with their advisor and approval by the Graduate Committee, they may register for up to six units of Chemical Engineering Research. This research need not be the same as the student’s ultimate Ph.D. research. These units may be applied toward either the 36-unit requirement for the M.S. or the 60-unit requirement for the Ph.D. degree. No credit will be given for Chemical Engineering 300, undergraduate Chemical Engineering courses, or courses usually required for the B.S. degree. All courses taken to satisfy the degree requirements must be taken for letter grades, if offered, with the minimum acceptable grade point average being 3.00.

Qualifying Examination—in order to be advanced to candidacy for the Ph.D. degree, the student must pass a qualifying examination. (1) Students identified by the Graduate Committee as making less than satisfactory progress in their courses during the academic year will be asked to present orally and defend a critical review of a published paper before the faculty at the end of the Spring quarter. This examination shall be used as the basis for allowing these students to choose advisors and begin their thesis research. Failure of this examination results in termination of the student’s study with an M.S. degree and precludes financial aid beyond that already promised. (2) Students considered to be making satisfactory progress in course work will choose advisors and begin their Ph.D. research at the end of Spring Quarter of their first year. These students and those passing the examination described in (1) above will take a qualifying examination consisting of an oral defense of their research work before the faculty early in the Fall quarter of their second year.

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 this 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 advisor. 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 and non-Newtonian Fluid Mechanics, Suspension Rheology, Hydrodynamic Stability, Electrochemical Energy Conversion, Applied Chemical Kinetics, Polymer Science, Surface Reactivity, Adsorption and Catalysis, Membrane Separation Processes, 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. The completed application should be received 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—This course is intended to provide an overview of the field of chemical engineering through discussion and engineering analysis of physical and chemical processes. Concepts of mass and energy transport in equilibrium processes are developed in the first part of the course. Their utility is illustrated by a number of typical examples. These will include methane and methanol syntheses, energy from municipal refuse, coal gasification, and others having an impact on U.S. energy resources. Rate processes are introduced in the second part of the course. Heat and mass transport are discussed, and application is made to the design of artificial-kidney devices and the analytical approaches commonly employed to predict operating efficiencies. The remainder of the course focuses on the kinetics of enzyme-catalyzed reactions and free-radical chain polymerization. Also considered are the concentration and temperature dependencies of reaction rates and the interpretation of batch reactor data. This course is intended for freshmen and sophomores. May be taken by upperclassmen with consent of instructor. Prerequisite: Chemistry 31, 33 recommended but not required. (DR:T)

3 units, Spr (Frank, Homsy, Robertson)
TTh 8:00-9:15

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, and a large petrochemical facility. Pass/no credit. (DR:X)

1 unit, Spr (Frank, Homsy, Robertson) by arrangement
110. Equilibrium in Thermodynamic Systems—Review of the postulates of thermodynamics; properties of nonideal systems including mixtures; phase equilibria and chemical equilibria. Prerequisite: Chemistry 171. (DR:T)
3 units, Win (Madix) MWF 10

120. 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: 110 or equivalent. (DR:T)
3 units, Spr (Staff) MWF 10

3 units, Win (Boudart) WF 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 (DR:T)
3 units, Aut (Acrivos) TTh 8:00-9:15

150. Energy and Mass Transport—A basic course in the transport of energy and mass in solid and fluid continua. Fourier's law, heat transfer in solids, laminar flow, forced and free convection, boundary-layer heat transfer, natural convection with application to geophysical flows, 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. (DR:T)
3 units, Win (Homsy) MWF 9:00

160. Chemical Engineering Plant Design—Application of chemical engineering principles to design of practical plants for chemical manufacture and oil refining. Topics include: preparation of flow sheets and material balances; equipment design for separation processes, chemical reactions, heat transfer, pumping and compression; estimation of capital expenditures and production costs; construction in the chemical industry; conservation of energy and water; waste treatment; environmental considerations. Open to seniors in chemical engineering or by consent of instructor. (DR:T)
4 units, Spr (Schwar) WF 1:15-3:05

170. Introduction to Polymeric Materials—This course examines fundamental molecular aspects related to the use of polymers as engineering materials. Topics to be included are: morphology and order in crystalline polymers, thermal transition behavior in amorphous polymers, rubber elasticity and linear viscoelasticity. (DR:T)
3 units, Aut (Frank) TTh 9:30-10:45

180. Chemical Engineering Laboratory—This comprehensive course is an intensive investigation of a number of experimental aspects of chemical engineering science. Experiments are selected to illustrate the broad range of fundamental principles developed in the lecture courses 110, 120, 130, 140, 150, and 170. The experiments are divided into six areas corresponding to the appropriate lecture course. These are: thermodynamics (partial molal volumes of nonideal solutions, second virial coefficient of a gas), separations and diffusional mass transfer (gas chromatographic separation, steady diffusional mass transfer), chemical reaction kinetics (continuous packed-bed flow reactor, semi-batch slurry reactor), fluid mechanics (laser-Doppler velocimetry, flow past spheres and cylinders), energy transfer (transient and steady conduction, double pipe heat exchanger, radiative energy transport) and polymer materials science (glass transition temperature, viscoelastic creep). Eight of the thirteen experiments from five of the six areas must be performed. This course is to be taken during the senior year following completion of the entire lecture course sequence.
6 units, Spr (Staff) by arrangement

190. Undergraduate Research in Chemical Engineering—Laboratory or theoretical work for undergraduate students under the direct supervision of a faculty member. This course involves research in one of the graduate research groups or other special projects in the demonstration laboratory. Students should consult their advisors for information on available projects. (DR:X)
(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 relevant 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. Topics covered include applications of matrix theory, Laplace transforms, solution of ordinary differential equations, perturbation techniques, expansion solutions of partial differential equations, and eigenvalue problems. Introductory stability theory with applications to chemical reaction engineering and fluid mechanics. Prerequisites: Mathematics 113, 130, 131 or equivalent.

3 units, Aut (Homsy) MWF 9:00

201. Bioengineering—This course covers the analytical and experimental aspects of selected biological and physiologival problems as viewed from a chemical engineering perspective, with emphasis on transport phenomena. Topics to be treated are: solute and water transport through membranes with applications to renal function; the design of immobilized enzyme reactors; advanced drug delivery systems; the engineering aspects of recombinant DNA; biomaterials; substitute fuels from biomass sources. (DR:T)

3 units, Spr (Robertson) TTh 9:30-10:45

3 units, Win (Frank) TTh 9:30-10:45


3 units, Aut (Boudart) WF 2:15-3:30

203. Chemical Reaction Engineering—Physical problems of engineering interest where transport of mass, energy and momentum in multicomponent systems is accompanied by homogeneous or heterogeneous chemical reactions. Behavior of conventional reactors will be analyzed. Selected topics include behavior of nonisothermal porous catalysts; thermal properties of reacting fluids; combustion and electrode kinetics; and oscillatory reactions. (DR:T)

3 units, Spr (Mason) TTh 2:15-3:30

207. Fluid Phase Equilibria—This course will examine advanced topics in phase equilibria with particular emphasis on systems of interest to chemical engineers. The relationship between equilibrium properties and molecular-based theories of solutions will be presented. Topics to be presented include various aspects of the interrelationships between molecular theories of matter and descriptive thermodynamic properties such as fugacity coefficients, activity coefficients, and the prediction of phase composition at equilibrium. Prerequisite: 110 or equivalent. (DR:T)

3 units, Aut (Madix) TTh 11:00-12:15

210A. 3 units, Win (Acritos) TTh 8:00-9:15

210B. 3 units, Spr (Acritos) TTh 8:00-9:15

212. Polymer Science—This course examines several aspects of the physical chemistry of macromolecules. Topics to be included are: configurational statistics of model polymer chains, statistical thermodynamics of polymer solutions, light scattering and transport properties of dilute polymer solutions. (DR:T)

3 units, Win (Frank) TTh 9:30-10:45

215. Introductory Colloid and Surface Chemistry—The properties and characteristics of fluid-fluid interfaces are discussed from the standpoint of thermodynamics and molecular structure. Surface tension, surface active agents, and interfacial adsorption, and their roles in foaming, wetting, detergency, emulsification, etc., are reviewed. The colloidal state is described, and distinguishing characteristics of colloidal systems discussed and explained. Classical means of preparing colloidal dispersions are reviewed. Phenomena of diffusion and sedimentation, and colloid osmotic pressure are discussed and analyzed. Origins of colloid stability are reviewed, with emphasis on surface electrochemistry, electrical double-layer theory, and interactions of charged particles. Electrokinetic phenomena, coagulation mechanisms and kinetics, protection and sensitization in colloidal dispersions are examined. Practical applications of colloidal phenomena in the chemical industry are emphasized. (DR:T)

3 units, Win (Michaels) WF 1:15-2:30

270-277. Special Topics in Chemical Engineering—Discussion of recent developments and current research in specialized fields. Open
to qualified students with consent of instructor; units by arrangement. (All courses DR:X)
Aut, Win, Spr (Staff) by arrangement

270A,B,C. Fluid Mechanics
(Acrivos)

271A,B,C. Adsorption and Catalysis
(Boudart)

272A,B,C. Applied Chemical Thermodynamics and Kinetics
(Mason)

273A,B,C. Bioengineering
(Robertson)

274A,B,C. Surface Chemistry
(Michaels)

275A,B,C. Surface Reactivity
(Madix)

276A,B,C. Applied Chemical Thermodynamics and Kinetics
(Frank)

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. (DR:X)
(Staff) by arrangement

298. Seminar in Fluid Mechanics—(Enroll in Engineering 298.) (DR:X)

300. Colloquium—Students enrolled in this course will be expected to attend the colloquia of the Department of Chemical Engineering. Must be taken every quarter by candidates for advanced degrees in Chemical Engineering. (DR:X)
1 unit, Aut, Win, Spr (Staff) by arrangement

CIVIL ENGINEERING


Chairman: Robert L. Street
Associate Chairman: Joseph B. Franzini
Professors: G. Wayne Clough, James Douglas, (on leave spring quarter), John W. Fondahl

Consulting Professor: Ralph T. Cheng, I. M. Idriss, Keshavan Nair, Theodore C. Zsutty

Associate Professors: Jarir S. Dajani, James O. Leckie, Leonard Ortolano (on leave winter and spring quarters), Boyd C. Paulson, Jr.

Adjunct Professor: Gilbert M. Masters, Paul V. Roberts

Visiting: Nathan Buras, George F. Pinder, Katherine P. Warner

Assistant Professors: Peter C. Flachsbart, Edward Kavazanjian, Jr., Anne S. Kiremidjian, Helmut Krawinkler, Lily Y. Young (on leave 1976-78)


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, or a great variety of other branches. Laboratory facilities are available to the student 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 late in their junior 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 col-
laboration with other departments of the University, offers graduate programs with particular strength in:

- Construction Engineering and Management
- Infrastructure Management
- Infrastructure Planning
- Structural and Geotechnical Engineering
- Earthquake Engineering
- Foundation Engineering
- Reliability and Risk Analysis
- Soil Mechanics
- Soil-Structure Interaction
- Structural Engineering
- Structural Mechanics

Environmental and Water Studies
- Environmental Engineering
- Hydrology
- Hydromechanics
- Nuclear Civil Engineering
- Water Resources Engineering

Research work and instruction under these programs is carried out in the following facilities—the hydraulics laboratory, the water quality control research and teaching laboratories, the construction teaching laboratory, the materials laboratory, the concrete laboratory, the soil mechanics laboratory, and the structural engineering laboratory. Research in earthquake engineering is conducted in the John A. Blume Earthquake Engineering Center. 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. The construction faculty also offers a program leading to a Master of Science in Engineering—Industrial Construction; this program is primarily intended for students having undergraduate degrees in electrical, mechanical, mining or chemical engineering. 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.

INFRASTRUCTURE

PLANNING AND MANAGEMENT

The program focuses on the engineer as a planner and manager of life-support and public facility systems which are necessary for the development of cities and regions. These systems, which are referred to collectively as infrastructure, include water resources and water quality projects, transportation systems, energy facilities, emergency services and land use controls. The planning and management of these systems require the integration of a variety of technical, social, economic, institutional and environmental considerations, all of which are incorporated into the curriculum of the infrastructure planning and management program.

Students design their programs by selecting an appropriate mix of courses from either the planning core or the management core, and from an analytical series and a specialty area. Core courses cover social, economic, institutional, financial and environmental aspects of infrastructure planning and management. The analytic series includes courses in quantitative methods and techniques. Courses making up the specialty may emphasize one or more of the following areas: water resources, water quality, transportation, emergency services, land use controls and urban and regional planning. Emphasis is on planning and management as discipline, and men and women are prepared for all levels of career positions with private industry, consulting firms and government agencies.

Students seeking training in engineering management, in areas outside of construction and infrastructure management, should consider the Engineering Management program in the Department of Industrial Engineering and Engineering Management.

STRUCTURAL AND GEOTECHNICAL ENGINEERING

Instructional programs and research opportunities are provided in the areas of structural, earthquake, and geotechnical engineering. Particular emphasis is given to earthquake en-
Engineering, risk and reliability analysis, computer-aided structural analysis and design, structural dynamics, finite-element methods, foundations and earth structures, and soil-structure interaction. Flexible programs enable students to prepare for careers as consulting engineers or as engineers in industry, government and universities. The John A. Blume Earthquake Engineering Center provides support and facilities for instruction and research in earthquake engineering and structural dynamics.

ENVIRONMENTAL AND WATER STUDIES

In the environmental and water studies area there 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 chemistry, 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 for a water resources engineering program or with appropriate offerings under Infrastructure Planning and Management to give water resources and environmental programs with technical emphasis, planning and management emphasis, or a combination of these 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 B.S. 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: Infrastructure Management, Infrastructure Planning, Construction Engineering and Management, Environmental Engineering, Hydrology, Hydromechanics, Nuclear Civil Engineering, Geotechnical Engineering, Soil Mechanics and Foundations, Stuctural Engineering, Structural Mechanics, Earthquake Engineering, and Water Resources Engineering. A general M.S. in Civil Engineering without special designation is also given; this permits a student to develop a program with substantial coursework in two or more fields, for example: construction and structures or soil mechanics and water studies. 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 of 2.7 LGI and a program of at least 45 quarter units are required for candidates to be recommended for the M.S. degree. 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, 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. (Thesis research in absentia is not permitted.) 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 program 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. All candidates for the Ph.D. degree are required to spend part of one quarter as a teaching assistant. Further information about Ph.D. requirements and regulation 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 advisor 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 $2,000 to $7,860. A generous student loan program is available. John A. Blume Fellowships are available in the areas of earthquake engineering and dynamics of structures. Applications for financial aid and assistantships should be filed by January 15; it is important that GRE scores be available at that time.

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. Successful applicants will be advised as to the degree for which they are admitted and to the Program described above to which they are admitted. If students wish to shift from one Program to another after being accepted, an application for transfer must be filed with the Department, and they will be advised if the transfer is possible. If, after enrollment at Stanford, students wish to continue toward a degree beyond the one for which they were originally admitted, a written application must be made to the Department of Civil Engineering.

UNDERGRADUATE COURSES

All courses are (DR:X) unless noted otherwise.

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.

5 units, Spr (Parker) 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

4 units, Win (Kavazanjian) 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) T 1:15-5:05 plus Th 1:15-4:05

130. Transportation—The role and history of transportation. Operational characteristics of alternative transportation modes. The technology and economics of vehicles, networks and terminals. Issues, concepts and methods of transportation system engineering and planning. Decision- making in transportation management and planning. (Graduate Students enroll in 230). Prerequisite: Math 43. (DR:T)
3 units, Aut (Parker) T 1:15-5:05 plus Th 1:15 -4:05

133. Introduction to Urban Planning—The nature of urbanization and evolution of urban form; survey of economic, political, sociological and technological factors affecting modern urban growth; the planning process and its role in solving selected urban problems with special emphasis on the contributions of technology and engineering; current and future issues in urban planning. (DR:C)
3 units, Aut (Flachsbart) TTh 11:00-12:15

140. Advanced Surveying—Additional study of surveying. Prerequisite: 40 or equivalent. 1 to 3 units, Aut, (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, Aut (Fondahl) TTh 11-12:15
Win (Fondahl) MW 11-12:15

144. Construction Engineering and Management—Forms of construction organizations, labor relations, estimating construction costs, planning and scheduling, safety, cost accounting and control, residential construction.
3 units, Aut (Paulson) MWF 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

Note: There will be several 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 causes, effects and methods of controlling environmental degradation. Stress is placed on problems associated with population and food supply; water resource development and water pollution; air pollution; and environmental effects of energy consumption. The environment as a constraint on probable alternative futures is considered. (Intended for both science and nonscience majors). (DR:T)
3 units, Aut (Masters) MWF 8

171. Environmental Planning—Environmental policies and programs with emphasis on the implementation of the National Environmental Policy Act of 1969 and federal legislation controlling air and water pollution; the integration of environmental considerations into public sector planning and decision making related to land use and infrastructure development. Desirable prerequisite: 170 or equivalent. (Graduate students enroll in 228.)
3 units, Win (Brendecke) 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 139.)

175. Environmental Measurements—(Enroll in Mechanical Engineering 139.)
176. Small Scale Energy Systems—Theoretical and practical considerations involved in the design of small scale energy systems suitable for a single dwelling or small cluster of buildings. Solar space heating and cooling; solar water heating; electricity from the wind and sun; methane digesters; and intensive food production techniques. Designs for self-sufficient living including individual water supply and waste handling systems. Open to all students. (Graduate students enroll in 219.) 3 units, Spr (Masters) MWF 10

177. Planning for Decentralized Energy Systems—Potential impact of decentralized thermal and electrical generation systems on electric utility load characteristics, capacity requirements, and rate structures; public policy aspects including sun rights, tax incentives, building codes, model subdivision regulations, and life cycle costing; land use aspects of medium-scale solar utilities. Prerequisite: 176 (may be taken concurrently). 2 units, Spr (Masters) T 2:15-4:05

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 (Kiremidjian) 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 C.E. 180 or equivalent. 4 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 C.E. 180 or equivalent. 4 units, Spr (Krawinkler) MW 9 plus Th 3:15-5:05

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.

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

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 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

All courses are (DR:X)

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 Th 1:15-3:05

204. Probabilistic and Risk Analyses in Civil Engineering—The principles of risk analysis, including acceptability criteria, are discussed. Emphasis is on practical applications. Discussion of case histories where formal probabilistic analyses have been conducted as input to design, licensing, and management decisions. Prerequisite: 203. 3 units, Win (Nair) TTh 3:15-4:30

206. Stochastic Processes and Decision Statistics for Civil Engineers—Description of stochastic processes; transportation models;
relationships between physical design, 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 203.

4 units, Win (Kiremidjian) TTh 10 plus W 2.15-4.05

219. Small Scale Energy Systems—Same as 176, with additional assignments for students who desire graduate credit.

3 units, Spr (Masters) MWF 10

220. Seminar in Infrastructure Planning and Management—Discussion by faculty and students on various aspects of infrastructure planning and management; course credit restricted to students in the Master's program in Infrastructure Planning and Management or by special permission.

1 unit, Aut (Staff) M 3.15-5.05

221. Planning and Management Methods I—Introduction to planning theory with emphasis on the alternative roles of the civil engineer/planner. Issues, concepts, and methods in demographic, economic, and technological forecasting. The application of analytical methods to the development and evaluation of civil engineering systems. Case studies and applications will be examined. Prerequisites: 226 or Operations Research 152.

3 units, Win (Dajani) MWF 1.15

222. Planning and Management Methods II—The logic of social inquiry in resolving planning and management problems; theory of measurement in the social sciences; survey research design including hypothesis construction, sample selection, instrument design, data collection and processing, survey research analysis including index and scale construction, proper use of statistics and complex modes of analysis; the ethics and uses of survey research; alternative approaches to involving citizens in planning. Prerequisite: A basic course in statistics.

3 units, Spr (Flachsbart) TTh 9.30-10.50


3 units, Win (Roggeveen; TTh 11.00-12.15

225. Financing of Infrastructure—Internal organization, personnel management, labor relations, operations, costs analysis, pricing, mar-
marketing, advertising, public information. These are considered in contexts of continuous operation and changes in levels of service of various kinds of publicly and privately provided infrastructure.

3 units, Spr (Roggeveen) MWF 1:15

232. Inter-City Transportation Systems—Fundamentals of air, rail, and water transport systems. Planning, design, and operation of interfaces and line-haul services. Technical, economic, managerial, institutional, and regulatory issues for passengers and for freight. Prerequisite: 130.

3 units, Win (Roggeveen) TThF 2:15; plus several field trips to be arranged.

233. Urban Redevelopment and Public Works—The course focuses on current urban redevelopment programs which involve large capital investments in urban infrastructure. Major attention will be given to organizational and financial arrangements and to the roles played by various private and public participants in such projects. Case studies and specific ongoing project efforts will be examined extensively. Enrollment limited to 15 students.

3 units, Win (Warner) Th 3:15-5:05, plus one hour by arrangement

234. Land Use Planning—The historical and intergovernmental context of land use planning; rationale for planning as a government activity; steps in plan preparation; basic studies prior to plan formulation; forecasting requirements for commercial, industrial and residential land uses; measures of plan implementation including zoning and growth management controls; application of the comprehensive planning process to typical problems of community growth and development; methodological, administrative, and political constraints to the rational planning process.

3 units, Win (Flachsbart) MWF 11

235. Infrastructure and Land Use—The implications of land use decisions on infrastructure requirements and the ways in which infrastructure decisions affect land use. Introduction to the study of urban spatial structure; use of mathematical models to examine the land use—transportation interface; the land use implications of infrastructure design parameters; effects of public works developments on regional growth. Prerequisite: Math 43 or equivalent; 221 is recommended.

3 units, Spr (Dajani) MWF 11:00

236. Infrastructure 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

237. Selected Topics in Infrastructure Planning and Management—Contents vary from year to year. Possible topics for the 1978-79 academic year include energy management and planning techniques for conservation; case studies in social impact assessment; solid waste planning and management; and aesthetic impacts of infrastructure. Enrollment will be limited to 20 students with first preference given to students in the Master's program in Infrastructure Planning and Management.

2 units, Spr (Staff) W 2:15-4:05

238A,B. Infrastructure Dynamics—This course will require student involvement in research dealing with the dynamic interrelationships between infrastructure investments and management decisions on the one hand and land use patterns on the other. Students' work will cover the investigation of alternative methodologies for forecasting such interrelationships and impacts, as well as the application of these methodologies to a particular field situation. Enrollment will be limited to 10 students.

238A. 3 units, Aut (Dajani) W 2:15-4:05
238B. 3 units, Win (Dajani) M 2:15-4:05

239. Seminar in Water Resources Planning—Selected topics. Possible choices include: theories of water resources planning, the U.S. Water Resources Council's multi-objective planning framework, the role of the public in planning, and techniques for assessing the environmental impacts of water projects. Enrollment will be limited to 20 students. Prerequisites: 160 or 266.

2 units, Spr (Ortolano) F 2:15-4:05
(Offered 1979-80)

240. Operations Analysis for Work Improvement in Construction—Application of crew balance, process charts, time-lapse motion pictures, and other techniques to construction operations. Accident prevention and safety management. Prerequisite: graduate standing.

3 units, Aut (Parker) T 8, Th 8-10

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

242. Project Control—Analytical techniques for bringing a project to completion within budget, on time and according to specifications, including study of cost engineering, schedule
and resource control, procurement, and quality control. This course may be taken for additional credit by students with programming experience who wish to develop computer applications for project control. Prerequisite: 241.

3 units, Win (Paulson) MWF 9

244. Construction Equipment Policy—The development of equipment policy from the owner's point of view. Topics studied will be the determination of economic life, replacement timing, equipment cost collection and record keeping, inventory management, security, safety, and maintenance. All students will learn the composition of a mathematical model for cost analysis; those taking the computer option for an additional unit will program the algorithm for the model. A term paper will be required on a topic of mutual choice on a subject related to equipment policy.

2 or 3 units, Win (Douglas) TTh 9, plus one hour by arrangement

246. Construction Administration—Business and management aspects of construction; industry profile, company organization, contracting methods, bonding and insurance, sub-contracts, legal aspects, cash flow, and markup. Prerequisites: 143, 144, and 145.

3 units, Win (Fondahl) TTh 8 and F 1:15

248. Construction Financing in Real Estate and Land Development—This course is a study of the interrelationships between all of the variables that make up a successful real estate project with heavy emphasis on the financial aspects involved in land acquisition, land development, construction, and permanent financing. In addition, we will discuss various aspects of joint venturing, including the control functions and equity financing. Enrollment limited to 30. Prerequisite: graduate standing.

3 units Spr (Medearis) TTh 8, plus one hour by arrangement

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 or co-requisite: 144 or equivalent.

4 units, Aut (Paulson) MWF 3:15-5:05

250. Human Resources in Construction and Engineering Management—Seminar dealing with the problems of working and communicating with individuals and groups. Enrollment limited to 15 students per section with preference to those from the graduate Construction and Planning Programs.

2 units, Win (Oglesby) MT or W 3:05-5:15

252. Heavy Construction Estimates—Estimating and bidding construction work, with emphasis on procedures adapted to large engineering projects. Prerequisites: 144, 145, and 254, or equivalent in general knowledge of construction methods and equipment, and graduate standing in construction option.

4 units, Spr (Paulson) MWF 9

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 (Jessup and Stetson) by arrangement


3 units, Win (Parker) MWF 11

255. Concrete Construction—The procedures, methods, and equipment for manufacturing concrete, including form design, placing and curing of concrete. Special placement techniques and the use of non-standard concretes are discussed. Prerequisite: graduate standing.

3 units, Spr (Parker) MWF 11

256. Waterfront Construction—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, Win (Douglas) TTh 10 and M 1:15

257. Industrial Construction—This is a finishing course that extends and provides practical applications for concepts introduced in earlier construction courses. It focuses in particular on total design-construct projects, many of which are in the international market. Subjects include engineering, procurement, construction, planning and controls, project execution, business development, sales, contracts, negotiations, and legal aspects. Prerequisites: 143, 144, 242, 246.

3 units, Spr (Kontny and Aley) T 3:15-6:00

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. Course credit restricted to students in graduate construction program or by special permission.

258A. 1 unit, Aut (Parker) by arrangement

258B. 1 unit, Win (Parker) by arrangement

258C. 1 unit, Spr (Parker) by arrangement
259A, B, C. 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.

259A. 1 to 3 units, Aut (Paulson) by arrangement
259B. 1 to 3 units, Win (Paulson) by arrangement
259C. 1 to 3 units, Spr (Paulson) by arrangement

260. Water Resources Systems Engineering—Economics of water resources systems design: efficient allocation of resources and project evaluation. Estimating water demand: urban use, irrigation, industry, energy. Water-energy interactions. Applications of operations research methods with illustrations selected from among management problems in storage systems; the conjunctive use of surface and groundwater reservoirs. Prerequisite: 226 or equivalent.

3 units, Spr (Buras) MWF 1:15

261. Environmental Fluid Mechanics I—Focus on technological and ecological problems associated with waste disposal and thermal pollution and their affects on water quality. Basic theory, construction of analytic, numerical and physical models, applications and use of the computer related to: dispersion and waste disposal in rivers, estuaries, and the ocean environment; thermal loading and transfers in rivers, lakes, cooling ponds, reservoirs, estuaries and the ocean. Design concepts; numerical and theoretical analyses; and physical modeling parameters derived by dimensional analysis. Prerequisites: Engr. 21 (or equivalent) and C.S. 103 and 106 (or equivalent); or consent of instructor.

4 units, Win (Street) MWF 11; problem session Th 12:15-1:05

262. Environmental Fluid Mechanics II—Review of the fundamental equations of fluid flow in streams, estuaries, lakes, etc. Development of finite-difference and finite-element methods for solution of two-dimensional systems. Construction of computer-based numerical models using the methods. Applications of computer modeling including existing large scale simulation models. Prerequisites: E. 21, C.E. 261 and C.S. 103; or equivalents; or consent of instructor.

4 units, Spr (Cheng) TTh 3:15-5:05

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


3 units, Win (Frazinzi) TTh 11 and F 1:15

265. Seminar in Fluid Mechanics—(Enroll in Engineering 298.)

266. Engineering Hydrology—The processes of the hydrologic cycle, hydrologic data, and methods of hydrologic analysis of stream flow.

4 units, Aut (Linsley, Franz) MWF 9 and W 2:15-4:05

267. Advanced Hydrology—Probability and stochastic methods in hydrology, hydrology and water quality, applications of hydrology to water resources problems, and readings in current literature. Prerequisite: 266 or a previous hydrology course.

4 units, Win (Linsley, Franz, Imhoff) MWF 10 and T 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. Background in fluid mechanics and engineering economy. Concurrent registration in 260 recommended.

4 units, Spr (Staff) MWF 9 and 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 (P. Kruger) W 4:15-6:05

270. Water Quality in Water Resource Development—Effects of organic, nutrient, and thermal pollution on the ecology and chemical quality of streams, lakes, reservoirs, and estuaries; cause and control of eutrophication; inplace 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 for municipal and industrial use. Prerequisites: 270 and 273 or equivalent.
   3 units, Win (Roberts, Leckie) MWF 8

271B. Water Quality Control II—Chemical and biological unit processes for the treatment of municipal and industrial wastes; advanced methods of wastewater treatment including nutrient removal and physicochemical methods. Prerequisites: 274 or equivalent and 271A.
   3 units, Spr (McCarty) MWF 8

271C. Water Quality Control III—Analysis of advanced or specialized wastewater treatment flowsheets, emphasizing industrial problems, and advanced treatment of municipal waste. Emphasis on identification of problem, objective, alternative solutions and deciding factors in each case. Use of resulting flowsheet design concepts in preliminary design. Course is conducted as a seminar and workshop based heavily on student participation in class. Prerequisite: 271A. Offered alternate years. To be given 1979-80.
   3 units, Spr (Roberts)
   T 1:15-3:05 and F 2:15-3:05

272. Environmental Biology—Discussions on some basic ecological principles and 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
   (Not offered 1978-79)

273. Water Chemistry—A systematic presentation of chemical principles and application of those principles to the analysis and solution of problems in aqueous geochemistry (temperatures near 25°C and atmospheric pressure). Particular attention is given to the analysis of natural water systems and to the understanding and solution of specific chemical 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. 31 and 33 or equivalent.
   3 units, Aut (Leckie) TTh 11 plus F 2:15

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.
   2 units, Aut (Leckie) W 2:15-5:05

273B. Hydrogeochemical Cycles—A study of the processes and mechanisms responsible for the natural circulation of major, minor, and trace elements through the hydrosphere, atmosphere, lithosphere, and biosphere. Emphasis will be placed on a mechanistic interpretation of global cycling of elements and man’s influence on accelerating or intercepting the normal processes. Considerations will include chemical weathering processes, biotransformations of elements, residence times in various environmental compartments, and fluxes between environmental compartments. Prerequisites: 273 and 274.
   2 units, Spr (Leckie) by arrangement
   Offered alternate years, given 1978-79

274. Water Microbiology—Fundamental aspects of microbiology and biochemistry as related to environmental pollution and water quality control processes; the role of major groups of microorganisms as pollutants, as purifying agents, and as agents of biogeochemical change; microbial identification and ecology as related to the aquatic environment. Prerequisite: 273.
   2 units, Win (Staff) TTh 9:00

274A. Water Microbiology Laboratory—Experimental approach to understanding fundamentals of microbiology; topics include morphology, metabolism, microbial interactions and water quality parameters. Prerequisite: 273.
   1 or 2 units, Win (Staff) W 2:15-5:05

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 (or equivalent) and 271B which may be taken concurrently.
   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 (P. Kruger) TTh 10 plus lab by arrangement

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.

3 units, Win (P. Kruger) MWF 10

276C. Environmental Radioactivity—The biological importance of environmental radiation 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) MWF 9


1 unit, Spr (Leckie) W 4:15

280A. Matrix Analysis of Structures—Analysis of complex framed structures by matrix methods; flexibility and stiffness methods developed, with emphasis on the latter; with orientation toward solution by digital computer. Optional concurrent registration in 280B. Prerequisites: elementary structural analysis (or mechanics of materials) and elementary matrix algebra.

3 units, Aut (Weaver) MWF 9


2 units, Aut (Weaver) M 3:15-4:30

281A. Finite-Element Method of Structural Analysis—Theory of finite elements applied to problems in structural mechanics; plane stress and plane strain; isoparametric formulations; axisymmetric and general solids; flexure in plates; axisymmetric and general shells. Optional concurrent registration in 281B. Pre-requisite: 280A or equivalent.

3 units, Win (Weaver) MWF 11


2 units, Win (Weaver) M 3:15-4:30

282A. Earthquake Engineering I—Earthquake phenomena, faulting, ground motion; study of past major earthquakes; effects of earthquakes on man-made structures; response spectra; Fourier spectra; structural dynamics; analysis and design of structures; building codes; current research in earthquake engineering.

3 units, Win (Gere) MWF 9

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 analysis. Prerequisite: 282A or consent of instructor.

3 units, Spr (Shah) MWF 9

285. Design of Structures I—Steel Design; inelastic behavior of structures; limit analysis and limit design; ultimate strength of structural elements; collapse loads for frames. Reinforced Concrete Design; columns—axial load plus biaxial bending; equivalent frame method for slab systems; yield line analysis of slabs; design of shear walls. Prerequisites: basic courses in design of steel and reinforced concrete structures.

4 units, Aut (Krawinkler) TTh 11, and 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. Laboratory experiments on structural elements and frame models. Prerequisites: basic courses in design of steel and reinforced concrete structures.

4 units, Spr (Krawinkler) MW 1:15-3:05

290. Soil Mechanics—Examination of basic principles of soil behavior. Discussion of shear
strength of soil under static and dynamic loading; liquefaction phenomena; new methods of soil exploration and testing; selection of shear strength parameters for soil. Prerequisite: 190 or equivalent.

3 units, Win (Clough) TTh 11:00-12:15

291. Foundation Engineering—Types and characteristics of foundations; design methodology for shallow and deep foundations; problems created by construction of foundations; stresses in soils. Problem sets, design project. Prerequisite: 190 or equivalent.

3 units, Win (Clough) MWF 10

292. Earth Structures—General aspects of design and construction of retaining structures, excavations, slopes and earth embankments and dams. Excavation support systems; braced and tied-back walls; slurry walls; underpinning. Slope stability analysis methodology; types of earth dams. Prerequisite: 190 or equivalent.

3 units, Spr (Kavazanjian) TTh 11:00-12:15

293. Experimental Soil Mechanics—Laboratory investigations of soil behavior; triaxial, direct shear, simple shear tests; measurement of pore pressure; seismic loading of soil. Illustrations of basic soil behavior principles. Seven laboratory experiments; weekly reporting of results and final course report. Prerequisite: 290 or equivalent.

2 units, Spr (Kavazanjian) by arrangement

294. Soil Dynamics—I—Introduction to foundation vibration problems and geotechnical aspects of earthquake engineering. Effects of wave propagation through soil; wave transmission during pile driving; design of vibrating foundations; analysis of liquefaction; slope performance, retaining wall loadings in earthquakes; site response effect of soil conditions during earthquakes. Prerequisites: 290, 291 or equivalent.

3 units, Aut (Kavazanjian) MWF 10

295. Introduction to Rock Mechanics—Basic principles of rock mass behavior under loadings by engineering structures. Classification of rock; response of rock to loads; measurement of in-situ stress. Design of slopes and underground openings in rock. Prerequisite: 190 or equivalent.

2 units, (Staff) T 2:15-4:05, alternate years, given 1979-80

296A. Structural Dynamics I—Vibrations and dynamic response of simple structures to periodic and arbitrary loadings; support motion; response spectra; two-degree-of-freedom systems. Prerequisites: 190 and Engineering 12.

3 units, Aut (Gere) MWF 10

296B. Structural Dynamics II—Vibration and dynamic response of complex structures by matrix methods; linear analysis of multi-degree-of-freedom systems by normal-mode and direct extrapolation methods; nonlinear analysis with step-by-step approximation formulas; response of multi-story buildings and other structures to dynamic loads and earthquake ground motion. Optional concurrent registration in 296C. Prerequisites: 280A and 296A or equivalents.

3 units, Spr (Weaver) MWF 11

296C. Computer Programming for Structural Dynamics—Implementation of matrix methods for structural dynamics on a digital computer; application of normal-mode and numerical approximation methods; automatic computation of dynamic response for complex structures. Mandatory concurrent registration in 296B.

2 units, Spr (Weaver) M 3:15-4:30

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) MWF 10

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


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—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


Chairman: John G. Linvill (on leave 1978-79)
Vice Chairman: Robert L. White (acting Chairman)
Associate Chairmen: James B. Angell, Martin Hellman
Assistant Chairman: Charles S. Williams


Assistant Professors: John L. Hennessy, Balasubramanian Kumar, Martin Morf, Susan Owicki, Richard M. Swanson, Fouad Tobagi, Willem vanCleemput, Charles S. Williams. By Courtesy: Jeffrey Barth. Acting: Umran S. Inan

Lecturers: Dennis R. Allison, Otis L. Frost, Harry T. Garland, Marcian E. Hoff, Matt Lehmann

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. Interdisciplinary Majors providing work in electrical engineering combined with study in another department are available. Note that it is possible for a Stanford undergraduate to work simultaneously toward the B.S. and M.S. degrees. See the School of Engineering section.

GRADUATE

The Electrical Engineering Department offers graduate courses in the following areas:

- Bioelectronics
- Communications and Information Theory
- Computer Systems
- Electromagnetic Theory and Microwaves
- Electronic Circuits and Devices
- Information Processing
- Integrated Circuits
- Modern Optics and Optical Devices
- 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.

APPLICATION FOR ADMISSION

Applications for admission with graduate standing in Electrical Engineering are made to the Graduate Admissions Office, Old Union, Stanford, CA 94305 and are reviewed by this Department. Inquiries may be addressed to the Committee on Graduate Admissions of the Department of Electrical Engineering.

Applicants who have not yet earned the equivalent of a Master of Science degree should apply for admission to study first toward the MSEE degree, indicating any intention of later working toward a more advanced degree. Admission to study directly toward either the Engineer or Ph.D. degree is normally available only to students who will have completed a Master's degree prior to the Quarter for which they are seeking admission. Since the MSEE does not require a thesis, no time is lost in first completing the MSEE. (See section on Study Beyond the Master's degree below.)
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 in 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 graded electrical engineering courses numbered above 200, to provide depth in one area.
2. At least one electrical engineering course numbered above 200 in each of three additional course 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 advisor.

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 advisor, 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, digital systems, 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 advisor, 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.

Permission to study beyond the Master of Science degree must be obtained from the Department (if possible, well before the M.S. degree is received). Full information should be obtained from the Department office. The decision is based on the applicant's academic record, performance in independent work, and potential for advanced study, and on the ability of the faculty to supervise such study.

Admission at the post-M.S. level is available only to students who have a Master of Science degree or its equivalent and for whom the Department Committee on Graduate Admissions has been able to identify a faculty research supervisor.

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.

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 of 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.

The best procedure for the prospective applicant to follow is: 1) if you are now working toward the Stanford Master's degree request permission to continue your graduate studies beyond the Master's degree using a form obtained from the Electrical Engineering Department office or, 2) if you are not planning to receive the Stanford Master's degree, apply for admission to the Electrical Engineering Department as a candidate for the degree of Engineer.

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 advisor 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. Enrollment in E.E. 391 Special Studies is recommended as a means for getting acquainted with a faculty member who might be willing to serve as a supervisor.

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 advisors, the student
should file an Application for Doctoral Candidacy. Only after receiving the 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.

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 five courses: E.E. 381A, B; C.S. 142 plus either (a) C.S. 246A and C.S. 311; or (b) two of: C.S. 143, C.S. 145, C.S. 246A.

2. At least one course in mathematical foundations for computer engineering. Acceptable courses: C.S. 150; C.S. 155; C.S. 156; or E.E. 284.

3. At least one course from two of the following areas: (a) Numerical Analysis—C.S. 135 or C.S. 137A; (b) Finance or Accounting—GSB 210 Management Accounting I; (c) GSB 220 Business Finance I, or I.E. 133; (d) Optimization—O.R. 153; O.R. 154: or E.E.S. 242; (e) Statistics—Stat 200.


5. At least 3 units of seminar with a total not to exceed 6 units; E.E. 380; E.E. 385A, B, C, D, or E; C.S. 300.

6. 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. (Course taken under guidelines 1 through 4 should normally be taken for a letter grade.) 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. In particular, students are not expected to take courses when they have had the equivalent subject matter previously. 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).

Upon entrance to the program, students are expected to have proficiency at the level of C.S. 111, E.E. 180, and E.E. 182. Students lacking one or more of these areas should enroll and complete these courses prior to entering the 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 ad-
vised 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.

**FINANCIAL ASSISTANCE**

The Department annually awards fellowships, teaching and research assistantships to graduate students. The fellowships are usually awarded only to first-year graduate students; most of these fellowship awards are restricted to U.S. citizens. Most of the awards to Engineer and Ph.D. candidates are research assistantships. These research assistantships are awarded by individual faculty research supervisors, working in conjunction with the Committee on Graduate Admissions of the Department. Research assistants are normally able to carry out their Engineer of Ph.D. thesis work and write their thesis as an integral part of their assistantship.

Applicants for all three forms of financial assistance should obtain the necessary application forms from the Office of Graduate Admission, Old Union, Stanford, CA 94305.

**OTHER ASSISTANCE PROGRAMS**

Many of the Department's graduate students are supported by other programs which provide particular advantages. The Honors Cooperative Program makes it possible for academically qualified engineers and scientists in nearby companies to be part-time graduate students in Electrical Engineering while continuing nearly full-time professional employment (see discussion in “School of Engineering” section of this bulletin).

An appointment in the Air Force Thermionic Engineering and Research program (AFTER) provides the student with an annual stipend of $10,000 and full tuition for a two-year course of study leading to the degree of Engineer. Courses in microwave electronics will prepare the student for work in the field of microwave tubes. The program is jointly sponsored by the U.S. Air Force and six electronic firms in cooperation with the Electrical Engineering Department at Stanford. Appointment to the AFTER program is made by an advisory board and is contingent upon admission to the Stanford Graduate Department of Electrical Engineering and acceptance for employment of the candidate by one of the participating companies.

Further information about these programs can be obtained by writing to the Committee on Graduate Admissions, Electrical Engineering Department, Stanford, CA 94305.

**AREAS OF RESEARCH**

Candidates for advanced degrees participate in the research activities of the department as paid research assistants or as students 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 vacancies in the primary area of interest. At present faculty members and students are actively engaged in research in the following areas.

**RADIOSCIENCE**

Generation and Propagation of Radio Waves in the Ionosphere and Magnetosphere.

Solar-Terrestrial Interactions

Radio Astronomy and Radio Telescopes

Radar Astronomy

Space Science and Engineering (also see Index)

Tropospheric Propagation and Lensing with Microwave, Optical and Acoustic Waves

Radar Oceanography and Underwater Communications

Planetary Exploration

Satellite Communications Systems

**SOLID STATE**

Amorphous Materials

Semiconductor and Solid State Physics
Electronic and Optical Properties of Solids
Crystal Preparation: Epitaxy and Ion Implantations
Solid State Devices
Applications to Medical Electronics
Surface Properties of Solids
Applied Superconductivity
Electron Spectroscopy
Solar Energy Conversion
Laser Processing

INTEGRATED CIRCUITS
Bipolar, MOS and Charge-Coupled Devices
Linear, Digital, and Optoelectronic Integrated Circuits
Ultrasonic & Optical Imaging Arrays
Large Scale Integration
Micropower Electronics
Computer-Aided Analysis & Design
Applications to Medical Electronics
Process Device and Circuit Modeling
Biomedical Transducers and Telemetry

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
Picosecond Laser Pulses
Laser Applications
Holography
Fiber Optics

MICROWAVE PHYSICS AND ELECTRONICS
Microwave Acoustics
Acoustic Imaging
Nondestructive Testing
Nonlinear and Parametric Devices
Magnetoooustic and Acoustooptic Phenomena
Acoustic Microscopes
Acoustic Signal Processing

INFORMATION SYSTEMS
Statistical Communication Theory
Information and Coding Theory
Detection, Estimation, and Identification
Statistical Signal Processing
Multivariable Linear Systems
Cryptography and Data Security
Pattern Recognition and Complexity

Control Theory and Optimization
Diagnostic Imaging
Fourier and Statistical Optics
Adaptive Systems
Real-Time Computer Applications
Biomedical Signal Analysis

COMPUTER SYSTEMS
Computer Reliability
Performance Measurement and Modeling
Computer Architecture
Computer Networks
Operating Systems
Design Automation
Program Verification
Software Engineering

COURSE NUMBERING SYSTEM
Electrical engineering courses are numbered 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
All courses (DR:T) if taken for 3 or more units.
Attention is called to courses listed under "Engineering" starting on page 92 that may be of special interest to Electrical Engineering undergraduates.

101. Circuits I—Analysis of simple circuit models, with a view to discovering their fundamental characteristics. Forced and natural components of response, natural frequencies, the complex-frequency plane, resonance; transfer functions 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 function. Prerequisites: Engineering 41, Mathematics 44, ability to use digital computation facilities, or consent of instructor
3 units, Aut (Inan) MWF 10
Win (Tuttle) MWF 8

102. Circuits II—Continued study of the properties and uses of transfer functions. The Laplace-transform point of view. Asymptotic behavior intime and in frequency. Ladder networks, feedback (active) circuits. Complete
104N. Introduction to Digital Filters—A course which builds on E.E. 101-102 but introduces discrete dynamic systems and teaches the analysis and design of digital filters—specifically Butterworth, Tschebycheff, and Elliptic filters. Special topics include the Fast Fourier Transform, selection of sampling rate, and effects of finite computer word length. Examples of implementation in BASIC on a minicomputer, LOTS, or a microprocessor, will be demonstrated. Design examples taken from telephony, laboratory data processing, and control system simulation. Prerequisite: 102.

3 units, Spr (Inan) MWF 10

106. Planetary Exploration—Analysis and description of characteristics of the planets, their satellites, and near space environments, with emphasis on recent work using space probe, radio, and radar methods of exploration. Comparative properties of the terrestrial and Jovian planets; planetary atmospheres, surfaces, interiors; rings of Saturn; planetary and satellite orbits and spacecraft trajectories, orbital perturbations; properties of the interplanetary gas, dust, comets, and meteorites. Origin and evolution of planetary systems. Remote sensing from spacecraft at radio, infra-red, light, and ultraviolet wavelengths. U.S. and Soviet space programs and their comparative engineering and scientific aspects. Prerequisite: One year of college engineering, mathematics or physics.

3 units, Spr (Eshleman) MW 2:15-3:30

111, 112, 113. Electronics—Basic electronic devices, integrated 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; hybrid integrated circuits. 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 Aut (Gibbons) TTh 8-9:15
   Win (Staff) MWF 11

112. 3 units, Win (Gibbons)
   Spr (Staff) MWF 11

113. 3 units, Aut (Staff) MWF 11
   Spr (Gibbons)


122: Design of active circuits; oscillators, amplifiers. Prerequisite 121 and prior or concurrent registration in 113.

121. 3 units, Win (Staff) Th 1:15 and
3-hour lab. weekly by arrangement

122. 3 units, Aut, Spr (Staff) T 1:15
and 3-hour lab. weekly by arrangement

139. Design Project—A laboratory course in which individuals or small teams design, build and test special circuits or simple systems. Projects are proposed by students or the professor. Ideally two students would make a team and propose a project. The requirements include a report giving the details of the project and the test results, a presentation to the class of the design features, and the constructed (and hopefully, working) project. Those primarily interested in microprocessors or digital circuits should take 315.

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 in simple media. Prerequisites: Physics 53 and Math 43.

3 units, Aut (Waterman) MWF 8
   Win (Quote) MWF 9

142. Electromagnetic Waves—Continuation of 141. Emphasis on waves—plane waves in lossy, inhomogeneous and anisotropic media,
and waves in simple guided systems. Phenomena of reflection, refraction, standing waves, transmission of energy, and radiation of energy. Transmission lines, waveguides, antennas. Electrical Engineering 141 is a prerequisite.

3 units, Win (Waterman) MWF 8  
Spr (Quate) MWF 9

180. Systematic Programming—Introduction to systematic program design, use of a variety of data structures, manipulation of text, macro processing. Program correctness, informal verification, and testing. Modularization, scope concepts, and portability. Prerequisite: C.S. 104, 105, 106 or equivalent.

3 units, Aut (Owicki)  
Win, Spr (Enroll in C.S. 107)

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 LOTS facility. Students will program and operate a small computer such as the (HP2109). Enrollment limited to 50. (Same content as Computer Science 111.) Prerequisite: Computer Science 105 or 106 or equivalent.

3 units, Aut (vanCleemput) MWF 11  
Win (Tobagi) MWF 10  
Spr (Williams) MWF 10


3 units, Aut (vanCleemput) MWF 11  
Win (Tobagi) MWF 10  
Spr (Williams) MWF 10

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

All courses (DR:T) if taken for 3 or more units.

200A,B,C. Seminar—Special section of 201A,B,C (See description below) open to students holding assistantships and registering under limited tuition grants.

200A. 0 units, Aut (Pantell) Th 11
200B. 0 units, Win (Williams) Th 11
200C. 0 units, Spr (Manning) Th 11

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 (Pantell) Th 11
201B. 1 unit, Win (Williams) Th 11
201C. 1 unit, Spr (Manning) Th 11

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 (Thompson)

204. Special Studies in Cardiovascular Physiology—(Enroll in Physiology 211.)

208. Biological Information Processing—Generation and propagation of signals in the nervous system. The neuron as a circuit component, the interconnect properties of neurons (synaptic behavior), and neural networks. Systems with excitatory or inhibitory interconne-
tions. Signal processing, especially in the peripheral nervous system where structure and function can be correlated. Illustrative examples from lower and higher organisms. Special attention to optical and auditory systems.

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 systems, 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 (Staff) TTh 8:00-9:15
   Win (Plummer) MWF 9

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

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. 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 and W 3:15

232. Lasers—Continuation of 231. More detailed coverage of selected topics in lasers, optics, quantum electronics. Prerequisite: 231.

3 units, Win (Siegman) TTh 9-10 and W 3:15

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. Prerequisite: Physics 57 or equivalent.

3 units, Aut (Staff) TTh 1:15-2:30

241. Waves I—Introduction to a variety of waves and wave phenomena as they appear in different natural, laboratory, and application settings. Electromagnetic, acoustic, seismic, atmospheric, plasma, and water waves and their mathematical and physical correspondence in terms of Hamilton's principle. Propagation, attenuation, reflection, refraction, surface and laminal guiding, and intrinsic and structural dispersion; energy density, power flow, and phase and group velocities. Geometrical and structural complexities are minimized in order to stress basic wave concepts common to diverse fields of application. Analysis in terms of transmission line and impedance concepts using exponential notation and vector phasors. Treatment limited to plane harmonic waves in isotropic media. Nonhomogeneous cases limited to plane interfaces and exponentially stratified media. Prerequisite: 142 or equivalent or other wave course.

3 units, Aut (Eshleman) MWF 10

242. Waves II—Continuation of 241 with emphasis on fundamental topics of importance for further study and application of microwave, optical, acoustic, or plasma phenomena. Plane, cylindrical, and spherical waves and boundary value problems; radiation, dipole and array antennas, interferometers, and reciprocity; wave guides, fiber optics, and acoustic delay lines. Uniaxial and gyrotropic anisotropic media with magnetoionic plasma, and ferrite applications. Non-linear effects. Mode coupling, resonators,
and gaussian wave packets. Prerequisite: 241.
3 units, Win (Eshleman) MWF 10

244A,B. Communication Satellite Systems Planning—This two-quarter course presents both theoretical and practical aspects of communication satellite systems planning. Topics to be covered include modulation techniques for telephony, data and television, link equations, demodulator performance, noise budgeting and the optimization problem, important spacecraft parameters, basic ground station design consideration, orbit-spectrum utilization and regulatory issues, system cost estimation, intermodulation distortion considerations, demand assignment—multiple access methods, traffic estimation and integration of satellite communications into existing terrestrial networks. Course will include design of a satellite system for a selected country.
3 units, Win, Spr (Lusignan) TTh 1:15-2:05 plus 2 hours dhr

261. The Fourier Transform and Its Applications—The Fourier transform as a tool for solving physical problems. Convolutions and correlations, the Dirac delta function, Fourier transform theorems, measures of time duration and bandwidth, the uncertainty relation, and the central limit theorem. Additional topics include analysis of linear systems, sampling theorems, the discrete Fourier transform, digital filtering, two-dimensional Fourier analysis, and convolution of probability distributions. Prerequisite: previous exposure to Fourier series at the level of E.E. 102.
3 units, Aut (Goodman) MWF 2:15, (Macovski) TTh 2:45-4:00

263. Digital Filtering—An introduction to computer-implemented signal processing systems. Digital impulse response and transfer functions; convolution; sampling theory; z-transforms; digital Fourier transforms; FFT algorithms; filters; generation of stochastic signals; quantization theory and roundoff; synthesis of digital filters to meet design specifications; digital Wiener filters. Prerequisite: familiarity with Fourier and Laplace transforms.
3 units, Aut (Widrow) MWF 9

274. The Computer as a Laboratory Instrument—Practical experience on a small, real-time digital computer system. Minicomputers, I/O programming techniques, data acquisition, digital signal processing, automatic circuit testing, and computer-generated displays. "Hands-on" experience in these subjects is acquired by completing a series of laboratory assignments. Limited enrollment. Prerequisite: 181 or equivalent assembly programming experience.
3-4 units (normally 4 units undergraduates, 3 units, graduates)
Aut (Staff) Win (Williams) MWF 3:15 and 3-hour lab. by arrangement
Spr (Staff) MWF 11 and 3-hour lab. by arrangement
Sum (Staff) MWF 9

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 average, stationarity, ergodicity, and linear system relations. Prerequisite: some acquaintance with elementary linear systems, transforms, and probability.
3 units, Aut (Kailath) MWF 3:15
Win (Gray) TTh 2:45-4:00

279. Information Transmission and Modulation—Analysis and design of communication systems; analog and digital modulation and demodulation, frequency conversion, multiplexing, noise and quantization; spectrum, envelope, and instantaneous frequency relations; heuristic discussion of systems from an information theory standpoint. Prerequisites: 102 and 278.
3 units, Win (Staff) 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 blood-pressure control using a computer-simulated model of an animal reaction to a pressure-elevating drug. Experimental research projects are developed in cooperation with faculty of 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 (Staff) TTh 2:45-4:00

281. Microcomputer Laboratory—Introduction to a specific microprocessor such as the INTEL 8080 or the ZILOG Z-80. Lectures covering the programming and structure of a microcomputer system, accompanied by laboratory exercises. Prerequisites: 181 and 182 or equiva-
lents, and some hands-on experience with TTL
Logic, such as 183.

3 units, Aut (Hennessy) TTh 3:15 plus
lab. by arrangement

Win (Gill)

284. Introduction to Discrete Mathematics—An introduction to the algebra and
combinatorics required for the advanced study of
digital systems and computer science. Sets, re-
lations, functions and homomorphisms. Semi-
groups and relevance to sequential machines.
Groups and relevance to coding. Basic concepts
of graph theory. Fields and relevance to linear
sequential machines and codes. Prerequisite:
Mathematics 113.

3 units, Win (vanCleemput) MWF 9

285. Language Features and Their Implementation—Aspects of algorithmic languages. Im-
plementation techniques for recursion, reen-
trancy, protection, and sharing. Program rep-
presentation and data management in a dynamic
environment, (garbage collection, etc.). Bind-
ning, process interaction, messages and events.
Module and class concepts. Prerequisites: E.E.
180, E.E. 181.

3 units, Aut (Enroll in Computer Science 142)

Win, (Owicki)

286. Compilers—(Enroll in Computer Science
143)

287. File and Database Systems—(Enroll in
Computer Science 145)

288. Software Engineering Laboratory—
Project-oriented software or software/hardware
systems design. Emphasis on practical systems
engineering and project management aspects,
as well as on design processes and design evalua-
tion. Students are encouraged to suggest and
define their own projects. Several written re-
ports are required in keeping with good
software engineering practices. Computer
facilities include a PDP-11 and various mic-
rocomputers. Registration for two quarters is
advised. Corequisite: 285/CS 142 or consent of
instructor.

3 units, Win, Spr (Staff) W 10

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 Of-
fice for detailed announcements.

293. Energy Processes—Theory of modern
energy conversion, transmission and storage
methods. Transmission of energy by electric
lines, microwaves and fuel lines. Production of
hydrogen; chemical, thermolytical, photolytical
and electrolytical. Fuel cells; thermodynamics,
kineti cs, configurations and applications. Stor-
age of energy. Solar radiation and insolation.
Photoelectric converters; photocells and
therm-photo-electric conversion. Thermoelec-
tricity; Seebeck, Peltier and Thomson effects;
generators, refrigerators and heat pumps.
Thermoionic converters. Ocean thermal energy
converters. Osmotic engines, Eolian energy,
emphasis on the theory of vertical axis
windmills. For seniors and graduate students.
3 units, Aut (da Rosa) MWF 3:15

3 units, Win (da Rosa)

COURSES FOR GRADUATE STUDENTS

All courses (DR:T) if taken for 3 or more units.

305. Seminar on Electronics in Medicine—
Weekly seminars on the application of elec-
tronics technology to problems of medical prac-
tice or research featuring speakers from educa-
tional institutions or industry.

1 unit, Aut, Win (White)

310. Integrated Circuits Technology and De-
sign Seminar—In-depth treatment of technol-
gy and circuit design problems. Content will
roughly parallel topics of interest from 313 and
314.

1 unit, Win, Spr (Dutton) offered 1979-80

312A. Integrated Circuit Fabrication
Processes—Fundamental principles of silicon
integrated circuit fabrication processes.
Technological limitations on integrated circuit
design. Physical and chemical models of bulk
and epitaxial crystal growth, oxidation, diffusion,
ion implantation and photoengraving.
Geometrical layout of bipolar and MOS devices
and integrated circuits. This course is designed
to be taken autumn quarter by students who will
be using the laboratory facilities for doctoral
research; those interested in the course as part
of their breadth sequence may take it either
autumn or spring quarter. Prerequisite: 113 or
equivalent.

2 units, Aut (Plummer)

2 units, Spr (Plummer)

312B. Integrated Circuit Fabrication Proces-
ses Laboratory—Laboratory projects em-
phasizing practical aspects of integrated circuit
fabrication, processes including silicon wafer
cleaning, photoengraving, chemical etching,
oxidation, diffusion and vacuum evaporation.
Registration by consent of instructor.
Corequisite: 312A.

1 unit, Aut (Plummer)

313. Digital Integrated Circuits—Analysis and
Design—Device and circuit modeling consid-
erations for digital IC's. Development of simple
circuit approximations for use in device perfor-
mance calculations and in computer-aided cir-
circuit analysis. Case studies of on- and off-chip design for specific digital circuits (TTL, ECL, I^2L, MOS/CMOS). Development of digital sub-block designs to parallel considerations in 381A. Prerequisite: 216 or consent of instructor.

3 units, Win (Staff)

314. Linear Integrated Circuits—Analysis and Design—Description and analysis of linear IC's including performance limitations for low-noise, low-drift, high-impedance, high-frequency, and wide-bandwidth service. Case studies of specific IC building blocks, such as op-amps with fast slew rate, wide-band amplifiers, phase-locked oscillators, multipliers. Prerequisite: 216.

3 units, Win (Staff)

315. Microprocessor Projects/Individualized—Laboratory projects designing high-performance circuits using state-of-the-art solid state components with emphasis on microprocessors. Prerequisite or corequisite: 281 or equivalent.

3 units, Aut, Win, Spr, Sum (Garland)

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, Sum (Garland)

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 (Staff)

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 (Staff)

323A. Acoustic Devices—Introduction to acoustic devices with emphasis on acoustic imaging. Applications to nondestructive testing, medicine, and radar. Topics covered include wave propagation in isotropic materials, piezoelectric transducers, diffraction and scattering from flaws and in body tissue, acoustical holography, and various types of acoustical imaging devices. Prerequisite: 142, 242 or equivalent.

3 units, Aut (Kino)

323B. Analog Signal Processing—Introduction to analog filters with emphasis on acoustic surface wave and related optical and semiconductor devices and applications to communication systems, radar, and sonar. Topics covered include surface acoustic and optical waveguides, coupled mode and normal mode theory, the interdigital transducer and CCD and ASW transversal filters correlators, convolvers, and the FFT, analog and digital coding, acousto-optical processors, and the storage correlator. Prerequisites: 242, 323A (323B can be taken without 323A), or equivalent.

3 units, Win (Kino) alternate years given 1978-79

324. Applications of Quantum Theory—A unified approach involving the density matrix to laser, 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 rate equations, spontaneous emission, laser action, infrared absorption, multiple photon absorption, and relativistic quantum effects. Prerequisite: 322B or Physics 231.

3 units, Spr (Pantell)

326A. Electron and Ion Dynamics—Detailed treatment of ion and electron motion in steady fields including space charge effects. Theory of beam formation, magnetic focusing by uniform and periodic fields, scaling relations, plasma and cyclotron waves on beams, relations between Eulerian and Lagrangian variables, instability in beams with circuits. (Same as Applied Physics 254.) Prerequisites: 141-142, Physics 51, or Physics 120-122, or equivalents.

3 units, Aut (Chodorow)

326B. Microwave Electronics—Electron dynamics in space- and time-varying fields, transit time effects in finite gaps, power transfer relationships in klystrons. Interaction with traveling waves, theory of traveling wave devices. Coupled mode treatment and energy relations for space charge waves in beams, coupled mode treatment of beam circuit interactions. General properties of periodic circuits. (Same as Applied Physics 255.) Prerequisite: 326A.

3 units, Win (Chodorow)

326C. Microwave Electronics—Equivalent circuits and interaction in cavity type TWT's space harmonics in traveling waves. Backward wave effects and backward wave devices. Large
signal effects and calculations in electron devices. Crossed field interactions, cyclotron wave interactions. (Same as Applied Physics 256.) Prerequisite: 326B.

3 units, Spr (Chodorow)

328A, B. Physics of Semiconductor Devices—Introduction to the physical principles underlying semiconductor device operation and the application of these principles to specific devices. Emphasis will be placed on understanding device operation, rather than circuit properties. Topics in 328A include elementary excitations in semiconductors such as phonons, photons, conduction electrons and holes, charge and heat transport, carrier trapping and recombination, effects of high doping, contacts, and the p-n junction. 328B will consider the junction transistor, surface effects, the MIS diode, the MOSFET and CCD, LED’s, and microwave devices. Prerequisites: 111-113; 216 and 238 recommended but not required.

3 units, Win (Swanson) Spr (Swanson)

330. Photoelectronic Materials and Devices Laboratory—Experimental projects on measuring the spatial frequency response (MTF) of low light level image intensifiers, preparation of conventional semitransparent-semiconductors 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) alternate years, given 1979-80

332. Optical Properties of Solids—Basic theory with emphasis on the relationship between electronic structure and optical properties of solids. Representative semiconductors, insulators, and metals will be discussed. Impurities and defects in solids. Surface states. Photoemission, Luminescence, applications, Prerequisite: 322A or equivalent.

3 units, Spr (Spicer) alternate years, given 1979-80

334. Superconducting Electronics—Introduction to superconducting electronics and applications. Course proceeds from a brief introduction to the phenomena of superconductivity through a discussion of Josephson junctions and superconducting quantum devices and finally to an analysis of some promising applications in computer logic and memory, magnetochemistry, and low noise electromagnetic detectors and mixers in the millimeter and submillimeter wave region. No formal prerequisites but an exposure to quantum mechanics and a good grounding in electromagnetic theory are desirable.

3 units, Win (Beasley)

335. Seminar in Quantum Electronics and Optics—Discussion by staff, students and industrial laser researchers of topics in lasers, optics, quantum electronics and nonlinear optical devices.

1 unit, Aut, Win, Spr (Siegman, Byer, Harris) M 4:15


337. 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: 241 or equivalent.

3 units, Spr (Buneman) alternate years, given 1978-79

346. Introduction to Nonlinear Optics—Wave propagation in anisotropic, non-linear, and time-varying media. Microscopic and macroscopic description of electric dipole susceptibilities. Free and forced waves—phasematching; slowly varying envelope approximation—dispersion, diffraction, space-time analogy; Green’s function and Fourier methods; harmonic generation; parametric amplification and oscillation; Brillouin and Raman scattering; and electro-optic light modulation. Prerequisites: 241, 242, 322A or equivalent.

3 units, Spr (Harris)

347. Introduction to Fourier Optics—Application of Fourier theory to the analysis and synthesis of optical imaging and optical data processing systems. Propagation and diffraction of light, Fresnel and Fraunhofer approximations, Fourier transforming properties of lenses, image formation with coherent and incoherent light, transfer functions of imaging systems, optical data processing, and holography. Prerequisite: familiarity with Fourier analysis, E.E. 261 recommended.

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; temperature and
electron-density profiles. Elementary radio-
wave propagation concepts and their practical
application to the ionosphere. Prerequisite: 142
or 241, or Phys. 121 or equivalent.
3 units Spr (Waterman) alternate years,
given 1979-80

349. Statistical Optics—Applications of statistical tools to a variety of problems in modern optics. First-order statistical properties of thermal and laser light, effects of partial polarization, basic definitions of coherence, propagation of mutual coherence functions, the Van Cittert-Zernike theorem, imaging with partially coherent light, imaging through randomly inhomogeneous media, and statistics of optical detection processes Prerequisite: 278.
3 units, Spr (Goodman) alternate years,
given 1979-80

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 (Lusignan)

352. Wave Propagation in the Ionosphere and Magnetosphere—Magnetioionic theory in multi-component media; signal dispersion; group ray velocity; wave polarization; refractive index surfaces; absorption; boundary effects; interpretation of natural phenomena (e.g., whistlers and VLF emissions); remote sensing in plasmas; communication; theory of wave-particle interactions in the magnetosphere. Prerequisite: 241 or equivalent.
3 units, Spr (HeUitvett) alternate years,
given 1978-79

353. Image Formation and Interferometry—Image reconstruction from X-ray scans, image filtering, image resolution loss due to scanning with sensor, restoration in the presence of noise. Diffraction theory of antennas and other sensors, interferometry, arrays of sensors. Coherence properties of random radiation fields, image-forming techniques, aperture synthesis, rotation synthesis. Prerequisite: 261 or equivalent
3 units, Spr (Hellilvett) alternate years,
given 1978-79

354. Theory and Application of Radio Wave Scattering—Fundamentals of scattering from rough surfaces, with large and small scale roughness, planetary surfaces, and the sea; scintillation in planetary atmospheres; scattering from simple geometric shapes, lamina, cylinders, and spheres; wave propagation concepts in scattering media; introduction to radiative transfer. Geometric optics and physical optics solutions. Limited full-wave examples. Applications to radar, radar astronomy, and remote sensing. Prerequisite: 241 or consent of instructor.
3 units, Spr (Tyler) alternate years,
given 1979-80

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, magentioionic propagation and dispersion. Sheath and probe theory, magnetic confinement, pinches, adiabatic motion, mirrors, pressures, stresses, magnetogasdynamics. Prerequisite: 241 or equivalent.
3 units, Aut (Buneman) alternate years,
given 1979-80

358A,B. Quantum Electronics Laboratory—(Enroll in Applied Physics 358A,B.)

358C. Condensed Matter Laboratory—(Enroll in Applied Physics 354.)

359. Remote Probing of Atmospheric Environment—Techniques for measuring the structure, content, properties, and motion of the atmosphere by remote means. Interactions between propagated waves and the atmospheric medium. Scattering, reflection and absorption of radio, optical and acoustic waves. Applications to measurement of temperature, humidity, rain, aerosols, inversion layers, waves, winds, turbulence, and pollutants. Prerequisite: 142 or 241 or Physics 121 or equivalent.
3 units, Spr (Waterman) alternate years,
given 1978-79

363. Introduction to Linear System Theory—Analysis of finite-dimensional 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 (Franklin) MWF 11:00-12:15
Spr (Staff)
Sum (Staff)

364. Multivariable System Theory—Structural properties, controllability, observability, canonical forms. Applications to pole-shifting, decoupling, system realization and identification. Introduction to multi-dimensional systems. A sequel to 363 where similar problems are studied for scalar systems. Prerequisite: 363.
3 units, Win (Franklin)
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.)

370. 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 (Williams) M 4:15-5:05
Win (Macovski) Spr (Gill)


3 units, Spr (Widrow)

376A. Information Theory—The Shannon Theory of Communication for memoryless sources and channels: entropy and information, asymptotic equipartition property, source coding (data compression) and coding for noisy channels (reliable communication). Prerequisite: E.E. 278, Statistics 116 or equivalent.

3 units, Aut (Gray)

376B. Information Theory—Asymptotic equipartition property for ergodic processes. Continuous channels; multiple user channels; broadcast channels, multiple access channels, two-way channels, information networks; capacity theorems; multiple user data compression; capacity of Gaussian channels; capacity of channels with feedback, information theoretic approach to cryptography; Kolmogorov complexity. Prerequisite: 376A.

3 units, Win (Cover)


3 units Spr (Cover) TTh 2:15


3 units, Win (Kailath)

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 nonlinear estimation and detection. The separation theorems of stochastic control and of the detection of random signals. Prerequisite: 378A or consent of the instructor.

3 units, Spr (Kailath)

379. Communication Channels—Fundamental principles of digital communications; 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 (Gray)

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 (Staff) W. 4:15

381A,B. Design of Digital Circuits and Systems—A two quarter sequence devoted to principles and techniques of digital design. Topics include code for representing information, integrated-circuit logic families, logic design, MSI design, sequential circuit analysis and synthesis. Also covered are computer organization, control units and microprogramming, memory systems, arithmetic units, and input-output structures. Each student does a project involving the detailed design of an entire digital system. Prerequisite: 182 or equivalent.

381A. 3 units, Aut (Peterson) MWF 9 and (Kumar) MWF 11
Win (McCluskey) MWF 11
Sum (Staff) MTWTh 11
381B. 3 units Win (Kumar) MWF 11 and Spr (Peterson) MWF 1:15
385A. Digital Systems Reliability Seminar—
Student-faculty discussions of research problems in the design of reliable digital systems. Specific areas include modeling and evaluation of multiprocessor and redundant architectures, as well as testing and diagnosis theories. Emphasis is placed on student presentations and Ph.D. thesis research.
1 to 4 units, Aut, Win, Spr (McCluskey) M 3:15-5:05
385B. Computer Systems Analysis Seminar—(Enroll in Computer Science 319B.)
385C. Computer Architecture and Emulation Seminar—Student/Faculty discussions of research problems in computer organization, memory hierarchy, machine representation, and emulation of both conventional and abstract machines. Students may use the Emulation Laboratory facilities and write interpreters for specific machines.
1 to 4 units, Aut, Win, Spr (Flynn)
385D. Design Automation Seminar—Student/Faculty discussions on digital design automation techniques and applications, including computer hardware description languages, logic simulation, fault-test generation, integrated circuit and printed circuit layout, design verification. Prerequisite: Consent of instructor.
1 to 4 units, Aut, Win, Spr (vanCleemput)
385E. Concurrent Programming Seminar—
Student/Faculty discussions of research problems in the design and verification of concurrent programs, parallel programming languages, and applications of concurrency. Prerequisite: 386 or equivalent.
1 to 4 units, Aut, Win, Spr (Owicki).
386A,B. Operating System Design—Multi-
386A. 3 units, Win (Hennessy)
386B. 3-6 units, Spr (Enroll in C.S. 246B.)
387. Error-Correcting Codes—Theory and implementation of codes for detection and correction of random errors and burst errors. Linear block codes, cyclic codes. Hamming codes, and BCH codes; the Berlekamp decoding algorithm for BCH codes. Convolutional encoding and sequential decoding; the Viterbi algorithm. Optional comma-free codes; codes with special correlation properties. Prerequisites: Some knowledge of information theory (376A) and modern algebra (284) is useful.
3 units, Spr (Gill)
389. Programming Language Design—(Enroll in Computer Science 242.)
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 details.
395. Electrical Engineering Instruction: Prac-
tice 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 Labora-
tory—Experimental projects and seminars on integrated circuit fabrication using epitaxial,
oxidation, diffusion, evaporation, ion implantation, 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.
1-3 units, Spr (Gibbons) alternate years, given 1978-79

414. Microenergy Electronics—Hierarchy of microenergy performance limits on large-scale monolithic integrated circuits including fundamental laws of physics, properties of materials, device characteristics, fabrication processes, circuit topologies and system architecture. Minimum energy operation of bipolar transistors, MOS transistors and charge transfer devices in amplifiers, oscillators, multipliers, delay lines, logic elements and memory cells without compromising speed, gain, bandwidth, stability margins, etc. Prerequisites: 216, 312, 313 and (or concurrently) 314 or equivalents.
3 units, Spr (Meindl)

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

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 systems. Prerequisite: consent of instructor.
1 to 4 units, Aut, Win, Spr, Sum

425. Applications of Acoustics—A reading course on theory and laboratory techniques for microwave acoustics, and biological applications of acoustics, nondestructive testing, and acoustic imaging. Prerequisite: consent of instructor.
3 units, Aut, Win, Spr, Sum

430. Surface and Interface Seminar—Technology’s developments are increasingly hindered by lack of knowledge of surfaces and interfaces: e.g., integrated circuits (Si-SiO̅̅ interface) and liquification of coal (metal catalytic surfaces). This seminar concentrates on application of new techniques in electron spectroscopy and theory to fundamentals of these problems. Outside experts, faculty and more advanced graduate students present material for discussion.
1 unit, Aut, Win, Spr (Lindau)

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 1979-80

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


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 (Staff)

449. Medical Imaging Systems—Basic modalities used for imaging internal structures within the volume of the body from a systems viewpoint: X-ray radiography, computerized tomography, nuclear medicine, and ultrasound. Analysis of existing and proposed systems in terms of resolution, modulation transfer function, detection sensitivity, noise, ability to visualize disease processes, and potential for im-
proving diagnosis. Prerequisites: Fourier transforms. 347 recommended.

3 units, Spr (Macovski)

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, daRosa
Section 3, Eshleman
Section 4, Hellucell
Section 5, Howard
Section 6, Lusignan
Section 7, Manning
Section 8, Peterson
Section 9, Tyler
Section 10, Villard
Section 11, Waterman


3 units, Aut (Buneman) alternate years, given 1978-79

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
Section 1, Cover
Section 2, Franklin
Section 3, Gill
Section 4, Goodman
Section 5, Gray
Section 6, Hellman
Section 7, Kailath
Section 8, Luenberger
Section 9, Macovski
Section 10, Tuttle
Section 11, Widrow
Section 12, Williams

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. For 1978: Cryptography and data security; technical history of cryptography with examples and solutions; new public key, signature and trap door systems based on number theory and combinatorics. Relation of cryptography to complexity theory. Brief discussion of non-cryptographic security methods.

3 units, Aut (Hellman)

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 1979: Emphasis on connections between probability and computation. Topics include computer algorithms for signal processing, system identification and control for one and two dimensional systems.

3 units, Spr (Morf)

481. Computer-Aided Design of Digital Systems—An up-to-date survey of design automation techniques for digital hardware designers. Digital design languages; survey-level simulation; register-transfer-level description and simulation; gate-level simulation; partitioning, placement and routing for printed and integrated circuits; fault simulation and test generation; automated documentation; integrated design systems. Hands-on experience on an actual design automation system. Same as CS 341. Prerequisites: 381A, some familiarity with basic programming concepts. Corequisite: 381B.

3 units, Spr (vanCleemput)

Analysis of hierarchical memory systems and their management. Data formats, instruction sets, addressing, and control. Comparison of advanced systems including multi-stream processors, and pipeline computers (Same as Computer Science 311.) Prerequisites: 181 and 381B.

3 units, Aut (Enroll in Computer Science 311)
Spr (Flynn)

483. Topics in Concurrent Programming—Current research topics in the design and verification of concurrent programs of the sort that occur in operating systems, networks, distributed systems, etc. Subjects that may be covered include programming language features, formal models, specification and verification, and system design. Same as Computer Science 343. Prerequisite: 386A.

2 to 4 units, Spr (Owicki) alternate years, given 1978-79

484. Computer Communication Networks—An introduction to packet-switched networks (land based point-to-point networks, satellite networks, and ground radio networks) is given. Experience with existing networks (the ARPANET, SATNET, and PRNET) is discussed and the operational procedures are presented. Design issues and modeling techniques are examined. Same as Computer Science 344. Prerequisite: Stat 116.

3 units, Spr (Tobagi) alternate years, given 1978-79

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
Section 1, Flynn
Section 2, Hennessy
Section 3, Kumar
Section 4, McCluskey
Section 5, Owicki
Section 6, Peterson
Section 7, Tobagi
Section 8, vanCleemput

ENGINEERING-ECONOMIC SYSTEMS

Chairman: William K. Linvill
Associate Chairman: Donald A. Dunn


Adjunct Professor: John T. McAlister, Jr.
Lecturer: Gerd D. Wallenstein.

OFFERINGS AND FACILITIES

The Department of Engineering-Economic Systems is dedicated to preparing individuals for careers dealing with the analysis, planning, operation, and control of large-scale technological-economic and socio-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 have 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 government or industry that allows a student to gain first-hand experience in the limitations of existing methodology. The internship experience often provides the basis for formulating meaningful doctoral research problems.

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 de-
scribed 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 contain a total of 42 units of course work. This total must include at least 33 units of regular lecture courses, 18 units of which must be courses in Engineering-Economic Systems with letter grades. An M.S. program must also contain at least 3 units of project 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 Ph. D. 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. 148), (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 student’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 Center for Technology Assessment and Resource Policy has been established within the department, with Professor McAlister as direc-
Mathematical System Analysis (Larson, Luenberger, Morris, Oren, Smallwood, Sweeney, 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 policy analysis. Faculty and students in the program have developed effective analytical approaches to problems such as analysis of U.S. energy options, the design of national housing allowance experiment; planning of electric power expansion; analysis of U.S. agricultural policy; the theory of instruction; the control of various physical, economic, and social systems; land-use planning; housing policy planning; word processing system evaluation; market forecasting systems; office information system structure; and water resource planning. Students have often been employed by local firms while working on these problems. In parallel with this practical involvement, members of the program have made several fundamental contributions to theory in dynamic systems, optimization, policy theory, and economics. Current projects in the program include study of dynamic economic systems, the theory of group policy selection, the study of international commodity cartels, and energy system analysis.

Decision Analysis (Howard, Matheson)

Decision analysis is a logical procedure for balancing the many factors that influence a decision, including economic, technical, and social factors. It simultaneously considers 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. Government applications have included optimal expansion through nuclear plants of the electrical power system of Mexico, evaluating social policies for the control of sulfur emissions, determining whether hurricanes threatening the United States should be seeded with silver iodide crystals, and analyzing the national policy on synthetic fuel commercialization. All of these applications have been made possible by the close liaison between the University program and the Decision Analysis Group of SRI International, both at the internship and post-doctoral levels. Current doctoral research areas are 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.

Technology Assessment and Public Policy Analysis (Dunn, Harman, Linvill, McAlister, Sweeney, Tse)
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 or assessment of public policy alternatives requires a synthesis of several disciplines, including decision analysis, economics, mathematical systems analysis, and law.

Technology assessment is a form of policy analysis which evaluates the potential and actual consequences, both adverse and beneficial, arising from the use of resources and the application of technology. Technology assessment techniques have been applied in EES recently in examining the impact of proposed offshore oil and gas development on the California coastal zone, in assessing the alternatives for the transportation and utilization of Alaskan north slope natural gas, and in evaluating the policy options related to the implementation of the Fishery Conservation and Management Act.

A policy analysis program emphasizing futures 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 program in information policy is being carried out under Professor Dunn and faculty from the Graduate School of Business and the Economics and Communication Departments. Studies of information services markets, computer-communication systems and associated policy issues, and information systems designed to serve consumers are now being studied under this program.

Professor Sweeney is conducting major research programs involving the development, analysis, and application of formal models in the study of energy policy issues. The Energy Modeling Forum is a national activity, with headquarters at Stanford University, that is directed at increasing the use of and usefulness of energy models in the evaluation of energy policy. The participants, a cross-section of energy policy makers and energy model developers, apply formal models to the analysis of important energy issues. For example, the first Forum study examined the relationship between energy availability and economic growth. Subsequent studies examined the shift toward coal and the use of models for load forecasting. An internship program has been established with the Department of Energy (DOE) whereby students first conduct energy-related research on campus and then spend a year as interns within the DOE. The first major on-campus research project has focused attention on improving the DOE system of decision-making for energy R&D investment.

**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 $6000 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 $300 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 $6500. 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 Graduate Admissions Office. Applications for fellowships must be made by the 15th of February 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 sequen-
temporarily 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 33 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: 155, 202, 203, 204, 210, 257, 258, 272, 273, 280, 281, 282.

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. **Modeling**
   a) Systems and Policy Analysis: 100A, B, C.
   b) Dynamic Systems: 201A*, B*
   c) Probabilistic Models for Problems of Uncertainty: 221*
   d) Modeling Process: 208†


   3. Economics: 155, 212A*, B*, 214, 258

   4. Decision Analysis: 231*, 232, 236†

   5. Applications and Research
   a) Urban Systems: 249
   b) Telecommunications Systems: 280†
   c) Technology Assessment Workshop: 285A†, C†
   d) Research Seminars: 292, 293, 294, 400 series
   e) Project Seminar: 300† SERIES

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**COURSES MODELING**

100A, B, C. **Introduction to Systems and Policy Analysis**—This course is designed to give undergraduate and graduate students with knowledge of algebra and introductory calculus the basic concepts of systems and policy analysis. All concepts are introduced through practical examples and all are presented verbally, mathematically and graphically. The course will provide methodological basis for EES project courses and will provide background for the EES core courses.


3 units Aut (Linvill) TTh 7:30-9:00


3 units Win (Linvill) TTh 7:30-9:00

*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.

†The courses identified by a dagger above qualify as project courses for M.S. degree programs.
3 units, Spr (Linvill) TTh 7:30-9:00

201A. Dynamic Systems—An introduction with about equal emphasis given to development of general dynamic system theory and to exploration of classical models from social, physical, and life systems. Goal is to develop ability to recognize and analyze dynamic phenomena in diverse situations. Concepts covered include: formulation and analysis of difference and differential equations; state-space formulation: linear systems, fundamental solution sets, equilibria, dynamic diagrams; eigenvector analysis of linear systems, the concept of stability. Systems with positive variables: Frobenius-Perron theory, stability, existence of positive equilibria, comparative statics. Applications that are discussed in some detail include: cohort population models, social structures, migration models, national economics, price cycles, cultural media dynamics, Peter Principle of organizational hierarchies, Richardson’s theory of arms races, Homans’ model of group interaction, population growth (DR:T)
4 units, Aut (Luenberger) TTh 9:30-10:50

201B. Dynamic Systems—Transforms, concepts of control, and feedback. Controllability, observability, and canonical forms. Nonlinear system analysis; stability, Liapunov functions, general summarizing functions. Introduction to optimal control theory; variational methods, the Pontriagin maximum principle, the Hamilton-Jacobi-Bellman equation. Applications include: Volterra’s predator-prey model, genetic transfer, the spread of epidemics, optimal resource allocation. (DR:T)
4 units, Win (Luenberger) TTh 9:30-10:50

208. The Art of Mathematical Modeling—Constructing mathematical models is essential to the successful application of quantitative analysis to new and unexplored problem areas. This course explores the wide range of practical and philosophical issues associated with the modeling process. Students are given first-hand experience in constructing and critiquing mathematical models. Emphasis is upon ingenuity and creativity rather than a particular set of mathematical models or techniques, although familiarity with calculus and probability is required. (DR:T)
3 or 4 units, Win (Smallwood and Morris) MW 1:15-2:30

211. 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 outcome 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. Most enrolling students have had previous probability courses, but they share a desire to learn how to apply probability concepts to problems of uncertainty. The course objective is to provide students with the same understanding and competence in analysis of probabilistic problems that they already possess in dealing with deterministic problems. Prerequisite: working knowledge of calculus. (DR:T)
5 units, Aut (Howard) TTh 11:00-12:15

OPTIMIZATION

242. Introduction to Optimization—Overview of optimization field. Basic notions related to convexity. An introduction to linear programming including: problem formulation, basic properties, simplex method, duality, dual simplex method, reduction of linear programs to minimal form. Special computing techniques and their economic interpretations. Applications. Recommended: Mathematics 113 or equivalent. (DR:X)
3 units, Win (Staff) MW 3:15-4:30

3 units, Spr (Oren) MW 8:00-9:15

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. (DR:X)

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<td>253. Optimal Dynamic Systems—Development of optimal control theory and its applications to social, economic, and life systems. Pontryagin maximum principle is developed from geometric point of view. Problems with integral and inequality constraints; transversality condition; singular control; linear systems with quadratic cost; discounting cost; infinite horizon problem. Sufficient conditions for optimality. Applications that are discussed in detail include: management of renewable resources, dynamic theory of the firm, control of predator-prey systems, and optimal economic growth. Prerequisite: 201B.</td>
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<td>Aut (Larson) TTh 2:45-4:00</td>
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263. Principles of Optimization—The main objective of this course is to demonstrate that a rather large segment of the field of optimization can be effectively unified by a few geometric principles of linear vector space theory. Introduction to functional analysis; linear vector spaces, normed spaces, Banach space, Hilbert space. Projection theorem in Hilbert spaces with applications to least-square estimation and minimum norm control. Dual spaces and linear functionals, the Hahn-Banach theorem. Convex optimization, duality theory, Kuhn-Tucker theorem with applications to production planning, resource extraction. Prerequisite: 201B or Mathematics 113, Mathematics 115. | 3 | Aut (Tse) TTh 9:30-10:45 |

**ECONOMICS**

155. Economics of Exhaustible Resources—(Enroll in Economics 155.)

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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 national product, 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. Prerequisite: Economics 51 or equivalent.

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<td>212A. 3</td>
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<tr>
<td>212B. 3</td>
<td>Spr (Staff) MW 9:30-10:45</td>
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<td>Spr (Dunn) MW 11:00-12:15</td>
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258. Systems Economics—A seminar discussion of the systems aspects of economic problems, with particular emphasis on principles and techniques for dealing with complex economic structures. The general objective is to relate economic theory and systems concepts to practical problem-solving. The course, which is partly tutorial and partly research-oriented, consists of presentations by faculty, guests, and students. Possible topics include: analysis of futures markets, the Thorpe approach to options trading, Sraffa's theory of economics, rational expectations as a basis for modeling, Lefschetz fixed-point theory, market games, modern approaches to large-scale economic modeling, and computational aspects of economic theory. Prerequisites: All EES Core Courses recommended.

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<td>Spr (Luenberger) T 2:15-3:30</td>
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**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: Knowledge of basic probability (221 or equivalent). (DR:T)

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. (DR:X)

3 units, Spr (Howard) Th 2:45-5:15

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. (DR:X)

4 units, Spr (Matheson) TTh 11:00-12:15

APPLICATIONS AND RESEARCH

249. Urban Economic Analysis—(Enroll in Economics 249.)

250. Telecommunications Policy Analysis—A project course in policy analysis for students with some background in economics. Teams of students analyze a current legislative or administrative decision problem in the field of telecommunications. Industry filings in recent or pending cases before the U.S. Federal Communications Commission and the U.S. Congress, along with previous FCC and court decisions, provide background and data for student analyses. Oral and written presentations are made by student teams at the end of the quarter. The policy issue analyzed in 1977–78 was telephone pricing policy and its relation to competition in the telephone industry. Prerequisite: 212A. (DR:T)

3 units, Win (Drum) MW 11:00-12:15

255A,B,C. Workshop in Technology Assessment—Seminar discussions focused on the development and role of technology assessment as a policy analytic technique and on an examination of the limits and potentialities of systems analysis in addressing public policy questions. Through seminar sessions with guest speakers, students will also assess situations in which systems analysis has proved effective and why; where it has not been effective and why not; and they will consider the possibilities of extending systems analysis to other problem areas through innovations in methodology. During the winter and spring quarters, the workshop will conduct a technology assessment on a topical issue of public concern. Previous technology assessments have been conducted on the impacts on the California coastal zone from proposed offshore oil and gas development and on the transportation and utilization of Alaskan north slope natural gas. (DR:X)

4 units, Aut, Win, Spr (McAlister) T 2:15-4:05

292. Directed Reading and Research in Engineering-Economic Systems—Directed study and research on subject of mutual interest to student and staff member. (DR:X)

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

293. Seminar in Engineering-Economic Systems—Lectures on research problems and recent results in engineering-economic systems by faculty, students, and visiting specialists. (DR:X)

1 unit, Aut, Win, Spr (Tse) T 4:15

294. Thesis and Thesis Research—Limited to students who have established candidacy for the degree of Engineer or Ph. D. A grade of + indicates satisfactory work; no letter grade is assigned. (DR,X)

Any quarter (Staff) by arrangement

300 Series. Project Seminar—An intensive study of a practical problem. (DR:X)

Any quarter (Staff) by arrangement

301. Internship Review—Discussion and review of a student's internship experience, together with an oral presentation. Open only to students after they have completed an internship. (DR:X)

Any quarter (Staff) by arrangement
400 Series. System Research Seminar—
Group study of an area of current system re-
search. Topics may include areas of theory as
well as areas of applications. Topics will be an-
nounced on a quarterly basis. In 1977-78 the
following 3-unit seminars were held: Control of
Dynamic Systems under Uncertainty (Tse), and
Systems Economics (Luenberger). (DR:X)
1 or more units, Aut, Win, Spr (Staff) by
arrangement

INDUSTRIAL
ENGINEERING
AND ENGINEERING
MANAGEMENT
Emeritus: Eugene L. Grant, Robert V. Oakford
(Professors)
Chairman: Henry E. Riggs
Professors: James L. Adams, Warren H. Haus-
man, W. Grant Ireson, Henry E. Riggs,
David A. Thompson. By Courtesy: Gayton
E.Germaine. Consulting: Stewart P. Blake
Associate Professors: Robert C. Carlson, James
V. Jucker
Assistant Professor: James E. Hodder
Lecturer: Charles F. Banfe
Affiliated Faculty: Professors: James R. Free-
land, Frederick S. Hillier, Charles A. Hollow-
way, C. Richard Liu, Douglass J. Wilde,
Richard S. Shevell, Arthur F. Veinott

PROGRAMS OF STUDY
Industrial Engineering is concerned with
how best to organize people, information,
money, and materials to produce and distribute
services and products. Depending on the de-
gree level, students are prepared to design,
manage, perform research on, or teach about
productive systems which may be in private
industry, federal, state or local government, or
in public, quasi-public, or non-profit institu-
tions.

Engineering Management is concerned with
the knowledge and processes required to man-
age technically based enterprises.

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, de-
signing, and implementing of complex
economic and technological management sys-
tems where a scientific and engineering
background is necessary or desirable. The fun-
damentals of engineering are stressed. The In-
dustrial Engineering program is designed to in-

troduce the student to measurement and con-
trol theory, organization theory and be-


ADVANCED DEGREES
The Department of Industrial Engineering and
Engineering Management, in collaboration
with other departments of the University, offers
programs leading to the degrees of Masters of
Science, Engineer, and Doctor of Philosophy in
Industrial Engineering.

Applicants for admission as graduate students
in Industrial Engineering and Engineering
Management must submit the results of the
verbal, quantitative, and analytical aptitude
parts of the Graduate Record Examination.

MASTER OF SCIENCE
The Master of Science degree programs re-
quire a minimum of 45 units beyond the equi-
valent of a Bachelor of Science degree at Stan-
ford. All programs represent substantial prog-

gress in the major field beyond the equivalent of

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 suc-
sessfully completed or must complete the equi-
valent of 45 units of mathematics, science and
engineering breadth. 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.
MASTER OF SCIENCE—INDUSTRIAL ENGINEERING

The Master of Science program is designed to provide sufficient additional skills over the B.S. course in Industrial Engineering to better prepare students for a professional career. It is also designed to prepare students with Bachelor's degrees in other engineering disciplines to learn more about production and distribution systems. An additional use of the Master's degree is as a step toward a second advanced degree.

Suggested or sample programs leading to the degree of Master of Science in Industrial Engineering are available. These sample programs and the requirements for the Masters of Science degree may be obtained from the Department of Industrial Engineering and Engineering Management. Also available are lists of suggested courses for students wishing to emphasize the areas of Engineering Economy, Engineering Management, Production Systems, Systems Analysis and Synthesis, Transportation Systems, and Man-Machine Systems.

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.

MASTER OF SCIENCE—ENGINEERING MANAGEMENT

The Master of Science degree in Engineering with a concentration in Engineering Management is designed to provide knowledge of the process of management as applied to technically-based enterprises and to provide additional skills in the student's basic engineering discipline. It is intended for students with the B.S. or M.S. degree in engineering disciplines other than Industrial Engineering (those with a B.S. degree in I.E. should pursue their M.S. in I.E.) It should be considered a terminal degree and not a step toward a second advanced degree. The Ph.D. is not offered in Engineering Management. Those students who expect eventually to pursue an M.B.A. degree should not apply. Students interested in management of construction or Civil Engineering Infrastructure should apply to the Civil Engineering Department at Stanford.

The Degree of Master of Science in Engineering with a concentration in Engineering Management requires 30 units of specified courses in the Engineering Management area and a coherent package of 15 additional units of coursework typically in the student’s technical area (beyond the previous degree level). A sample program outlining detailed requirements for the degree is available from the department of Industrial Engineering and Engineering Management. This program should be of particular interest to Honors Cooperative students.

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 in Industrial Engineering degree is for students who desire careers in teaching or in 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 of study is usually represented by the M.S. program. The completion of an acceptable dissertation may occupy most of the candidate's 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 up to $7,860 a year are awarded each year. Application forms and detailed information may be obtained by writing the Department of Industrial Engineering and Engineering Management or the Graduate Admissions Office. Applications for assistantships and scholarships should be made by February 1 preceding the start of the academic year for which the award is to be made.

UNDERGRADUATE COURSES

100. Organizations: Theory and Manage-
151. Problem Solving—An investigation of problem solving with particular emphasis on problem definition, creativity, and interpersonal factors that influence thinking. Common blocks to problem solving will be explored and methods of dealing with them will be presented. The advantages of integrating various problem solving strategies will be stressed through use of reading, abstracted problem situations, and projects. (DR:X)

3 units, Spr (Adams) M 2:15-5:05

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. (DR:T)

3 units, Spr (Thompson) MWF 11

130. Quality Assurance—Concepts and statistical methods employed in the assurance of product conformance to specifications in the procurement of components and parts, production, assembly, distribution, and ultimate use. Emphasis is placed on setting quality standards and methods of achieving the desired results by using statistical methods and technology in design, design review, acceptance sampling, process control, economic analysis, reliability appraisal, corrective action and vendor relations. Prerequisite: Statistics 40, 110, or 116. (DR:T)

3 units, Win (Ireson) MWF 11

133. Industrial Accounting—Introduction to basic accounting concepts and operating characteristics of accounting systems. Principles of financial and cost accounting, design of accounting systems, techniques of analysis and cost control. Course is designed for the user of accounting information and not as a first course for those preparing for careers as professional accountants. Interpretation and use of accounting information for decision making is stressed through case discussions. An understanding is developed of the usefulness and benefits of accounting data as well as of the limitations of that data. Students who have taken or are taking another University course in elementary accounting should not enroll. (DR:X)

4 units, Aut (Riggs) MWF 1:15 and one hour by arrangement
Spr (Riggs) MWF 10 and one hour by arrangement

141. Utilization of Computers—Background necessary for effective use of computers in industrial engineering and management problems; machine characteristics; automatic languages. Data processing, Numerical techniques. Systems applications. Prerequisite: Computer Science 106 or equivalent. (DR:T)

3 units, Aut (Staff) MWF 2:15

144. Computer Simulation—The design, creation, and analysis of computer simulations. The use of simulation for estimation, comparison of policies, optimization, and education. Emphasis will be primarily on applications in the areas of production and management. Prerequisites: I.E. 141, Statistics 116, and Statistics 110. (DR:T)

3 units, Spr (Jucker) MWF 9

152. Introduction to Operations Research I—(Enroll in Operations Research 152.) (DR:T)


160. Analysis of Production Systems I—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 optimal facility location, line balancing for continuous production processes, and optimal timing and sizing of production capacity expansion. Graduate students enroll in 260. Prerequisites: 152, Engineering 161, and Statistics 116 or 110. (DR:T)

3 units, Aut (Hausman) TTh 10-11:15
Win (Hausman) TTh 1:15-2:30

164. Production Engineering Problems—Each student will participate in a major project as a member of a group of three or four students. Special attention will be given to problem identification and definition. Students will be expected to apply analytic methodology obtained from previous course work, when appropriate; but the emphasis will be on synthesizing feasible solutions to real problems. Not open to graduate students. Prerequisite: I.E. 160. (DR:T)

3 units, Win (Hausman, Jucker) dhr

191. Directed Study—Directed study on subject of mutual interest to student and staff
memember. Student must find a sponsor and submit a one-page description of plan. (DR:X)

1 or more units, (Staff) by arrangement

Courses Primarily for Graduate Students

201. Problem Solving—For graduate students. Lectures same as 101. (DR:X)
3 units, Spr (Adams) M 2:15-5:05

208. Man-Machine Systems—Design and analysis of human and man-machine systems with emphasis on man-machine interface. Physiological considerations such as size, effort and skill; informational considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; and intellectual considerations, such as vision audition, and tactile sensing; 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and intellectual considerations, such as vision audition, and tactic
240. Linear Programming—(Enroll in Operations Research 240.) (DR:T)

244. Computer Simulation—For graduate students. Lectures and prerequisites same as 144. (DR:T)

3 units Spr (Jucker) MWF 9:00


260. Analysis of Production Systems I—For graduate students. Lectures same as 160. Prerequisites: same as 160. (DR:T)

3 units, Aut (Hausman) TTh 10-11:15
Win (Hausman) TTh 1:15-2:30

261. Analysis of Production Systems II—Scheduling and control of production—inventory systems. Demand forecasting, inventory control, production scheduling, aggregate production and work force planning, multistage systems, hierarchical systems, materials requirements planning and integrated systems. Prerequisites: I.E. 260 and 153. (DR:T)

3 units, Win (Jucker) MWF 1:15
Spr (Hausman) TTh 1:15-2:30

262. Analysis of Production Systems III—Design and operation of production—inventory systems. Production scheduling, job shop scheduling, capacity planning, plant location, sequencing, assembly line balancing, multigoal optimization. The reading material will be drawn primarily from journal articles. Prerequisite: I.E. 260. (DR:T)

3 units, not offered 1978-79

269. Industrial Marketing—The various elements of the marketing plan are investigated as they relate to the marketing of industrial (as contrasted with consumer) products and services. The importance of identifying market needs and relating them to product development is stressed. Other elements such as pricing, channels of distribution, sales organization, promotion, communication and response to competitive actions are examined, largely through the discussion of cases. Throughout the course, the interaction of the marketing plan and overall corporate strategy is stressed. (DR:X)

3 units, Aut (Staff) TTh 8-9:15

270. Managing Technical Companies—This course focuses on the role of general management in technical companies, integrating marketing, finance, operations, control and organization. The course provides experience in “matching” market needs and technical product developments. Cases are used extensively to provide real-life opportunities for analysis, planning and decision-making. The course provides the necessary background for I.E. 271 which focuses on the start-up of a new business venture. Open to graduates and senior undergraduates, including non-engineering majors. Prerequisites: I.E. 133 (or equivalent) and I.E. 269. I.E. 100 (Organizations: Theory and Management) is recommended but not required. Enrollment limited and at discretion of instructor. (DR:T)

4 units, Win (Riggs) MWF 8 plus one hour by arrangement

271. New Enterprise Management—Following on the course in Managing Technical Companies, this course is offered for students interested in starting a new business and/or participating in the management of a small, ongoing business during its formative stages. Emphasis is on the development and evaluation of realistic, action-oriented business plans to launch new enterprises. Legal, financial and related considerations that are peculiar to new ventures are also discussed. Students, working alone or in small groups, are required to develop a detailed business plan for a specific, proposed new venture. Prerequisite: I.E. 270. Enrollment limited and at discretion of instructor. (DR:T)

4 units, Spr (Riggs) MF 8-9:50

291. Industrial Engineering Problems—Directed study on subject of mutual interest to student and staff member. Student must find a faculty sponsor. (DR:X)

1 or more units, (Staff) by arrangement

300. Thesis—Work on thesis for degree of Engineer. (DR:X)

Aut, Win, Spr (Staff) by arrangement

301. Dissertation—Work on dissertation for degree of Doctor of Philosophy. (DR:X)

Aut, Win, Spr (Staff) by arrangement

310. Colloquium in Industrial Engineering—Departmental colloquium on current research and applications in industrial engineering. There will be approximately four presentations each quarter by visitors, faculty, and students. Graduate students may register for one unit (total) for three quarters. No letter grades will be given. Ph.D. students must attend during every quarter in residence. (DR:X)

1 unit, Aut, Win, Spr (Staff) T 4:15-5:30

360. Doctoral Research Seminar in Production—Topics from current published literature and working papers. Content will vary from year to year. Open to doctoral students interested in research problems and issues in the production-inventory area. Prerequisite: I.E.
260 and at least one of I.E. 261, 262 or equivalent. (DR:T)
3 units, Aut (Hausman, Jucker) MW 1:15-2:30

MATERIALS SCIENCE AND ENGINEERING
Emeritus: O. Cutler Shepard (Professor)
Chairman: Richard H. Bube
Associate Chairman: William D. Nix
Consulting Professors: Farid Abraham, Robert I. Jaffee, Helmut R. Poppa, John Stringer
Adjunct Professor: Klaus Heinemann
Assistant Professors: Alan K. Miller, Robert Sinclair
Lecturers: Alan L. Fahrenbruch, Claus G. Goetzel, Glen B. Haydon

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 graduate study to extend their coursework and to obtain training in research. Co-terminal degree programs are encouraged both for undergraduate majors in Materials Science and Engineering and for undergraduate majors in related disciplines. 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 Depart-
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 with a minimum grade point average of 2.75 for course work.

The Department offers several different programs of study leading to the Master of Science degree. The majority of students take a general program in Materials Science; however, programs are available that specialize in various technological areas of Materials Engineering. The requirements for the M.S. degree programs are itemized 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 advisor 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 advisor. Zero units of Materials Science and Engineering 200 are allowed if no Master’s Report is required.

2. **Materials Engineering**
   - Three 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 Master’s programs although transfer into the Ph.D. program may be possible in some cases. Course requirements are listed below. Other programs are possible to meet other special needs.

### Mechanics of Materials

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
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<tbody>
<tr>
<td>E 51</td>
<td>Materials Technology for Structural Applications</td>
<td>3</td>
</tr>
<tr>
<td>M&amp;E 205</td>
<td>Strength and Microstructure</td>
<td>3</td>
</tr>
<tr>
<td>M&amp;E 185</td>
<td>Mechanical Behavior of Solids</td>
<td>3</td>
</tr>
<tr>
<td>M&amp;E 202A, B, C</td>
<td>Experimental Methods in Materials Science</td>
<td>6</td>
</tr>
<tr>
<td>M&amp;E 238</td>
<td>Fracture of Solids</td>
<td>3</td>
</tr>
<tr>
<td>M&amp;E 249</td>
<td>Time-dependent Plasticity</td>
<td>3</td>
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<tr>
<td>ME 238A, B</td>
<td>Theory of Elasticity</td>
<td>6</td>
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<tr>
<td>ME 200A</td>
<td>Math. Methods (or equivalent)</td>
<td>6</td>
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<tr>
<td>Electives</td>
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<td>12</td>
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<td>45</td>
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### 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>M&amp;E 188</td>
<td>Electrical, Optical, and Magnetic Properties of Materials</td>
<td>3</td>
</tr>
<tr>
<td>M&amp;E 202A, B, C</td>
<td>Experimental Methods in Materials Science</td>
<td>6</td>
</tr>
<tr>
<td>M&amp;E 209</td>
<td>Mathematical Methods in Materials Science</td>
<td>3</td>
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<tr>
<td>M&amp;E 222</td>
<td>Statistical Thermodynamics</td>
<td>3</td>
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<tr>
<td>E.E. 322A, B</td>
<td>Quantum Mechanics</td>
<td>6</td>
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<tr>
<td>M&amp;E 233</td>
<td>Quantum Theory of Energy</td>
<td>3</td>
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<tr>
<td>M&amp;E 234</td>
<td>Electronic Transport in Solids</td>
<td>3</td>
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<tr>
<td>E.E. 332</td>
<td>Optical Properties of Solids</td>
<td>3</td>
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<tr>
<td>Electives</td>
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### 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.

**Course No.** | **Subject** | **Units**
--- | --- | ---
MS&E 181 | Thermodynamics and Phase Equilibria | 4
MS&E 182 | Rate Processes in Materials | 3
MS&E 185 | Mechanical Behavior of Solids | 3
MS&E 105 | (AES 105), Extractive Process Metallurgy | 2
MS&E 150 | (AES 150), Introduction to Mineral Extractive Processes | 3
MS&E 207 | (AES 207), Metal Refining and the Nature of Liquid Metals | 3
MS&E 228 | (AES 228), Extractive Metallurgy Seminar | 3
Ch.E. 120, or 160, or 205 | Electives | 21
--- | --- | ---
| |  | 45

**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. 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.

4. Maintain a grade point average of 3.0 for all course work taken as a graduate student at Stanford.

5. A candidate must present the results of his or her dissertation at a Departmental Seminar prior to his University Oral Examination.

**COURSES**

All courses are (DR:T) if taken for 3 or more units.

**50. Introductory Science of Materials**—(Enroll in Engineering 50.)

**51. Materials Technology for Structural Applications**—(Enroll in Engineering 51.)

**52. Electronic Properties of Materials**—(Enroll in Engineering 52.)

**100. Undergraduate Special Problems**—Independent study in Materials Science under supervision of a faculty member.

   1 to 3 units, any quarter (Staff) and by arrangement

**105. Extractive Process Metallurgy**—(Enroll in Applied Earth Sciences 105.)

**150. Introduction to Mineral Extraction Processes**—(Enroll in Applied Earth Sciences 150.)

**180. Atomic Arrangements in Solids**—Description and determination of atomic arrangements in perfect and imperfect crystals, including treatment of formal crystallography, crystalline defects, and diffraction phenomena.

   4 units, Aut (Sinclair) MTWTh 10

**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 1:15-3:05

**182. Rate Processes in Materials**—Diffusion in solids, structural transitions including recrys-
tallization and liquid-solid and solid-solid phase transformations, property control by micro-
structural control. Prerequisites: 180 and 181.
3 units, Win (Pound) MWF 10

185. Mechanical Behavior of Solids—Mechanics and mechanisms of mechanical properties of solids. Introductory treatments of continuum mechanics, elasticity, anelasticity and damping, and continuum plasticity are given. Phenomenological aspects of plastic deformation including strain hardening, strain rate sensitivity, plastic instability and ductility are also presented. Mechanisms of plastic deformation in crystalline solids based on the properties of dislocations are discussed. The relationship between strength and microstructure is also developed. Prerequisite: Engineering 11 and 50.
3 units, Win (Barnett) MWF 9

3 units, Win (Bube) TTh 9-10:15

190. Polymer Science and Engineering—Relationships of structure and composition of polymers to their physical properties. Chemistry and structure of polymers; polymerization and phase transition in polymers. Transport, mechanical, electrical and optical properties of polymers. Fabrication of polymers. Prerequisite: Engineering 50 or equivalent.
3 units, Aut (Sinclair) TTh 11:00-12:15, given in 1979-80

192. Biomaterials—A study of the properties and functions of materials in the body environment. The electrical characteristics of skin and bone and their changes with change of physiological state of the body. The structure and function of membrane processes. Blood surface interactions, medical prosthesis of plastics and the application of polymers to artificial organs. A general attempt will be made to show the great similarity that exists between phase equilibria and growth processes dealt with in the mainstream of materials science and that observed in body tissues and structures. Prerequisites: Engineering 50 or equivalent.
3 units, Win (Tiller) TTh 11:00-12:15, given 1979-80

200. Graduate Special Problems.
Any quarter (Staff) by arrangement

201. Principles and Methods of Crystal Growth—Main emphasis on principles and qualitative understanding. Broad look at the important phenomena involved in the growth and perfection of crystalline solids from the melt, solution, vapor or electro-deposition, etc. Application to electrical, metallurgical, chemical, geological and medical fields. Discussion of relative merits of different crystal growth techniques.
3 units, Aut (Sherby) TTh 8:30-9:45
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. Relation between dislocation mechanics and the mechanical properties of crystals. Structure and properties of interfaces. Prerequisites: 180, 185. 3 units, Spr (Nix) MWF 8

207. Metal Refining and the Nature of Liquid Metals—(Enroll in Applied Earth Sciences 207.)

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, variational, 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 130.
3 units, Spr (Barnett) MWF 9

210. Semiconductor Materials Processing—Basic principles of the synthesis processing of elemental and compound semiconducting materials and techniques for characterizing structural defects in semiconductors. Topics include: thermodynamic and kinetic considerations in crystal growth from the liquid and by chemical vapor deposition; structural characterization techniques such as scanning and transmission microscopy, x-ray topography, photoluminescence and mass spectroscopy; and analytical techniques used to study failures in processing and in service. Field trips will be made to observe industrial processing operations. Prerequisite: Engineering 50 or E.E. 111 or equivalent.
3 units, Win (Staff) MWF 8

212. High Temperature Materials—Applications, product specifications, properties, and fabrication methods for refractory metals, dispersion hardened alloys, reactive metals, graphite, ceramics, cements, and intermetallic compounds.
3 units, Sum (Goetzel) TTh 10:30-12:00, given 1979–80

215. Photovoltaic Solar Energy Conversion—This course discusses the fundamental of solar cells as well as pertinent disciplines including electronic properties of materials, semiconductor junction theory, and crystal and film growth. The Si single crystal, AlGaAs/GaAs heterojunction, and Cu2S/CdS thin film cells are described in detail as examples of the basic types of solar cells. Prerequisites: E.E. 112 or equivalent and M.S.E. 188 (may be concurrent) or by permission.
3 units, Win (Staff) MWF 1:15

3 units, Aut (Shyne) MWF 10

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

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.
2 units, Win (Staff) TTh 10:00-11:15 given 1979–80

226. Electrochemistry and Corrosion—Development of electrochemical principles with application to corrosion, electrolytic processes, and galvanic cells. Prerequisites: elementary thermodynamics.
3 units, Spr (Stevenson) TTh 8:30-9:45

228. Extractive Metallurgy Seminar—(Enroll in Applied Earth Sciences 228.)

229. Principles of Steelmaking—(Enroll in Applied Earth Sciences 229.)

232. Point Defects in Crystals—Structure of point defects. Defect equilibria; influence of temperature, chemical and electrical potentials, interfaces, 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: 186 or Electrical Engineering 322A.
3 units, Spr (Bienenstock) TTh 9:00-10:15

equation for galvanomagnetic, thermal, and thermoelectric processes in metals and semiconductors. Localized levels and Fermi level analysis of semiconductors. Prerequisite: 233 or Electrical Engineering 322B.

3 units, Aut (Bube) MWF 2:15

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 (Staff) MWF 2:15

236. Modern Imaging Techniques in Materials Science—Currently important methods of directly examining the microstructure of materials are surveyed. The following topics are covered: optical microscopy, scanning electron microscopy, field-ion microscopy, transmission electron microscopy, x-ray topography and scanning transmission electron microscopy. Emphasis is placed on the electron-optical techniques. Prerequisite: 180.

3 units, Aut (Sinclair) TTh 2:15-3:30

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. Prerequisites: 206, 246.

3 units, Win (Sinclair) TTh 2:15-3:30


3 units, Spr (Shyne) TTh 10:00-11:15


3 units, Aut (Pound) MWF 1:15

243. Transmission Electron Microscopy—Image formation and interpretation is covered in detail. The contrast phenomena associated with perfect and imperfect crystals are discussed both from a physical point-of-view and from a formal treatment of electron diffraction theory. The importance of electron diffraction to systematic analysis is emphasized and recent imaging developments are described. Prerequisite: 180.

3 units, Win (Sinclair) TTh 2:15-3:30; alternate years, given 1979-80

244. Failure Analysis—A study of techniques and methods used in the analysis of failures in the field of materials science and engineering. Topics covered include optical and electron fractography, localized chemical analysis, x-ray techniques, voltage contrast scanning electron microscopy, nondestructive testing methods, and selected case studies from the areas of mechanical properties and solid state electronics.

3 units, Win (Staff) TTh 1:15-2:05, given 1979-80

245. Dislocation Dynamics—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.

3 units, Win (Nix) dhr


3 units, Spr (Shyne) TTh 10:00-11:15

248. Photoelectronic Materials and Devices Laboratory—(Enroll in Electrical Engineering 330.)

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 1:15-2:30

250. Non-Elastic Deformation in Engineering Applications—Constitutive equations for deformation of metals and alloys. Physical mechanisms and phenomenological considerations. Irradiation effects. Interactions with fracture. Materials processing operations and analysis. Case studies and high-temperature structural applications will be emphasized throughout the course. Prerequisite: 185 or 205.

3 units, Aut (Miller) TTh 10:00-11:15

253. Transmission Electron Microscopy Laboratory—Experimental application of electron microscopy to typical problems in materials science, including specimen preparation, mic-
roscope operation and alignment, recording and analysis of bright and dark field images and diffraction patterns, dislocation and stacking fault characterization, precipitate identification, etc.

3 units, Spr (Sinclair) dhr; given 1979-80

255. Advanced Experimental Techniques in Surface Analysis—Auger electron spectroscopy and microanalysis, secondary ion mass spectroscopy (SIMS), low energy electron diffraction (LEED), ion scattering spectroscopy, thermal desorption spectroscopy, electron stimulated desorption, work function measurement, in-situ transmission electron microscopy. Course includes visits at off-campus laboratories.

3 units, Spr (Staff) dhr

257. Fatigue of Metal Structures—(Enroll in Mechanical Engineering 245.)

258. Optical Properties of Solids—(Enroll in Electrical Engineering 332.)

259. Basic Quantum Mechanics—(Enroll in Electrical Engineering 322A.)

260. Basic Quantum Mechanics—(Enroll in Electrical Engineering 322B.)

263. The Science of Crystallization—Quantitative determination of key aspects of liquid-solid and vapor-solid crystal formation: solute redistribution, growth rate determination, interface stability, dendritic growth, single phase and cooperative-mode polyphase formations, interface attachment-kinetic dominated growth forms, adsorption effects, electric field effects, etc. Prerequisite: 201.

3 units, Aut (Tiller) TTh 11:00-12:15

264. The Equilibrium Structure of Surfaces—Quantitative treatment of diffuse interfaces, gamma plots, thermal faceting, electrical double layers, adsorption, equilibrium forms, interface attachment kinetics. Application to nucleation, crystal growth, phase transformations, catalysis, stress corrosion cracking, etc. Prerequisite: 181, 240 or equivalent.

3 units, Win (Tiller) TTh 11:00-12:15


3 units, Win (Pound) by arrangement

266. Scientific Foundations of Stress Corrosion Cracking—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 polarization in surface 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) by arrangement


3 units, Win (Stevenson) TTh 2:15-3:30

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 9, given 1979-80

297. Principles of Electron Microscopy—(Enroll in Pathology 207)

300. Research.

Any quarter (Staff) by arrangement

340 Seminar in Kinetics.

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

341. Seminar in Mechanical Properties of Solids.

1 unit, Aut, Win, Spr (Sherby, Nix) by arrangement


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

343. Seminar in Photoelectronic Materials

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

344. Seminar in Amorphous Materials.

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

345. Seminar on Advanced Topics in Materials Science.

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

Emeriti: Wilhelm Flügge, Henry O. Fuchs, Boynton M. Green Mikló Hetényi, A. Louis London, Donovan H. Young (Professors)

Chairman: William C. Reynolds

Associate Chairman: Thomas J. Connolly

Division Chairmen: George Herrmann (Applied Mechanics), Robert J. Moffat (Thermosciences) (The Design Division operates without a Chairman.)

Laboratory Directors: Robert L. Piziali (Medical Design), Daniel B. DeBra (Guidance and Control), Robert H. Eustis (High Temperature Gasdynamics), Robert J. Moffat (Thermosciences), Larry L. Leifer (Smart Products Design)


Associate Professors: David M. Barnett, C. Thomas Bowman, Larry H. Leifer, Robert L. Piziali, J. David Powell

Adjunct Professors: Ronald K. Hanson, Sidney A. Self

Assistant Professor: Drew V. Nelson

Consulting Professors: Frank R. Arnold, Ralph M. Heintz, Anthony Leonard, Chauncey Starr, Harry T. Whitehouse

Acting Assistant Professor: Pradip G. Parikh


Teaching Specialist: David W. Beach

Affiliated Faculty: John V. Breakwell (Dynamics), Daniel Bershader (Acoustics), C. C. Chao (Elasticity), I. D. Chang (Fluid Mechanics), Gene F. Franklin (Controls), James M. Gere (Structures), Matthew S. Kahn (Art), Krishnamurty Karmacheti (Acoustics), Jan W. Molenkamp (Art), Cedric W. Richards (Structures), Oleg D. Sherby (Materials), Robert L. Street (Fluid Mechanics), David A. Thompson (Biotechnology), Walter G. Vincenti (History of Technology)

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 three divisions, Applied Mechanics, Design, and Thermosciences, each of which maintains its own laboratories, shops, and offices. The Applied Mechanics Division covers the areas of dynamics, mechanics of deformable solids, fluid dynamics and experimental mechanics. 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, biomechanics, computer-aided design, micro computers in design, and systems design. The Design Division also offers undergraduate and graduate programs in Product Design (jointly with the Art Department). The Thermosciences Division offers courses and specialized work in the areas of applied thermodynamics, energy systems, nuclear energy, pollution control, combustion, fluid mechanics, and heat transfer.
Many faculty members of the three divisions are involved in advanced mathematical analyses, and the Department as a whole provides a number of basic and advanced courses in applied mathematics.

**FACILITIES**

All three Divisions of the Department maintain modern laboratories which are used for both undergraduate and graduate instruction and graduate research work.

The Division 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 and the Palo Alto Veterans Administration Hospital. 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.

The Design Division maintains machine, foundry, welding and wood and plastic shops. Laboratory space is available for use in instruction, for construction of projects, and for graduate research work in various disciplines of interest to the Design Division faculty. The School of Engineering Structures Laboratory is used extensively for experimental work in structural mechanics and biomechanics. A Smart Products Design Laboratory supports microprocessor applications projects. An affiliation with the Stanford Artificial Intelligence Laboratory provides facilities for computer-aided design projects. The Design Division also has a unique "Product Design Loft," in which students in the product Design program develop their graduate design projects.

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, turbulence, internal combustion engine research and other work relevant to energy systems, conducted by the Heat Transfer and Turbulence Mechanics (HTTM) group. The High Temperature Gasdynamics Laboratory (HTGL) is engaged in a variety of research activities relating to the practical generation of electrical energy from flowing plasmas, electrostatic precipitators, combustion, kinetics of pollutants, and diagnostics for high temperature gases. 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 laboratory combustors. 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 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. Free computation is available on the PDP-10 LOTS system. A Sigma V hybrid computer is also available and a microcomputer applications development laboratory. There are several minicomputers available within the Department's laboratories. Various groups within the Department now use all these machines. The Thermosciences Division includes a group that is particularly strong in the numerical simulation of fluid flows, especially turbulence; this group uses NASA's CDC 7600 and ILLIAC computers.
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 for 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 at Stanford.

CO-TERMINAL BS/MS PROGRAM

Stanford undergraduates who wish to continue their studies through the Master of Science degree under the co-terminal program should petition the Department for entrance to the program at least one year before the co-terminal commencement. A minimum scholastic average of 3.25 in engineering, mathematics, and science courses taken over the most recent three quarters is a necessary condition for admission to the co-terminal program in Mechanical Engineering. Alternatively, a Stanford undergraduate may qualify for the co-terminal program in Mechanical Engineering by achieving scores in the quantitative and verbal segments of the Graduate Record Examination equivalent to those students accepted from other institutions by the Department.

MASTER OF SCIENCE

General Information

At Stanford the Master's program normally involves three quarters of academic study; no thesis is required, although many students become involved in directed study during the M.S. year in order to explore their interests in working for the Ph.D. degree.

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 unrestricted electives (see item 4 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, biomechanics, systems engineering, to name a few. No mechanical engineer is expected to have a mastery of this entire spectrum.

The Master's degree program requires 45 units of course work taken as a graduate student.
No 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. **Mathematical Competence in two of the following areas:** partial differential equations, linear algebra, complex variables, or numerical analysis, as demonstrated by completion of two appropriate courses from the following list: Mechanical Engineering 200-209; Mathematics 106, 113, 131, 132; Computer Science 137A, B. (Requirement—6 units.)

Students who completed comparable graduate-level courses as undergraduates and who can demonstrate their competence to the satisfaction of the instructors of the Stanford courses may be exempted from this requirement by their advisors, and place the units in the approved elective category.

2. **18 units** of graduate level courses in Mechanical Engineering consisting of:
   a) **A Specialty in Mechanical Engineering:** A set of graduate-level courses in Mechanical Engineering to provide depth in one area. These sets have been approved by the faculty as providing depth in specific areas as well as a significant component of applications of the material in the context of engineering synthesis. Lists of approved depth packages are available from the Department Office. The currently approved depth packages involve 3 to 4 courses.
   b) **Breadth in Mechanical Engineering:**
      1) At least one additional approved Mechanical Engineering course numbered 210-285 in each of two additional depth areas outside of the depth area selected in Item 2a.
      2) Additional graduate-level courses, if necessary, in Mechanical Engineering to bring the total number of graduate course units in Mechanical Engineering to 18.

Courses 200-209, 280, and 286-301 may not be counted in these categories.

3. **Approved electives,** to bring the total number of units in engineering, mathematics, or the sciences to 39. Of these 39 units, no more than 6 units may come from Mechanical Engineering 291, 292, and no more than 3 units may come from the other courses numbered M.E. 290-299 or other seminars. A student planning to go on for a Ph.D. degree should discuss with his or her faculty advisor the desirability of taking M.E. 291 or 292 during the Master’s year.

4. **Unrestricted electives** to bring the total number of units submitted for the M.S. degree to 45. Students are strongly encouraged to use these units outside of engineering, mathematics, or the sciences. Students should consult their advisors for recommendations on course loads and on ways to use the unrestricted electives to make a manageable program.

5. Within the courses satisfying the requirements above, there must be at least one graduate-level course dealing with laboratory studies. Courses which satisfy this requirement are Mechanical Engineering 210C, 225, 248, 249, 266, 268A. Mechanical Engineering 292 will satisfy this requirement if 3 units are taken for work involving laboratory experiments. A student who has had a substantial laboratory experience in an industrial or government research institute may be exempted from this requirement by his advisor.

Candidates for the degree of Master of Science will be expected to have the approval of the faculty, and a minimum scholastic average of 2.75 in the 45 units presented in fulfillment of the degree requirements. All courses used in fulfillment of requirements 1, 2, 3, and 5 must be graded courses (excluding courses numbered Mechanical Engineering 290-299, 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, or in Mechanical Engineering Design, 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 Engineering (Product Design) (see the “Engineering Majors” section of the School
of Engineering introductory material). 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>
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<tbody>
<tr>
<td>*M.E. 211A,B,C. Product Design Master's Project</td>
<td>12</td>
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<tr>
<td>M.E. 214. Philosophy of Design</td>
<td>3</td>
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<td>*Art 360. Master's Project</td>
<td>6</td>
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<tr>
<td>I.E. 208. Man-Machine Systems</td>
<td>3</td>
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<tr>
<td>**Approved Electives</td>
<td>15</td>
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<tr>
<td>Free Electives</td>
<td>6</td>
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<td>45</td>
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</tbody>
</table>

Students are encouraged to follow one of graduate design options:

- **Design Management**
  - I.E. 133. Industrial Accounting
  - I.E. 269. Industrial Marketing
  - I.E. 270. Managing Small Technical Companies
  - I.E. 272. New Enterprise Management

- **Engineering Design**
  - M.E. 210A,B,C. Engineering Design
  - M.E. 216. Design of Optimal Components

- **Biomedical Design**
  - M.E. 280. Biomechanics Seminar
  - M.E. 281. Orthopedic Biomechanics
  - M.E. 282. Neuromuscular Biomechanics
  - M.E. 284. Dynamics of Viscous Fluids and Suspensions
  - M.E. 285. Cardiovascular Dynamics and Respiration

- **Smart Product Design**
  - M.E. 212. Computer Aided Design
  - M.E. 217. Design of Optimal Systems
  - M.E. 218. Smart Product Design
  - E.E. 290A,B. Computer Applications Laboratory

- **Visual Design**
  - Art 261. Advanced Graphics Design
  - Art 268. Design Synthesis
  - Art 269. Advanced Creative Studies

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).

**Engineering Design**—Additional programs in Process Design, Control Systems Design, Mechanics and Design, Machine Design, Production Design and Biomechanics, each leading to a Master of Science in Engineering, are available. Contact the Design Division for detailed descriptions.

*Taken jointly each quarter.

**Approved electives must be graduate level courses.

**MASTER OF SCIENCE IN ENGINEERING OR ENGINEERING SCIENCE**

As described on page 90 of this bulletin, each department in the School of Engineering may sponsor students in the more general degrees, Master of Science in Engineering, or Master of Science in Engineering Science. Sponsorship by the Department of Mechanical Engineering requires that the student file a petition for admission to this program on a Registration Day, and that the center of gravity of the proposed program lie in Mechanical Engineering, no more than 18 units used for the proposed program can have been previously completed. The proposed program must include at least 9 units of graduate level work in the Department of Mechanical Engineering other than Mechanical Engineering 200-209 and 290-292. The petition must be accompanied by a statement explaining the objectives of the program, how it is coherent, contains depth, and fulfills a well-defined career objective. The grade requirements are the same as for the Master of Science in Mechanical Engineering.

**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 can-
not 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 advisor. 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.

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 90 (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. 211A,B,C Master's Project.

The total of 90 units 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 of 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 advisor. If the student has not arranged with a faculty member for supervision or research prior to admission, the student's advisor 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 advisor. 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, elasticity, dynamics, high temperature gasdynamics and combustion, nuclear engineering, or applied thermodynamics. 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. A student must have the written approval of a tentative dissertation supervisor in order to be permitted to take the examination. (Sponsorship for the examination carries no implication of financial support.) To apply for the examination a student must have a Stanford graduate GPA of at least 3.25. Courses used in the GPA evaluation will be the same as those that would be used to meet the M.S. GPA requirement. Students entering Stanford with an M.S. from another school must have a 3.25 GPA in the M.S. program at the previous school to take the examination in their first quarter at Stanford.

Ph.D. candidates must complete a minimum of 36 units of approved formal course work (excluding research, directed study and seminars) in advanced study beyond the M.S. degree. These courses should consist primarily of graduate courses in engineering and the sciences, although the candidate's reading committee may approve a limited number of upper division undergraduate courses and courses outside of engineering and the sciences, as long as such courses contribute to a strong and coherent program. In addition to this 36-unit requirement all Ph.D. candidates are expected to participate each quarter in one of the following (or equivalent) seminars: Mechanical Engineering 280, 290, 293, 294, 295, 296, 298, Aeronautics and Astronautics 296 or 297.

The Ph.D. thesis normally represents at least one full year of research work and must be a substantial contribution to knowledge. Students may register for course credit for thesis work (Mechanical Engineering 301) to help fulfill University residence requirements, but there is no minimum limit on registered thesis units. Candidates should note that University residence requirements (see section on Degrees) are expressed in terms of equivalent full-time registration and not in terms of units per se; questions on this point should be addressed to the departmental administrative assistant.

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 may be approved by the dissertation reading committee.

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 or departments with related interests. Usually the committee includes the candidate's advisor 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.

A representative timetable for progress toward the Ph.D. degree may be obtained from the Departmental Office. A student wishing to complete the Ph.D. requirements in four years of graduate study should ordinarily complete the M.S. by the spring of the first year, pass the qualifying examination by the fall of the second year, and complete course work, demonstrate feasibility of research methods and obtain approval of the thesis proposal by the end of the third year.

PH.D. MINOR

Students who wish a Ph.D. minor in Mechanical Engineering should consult the Department Office for designation of a minor advisor. A minor in Mechanical Engineering may be obtained by completing 15 units of approved graduate level courses in Mechanical Engineering, or by completing 9 units of graduate level courses and passing the Departmental Qualifying Oral Examination in two appropriate areas identified by the minor advisor.

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 Graduate 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**
--- | ---
M.E. 30 | Social Aspects of Nuclear Power
M.E. 101 | Visual Thinking
M.E. 103 | Manufacturing Technology

**COURSES PRIMARILY FOR UNDERGRADUATES**

All courses are (DR:T) if taken for 3 or more units unless noted otherwise.

*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, given 1979-80*

**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 selected from but not restricted to flow metering, energy losses in pipe flow, drag on a body, jet engine thrust, operation and performance of turbines, compressors and pumps. Prerequisites: Engineering 32, Engineering 11, and Engineering 5 or 12.

*3 units, Spr (Johnston) MWF 9, Lab MTWTh 1:15-3:05 or 3:15-5:05*

**101. Visual Thinking**—Visual thinking and visual language skill developed and exercised in context of solving design problems. Exercises for the mind’s eye. Quickly executed diagrammatic, orthographic, perspective and three-dimensional sketching. Relation of visual thinking to creative process. Emphasis upon fluent and flexible idea production.

*3 units, Aut (Leifer, Sanders)*

**102. Design Communication**—Simple design projects form the basis for learning engineering drawing as well as verbal and written communication techniques. Freehand sketching, engineering drawing (orthographic projection), charts, graphs, perspective drawing, the construction of three-dimensional models, and the organization and delivery of verbal-visual presentations. For students with little or no experience in communicating design ideas.

*3 units, Spr (Chilton) MWF 8-10*

**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, Aut (Barkan) Win (Staff)*

**104. Dynamic Response**—(Enroll in Engineering 104.)

**105. Control System Analysis and Design**—(Enroll in Engineering 105.)

**111. Stress, Strain and Strength**—Review of strength of materials (stress, strain and deflection concepts). Application to beams and pres-
sure vessels. Two dimensional stresses (Mohr's circle). Static failure theories and fatigue failure criteria. Prerequisites: Engineering 11 and 12 or consent of instructor.

3 units, Aut (Nelson) TTh 1:15-3:05

112. 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.) Prerequisites: Engineering 11 and 12 or consent of instructor. Mechanical Engineering 111.

3 units, Spring (Chilton) TTh 1:15-3:05

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, 111, and 112.

3 units, Spr (Roth) TTh 1:15-3:05

115A. Human Values in 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 (Chilton) TTh 1:15-3:05


3 units, Spr (Lucey) MW 1:15-4:05

116. Advanced Product Design—Small-scale projects carried to a high degree of refinement. Emphasis upon craftsmanship and aesthetics. Prerequisite: 115B.

3 units, Aut (Horine) TTh 11:00-1:05

116B. Advanced Product Design—New product innovation via need-finding. Prerequisite: 116A.

3 units, Win (Derby) TTh 11:00-1:05

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 (McKim) TTh 11:00-1:05

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 (Moffat) MWF 10; lab. one afternoon by arrangement

131B. Thermosciences—Continuation of 131A.

5 units, Win (Kline) MWF 10 plus one lec. hour and 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.

3 units, Spr (C. Kruger) MWF 11


3 units, Aut (Bershader) TTh 1:15-2:30

139. Environmental Measurements—The course will consist of laboratory experiments involving measurement techniques for determining environmental quality and pollutant concentrations. Air particulate measurements and techniques applicable to trace element de-
terminations will be covered. Prerequisite: 137 recommended.

3 units, Spr (Sher) lab. one afternoon by arrangement, given 1979-80


3 units, Win (Staff) MWF 11

176. Nuclear Energy—(Enroll in Engineering 176.)

180. Energy and Society—(Same as VTS 180.) A unified analysis of the production, distribution and consumption of energy in the United States and the world. 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 (Staff) MW 1:15

191. Engineering Problems and Experimental Investigation—Directed study and research for the undergraduate student on a subject of mutual interest to student and faculty member. Student must find faculty sponsor and have approval of his advisor.

1 to 5 units, any quarter (Staff) by arrangement

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, 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. 176. Nuclear Energy (Enroll in Engineering 176)
M.E. 180. Energy and Society
M.E. 218. Smart Product Design
M.E. 224. Advanced Manufacturing Technology
M.E. 225. Control System Analysis and Design (Enroll in Engineering 106)
M.E. 250A. Heat Transfer
M.E. 255. Gasdynamics

COURSES PRIMARILY FOR GRADUATES

All courses (DR:T) if taken for 3 or more units unless noted otherwise.

ENGINEERING MATHEMATICS


3 units, Aut (Ferziger) MWF 11

200B. 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. Prerequisites: background in linear algebra, advanced calculus, and ordinary differential equations.

3 units, Win (Reynolds) MWF 9


3 units, Spr (Ghose) MWF 9

201. Applications of Complex Variables—The theory of analytic functions, with applications to the evaluation of definite integrals by contour integration, the solution of physical problems by conformal mapping, and the solution of partial differential equations by means of integral transforms. A knowledge of the algebra of complex numbers and the derivative of a complex function is assumed.

3 units, Aut (Van Dyke) MWF 11
206. 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 M.E. 200B, or consent of instructor.
3 units, Win (Van Dyke) MWF 10

207. Perturbation Methods in Engineering Mechanics—Examples of perturbation solutions in fluid mechanics, solid mechanics, dynamics, and other fields; asymptotic expansions; series and iteration schemes; regular 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, Spr (Van Dyke) MWF 10

208. Vector Analysis and Cartesian Tensors with Applications—(Enroll in Aeronautics and Astronautics 192.)

209A. Linear Transforms and Their Applications to Engineering Problems I—(Enroll in Aeronautics and Astronautics 291A.)

209B. Linear Transforms and Their Applications to Engineering Problems II—(Enroll in Aeronautics and Astronautics 291B.)

DESIGN AND CONTROLS

210A,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 completion of 210C. Limited enrollment. Prerequisite: 113 or equivalent.
3 units, Aut (Barkan, Staff) TTh 1:15-4:05
210B. 3 units, Win (Barkan, Staff) Th 2:15-5:05
210C. 3 units, Spr (Barkan, Staff) T 2:15-5:05

211A,B,C. Product Design Master’s Project—Three-quarter graduate design project taught jointly with Art Department faculty (enroll concurrently in Art 360). 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 a project to the stage of a working prototype. In the third quarter, the student refines the design from the standpoint of cost, production and aesthetics. A demonstration model is built and presented to a professional jury. (For Product Design majors only.)
211A. 4 units, Aut (McKim) dh
211B. 4 units, Win (Leifer, McKim) dh
211C. 4 units, Spr (Leifer, McKim) dh

212. 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: FORTAN (or ALGOL or LISP) programming ability.
3 units, Aut (Roth) MWF 12

214. Philosophy of Design—Student encouraged to develop and clarify his/her personal design philosophy by reading design-related literature, writing, and experiencing projects structured to illuminate specific philosophical issues. Discussions and experiences with individual Design Division faculty will include personal creativity, design methodology, interpersonal relationships, ethics, goal-setting, aesthetics, human values in design, ecology, appropriate technology, and decision making. Prerequisite: Concurrent enrollment in 210A or 211A.
3 units, Aut (Fadiman, Roth) M 2:15-5:05

215. The Designer in Society—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 assisting individuals in assessing their roles in modern society. Students are required to do readings on political, social, and humanistic thought related to technology and design. A term project will be required. Limited enrollment; open to graduate students of all disciplines.
3 units, Win (Roth) M 1:15-4:05

216. Design of Optimal Components—Optimizing multivariable, constrained, nonlinear mechanical, thermal structural and
chemical devices. Students apply theory of monotonicity, power functions, and geometric programming to design devices of their choice; turbines, transmissions, steering gear, bearings, chemical reactors, heat exchangers, shells, plates, and beams. Prerequisite: calculus, matrix algebra.

3 units, Win (Wilde) MWF 11


3 units, Spr (Wilde) MWF 10

218. Smart Product Design—Deals with the application of micro-mini computer technology to the design of modern “Smart” consumer products and industrial instrumentation. Computer hardware is dealt with at the functional unit level (I/O board, CPU board, keyboards, etc., rather than at the discrete component level). Students will, however, be expected to write user programs in both higher level and assembly languages. There will be an emphasis upon human factors and the computer interface. Upon completion of the course the student will be able to specify a computer configuration and write programs necessary to accomplish a practical goal. Prerequisites: Computer Sciences 111 or Electrical Engineering 181 or consent of instructor.

3 to 5 units, Win (Leifer) T 1:15-3:05; Th 1:15-2:05


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 (DeBra) MWF 9, alternate years, given 1978-79

223. Design and Analysis of Dynamic Systems—Modeling, analysis and synthesis of practical devices in which dynamic response is a dominant consideration. Representations of dynamic systems including mass distribution, flexibility and friction effects. Mathematical description of actuators including hydraulic, pneumatic, springs, electro-magnetic, electro-hydraulic and cam-driven systems; dynamic significance of kinematics properties of coupling between actuator and driven systems. Design criteria. Prerequisite: 161.

3 units, Spr (Barkan) MWF 9

224. Advanced Manufacturing Technology—Automation in manufacturing. Numerical controls and optimal control of machining. Capabilities and limitations of different types of manufacturing systems. Topics in production research, including automated assembly, group technology and unconventional processing methods. Field trips will be integrated into course content where possible. Prerequisite: 103 or equivalent first-level materials and processes course.

3 units, Spr (Staff) given 1979-80

225. Control System Design and Simulation—(Enroll in Engineering 206.)

226A. Digital Control I—(Enroll in Engineering 207.)

226B. Digital Control II—(Enroll in Engineering 208.)

227A. Optimal Control of Dynamic Systems—(Enroll in Aeronautics and Astronautics 278A.)

227B. Optimal Estimation and Control Logic in the Presence of Noise—(Enroll in Aeronautics and Astronautics 278B.)

227C. Differential Games—(Enroll in Aeronautics and Astronautics 278C.)

228. On-Off Control Logic—(Enroll in Engineering 209.)


3 units, Spr (DeBra) MWF 9, alternate years, given 1978-79

MECHANICS OF SOLIDS

230. 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.

3 units, Win (Roth) by arrangement

231A. 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
231B. 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

231C. 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, Win (Kane) T 2:15-4:05 and Th 2:15, alternate years, given 1979-80


3 units, Spr (Kane) W 2:15-4:05 plus one hour by arrangement, alternate years, given 1978-79


3 units, Spr (Kane) T 2:15-4:05 plus one hour by arrangement, alternate years, given 1978-79

235A. The Finite Element Method of Continuum Analysis—Theory of finite elements applied to linear and nonlinear problems in solid and fluid mechanics. Topics will include: variational methods; weighted residual methods; application of the method to boundary value problems; relationship to other numerical techniques; element types; numerical integration in space and time; solution of large systems of equations; examples drawn from elasticity, plasticity and fluid flow. Prerequisites: 200A, 238A or equivalent.

3 units, Spr (Staff) MWF 3:15

235B. Advanced Finite Element Analysis—Application of finite elements to boundary value problems in static and dynamic elasticity, plasticity, viscoelasticity and viscoplasticity, fluid flow, heat and mass transport. Also, convergence, error estimates and eigenvalue problems will be discussed. Other topics will be selected from thermo-mechanical coupling, fracture mechanics, finite deformation and stability. Prerequisite: 235A.

3 units, Aut (Staff) MWF 3:15, given 1979-80


236A. 3 units, Aut (Staff) TTh 2:15-3:30, alternate years, given 1980-81

236B. 3 units, Spr (Staff) TTh 2:15-3:30, alternate years, given 1980-81

237. Free and Forced Motion of Structures—(Enroll in Aeronautics and Astronautics 244A.)


3 units, Aut (Herrmann) MWF 10


3 units, Win (Barnett) MWF 10


3 units, Spr (Herrmann) MWF 11

Yield hinges, limit analysis, bound theorems, frame structures. Shake-down. Inelastic buckling. Open to qualified undergraduates. Prerequisite: Civil Engineering 114.

3 units, Aut (Lee) MWF 2:15, alternate years, given 1979-80


3 units, Win (Lee) MWF 11, alternate years, given 1979-80


3 units, Win (Lee) MWF 2:15, alternate years, given 1978-79

240B. 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: 238A and 240A.

3 units, Spr (Lee) MWF 2:15, alternate years, given 1978-79

241A. 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, Aut (Steele) MWF 1:15, given 1979-80

241B. Theory of Shells—Axisymmetric deformation of shells of revolution. Asymptotic expansions; direct and bending stresses. Application to designs of domes, pressure vessels, expansion joints and pressure sensing devices. Membrane theory for general surfaces; hyperbolic paraboloids. Prerequisite: Civil Engineering 114.

3 units, Spr (Chao and Mayers) TTh 2:45-4:00


3 units, Spr (Steele) TTh 1:15-2:30, given 1979-80

242A. 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: 238A.

3 units, Spr (Lee) TTh 11:00-12:15, alternate years, given 1979-80

242B. 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: 242A.

3 units, Aut (Lee) MWF 10, alternate years, given 1978-79


3 units, Spr (Chao and Mayers) TTh 2:45-4:00

245. Fatigue of Metal Structures—Occurrence and prevention of fatigue failures. Effects of materials properties, load sequences, dimensions, processing, environment. Initiation and propagation of cracks. Scatter and statistical treatment of test results. The subject will be considered from the viewpoints of the designer looking for reliable methods of prediction and of the researcher looking for interesting problems. Prerequisite knowledge: strength of materials, mechanical behavior of materials, elementary statistics.

3 units, (Fuchs) to be announced

247A. Strength and Microstructure—(Enroll in Materials Science 205.)

247B. Fracture of Solids—(Enroll in Materials Science 238.)

248. Introduction to Experimental Mechanics—Transducers and measurement systems. Experimental design and statistical evaluation of data. Use of strain gauges, photoelasticity, accelerometers, displacement transducers and closed-loop materials test systems. Laboratory applications to: 1) Static and dynamic stress analysis; 2) Shock and vibration; 3) Materials testing; 4) Structural mechanics. Prerequisite: undergraduate strength of materials and vibration. Preference for mechanical engineering
graduate students. Limited enrollment (20).

3 units, Spr (Nelson) W 1:15-4:05, plus lab. by arrangement

249. Experimentation in Aeronautics and Astronautics—(Enroll in Aeronautics and Astronautics 131.)

HEAT TRANSFER, FLUID MECHANICS, AND TRANSPORT PROCESSES

250A. Heat Transfer—An application-oriented first course open to all graduate students. 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. 250B or for the M.E. 252 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.

4 units, Aut (Eustis) MWF 9

250B. 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. Prerequisite: 250A or an equivalent undergraduate course in heat transfer is required.

3 units, given 1979-80

251A. Advanced Fluids Engineering—Exact and approximate analysis to inviscid and viscous (laminar and turbulent) flows. Development of fundamentals of fluid mechanics with emphasis on applications in internal flow situations (duct, diffusers, turbomachines, etc.). Fluid mechanics coverage in 251A, B includes mathematical models of continuum fluids, kinematics, rotation, vorticity, circulation, rate of strain and stress tensors, dynamic equations of motion, Navier-Stokes equations, Euler’s inviscid flow equation, the Bernoulli theorem, elements of potential flow theory, creeping flow, parallel viscous flow, the boundary layer, flow separation, wakes, jets, shear layers, lift and drag. Prerequisite: graduate standing.

4 units, Aut (Johnston) MWF 8

251B. Advanced Fluids Engineering—Continuation of 251A.

3 units, Win (Johnston) MWF 11


3 units, Win (Moffat) MWF 9

252B. Convective Heat and Mass Transfer—Turbulent heat transfer in internal flows and boundary layers. Transport mechanisms and models. Finite-difference methods of prediction compared with integral and analytical solutions. Prerequisite: 252A.

3 units, Spr (Kays) MWF 10

255. 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. Other topics to be selected from 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 (Kline) MWF 1:15

256. Fluid Dynamics of Turbomachinery—Operation, theory and elements of the design of turbines, bladed pumps and compressors, windmills, propellers and other machines that perform by the dynamic interaction of a moving fluid with a bladed rotor. Emphasis to be placed on the problem of efficient exchange of energy between the fluid stream and the mechanical elements of the machine. Prerequisites: 251A and 255 or equivalents.

3 units, Spr (Johnston) TTh 8:35-9:50, alternate years, given 1979-80

high Reynolds number flow. Separation and transition to turbulence, and introduction to turbulent boundary-layer theory.

3 units, Win (Kruger) TTh 2:45-4:00

258B. Fluid Dynamics—Continuation of 258A. 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, aerodynamic of thin wings and slender bodies at subsonic, transonic, and supersonic speeds, and selected geophysical and astrophysical phenomena.

3 units, Spr (Koester) TTh 2:45-4:00

260. 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: 258A.

3 units, Aut (Spreiter) TTh 2:45-4:00

261. Turbulence—Introduction to the basic concepts of turbulence structure, kinematics, dynamics, with emphasis on shear flows and mixing processes. Prerequisite: any graduate level course in fluid mechanics.

3 units, Spr (Reynolds) MWF 9 alternate years, given 1978-79

262A. Physical Gas Dynamics—Introductory kinetic theory, chemical thermodynamics, and statistical mechanics as applied to the properties of gases and gas mixtures. Transport and thermodynamic properties, the law of mass action and equilibrium chemical composition. Maxwellian and Boltzmann distributions of velocity and molecular energy. Concepts and techniques for the description of high temperature and chemically reacting gases from a molecular point of view.

3 units, Aut (Kruger) MWF 10

262B. Introductory Aerothermodynamics—(Enroll in Aeronautics and Astronautics 212.)

263. Introduction to Partially Ionized Gases—An introduction to the main microscopic concepts that enter into a description of partially ionized gases, and a discussion of how the microscopic properties of gases may be calculated from a knowledge of the microscopic processes. Some of the topics covered include cross sections for collisional and radiative processes, reaction rates, recombination, velocity distribution functions, Rutherford scattering, Saha equation, principle of detailed balancing, molecular radiation, transport coefficients of mixtures, electrical conductivity, plasmas, the Debye length, plasma frequency, sheaths. Familiarity with some of the material in 262A is desirable, but not necessary.

3 units, Spr (Koester) MWF 1:15 alternate years, given 1979-80

264. The Physics of High-Temperature Gases—This is a one-quarter course specially 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, black body 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 1979-80

265. Special Topics in High-Temperature Gasdynamics—Detailed study of selected topics in high-temperature gasdynamics, such as molecular spectroscopy, chemical kinetics of high-temperature gases or advanced kinetic theory.

3 units, Win (Staff) MWF 9:00, alternate years, given 1979-80

266. High Temperature Thermosciences Measurements Laboratory—Optical measurement of temperature, species concentration and velocity in high temperature gases with particular application to the products of combustion. Emission, absorption and line reversal spectroscopy in the visible and infrared portions of the spectrum; laser doppler velocimetry. Discussion of optics, radiative transfer, spectrometers, molecular structure and signal to noise considerations as required to interpret the measurements.

4 units, Spr (Kruger, Hanson, Self, Bowman) Lecture MW 10 plus one lab. by arrangement

267. 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 non-equilibrium partially ionized gases.

3 units, Spr (Koester) MWF 1:15
268A. 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 plus one 4-hour lab. by arrangement

268B. 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. Prerequisite: graduate standing or consent of the instructor.
3 units, Sum (Moffat) MWF 10 plus lab. or discussion period by arrangement, given 1979-80

3 units, Sum (Ferziger) MWF 11

THERMODYNAMICS AND ENERGY CONVERSION

270. 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, Aut (Reynolds) MWF 2:15

3 units, Win (Hanson) MWF 2:15

272. Advanced Combustion—The role of chemical and physical processes in combustion; ignition, flammability and quenching of combustible gas mixtures; flame stabilization; laminar and turbulent flames; combustion of fuel sprays; combustion in stirred reactors. Prerequisite: 271 or consent of instructor.
3 units, Spr (Boorman) MWF 2:15

273. 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, Win (Boorman) MWF 9 plus one hour by arrangement

275. Solar Energy—The Sun as a source of energy, economic value of solar energy, solar position calculations. Radiative properties of materials, materials for solar applications. Heat transfer aspects of solar collection: radiation, conduction, convection. Applications to water and space heating, air-conditioning and other uses. High performance solar devices; concentrators, special surfaces, electrical power plants. Solar conversion by biological systems, solar cells. This course will normally include a project—a solar device to be built by the student. Prerequisite: 131B or equivalent.
3 units, Spr (Whitehouse) MWF 11

276. 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 (P. Kruger) MWF 11

3 units, Aut (Staff) MWF 10

3 units, Win (Staff) dhr
279. 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-electric generators. Prerequisite: consent of instructor. 3 units, Spr (Staff) by arrangement, given 1979-80

BIOMECHANICS

280. Biomechanics Seminar—Weekly seminar presentations by faculty and professionals who are actively involved in biomechanics or related research. The series is intended to identify the state of the art in structural biomechanics, neuromuscular biomechanics, mechanics of hearing and balance, biological fluid mechanics, cardiovascular dynamics, rehabilitation engineering, and injury mechanics. 1 unit, Aut (Leifer) T 4:15-5:05

281. Orthopaedic Biomechanics—Engineering mechanics applied to the human musculoskeletal system. Biological tissue mechanics; viscoelasticity, large deformations, finite element analysis. Applications to bone, muscle and synovial joints. Experimental methods. Whole body and component dynamic response. Topics of current research interest are emphasized. Introductory anatomy and physiology will be presented. Prerequisite: graduate standing or consent of instructor. 3 units, Win (Piziali) MW 4:15-5:30

282. Neuromuscular Biomechanics—A detailed review of selected topics in neuromuscular biomechanics with an emphasis on experimental methods, signal processing, and analytical models. Within a framework of clinical and rehabilitative needs, topics will include signal propagation in peripheral and central nerve paths, neuromuscular transmission, contraction, coupling, postural and ocular reflexes, voluntary manual, postural and ocular control. Prerequisite: graduate standing or consent of instructor. 3 units, Spr (Leifer) Th 2:15-5:05, alternate years, given 1978-79

284. Dynamics of Viscous Fluids and Suspensions—(Enroll in Engineering 209.)

285. Cardiovascular Dynamics and Respiration—(Enroll in Aeronautics and Astronautics 229.)

SPECIAL AREAS

286. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)

287. Methods and Experiences in Engineering Education—(Enroll in Engineering 287.)

288A, B. Energy Systems Assessment—Analysis of present and developing energy systems, with emphasis on assessing their social costs and benefits. Autumn Quarter covers issues, methodologies and factual background. During the Winter Quarter students will report on selected issues. Grading will be deferred until completion of 288B. Open to graduate students in engineering and sciences.

288A. 2 units, Aut (Starr, Whipple) M 3:15-5:05

288B. 2 units, Win (Starr, Whipple) M 3:15-5:05

289. The Social Impact of Technology and Science—(Enroll in Engineering 221.) (DR:X.)

DIRECTED STUDY AND SEMINARS

All courses are (DR:X)

290. Research Project Seminar—Review of work in a particular research program and presentations of other related work. 1 unit, any quarter (Staff) by arrangement

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 a faculty sponsor. 1 to 5 units, any quarter (Staff) by arrangement

292. Experimental Investigation of Engineering Problems—Graduate engineering student may undertake experimental investigation under guidance of staff member. Previous work under 291 may be required to provide background for experimental program. The student must find a faculty sponsor. 1 to 5 units, any quarter (Staff) by arrangement

293. Experiential Workshops in Design Education—Experiential and intellectual study of psychological influences on the design process; awareness, inhibition, repression, communication, and group dynamics. Prerequisite: advanced graduate standing in Design. (Concurrent with Engineering 2, People dynamics Lab.) 1 unit, Aut Win, Spr (Wilde) W 1:15-5:05

294. Design Research Colloquium—Students, faculty, and visitors survey research results from design-related science and technology. 1 unit, Aut, Win, Spr (Wilde) F 2:15-3:05

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 (Lee) Th 4:15-5:30

296. Design Forum—Presentations, discussions, and happenings; matters of concern to entire Design community which do not fit into regular courses.

1 unit, Aut, Win (Wilde) Th 4:15-5:05

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, given 1979-80

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

OPERATIONS RESEARCH


Associate Chairman: Frederick S. Hillier


Assistant Professor: Patricia A. Jacobs

Affiliated Faculty

Professors: Gene H. Golub, J. Michael Harrison, Ronald W. Howard, Samuel Karlin, David G. Luenberger, Ingram Olkin, Douglas J. Wilde, Robert B. Wilson

Associate Professors: Charles P. Bonini, David M. Kreps, Evan Porteus

Assistant Professor: Sergiu Hart

OFFERINGS AND FACILITIES

Operations Research is concerned with the formulation, analysis, and use of mathematical models relevant to the understanding and/or solution of significant problems of decision making. The department’s principal objectives are to provide a comprehensive program of instruction in the mathematical foundations of operations research, to acquaint students with applications of these methods to significant problems, and to develop research scholars.

The department offers programs leading to a Master of Science, Engineer and Doctor of Philosophy, and participates in a program leading to a Bachelor of Science in Mathematical Sciences. 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.

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; networks, graphs, and combinatorial theory; and energy and economy modeling.

Students have the opportunity, in the department’s Systems Optimization Laboratory, to gain firsthand experience with computational methods, to participate in the research on new algorithms, and to learn about modeling complex systems dealing with energy, the economy, water, etc.

Office facilities are available for visiting scholars and doctoral students. In addition the department has its own library, lounge, remote-access computer terminals, minicomputer and plotter.

Introductory Courses

The department offers introductory courses for both undergraduate and graduate students. The courses are given at several levels and in a variety of combinations to accommodate the needs of different students.

Operations Research 80 is 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. Applications are given to important economic problems.

Operations Research 152 is an introduction to linear, nonlinear, and dynamic programming for students familiar with calculus. Operations Research 151 is similar except that it also assumes a knowledge of the elements of matrix algebra, includes a discussion of game theory, and gives less emphasis to nonlinear and dynamic programming. Operations Research 153 is an introduction to stochastic processes and models in operations research for students with a knowledge of calculus and undergraduate level probability theory. Operations Research 154 is a condensation of Operations Research
152 and 153 for students with similar backgrounds.

Operations Research 240 is a first course in linear programming having matrix algebra as a corequisite. Operations Research 250 is a sequel which discusses nonlinear and dynamic programming as well as game theory. Operations Research 251 is an introduction to stochastic models in operations research for students acquainted with the elements of stochastic processes. Operations Research 240 and 250 provide a more extensive and higher-level presentation of topics of 151 and 152. Operations Research 251 bears a similar relationship to 153.

Students with a good mathematical background and an interest in an advanced introduction to the various fields of operations research may wish to consider one or more of Operations Research 340A, B, C, 347, 351, 355, 356, 359.

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 does participate with the Departments of Computer Science, Mathematics, and Statistics in a program leading to a Bachelor of Science in Mathematical Sciences. See "Mathematical Sciences, Program in" section of this Bulletin.

MASTER OF SCIENCE

The program leading to a 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, analysis, and implementation of operations research models of complex systems problems in business or government.

In addition to the University's basic requirements for the Master's degree discussed in the "Degrees" section 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 practitioners 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>3</td>
</tr>
<tr>
<td>Stat. 116</td>
<td>Theory of Probability</td>
<td>4</td>
</tr>
<tr>
<td>Stat. 217</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>Electives from the 200 or higher-level offerings of the department or from authorized courses in other departments</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>

No thesis is required. A minimum grade point average of 2.75 is expected.

Students wishing a more advanced master's program may substitute appropriate 300-level courses in the department for required 200-level courses in the department with the approval of their advisors.

ENGINEER

The Engineer in Operations Research is for students desiring additional academic preparation beyond the Master's degree for a career of professional practice in Operations Research.

This degree nominally represents an additional academic year of full time study beyond the Master of Science degree in Operations Research, including a thesis. The thesis normally is in the form of a technical report on a successful contribution to (and participation in) an applied project, such as those being carried on in the department's Systems Optimization Laboratory or Energy Studies Project.

Since thesis supervision is required, and the department gives precedence to providing thesis advisors for qualified students in the Ph.D. program, the availability of thesis supervisors for the Engineer degree is very limited. Therefore, before being permitted by the department to continue study after the M.S. degree toward this degree, the student must have personally arranged for a faculty sponsor for thesis supervision and, if financial support is needed, for a research assistantship for the thesis project. These arrangements are then subject to the approval of the department's Admissions and Financial Aid Committee.

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

DOCTOR OF PHILOSOPHY

The program leading to a Doctor of Philosophy in Operations Research is directed to those primarily interested in a career of re-

*Comp. Sci. 135 (or 137A) may be substituted with the permission of the student's advisor.
search, teaching, or high-level technical work in universities, business, or government. 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, energy modeling, network flow models of transportation and communication systems, reliability models of complex engineering systems, queueing models of congestion, modeling and control of dynamic systems, 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 theory necessary for the study of these models.

Examples of the disciplines studied include energy and economic modeling, mathematical programming, dynamic programming, stochastic systems, stochastic processes, network and combinatorial theory, reliability, queueing theory, inventory theory, and game theory.

Candidates for the Ph.D. in Operations Research will normally meet the course requirements shown below.

1. Prerequisites: Mathematics 113, 115, 116; Statistics 116, 119, 120; Computer Science 106. Engineering-Economic Systems 212A. Students lacking background in some of these areas can include appropriate courses in their program at Stanford.

2. Requirements in Operations Research: 340A,B,C, 347, 351, 355, 356, 359; and four other 300-level, 3 or more unit, quarter courses in the department (excluding 399 and courses requiring enrollment in other departments).

3. Requirements in other departments: Statistics 217, 218, and three 200-level, 3 or more units, quarter lecture courses in either Computer Science, Economics, Mathematics, or Statistics (only doctoral courses in Statistics).

In addition to the course requirements, a doctoral candidate must fulfill several University requirements, as described in the "Degrees" section 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 also requires that candidates successfully complete written comprehensive examinations on the content of Operations Research 340A, B, C, 347, 351, 355, 356, and 359, and have a reading knowledge of at least one foreign language (French, German, or Russian).

A student performing satisfactorily in the Ph.D. program normally would be eligible to receive a Master of Science in Operations Research, if he or she so desires, after completing 45 units of course work.

PH.D. MINOR IN OPERATIONS RESEARCH

Doctoral students in other departments may obtain a minor in Operations Research by completing 15 units of 200 or higher-level courses in the department with an average grade of 3.0 or higher. The courses will normally include Operations Research 240, 250, 251, and 257 or approved substitutes.

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 Graduate Admissions Office by March 1.

COURSES PRIMARILY FOR UNDERGRADUATES AND GRADUATE STUDENTS FROM OTHER DEPARTMENTS

All courses (DR:T) if taken for 3 or more units.

50. Models and Applications of Operations Research in Society—Analysis of important socioeconomic problems by methods of operations research. Problem areas include 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 (Jacobs) MWF 10
Spr (Manne) MWF 10

150. Models and Applications of Operations
Research in Society—Lectures same as 50, but a term paper is required.
3 units, Win (Jacobs) MWF 10
Spr (Manne) MWF 10

151. Introduction to Operations Research I—Theory and computation of optimal selection of decisions under certainty with common or conflicting objectives. Linear programming (simplex method and duality theorem), network flows, dynamic programming, game theory (minimax theorem), nonlinear programming. Applications drawn from problems in pricing resources, production planning, inventory control, transportation, pollution control, personnel assignment, construction management, political tactics, equilibria of competitive economies, and financial management. Prerequisites: Mathematics 43 and 113 or consent of instructor.
3 units, Spr (Jacobs) MW 9:35-10:50

152. Introduction to Operations Research I—Theory and computation of optimal selection of decisions under certainty. Linear programming (simplex method and duality theorem), network flows, dynamic programming, convex programming (convex sets and functions, Lagrange multipliers, Kuhn-Tucker conditions, algorithms), integer programming. Applications drawn from problems in pricing resources, production planning, inventory control, transportation, pollution control, personnel assignment, construction management, capacity expansion, and financial management. Prerequisites: Mathematics 43 or consent of instructor.
4 units, Aut (Hillier) MWF 11:00-12:05

4 units, Win (Hillier) MWF 11:00-12:05

154. Operations Research—An introduction to the techniques and models of operations research for students who have not had the equivalent of 151 or 152, and 153. Topics are similar to those of 152 and 153. Prerequisites: calculus and Statistics 116.
4 units, Sum (Staff) TTh 3:15-5:30

180. 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. (Graduate students enroll in 280.) Prerequisites: 151 or 152, or both 240 and 250, 153 or 251 (concurrently) or equivalent.
3 units, Spr (Jacobs) MW 9:35-10:50

**COURSES PRIMARILY FOR MASTER'S CANDIDATES AND GRADUATE STUDENTS IN OTHER DEPARTMENTS**

All courses (DR:T) if taken for 3 or more units.

These courses are oriented toward applications. Operations Research 240, 250, 251, 257, and 280 form a basic one-year core program aimed at students who desire a professional career involving application of operations research in business, government, or industry. Operations Research 245 and 246 are useful supplementary electives.

240. Linear Programming—This course will survey linear programming emphasizing standard model formulation, fundamental theorems, variations of the simplex method and parametric programming. The orientation is applied and directed to students who anticipate doing project work in government or industry which involves deterministic systems. Corequisite: Mathematics 113.
3 units, Aut (Staff) TTh 4:15-5:30
Sum (Staff) TTh 1:15-3:00

241. Computational Methods in Linear Programming—(Enroll in Computer Science 234.) Solution of linear programs on computers, pricing strategies, graphs algorithms, polynomial-time algorithms, trade-offs between solution time and storage requirements. Prerequisites: Some experience with computer programming and data structures (e.g., linked lists and binary search trees).
3 units, Aut (Dantzig) TTh 9:30-10:45

3 units, Win (Staff) TTh 9:30-10:45

246. Mathematical Programming Computation—This course will present an overview of the major computational procedures used in solving mathematical programming problems, including large-scale systems. Students will become familiar with computer implementation of
algorithms for: linear programming; quadratic programming; unconstrained, linearly constrained, and nonlinearly constrained optimization. In addition they will gain practical experience with techniques that increase speed, stability, and accuracy of computation. Prerequisites: 250 or 340C, and Computer Science 106 or equivalent, or consent of instructor.

3 units, Sum (Staff) TTh 3:15-5:00

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 (Hart) TTh 4:15-5:30

251. Stochastic Models in Operations Research—Introduction to stochastic modeling. The orientation is applied and directed to students who anticipate doing project work in government or industry which involves stochastic modeling. The course content will stress formulation, solution, and analysis of stochastic models in operations research. Topics covered will include queueing theory, inventory theory, Markov decision processes, dynamic programming, and reliability theory. Prerequisite: Statistics 217.

3 units, Spr (Hartley) TTh 4:15-5:30

257. Simulation—Generation of uniform and non-uniform random numbers, discrete-event simulations, simulation languages, design of simulations, statistical analysis of the output of simulations, applications to modeling stochastic systems in computer science, engineering, and operations research. Prerequisites: a working knowledge of a programming language such as FORTRAN, BASIC, or ALGOL; Statistics 217 or the equivalent.

3 units, Spr (Iglehart) TTh 2:40-3:55


3 units, Spr (Staff) TTh 11:00-12:15

280. Applications of Operations Research—Same as 180

3 units, Spr (Jacobs) MW 9:35-10:50

299. Independent Study—Intensive study of literature of special topics.

Any quarter (Staff) by arrangement

COURSES PRIMARILY FOR DOCTORAL STUDENTS

All courses (DR:T) if taken for 3 or more units.

These advanced courses are concerned with the development of the mathematical theory of operations research and sophisticated applications thereof.


3 units, Aut (Dantzig) TTh 1:15-2:30


3 units, Win (Eaves) TTh 1:15-2:30


3 units, Spr (Eaves) TTh 1:15-2:30


3 units, Spr (Eaves) TTh 1:15-2:30

341. Topics in Mathematical Programming—A seminar-type course with presentations by students and invited speakers. General topics covered include: Structured linear programs, generalized upper bounding (GUB), generalized linear programming, decomposition principle, basis factorization, convex programming, stochastic programming, continuous
programming, multi-commodity problems, large-scale networks, integer programming. In addition, one or two research topics will be selected from the following typical list: Linkage of models and submodels (for example, of different sectors of the economy); development of end conditions in finite-horizon models; experimentation with different strategies for choosing the entering and exiting variables in large linear programs development of new algorithms for large, structured optimization problems. Corequisite: 340B.

3 units, given 1979-80

344. Methods on Nonlinear Programming Seminar—Motivation and analysis of procedures for solving nonlinear programming problems in finite-dimensional spaces. One-dimensional zero-finding minimization. Descent algorithms for n-dimensional minimization (convergence analysis, steplength criteria). Newton-type, quasi-Newton, and conjugate gradient methods for unconstrained optimization including linear and quadratic programming. Algorithms for nonlinearly-constrained optimization, including penalty and barrier function methods, reduced and projected gradient methods, augmented and projected Lagrangian methods. Some use of the computer will be required. Prerequisite: 340C or consent of instructor.

3 units, given 1979-80

346. Mathematical Programming Computation—Same as 246.

3 units, Sum (Staff) TTh 3:15-5:00


3 units, Win (Manne) TTh 11:00-12:15

351. Dynamic Programming and Stochastic Control—Sequential decisions under uncertainty with emphasis on discrete-time Markov decision chains. Finite stage models. Discount and average optimality criteria for the infinite stage model. Methods of successive approximation and policy improvement. Linear programming methods of solution. Continuous-time Markov decision chains and diffusions. Examples from inventory, queueing, reliability, and stopping problems. Prerequisites: Mathematics 113 and 116. Corequisite: Statistics 218 or consent of instructor.

3 units, Spr (Staff) TTh 9:30-10:45

352. Stochastic Calculus and Control—(Enroll in Business 461). Introduction to Brownian Motion and one-dimensional diffusions, Ito stochastic calculus, and stochastic control (of diffusions). Emphasis on statements and interpretations of principal results, including especially financial and economic applications. Prerequisites: Statistics 217A and Mathematics 115.

4 units, Spr (Harrison) by arrangement

353. Topics in Dynamic Programming—(Enroll in Business 469). This course first reviews and develops the foundations of periodic review dynamic programming, with an emphasis on the operator approach. It then turns to contextual applications of dynamic programming, with topics drawn from the literature in finance, economics, and operations management.

4 units, Aut (Porteus) by arrangement


3 units, Aut (Lieberman) TTh 1:15-2:30

356. Inventory Theory—Methods for qualitative characterization and efficient computation of optimal solutions of structured nonlinear and dynamic programs. Lattice programming, invariant network flows, polynomial search of extreme points in networks and Leontief substitution systems, stochastic comparison of distributions, and total positivity. Application to selection 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. Multi-echelon models. Prerequisites: Lagrangian duality theory and Statistics 116 or Mathematics 123.

3 units, Aut (Jaquette) TTh 9:30-10:45

358. Queueing Theory—(Same as 258.)

3 units, Spr (Staff) TTh 11:00-12:15


3 units, Spr (Jacobs) TTh 8-9:15

applications in economic analysis. Non-cooperative games and cooperative games (including both market games and voting games). Alternative-solution concepts. Prerequisite: Mathematics 116 and basic probability concepts.

3-5 units, Aut (Hart) MW 11:00-12:50

365. Special Topics in Game Theory and Its Applications—Topics will be chosen from bargaining theory, repeated games, games without side payments, games in extensive form, games with a continuum of players, and others.

3 units, Spr (Hart) by arrangement

368. Multi-person Decision Theory—(Enroll in Business 468). This course focuses on the role of differences in information among economic agents. The two main topics are the functioning of markets and price systems in economics with differential information, and the game-theoretic analysis of competitive processes with differential information.

4 units, Win (Wilson) by arrangement

376. Solving Nonlinear Equations Parametrically—A unified and comprehensive view of a new and powerful deformation method for solving nonlinear equations based on complementary pivot theory. Constructive proof of Brouwer's fixed point theorem. Applications to optimization and to computation of equilibrium points in economics and game theory.

3 units, Aut (Eaves) by arrangement

390A,B. Advanced Topics in Operations Research—Two seminars will be offered, topics to be announced. Prerequisite: consent of instructor.

390A. 3 units, Sum (Staff) by arrangement

390B. 3 units, Sum (Staff) by arrangement


Any quarter (Staff) by arrangement
ORGANIZATIONS

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, Food Research, French and Italian, German Studies, History, Humanities Special Programs, Linguistics, Mathematics, Music, Philosophy, Physics, Political Science, Psychology, Religious Studies, Slavic Languages and Literatures, Sociology, Spanish and Portuguese, and Statistics.

Members of the School of Humanities and Sciences are listed under their respective departments, or under the staff for Special Interdepartmental Programs.

UNDERGRADUATE PROGRAM IN AFRICAN AND AFRO-AMERICAN STUDIES

Chairperson of Committee-in-Charge: Sylvia Wynter (Spanish and Portuguese); Sr. Research Associate, St. Clair Drake (Emeritus, Anthropology); David Abernethy (Political Science, on leave 1978-79), Frederick Bowser (History), Irvin Brown (Psychology), Clayborne Carson (History), John Cochran (Drama), James Gibbs (Anthropology), Paul Irwin (History), Kennell Jackson, Jr. (History), Tetteh Kofi (Food Research), Arnold Rampersad (English, on leave 1978-79), Clyde Taylor (Visiting Assistant Professor, English)

African and Afro-American Studies at Stanford is the systematic investigation of the history, culture and circumstances of peoples of African descent. In literature, African and Afro-American Studies is the analysis and understanding of the significant Black writers from Phyllis Wheatley or Gustavus Vassa, Paul Lawrence Dunbar, Richard Wright to Amiri Baraka. In anthropology, it is the study of cultures, values and social relations of the world's Black communities and how they have been viewed by W.E.B. Dubois, E. Franklin Frazier or St. Clair Drake. In political and liberation movements, African political systems and development, and leaders such as Frederick Douglass, Martin Luther King, Jr., Malcolm X...
and Amilcar Cabral. In history, it is the study of the ancient African cultures, slavery, colonialism and struggles for independence both in Africa and the Americas. In psychology, it is the study of the psychological dimensions of racism and the psychological experience of Blackness in a race-conscious environment.

The sociology of knowledge suggests that one's exposure to information is in part a function of several factors, such as time and geography, or status and position in society. Consistent with this perspective, this Program of study is an eclectic concentration in which major disciplines intersect with the experiences, aspirations and world views of people of African descent. It recognizes the need for continued teaching and research in these content areas, which have often been neglected by Western education.

**THE PROGRAM**

The Undergraduate Program in African and Afro-American Studies, an interdepartmental academic concentration, is designed to provide the student with an interdisciplinary approach to the history, culture and experience of peoples of African origin. It is also designed to assist students in the development of literary and analytic skills while providing an intellectual framework to satisfy the traditional expectations of a liberal education. The course of study focuses on sub-Saharan Africa and those societies in the Western hemisphere where peoples of African heritage are a significant element in the population.

**BACHELOR OF ARTS**

For the student who desires an A.B., the Program enables the development of a measure of disciplinary competence in a specific field such as Anthropology, Economics, English, History, Political Science, Psychology or Sociology. The disciplines are seen as one tool among many with which the student can research and assess issues of particular interests.

The Program is also designed to provide course work and direction for non-majors who have an interest in topics related to Africans and Afro-Americans as those topics relate to the student's particular discipline. Pre-med majors, for example, are offered a special course designed to present information concerning the particular medical problems peculiar to Black people.

Opportunities for training and education beyond the A.B. parallel those open to any student majoring in most Humanities or Social Sciences disciplines. Majors typically pursue graduate degrees in Humanities and Social Sciences disciplines, or professional schools such as law, medicine or social work.

**REQUIREMENTS FOR THE MAJOR**

The major in African and Afro-American Studies requires 50 units of credit for a bachelor's degree. Twenty-five units must come from "CORE" courses, i.e., the Core Seminar, and 20 units from departmental offerings. An additional 25 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 may also satisfy the collateral course requirement with concentrated study in an African language. The precise content of each student's program will be worked out in consultation with an advisor from the department with which he or she is affiliated.

**MULTIPLE MAJOR**

Information on more than one major within a single baccalaureate program is available at the Academic Information Center for interested students. This arrangement has been particularly attractive to students who prefer the A.B. or B.S. degree in a traditional discipline with the African and Afro-American major as a special interest.

**HONORS**

The major who qualifies for Honors at graduation in African and Afro-American Studies must complete a senior essay or project of comparable quality by the end of the senior year, quite the same as the honors thesis in the Departments.

The essay or project is intended to enable the student to synthesize several of the skills he or she has acquired and produce a document or project (such as a film for the double major in Communications), demonstrating a measure of competence in the student's specialty. The essay or project should be discussed with and approved by the student's major advisor and the Program Director.

**COURSES**

The student is encouraged to concentrate study in a particular humanities or social science discipline to satisfy the collateral course requirement. Courses associated solely with the program are offered under the program title. These courses are commonly offered only once a year.

The Core Seminar, which is offered annually, is central to the program. Professor Sylvia Wynter will lead the core seminar. "The Black Experience in Fact and Fiction" as an exploration of the complex relation of Black literature and scholarship to the normative Western model. The intention of the course is to intro-
duce students to an inter-disciplinary model which will begin to define both the perspective and the domain of Afro-American Studies. The Core Seminar, AAAS 101, will be offered from 1:15 to 3:15 p.m. on Tuesdays and Thursdays during the winter quarter, 1978-79.

Introduction to African and Afro-American Studies, AAAS 105, is a new interdisciplinary course designed to provide a broad survey of the African and Afro-American experience. Although one professor assumes primary responsibility for the course, students will be exposed to the entire faculty of the African and Afro-American Studies Program and to their areas of interest.

Courses will be offered in Black Performing Arts—Drama, Dance and Music. Several courses are offered annually in conjunction with the Black Pre-professional organizations, such as "Black Perspectives in Medicine," "Black Perspectives in Law" and "The Black Communication Experience." Check with the African and Afro-American Studies office for each quarter's offerings in these areas.

CORE COURSES OFFERED BY DEPARTMENTS

See respective department listings for (DR) information.

AFRICAN AND AFRO-AMERICAN STUDIES

101. Core Seminar: The Black Experience in Fact and Fiction. (DR:S)
5 units, Win (Wynter) TTh 1:15-3:05

105. Introduction to African and Afro-American Studies. (DR:S)
5 units, Aut (Staff) TTh 2:15-4:05

ANTHROPOLOGY

107. Cultures and Societies of Sub-Saharan Africa.
5 units, Aut (Gibbs) MWF 11

ENGLISH

1a/2a, section 13. Freshman English: Introduction to Contemporary Black American Fiction. (DR:W)
3 units, Aut, Win (Hogue)

1a/2a, section 25. Freshman English: Dark Symphony—Black Literature in America. (DR:W)
3 units, Aut, Win (Yarborough)

1b/2b, section 15. Freshman English: Literature of the Third World. (DR:W)
3 units, Win, Spr (Grey)

161. Afro-American Literature.
5 units, Aut (Taylor) MTWTh 1:15

161C. Black Folklore and Afro-American Literature.
5 units, Win (Taylor)

162E. Introduction to Caribbean Poetry: English, French, Spanish.
4-5 units, Win (Davis)

HISTORY

5 units, Aut (Irwin)

147. Kingdoms of Africa: Societies and History.
5 units, Win (Jackson)

147A. Rebellions in Colonial and Post-Colonial Africa.
5 units, Spr (Jackson)

148A. The History of West Africa.
5 units, Fall (Irwin) MTWTh 10

148B. Colonial Africa.
4 units, Win (Irwin)

5 units, Spr (Carson) given 1979–80

182. Latin America and the African.
4-5 units, Win (Bowser)

5 units, Aut (Jackson) M 2:15-4:05

249B/349B. Undergraduate/Graduate Colloquium: White Administrators and the Black Elite in Colonial Africa.
5 units, Spr (Irwin)

257A. Undergraduate Colloquium: Afro-American Politics in the 1960's.
5 units, Spr (Carson)

FOOD RESEARCH INSTITUTE

118. Economics of Underdevelopment—(Same as Economics 118.)
5 units, Aut (Yotopoulos) MW 2:15-4:05

133/233. Economic Development Problems of Third World Economies with Colonial Heritage—(Same as Economics 127.)
5 units, Win (Kofi) MW 3:15-5:05
160. Trade and Development Problems of Tropical Africa—(Same as Economics 160.)
3-5 units, TTh 3:15-5:05

LINGUISTICS

4 units, Spr (Leben) 2:15
185A,B,C. Beginning Hausa. (DR:X)
5 units, Win, Spr (Leben) MTWThF 12
186A,B,C. Intermediate Hausa. (DR:X)
Aut, Win, Spr (Staff) by arrangement
190A,B,C. Beginning Swahili. (DR:X)
5 units, Aut, Win, Spr (Staff)
191A,B,C. Intermediate Swahili. (DR:X)
5 units, Aut, Win, Spr (Staff)
193A,B,C. Beginning Yoruba. (DR:X)
5 units, Aut, Win, Spr (Kaufman)

POLITICAL SCIENCE

137W. Underdevelopment and Foreign Policy.
5 units, Spr (Weinstein)

PSYCHOLOGY

126A. Psychology of Black Experience.
3-4 units, Aut (Brown) TTh 2:15-3:30
3 units, Win (Brown) by arrangement

SPANISH AND PORTUGUESE

248. Contemporary Caribbean Fiction—
(Same as AAAS 248.)
5 units, Aut (Wynter) TTh 10-12

ANTHROPOLOGY

Emeriti: St. Clair Drake, Bert A. Gerow, Benjamin D. Paul, George D. Spindler (Professors)

Chair: Clifford R. Barnett


Associate Professors: George A. Collier, Renato I. Rosaldo, Arthur P. Wolf

Assistant Professors: Jane F. Collier, William Durham, James A. Fox (on leave Winter, Spring), Michelle M. Rosaldo, Sylvia Yanagisako (on leave)

Lecturer: Louise S. Spindler

OFFERINGS AND FACILITIES

The courses offered by this department are designed (1) to provide undergraduate students with instruction in anthropology, a discipline treating man from the broad 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 the discipline.

PROGRAMS OF STUDY

BACHELOR OF ARTS

The Department of Anthropology offers three programs leading to the Bachelor of Arts degree: the Major in Anthropology, the Honors Program in Anthropology, and an interdisciplinary program entitled Major in Social Sciences (Anthropology). To declare a major in one of these fields a student must apply to the department’s Committee on Undergraduate Studies. The committee will explain the degree requirements and help the student choose an appropriate academic advisor. It will also establish a file to keep track of the student’s progress toward fulfillment of the requirements. It is the student’s responsibility to see that this file is kept up to date.

The Honors Program in Anthropology is open to all majors who have a 3.5 grade point average in anthropology courses. Candidates of sophomore or junior standing should apply for admission no later than the end of the fourth week of the Spring Quarter. The application must include a transcript, a short paper, and a letter of recommendation from the professor who will supervise the honors project. Students who cannot meet all of these requirements but wish to be considered for admission to the Honors Program should petition the Committee on Undergraduate Studies for special consideration.

The Major in Social Science also requires a written application. The student must submit a tentative list of courses and a brief statement that presents an intellectual rationale for the proposed program of study. Applications for this major must be received no later than the beginning of the Winter Quarter of the student’s junior year. The Major in Social Science allows a candidate to combine a concentration in anthropology with a selection of courses from history, sociology, economics, political science, and psychology. Students who want a program that combines anthropology courses with courses from some other field (e.g., classics or
geography) are advised to arrange for a special major with the Dean of Undergraduate Studies.

All majors in the Department of Anthropology must fulfill the following requirements:

1) Reading competence in a modern foreign language. Such competence is usually demonstrated by completing a course on the second-year level, but the requirement may be met by special examination, presentation of superior foreign language placement scores, or certification in writing from an appropriate department.

2) A passing grade in Anthropology 90. This course is required of all anthropology majors and is intended to introduce anthropological theory and the relation between theory and method.

The remaining requirements for each of the three degree programs are as follows:

**Major in Anthropology** Forty-five units in anthropology or 40 units in anthropology and 5 units in either sociology or psychology. The anthropology units must include at least one course from each of the following topical categories: (a) Area Studies (100-127); (b) Social and Cultural Anthropology (1, 2, 7-10, 12, 128-169, 190, 192, 193, 230-278); (c) Linguistic Anthropology (3, 70, 71, 72, 73, 170 and 173); Archaeological and Biological Anthropology (4, 6, 183, 187, 195).

**Honors Program in Anthropology.** The candidate must complete all of the requirements for the Major in Anthropology and submit an honors thesis no later than four weeks prior to the end of the quarter in which graduation is anticipated. The thesis will be read by the candidate's advisor and a second reader appointed by the Committee on Undergraduate Studies. An honors candidate may enroll in Anthropology 95 for as many as 15 units but may not count more than 5 of these units in fulfilling the 45 unit requirement.

**Major in Social Sciences.** Thirty units in Anthropology and 20 units in related social science fields. The 50 units must form a coherent program of study and must be approved by the student's academic advisor.

All units required for these programs must be passed with a grade of "C" or better, and not more than 5 of the required 45 units may be taken for a Pass/No Credit grade.

Undergraduate majors who have completed the prerequisites are encouraged to enroll in 100- or 200-level seminars. They may also take part in field work on local archaeological sites, obtain training in museum methods by means of research with Stanford collections, and apply for funds to support summer field research in archaeological and social anthropology. In addition, they are encouraged to take part in departmental activities and to attend the department's weekly colloquium. The time and topic are posted in the department and announced in the Stanford Daily.

**ADVANCED DEGREES**

**MASTER OF ARTS**

The Department of Anthropology offers the Master of Arts degree to four types of students: (1) Stanford undergraduates who enroll in the co-terminal program; (2) Stanford graduate students taking advanced degrees in other departments or schools at Stanford; (3) Ph.D. students in Anthropology who fulfill the A.M. requirements in the course of their work towards the Ph.D. degree; and (4) students who apply from outside of Stanford for entry into the terminal A.M. program.

Stanford students interested in the co-terminal program should consult the "Degrees" section of this catalog. Co-terminal students and graduate students in other departments or schools at Stanford should consult with the Graduate Secretary in the department. Students from outside of Stanford should address a letter of inquiry to the Graduate Secretary of the Anthropology Department. Successful applicants for the A.M. Program may enter during any quarter. Application deadlines are: April 15 (for Fall); November 1 (for Winter) and February 1 (for Spring). Applicants must file a report of their scores on the Graduate Record Examination. Students planning to obtain the Ph.D. must apply directly for admission to the Ph.D. Program.

The requirements for the A.M. degree consist of residence at Stanford University as a graduate student for at least one year. Students must take a minimum of 45 quarter units in anthropology with a grade of B or better in each course. They must have at least 15 additional units of anthropology, taken anywhere, including at Stanford making a minimum total of 60 units in anthropology. Within the 45 units taken at Stanford, students must take one quarter (5 units) of the History of Anthropological Theory plus one additional course from those designated as "core courses" by the faculty. The remaining units may be made up of courses selected in consultation with the faculty advisor to meet the needs and interests of the student. A field or library research paper read and approved by at least two departmental faculty members must be presented. Full-time students entering the Program with appropriate background in Anthropology can complete the A.M. Program in one calendar year. Others may require a longer time.
ANTHROPOLOGY MINOR

The requirements for a minor in Anthropology consist of 30 units of Anthropology taken at Stanford with a grade of B or better in each course. All students must have a departmental advisor and should develop a coherent course of study related to their particular interests. The course of study approved by the advisor must be filed with the Committee on Higher Degrees.

DOCTOR OF PHILOSOPHY

Prospective graduate students should apply formally through the Graduate Admissions Office, which will transmit their records to the department for consideration when application requirements have been completed. Applicants for admissions must file a report of their scores on the Graduate Record Examination.

The Ph.D. Program consists of a number of required courses and examinations which also allow students to develop a flexible program designed to reflect their special interests under the supervision of a faculty committee chosen by them. Students are encouraged to plan a Program that will enable them to complete all work for the Ph.D. in five years or less.

The requirements for the Ph.D. degree include:
1. Pass within the first two years, 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. Serve as a Teaching Assistant for two courses, usually during the second year of graduate study.
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 doctoral research.
8. Present an approved dissertation based upon independent research.

FINANCIAL SUPPORT

The Department endeavors to provide financial support (tuition plus scholarship) when needed to all students admitted to the Ph.D. Program who maintain a satisfactory course of study. Applicants for the Ph.D. Program must file a request for financial aid when applying to the Program if they wish to be considered for support. No financial aid is available for students in the A.M. Program.

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.

GENERAL EDUCATION COURSES

These courses are open to all students and are all introductory in the sense that prior knowledge is not assumed. The numbers are only labels; they say nothing about the level of the course. Students who want a general introduction to anthropology are advised to take Anthropology 1; those with more specialized interests should choose the course that best satisfies their interest.

1. Social and Cultural Anthropology—A general introduction to anthropological perspectives on human behavior, thought, and institutions. Through lectures and films the course examines a wide range of human societies and introduces the assumptions and concepts anthropologists employ in examining the relationship between human nature, society, and culture. (DR:A)
   5 units, Aut (Wolf, G. Collier)
   MTWThF 1:15
   5 units, Spr (G. and L. Spindler)
   MTWThF 1:15

2. Problems in Anthropology—Where Anthropology 1 examines particular societies, this course focuses on such problems as the origins of the incest taboo, warfare and aggression, initiation ceremonies, ancestor worship, and male-female relations. The goal of the course is to evaluate the assumptions underlying anthropological views of human nature and society. (DR:A)
   5 units, Win (Gibbs and Wolf) MWF 2:15

   5 units, Win (Greenberg, et al.) MWF 10
4. Introduction to Prehistoric Archaeology—
This course is an introduction to the aims, methods and data of prehistoric archaeology. The development of human society will be traced from early hunters through late prehistoric civilizations. Archaeology sites and remains characteristic of the stages of cultural development will be examined for selected geographical areas, emphasizing methods of data collection and analysis appropriate to each. (DR:D)
5 units, Aut (Rick) MWF 10

5. Culture and Biology—(Same as Human Biology 135). (Same as Anthropology 135.) This course examines the relationship between human biology and culture in both the evolutionary past and ethnographic present. Following a review of the major contending viewpoints including the controversial field of "sociobiology," the focus shifts to a consideration of the biological and cultural evolution of human beings as interdependent, mutually complementary processes. Both theoretical and practical implications of this "coevolutionary" view are discussed. (DR:C)
5 units, Win (Durham) MWF 11

6. Family and Sexuality in Anthropological Perspective—Course of lectures exploring inter- and intra-societal variation in family structure, cross-sex influences, and sexual behavior. The effort is made to link patterns of family interaction and socialization to sexual behavior and cross-sex relations generally. (DR:A)
5 units, Win (Skinner) MWF 9

7. Anthropological Perspectives on American Culture—(Same as Modern Thought and Literature 247). Areas of convergence and divergence in values, life styles, and psychocultural attributes are analyzed for mainstream, minority, and variant cultural patterns in United States society. Processes of boundary maintenance and identity reference are discussed. Current social movements are placed in the perspective of counter-culturalism, marginality, and cultural change. Field studies of relevant phenomena will be encouraged. (DR:A)
5 units, Win (G. and L. Spindler) TTh 2:15-3:50

8. Sex Roles and Society—(Same as Modern Thought and Literature 248). The purpose of this course is to develop an appreciation of the diversity of men's and women's roles, experiences and self-conceptions in a number of human societies, in order to provide a critical perspective on contemporary views of the "nature" of men and women, and to understand how men and women shape and are shaped by particular forms of social life. Readings will combine ethnographic studies of particular societies with theoretical discussions of sex and gender. (DR:S)
5 units, Aut (J. Collier, M. Rosaldo) MWF 10

10. Culture and History—Seminal works in social thought, cultural history, and anthropology—Benedict, Huizinga, Marx, Weber, Tocqueville, and Freud. Problems include: relation of cultural pattern and historical process; culture and social class; change as gradual transition and revolution. (DR:A)
5 units, Spr (R. Rosaldo) MWF 11

11. Asians in the West—A lecture and discussion course designed to introduce students to the history and contemporary experience of Asian-Americans. Topics covered are: the social and cultural background of Asian immigrants, legal history of Asians in the United States, economic and social organization of Asian-American communities, political movements, inter-generational conflict and inter-ethnic relations. (DR:S)
Given alternate years

12. Culture and the Sea: Maritime Orientations and Adaptations in Human Societies—This seminar is an introduction to maritime anthropology. We will consider the sea from an anthropological perspective with the purpose of learning something of man's nature and mind from the diverse ways—ecological, conceptual, and symbolic—he has coped with this challenging element. Specific topics will include: technical and social aspects of early long-distance voyaging, especially in the Pacific; technical, economic, and social characteristics of fishing as an ecological adaptation; maritime trade in simpler societies; maritime economics and national development in modern nations; maritime orientations and social identity; the sea as a symbol in myth and literature. (DR:S)
5 units, Aut (Frake) MWF 12 plus 2 hrs to be arranged

COURSES FOR UNDERGRADUATES AND GRADUATES

70. Introduction to Linguistics—(Same as Linguistics 10.) Theoretical foundation of linguistics, with emphasis on application of theory to solution of homework problems from a variety of languages. Topics include: phonetics, phonology, morphology, syntax, semantics, pragmatics, universals, and language change. This course or its equivalent is required for many advanced courses in linguistics. (DR:A)
5 units, Aut (Fox) MWF 11, plus optional sections

71. Introduction to Sociolinguistics—(Same as Linguistics 148). The study of language in
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society—Social dialects, awareness of social and ethnic differences in speech. Prestige and stigma associated with different ways of speaking. The aim of this course is to train students in the systematic observation of speech, there will be some practice in participant-observation, interviewing, and recording of conversations. Prerequisite: Anthropology 70 or its equivalent. (DR:A)

5 units, Aut (Lavandera) MWTh 9


5 units, Spr (Frake) MWF 10

73. Language in Use—(Same as Linguistics 50). 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. Prerequisites: Anthropology 70 or consent of instructor. (DR:A)

4 units, Spr (Staff) MWF 11

90. Theory in Social Anthropology—Lecture course designed as an overview of anthropological theory for undergraduate majors. Key controversies in anthropology will be discussed as a way of understanding divergent approaches to the analysis of culture and society. Special attention will be given to the relation between theory and method in anthropological traditions of investigation. (DR:S)

5 units, Win (M. Rosaldo) MWF 10

95. Honors Program—Directed independent study and honors thesis work for students admitted to this program. (DR:X)

Any quarter (Staff) by arrangement

96. Directed Individual Study—For undergraduate students with special needs, and showing capacity to do independent work. Prerequisite: 1 or consent of instructor. (DR:X)

Any quarter (Staff) by arrangement

AREA STUDIES

100. Astrology and Astronomy of the Maya—Introduction to the mathematics, calendar, and astronomical observations of the Classic Maya with special emphasis on their relationship to Classic and Modern Maya culture. Topics include: counting, arithmetic, calendars, calendar correlation, solstices and equinoxes, eclipses, planetary observations, the zodiac, almanacs, divination, curing, and rites of passage. This course is required for enrollment in Anthropology 101. (DR:C)

Given alternate years

101. Maya Hieroglyphic Decipherment—Decipherment of pre-Columbian Maya books and inscriptions, with emphasis on phoneticism, and decipherments bearing on Classic Maya culture and social organization. The origin or writing in Mesoamerica. Brief sketches of the Yucatec and Cholan languages. General principles of archaeological decipherment. Prerequisite: Anthropology 100, or consent of instructor. (DR:S)

Given alternate years

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. (DR:S)

5 units, Aut (G. Collier) MWF 9

104. The Incas and the Aztecs—Proseminar on the formation of the Inca and Aztec states and on their changes under Spanish colonial rule. (DR:A)

5 units, Spr (G. Collier, R. Rosaldo) M 3:15-6:05

105A, B. Peoples of Latin America—Survey of the culture history of the indigenous civilizations of Mesoamerica and South America. The course follows the development of indigenous high civilizations in the Americas from the prehistoric period on, tracing postconquest continuities and changes and considering the broader contexts of Latin American society during the colonial and contemporary periods. Credit offered only for two-quarter continuous enrollment. (DR:S)

Given alternate years

106. Seminar on Structure and Change in Rural Latin America—Selected problems in the study of social structure and change in agrarian societies of Latin America. Among those to be considered are: changing relations between agrarian communities and complex societies of which they are a part; power and patronage; plantation systems; ethnicity and race; and peasant movements. (DR:S)

5 units, Win (Siegel) W 2:15-5:05

107. Cultures and Societies of Sub-Saharan Africa—Lectures, readings, films, and study of art and other African cultural products provide an overview of the nature and variety of cultural
and social institutions of representative societies of Sub-Saharan Africa; also examines the ways in which African traditional societies are changing because of the impact of economic "development" and political changes. (DR:S)

5 units, Aut (Gibbs) MTWF 11

113. Peoples of the Pacific—Technology of the Malayo-Polynesian speaking world focusing on linguistics, ecology, social structure, and cultural history. Emphasis on the importance of this area to a variety of general problems in anthropological theory. Prerequisite: 1 or consent of instructor. (DR:S)

Given alternate years

115. Peoples of Island Southeast Asia—This course will show how the contemporary cultural unity and diversity within the Southeast Asian region may be accounted for in terms of the interaction between indigenous societies and a succession of outside colonizing influences. Among topics discussed are: prehistory, the process and impact of colonization, the contrast between hill and valley peoples, subsistence modes, social organization, religion, and aesthetics. (DR:S)

5 units, Aut (M. and R. Rosaldo) MWF 9

117. Chinese Culture and Society—An introduction to the study of Chinese social structure, culture, and political economy since the late 19th century. The emphasis is on the sources of revolutionary change and the anatomy of social transformation in the People's Republic. (DR:S)

5 units, Aut (Skinner) MWF 9

118. Communist Chinese Society—An examination of social and cultural change and political and economic development in the People's Republic of China in light of current social-science theory. Prerequisite: 117. (DR:S)

Given alternate years

120. Religion in Japan—(Same as Religious Studies 15). The religious life of the Japanese: the syncretism of Shinto and Buddhist sects, Confucian schools; the religious outlook of both the folk and the elite traditions. (DR:A)

3 units, Aut (Davis) TTh 11

121. 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. (DR:S)

Given alternate years

122. Seminar on Japan—Analysis of, and research on, selected topics on Japan, such as kinship, modernization, industrial organization, demography, urbanization, sociolinguistics, non-verbal communication. Emphasis on comparison with other cultures. Prerequisite: 121. (DR:S)

Given alternate years

125. Japanese Culture Through Novels and Films—(Same as Asian Language 125). Explorations of Japanese social structure (family, socialization, community, work, etc.) and cultural values through novels (in translation) by leading writers (Mishima, Natsume, Takizaki, etc.) and feature length films by well known directors (Kurosawa, Ozu, etc.). The course will focus on the individual in the social and cultural setting of modern, changing Japan. (DR:A)

Given alternate years

127. Peoples and Cultural Adaptation in Mediterranean Europe—Comparative analysis of agrarian societies and cultures of Mediterranean Europe, with special emphasis on Italy, Greece, Spain and Portugal. Focus will be on the relations among ecology, forms of land tenure, social structure, beliefs and values, and external forces historically affecting adaptations in the region from medieval times to the present. (DR:S)

5 units, Win (Siegel) TTh 11

128. Anthropology of Film—(Same as Communication 143). Nature of the ethnographic film as a documentary form is examined through viewing and analysis of classical and current films; also explores uses of film and video tapes as a tool for the analysis and presentation of cognitive, social, and kinesic aspects of culture and as a vehicle for anthropological research. Prerequisite: Anthropology 1 is recommended. (DR:A)

5 units, Spr (Gibbs) MW 10; T 7:30-10:00

130. Seminar on Primitive Curers—Primarily for advanced anthropology majors and anthropology graduates, centering on the recruitment and performance of such ritual specialists as shamans, medicine men, midwives, bonesetters, 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. (DR:S)

5 units, Win (Paul) M 4:15-6:05

131. Cultural Evolution—Analysis of the origin of human culture using evidence from primate ethnology, paleontology, archaeology and culture theory; examination of theories of cultural development from hunting-gathering economy through agriculture to industrialism, such as those of Morgan, Tyler, White, Steward, Marx, Ribeiro and others; systematic outline of proc-
132. Modernization, Development, and Population—Lecture course approaching "modernization" and "development" cross-culturally in a context of demography, interdependence, and ecology. Includes ethical issues concerning growth maximization, quality of life, equity, dependency, exploitation, and local control. Case studies, especially from Asia, will illuminate and model planned modernization programs and unplanned developmental processes. Prerequisite: declared major in any social science or history, or consent of instructor. (DR:S)

133. Ethics of Development in a Global Environment (EDGE): Cross-Discipline Seminar—(Same as Eng 297 A,B,C; Ed 274 A,B,C; Pol Sci 140 A,B,C; Soc Thought 197 A,B,C; Grad Sp 297 A,B,C.) Three quarter sequence examining theory and practice of development in a global setting. Interdisciplinary; encourages convergence of engineering and natural sciences with the social and behavioral sciences in the study of development processes and the ethics implicit in development choices. "Appropriate" development refers to process by which people in developing and industrialized countries alike seek individual and national fulfillment and liberation. By making underlying values explicit development options can be tested for appropriateness. Autumn: Major world trends—population, food, energy, technology life-styles. Development examined in terms of satisfaction of basic human needs. Lectures, discussions, work-groups. Winter: Alternative development strategies—country case studies. Lectures, discussions, work-groups. Spring: The individual and social change. The individual engineer, political scientist, educator, etc., as policy and decision-maker. Work-groups only. 2 units: pass/no credit. 3-5 units: pass/no credit or grade, small workshops, each limited to 10 participants, development policies for particular countries formulated. (DR:X)

A,B,C, 2-5 units, Aut, Win, Spr (Cooper, Fagen, Lusignan, McWhorter, Siegel, TeXtor, Weiler) M 7:30-9:30 p.m. and by arrangement

135. Culture and Biology—(Same as Human Biology 135). (Same as Anthropology 6). (DR:C)

136. Film Studies of Trance and Spirit Possession—Uses films and readings to examine the state of altered consciousness known as spirit possession, possession hysteria, to trance as it is found in our society and in other cultures. Focuses on the causes of trance and the reasons why it takes on a highly patterned almost stylized form; considers hypotheses offered by anthropology, psychology, and ethnopsychiatry. Compares film and expository writing as means for examining and explaining behavioral phenomena. (DR:A)

137. Applied Anthropology—Anthropologists have been called upon to apply their knowledge and skills in a variety of situations, including: establishing American Indian claims to land; developing and evaluating medical care delivery systems and educational programs at home and abroad; assisting in the transmission of technological innovations and measuring their impact; and serving as administrators and advisors for community development programs. The course addresses itself to the substance of such programs, the potential utility of anthropological findings and techniques in solving contemporary problems, the limitations of both findings and methods for these purposes, and the ethics of professional practice. (DR:S)

139. 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. (DR:S)

142. The Female Experience: Victorian Heritage, Part II—(Same as Modern Thought and Literature 142). This course presents an examination of the place of gender in social and political theory, from Fourier to Freud. (DR:A)

5 units, Spr (J. Collier, M. Rosaldo, et al.) MTWTh 1:15

144. Social and Religious Movements—Review of types of social movements: Millenarian defensive (nativistic), revitalization, redemptive, and utopian movements. Consideration of such aspects of the phenomenon as origins, leadership and organization, recruitment to membership, and their role in social change. Examples drawn principally from North America, Latin America, Africa, and Europe. Prerequisite: consent of instructor. (DR:S)

146. Urban Problems in Anthropological Perspective—A series of issues derived from current urban problems are examined from the cross-cultural perspective of anthropology. Topics covered include pre-industrial, non-Western forms of urbanism, ethological and socio-psychological research on density and crowding, rural-urban migration, changing family and kinship patterns, urban ethnic com-
munities and inter-ethnic relations, urban poverty, and crime. A combination of lectures, readings, and study group sessions is employed to provide students with an expanded, comparative view of urbanism. (DR:S)
5 units, Aut (Siegel) MWF 11

147. Peasant Migration and Social Change—A lecture course concentrating on rural-to-urban movements that have played, and continue to play such an important role in industrialization and social change. We shall examine the contributions to anthropology to theories about migration, forces that impel people to adopt migration as an adaptive strategy in agrarian societies: the impact of out-migration on the cultures of sending communities, and modes of coping of migrants in urban-industrial settings. Case studies from Africa, Latin America, Asia, and Europe will provide the basis for comparative analysis about (1) the relation between depopulation and various aspects of village life; (2) the significance of forms of communication between migrants and non-migrants for cultural change at the local level; and (3) the presumed disruptive effects of urban-industrial life for rural migrants. (DR:S)

Given alternate years

152. Symbolic Anthropology—(Same as Modern Thought and Literature 152). The past and current trends in the analyses 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 analyses and interpretation. (DR:A)

Given alternate years

153. Religion—(Same as Modern Thought and Literature 153). Interpretation of myths, symbols, and rituals, in sacrifice, magic, and witchcraft; stress on case studies rather than survey. (DR:A)

5 units, Win (R. Rosaldo) MWF 9

155. Political Anthropology—A course of lectures treating political processes in traditional societies ranging from primitive tribes to agrarian civilizations. Also treated are political evolution, political development, and selected theoretical issues within political anthropology. Prerequisite: 1, 2, or consent of instructor. (DR:S)

Given alternate years

156. Law and Conflict Management—A cross-cultural approach to the problems of order and conflict in society. The course will take up the question of whether all societies have "law" and will examine the social settings of such dispute handling mechanisms as negotiation, mediation, arbitration and adjudication. Students will read ethnographic accounts of conflict management in other societies and will be required to visit local courts in order to obtain first-hand knowledge of disputing in our society. (DR:S)

5 units, Spr (J. Collier) MWF 9

161. 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. (DR:S)

Given alternate years

164. Seminar on Cultural Ecology—This seminar focuses on the cultural adaptations of human societies to their environments. Major theories relating cultures and ecosystems will be evaluated in light of examples from diverse habitats (e.g., tropical rainforests, deserts and oasis, the arctic, high altitudes, etc.). Selected topics in ecological anthropology including human population dynamics and regulation, energetics, niche analysis, and resource management, will also be considered. Prerequisite: 1 or consent of the instructor. (DR:S)

5 units, Spr (Durham) TTh 3:15-4:50

165. Psychological Anthropology—Introduction to the anthropological study of the role of personality in individual adaptation in different cultural settings. Focus on: the problem of what is "normal" and "abnormal" in human behavior; national and ethnic character, sex differences; the role of socialization and cultural transmission in the development of personality; and culture change and the psychology of social and religious movements. Prerequisite: Anthropology 1 and Psychology 1 or consent of instructor. (DR:S)

5 units, Win (Gibbs) MWF 10

168. Medical Anthropology—The course will introduce students to the stimulating problems and approaches in the relatively new field of medical anthropology. The field encompasses more traditional areas of anthropological interest in non-Western medical beliefs and curing systems, as well as problems of how to adapt modern medicine to the needs of diverse cultural groups. The methods and findings of studies which focus upon the social and cultural correlates of physical and mental health and disease (social epidemiology) also form part of the course content. (DR:C)

5 units, Aut (Barnett) MWF 11

plus section meeting

169. Seminar in Advanced Medical Anthropology—Devoted to examination in depth of selected research problems requiring medical and behavioral science collaboration. Prerequisite: 168 or consent of instructor. (DR:S)

5 units, Win (Barnett) M 3:15-6:05
LINGUISTIC ANTHROPOLOGY

170. Sociolinguistic Analysis—(Same as Linguistics 248). The place of social and stylistic significance in language structure. The variable component of linguistic structure is investigated in some detail with data from several languages with a view to evaluating alternative models for the description of variation. Prerequisites: Linguistics 146, 200, 220, and 230, or consent of instructor. (DR:A)

4 units, Win (Lavandera) TTh 11:00-12:50

171. Linguistic Field Methods—(Same as Linguistics 175). Rapid introduction to descriptive 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. (DR:S)

Given alternate years

173. Spoken Bolivian Quechua—(Same as Linguistics 173). Introduction to the language of the Quechua Indians of Bolivia, a dialect closely related to the classical Quechua of the Inca Empire. (DR:S)

5 units, Aut (Fox) MWF 2:15

plus 2 hours lab

174. Typology and Universals of Language—(Same as Linguistics 208). The relation between typology and universals; universals in phonology, grammar and semantics; universals and linguistic change; the role of universals in overall explanatory theory in linguistics; universals research in contemporary linguistic theory. Prerequisite: Anthropology 70/Linguistics 10 or consent of instructor. (DR:S)

Given alternate years

175. Cognitive Anthropology—Investigation of the cognitive process and cultural behavior. Selected topics from the fields of perception, language, and belief will be considered. (DR:S)

Given alternate years

177. Pidgins and Creoles—Lecture course on the analysis of intense language and culture contact. Emphasis on the relationship between language structure and function, and the relevance of political power, social structure, and ethnic identity to the formation of simplified contact language (pidginization) and their subsequent elaboration (creolization). Attention will be given to other simplified (e.g., “foreigner talk,” “talking down,” “baby talk”), child language, and to applications in politics and education. Prerequisite: Anthropology 70/Linguistics 10, or an introductory course in anthropology, sociology, political science, or education, or consent of the instructors. (DR:S)

Given alternate years

178. Seminar on Pidgins and Creoles—Advanced continuation of the analysis of selected problems from the material in Anthropology 177 (Linguistics 246), with presentations by faculty, guest lecturers, and students. Prerequisite: Anthropology 177 (Linguistics 246), or consent of instructors. (DR:S)

Given alternate years

ARCHAEOLOGY AND BIOLOGICAL ANTHROPOLOGY

183. Geological Archaeology—(Same as AES 183). This course treats the application of geology to archaeology. Topics include the role of geochronology in providing a framework of relative as well as numerical dates, the use of sedimentology, paleontology and geomorphology in environmental reconstruction, and the methods of archaeological exploration, including use of geophysical techniques. Stress is placed on the student’s involvement in actual problems that are introduced in a succession of week-end field trips. The class will be divided into teams consisting of 4 to 5 students. Each team will conduct an original research investigation and prepare a comprehensive report as a group effort. The research projects will be field oriented and will take advantage of opportunities in the region, including those at Ano Nuevo and the many archaeological sites in the Clear Lake area. An introductory course in geology would be helpful as background, but is not a prerequisite. Students should anticipate spending an aggregate of about five days in the field, principally on week-ends. (DR:C)

5 units, Spr (Harbaugh, Rick) TTh 3:15

Field trips by arrangement
188. The Evolution of Prehistoric Civilizations—This course will look at the radical transitions involved in the evolution from original non-complex societies to complex state organizations. Basic problems to be considered include the change from food collecting (hunter-gatherer) to food producing (agricultural and pastoral) societies, the evolution of rank and stratification in society, as well as the role of trade, interaction, mobility, population growth, and ideology in the development of civilizations. Various theories of state evolution will be examined in the light of prehistoric Mesoamerican and South American complex societies. (DR:A)

Given alternate years

RESEARCH METHODS

190A,B. Data Analysis—Introduction to data analysis through theory and use of parametric and non-parametric statistics with special emphasis on applications in anthropology. The course offers training in the use of the computer for data analysis. Continuous enrollment through both quarters required for credit. (DR:S)

Given alternate years

191. Archaeological Field Methods—Studies, excavations of local archaeological sites, and related work in the department archaeological laboratory. Prerequisite: consent of instructor. (DR:C)

Given alternate years

192. Anthropological Research Methods with Implications for Education—(Same as Education 254). Seminar and practicum in anthropological approaches to educational process. Coverage includes ethnological and formal cross-cultural approaches, but emphasizes ethnographic techniques such as collecting genealogies and life histories, doing semi-structured participant and non-participant observation, and interviewing key informants. Articulation between ethnographic and more structured approaches is examined. Role-playing in simulated field situations attempts to develop empathy and sensitivity to feedback. Students are encouraged to collect and analyze their own field data. (DR:S)

4-5 units, Win (Textor) Th 7-10 and dhr

193. Methods of Research on the Local Community—This course is designed to provide students with training and experience in anthropological field research in the local community. Students will be introduced to a range of data collection techniques including survey interviews, intensive interviews, life-histories, participant observation, and various unobtrusive measures. Class members will be assisted in the design and implementation of an individual or group research project to be conducted in the greater Bay Area. (DR:S)

Given alternate years.

195. Museum Methods—Directed work on anthropological collections. Can be taken for one or two quarters with consent of instructor. (DR:S) if taken for 3 or more units.

1-4 units, Aut, Win, Spr (Gerow) dhr

COURSES FOR GRADUATES AND ADVANCED UNDERGRADUATES

230. Research Seminar on Sex Roles: Men, Women and Marriage—A research seminar focusing on sex roles among Australian Aborigines. The native peoples of Australia have provided anthropologists with data that is crucial to discussions on ritual, kinship, “primitive mentality” and the relationship between psychology and social life. These materials will be reanalyzed from a feminist perspective. Prerequisite: Anthropology 009 or consent of instructor. (DR:S)

Given alternate years

235. Cultural Dynamics—Examination of the processes of social-cultural continuity and change, with reference to major conceptual and theoretical orientations. Use of selected case studies that bear upon the role of e.g., interaction, conflict, new alternatives and decision-making, inherent instability within societies, external threats, involvement in the larger social order, migration and urbanization, and the search for order as forces contributing to change.

5 units, Aut (Siegel) T 2:15-5:05

238. Education and Sociocultural Change—(Same as Education 306C). Examines the role of education in modernization, within a context of interdependency and ecology. Relies on theories and models of change and on case studies from modernizing areas. Examines ethnocentric and ethical implications of “development.” Experiential techniques complement a lecture-and-discussion format.

5 units, Spr (Textor) TTh 2:15-4:05 plus dhr

242. Comparative Family Systems—Proseminar devoted to inter- and intrasocietal variation in family structure, the domestic cycle, and family interaction. Research in historical demography, social psychological studies of birth order and child development, and sociological work on small groups and families are brought into confrontation with anthropological work on family kinship.

5 units, Win (Skinner) TTh 1:15-3:05
243. 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.

Given alternate years.

246. Anthropology and History—(Same as History 346A). Seminar on cultural patterns and historical processes. Attention to historiography of oral tradition and written sources as well as research methods in social science.

5 units, Win (Jackson and R. Rosaldo) to be arranged

250. Nutritional Problems of Developing Nations—(Same as Food Research 250). The various malnutrition syndromes common in developing countries will be described, with emphasis upon protein-calorie malnutrition, nutritional anemias, and vitamin A deficiency. Methods and techniques of nutritional assessment applicable for use in developing nations will be reviewed. Detailed consideration will be given to effects of malnutrition throughout the life cycle, from fetal growth to fertility, with assessment of societal cost of malnutrition and its effects on learning, productivity, and other aspects of national development. Prerequisite: permission of instructor.

5 units, Spr (Martorell) MWF 10

252. Advanced Studies in Comparative Modes of Thought—(Same as Modern Thought and Literature 342). Current structuralist, hermeneutic and psychoanalytic approaches to the interpretation of the distinctive "world views" or "styles of thought" in other cultures. To be considered with special attention to issues in social theory and the question of whether so-called "primitive" cultural forms differ radically from our own.

Given alternate years

253. Religion—(Same as Modern Thought and Literature 343). Readings in classical social theory (Weber, Durkheim, Freud) on the nature of religion with special emphasis on their importance for a theory of culture. Theory will be complemented by ethnography and contemporary works which continue and further interpretation of such phenomena as religious sects, worship, rites of passage, magic, shamanism and dreaming. Prerequisite: consent of instructor.

5 units, Spr (M. Rosaldo) TTh 9:00-10:50

255. Political Anthropology—Proseminar treating the political process in traditional societies ranging from bands to agrarian civilizations. Attention is also given to political development in such societies. Prerequisite: graduate standing.

Given alternate years.

261. 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 and consent of instructor.

Given alternate years

263. Regional Systems in Agrarian Society—Seminar devoted to the comparative analysis of the social structure and political economy of peasant-based societies. The regional-systems approach strives for holistic understanding of the larger spatial-temporal systems that envelop and condition peasant livelihood and culture. Cases may be drawn from any of the historical or contemporary agrarian societies in Asia, the Middle East, Africa, Europe, or Latin America.

5 units, Aut ( Skinner) TTh 10:00-11:50

266. Cultural Transmission—(Same as Education 315). The transmission of values, implicit cultural assumptions, and the patterning of education in cross-cultural perspective, with special attention to American culture. Prerequisite: consent of instructor.

5 units, Win (G. and L. Spindler) T 7:00-10:00 plus dhr

268. 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, Spr (Barnett) Th 4:15-6:00

269. Cultural Approaches to Alternative Futures—(Same as Education 287). Seminar exploring alternative middle-range futures from an anthropological perspective. Stress is laid upon developing ability to read the futures literature critically, and upon developing skills in forecasting, scenario-building, and ethnographic interviewing. In the context of global ecological and social imperatives, particular cultures and subcultures are examined in terms of
their adaptive capacity or lack thereof. Relevant educational and other policy implications are addressed.

5 units, Win (Textor) M 2:15-5:05

278. Advanced Cognitive Anthropology—This course is concerned with how people give meaning to behavior and other events they experience. The point of view is from the anthropological side of the intersection of anthropology, linguistics, cognitive psychology, and sociology thus presenting a cross-cultural perspective on the relations among knowledge, language, and social behavior.

5 units, Aut (Frake) TTh 9:00-10:50

HISTORY AND RESEARCH METHODS

280. Field Methods—This seminar is designed to expose students to basic techniques, methods and problems of ethnographic field work. Topics to be covered include: techniques of data collection and recording using observation, participation, and interviewing, methods of quantitative, graphic, and qualitative data analysis. The seminar also will deal with problems in developing rapport, the politics and ethics of research as well as health problems and precautions in the field. Emphasis will be placed on the interrelationship of techniques, methods and theory of ethnography. The course will include demonstrations and field practice.

5 units, Win (Frake and Textor)
T 3:15-6:05

290. The Historical Background of Contemporary Anthropological Theory—A critical treatment of contemporary anthropological theory and its historical background.

5 units, Win (Greenberg) TTh 10:00-11:50

293. 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.

3-12 units, Sum (Staff)

294. Design of Field Research—A seminar treating research design and the research process, with special attention to the interrelation of both with theory and method. Consideration is also given to problems of preparing dissertation proposals and applications for research grants. Limited enrollment. Prerequisite: consent of instructor.

5 units, Spr (G. Collier) TTh 2:15-4:05

295. 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 (R. Rosaldo) W 2:15-4:05

296. Research Apprenticeship—Supervised work with an individual faculty member on his/her research project. May be taken for more than one quarter. Graduate secretary will have lists of projects at the beginning of each quarter.

3-5 units, any quarter (Staff) by arrangement

297. Directed Individual Study—Provides opportunities for advanced students to explore special areas of interest.

Any quarter (Staff) by arrangement

298. Teaching Apprenticeship—Supervised experience as assistant in one undergraduate course.

5 units, any quarter (Staff) by arrangement


Any quarter (Staff) by arrangement

APPLIED PHYSICS

Emeritus: Marvin Chodorow (Professor)

Chair: Calvin F. Quate


Consulting: Richard G. Brewer, Peter M. Eisenberger, Stig B. M. Hagstrom

Professors by Courtesy: Stephen E. Harris (Electrical Engineering), Gordon S. Kino (Electrical Engineering), Anthony E. Siegman (Electrical Engineering), William E. Spicer (Electrical Engineering)


Adjunct Professor: John M. Wilcox

Adjunct Professors by Courtesy: Bertram A. Auld (Edward L. Ginzton Laboratory), H. John Shaw (Edward L. Ginzton Laboratory)

Assistant Professor: Robert A. Stern

Lecturers: Bernardo A. Huberman, Robert M. White

Visiting Associate Professor: Johan E. Mooij

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 Physics, 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, the McCullough Laboratory, and the Stanford Synchrotron Radiation Laboratory.

The number of graduate students admitted to Applied Physics is limited. Applications should be received by January 15, 1979. 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 courses are listed under several categories: 1) General 2) Astrophysics 3) Condensed Matter Physics 4) Acoustics-Quantum Electronics-Microwaves. These reflect major programs for graduate study. Attention is directed toward the series entitled Special Topics. This year the 220 series on Device Physics will emphasize the properties of particle beams and radiation (synchrotron) from accelerators. The 320 series on Condensed Matter Physics will emphasize new developments in lattice dynamics and superconductivity.

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 Physics 170, 171, 290 (or Electrical Engineering 342), Physics 230, 231, 232 (recommended but not required), Applied Physics 213, 215 (or Physics 210, 211; or Mathematics 220A, 220B), one quarter of advanced laboratory (chosen from Physics 200, 201, or Applied Physics 354, 356A, 356B, 358A, 358B) plus sufficient additional approved courses in applied physics, physics, chemistry, engineering, or mathematics, to total 36 units. A minimum grade average of B is required in the courses taken toward the Master’s degree.

DOCTOR OF PHILOSOPHY

The University’s basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the section “Degrees” in this bulletin. Each candidate for this degree will be required to pass an oral qualifying examination before an application for the Ph.D. degree is accepted and before the end of the sixth quarter of registration, excluding summers. This examination will consist of a seminar given by the candidate on a suitable technical topic, and questioning by a faculty committee on that topic and related material.

Minimum subject matter requirements for the Ph.D. degree include: Applied Physics 213, 215 (or Physics 210, 211; or Mathematics 220A, 220B); Physics 220 (or Electrical Engineering 342); Physics 221; Physics 230, 231, 232 (or Electrical Engineering 322A, 322B, 324); and two quarters of advanced laboratory (chosen from Physics 200, 201, or Applied Physics 354, 356A, 356B, 358A, 358B). Additional course requirements are 12 units in a major field (such as astrophysics, condensed matter 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,” “Space Science and Related Programs,” and “Institute for Plasma Research.”

FELLOWSHIPS AND ASSISTANTSHIPS

Fellowship and assistantships are available. Applications for financial aid are included in the admission packet received from the Graduate Admissions Office.
COURSES

GENERAL

10. Physics and Technology—For nonscience majors. The relationship between science (specifically physics) and technology is explored by means of case studies selected to illustrate how modern technology has its origins in science and how science itself is influenced by its interaction with technology. Case studies will be chosen from areas of historical, contemporary, and possible future technological significance, providing a progress from the retrospective to prospective points of view. Course includes both lectures and discussion groups. No prerequisites. (DR:T)

3 units, Spr (Beasley)

40. Images and Imaging—Images have been used continuously in science to extend our visual range. In this course we will introduce the concepts that underlie the various forms of imaging. We will use this as a format to introduce the student to a number of broad fields in science and technology. The topics will range from the microscopic examination of integrated circuits and living cells to the telescopic examination of the planets. Course will be based on a weekly series of lectures. No prerequisites. (DR:T)

3 units, Aut (Quate) given 1979–80

89. Modern Technology and Its Impact—(Enroll in Freshman Seminar 89.)

213. Methods of Theoretical Physics—A course designed to provide background for the theory of atoms and molecules. Topics include group theory—general concepts and definitions, representations, finite and continuous rotation groups, double groups, permutation groups; behavior of scalar and vector functions under rotations, connection with angular momentum, coupling schemes, Clebsch-Gordan coefficients, nj symbols, spherical harmonics, vector spherical harmonics, multipole expansions; tensors—cartesian and irreducible tensors, Wigner-Eckart theorem. Prerequisites: Mathematics 130 and 131 or equivalents. (DR:X)

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. Subject matter: (1) basic numerical methods—polynomial fitting to functions and data—Lagrange formula, Gauss integration, Tchebyshhev 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; List processing, lambda conversion, recursive functions, Turing machines, introduction to LISP. Prerequisite: Mathematics 113 and 130, or equivalent. (DR:X)

3 units, Spr (Doniach)

220, 221, 222. Special Topics in Device Physics—Lectures and discussions of current topics in devices and electronic systems. Content varies from year to year, and it will reflect the research interests of faculty and staff. The series may be repeated. This year beams of particles from accelerators will be emphasized.

220. “Introduction to Particle Accelerators”—Course starts with a brief history of particle accelerators. It follows with a review of pertinent topics in general beam dynamics, relativistic mechanics and beam transport. Linear accelerators for electrons, positrons; protons and heavy ions are covered in some detail, including topics such as injection, acceleration by radio frequency and induction fields, accelerating structures, beam characteristics and general systems design. Also covered in some detail are circular accelerators and storage rings. The discussion of these involves the description of betatrons, cyclotrons, microtrons, and synchrotrons and the various beam properties and systems which are characteristic of these accelerators as well as storage rings. The last lectures are devoted to the modern applications of these machines, including physics research, medical therapy and diagnostics, radiography, material science and the production and use of synchrotron light. The course is open to qualified undergraduates as well as graduate students. No prerequisites. (DR:X)

3 units, Aut (Loew, Wiedemann, Staff)

MWF 3:15

221. “Advanced Topics in Particle Accelerator Design”—This course is a continuation of Applied Physics 220, for students interested in deepening their understanding of particle accelerator design. Machines specifically to be covered are those existent at SLAC, namely electron linacs and electron-positron storage rings. Examples of topics to be discussed include injection, conventional and superconducting magnets, room temperature and superconducting microwave structures and systems, beam dynamics and beam guidance, in-
stabilities, positron sources, electron cooling, vacuum, instrumentation and control, and radiation shielding. No prerequisites. (DR:X)
3 units, Win (Staff)

222. Topic to be Announced. (DR:X)
3 units, Spr (Staff)

232. 233. 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 Schroderinger 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: Applied Physics 213 and Physics 131 or Electrical Engineering 322B. (DR:X)
232. 3 units, Win (Weissbluth) given 1979-80
233. 3 units, Spr (Weissbluth) given 1979-80

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. (DR:X)
Any quarter (Staff) by arrangement

300. Dissertation Research (DR:X)
Any quarter (Staff) by arrangement

ASTROPHYSICS
All courses (DR:X) unless noted otherwise.
Applied Physics 15 and Physics 15 (see Astronomy Course Program listing) are addressed to students not majoring in the sciences. They are taught in different quarters by different instructors but are closely related in topic. Students are advised against taking more than one of the courses.

15. The Nature of the Universe—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, black holes, and pulsars, will also be discussed. The presentation will be non-mathematical and will be illustrated with slide and films. There will be opportunities for telescopic observations. (DR:T)
3 units, Aut (Petrosian) MWF 11

15. Modern Astronomy—A non-mathematical examination of the components of the universe from stars to quasars including their origin, evolution and mutual relationship to the universe as a whole. Discussion will emphasize current accepted concepts and also those that are speculative. The impact of recent and ongoing research results will be reviewed. There will be opportunities for telescopic observations during the quarter. No prerequisites. (DR:T)
3 units, Spr (Stern) MWF 11

25. Extraterrestrial Intelligent Life—This discussion of the possible existence of extraterrestrial intelligent life, and of the prospects of contact with extraterrestrial civilizations, will be based on present day knowledge of the physical universe and on the capabilities of technology as we can now assess them. Relevant astronomical information includes galactic structure, star types, solar planets, and evidence for planets associated with other stars. This is followed by discussion of chemical and biological evolution and the development of intelligence and technology. The prospects of radio communication, interstellar probes, interstellar travel and space colonization will be evaluated. Purported evidence (archaeological, historical and current) or extraterrestrial visitation will be reviewed. No prerequisites. (DR:T)
3 units, Win (Sturrock) TTh 2:15-3:30

3 units, Aut (Underwood) MWF 1:15

102A,B,C. Astronomy Laboratory and Observational Astronomy—(Enroll in Astronomy 102A,B,C). (DR:T)

103. Stellar and Galactic Astrophysics—Introduction to stellar and galactic astrophysics; galactic structure, interstellar medium, element abundance, star formation, stellar evolution, planetary nebulae, binary and variable stars, novae, supernovae. Modern developments: pulsars, x-ray stars, black holes, x-ray bursters. Prerequisites: one year college physics at the Physics 50 series or equivalent level, or Applied Physics 101. (DR:T)
3 units, Win (Liang) TTh 2:15-3:30

104. Solar-Terrestrial Relations—(Enroll in Astronomy 104.) (DR:T)

105. Extragalactic Astrophysics and Cosmology—Extragalactic astronomy and related phenomena of astrophysics: radio and x-ray
radiation from galaxies and quasars. The radio, infrared and x-ray background radiation and the production of cosmic rays. Introduction to cosmology, with discussion of models and evolution of the universe. Prerequisites: one year of college physics, chemistry, or engineering, or Applied Physics 103. (DR:T)

3 units, Spr (Petrosian) TTh 2:15-3:30

150A. C. Advanced Astronomy Laboratory—(Enroll in Astronomy 150A,C). (DR:T)

193. Astrophysics Seminar: X-ray Astronomy—The study of x-rays from the sun and from galactic and extragalactic objects has opened up a new field of astronomy. This course is intended to introduce the student to this important new field in astronomy. Topics will include mechanisms of x-ray emission; experimental techniques in x-ray astronomy; the solar corona, and evidence for coronae in other stars; galactic x-ray sources; supernovae remnants, pulsars, x-ray binaries; extragalactic x-ray sources; x-ray emission from normal galaxies, quasars, Seyfert galaxies, and clusters of galaxies. Prerequisites: Applied Physics 101 or 103 or 105, or consent of instructor. (DR:T)

3 units, Spr (Walker) by arrangement

356A. Astrophysics Laboratory I—Combined seminar and laboratory course which allows the student to investigate the fundamental observational basis of physical models of astronomical objects. The observational component of the course makes use of the 16-inch telescope at the Stanford Observatory, and auxiliary photometric and spectroscopic instrumentation. Emphasis is placed on spectroscopic observation of main sequence and post-main sequence stars, on stellar structure, models of stellar atmosphere, and on stellar evolution. Limited enrollment. Prerequisite: consent of instructor. (DR:X)

3 units, Sum (Walker) M 9-12 plus lab by arrangement

356B. Astrophysics Laboratory II—Combined seminar and laboratory course which allows the student to investigate the fundamental observational basis of physical models of astronomical objects. The observational component of the course makes use of the 16-inch telescope at the Stanford Observatory, and auxiliary photometric and spectroscopic instrumentation. Emphasis is placed on photometric and spectroscopic observations of binary stars and on UBV photometry, and on spectral studies of diffuse objects (planetary nebula and galaxies). Topics include the determination of stellar mass and stellar radii, and the study of the interstellar medium. Limited enrollment. Prerequisite: consent of the instructor. (DR:X)

3 units, Sum (Walker) T 9-12 plus lab by arrangement


3 units, Aut (Sturrock) TTh 2:30-3:45, alternate years, given 1978-79

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.) (DR:X)

3 units, Win (Petrosian) alternate years, given 1978-79

364. Plasma Astrophysics—Survey of mechanisms of plasma physics which have application to astrophysics. Orbit theory; MHD equations, waves and instabilities; electromagnetic waves; velocity-space instabilities; radiation mechanisms; shock waves; force-free magnetic fields; dynamo theory; and thermal instabilities. Applications to magnetosphere, solar activity, pulsars, radio galaxies, etc. Prerequisite: Physics 220 or equivalent. (DR:X)

3 units, Spr (Staff) alternate years, given 1979-80


3 units, Spr (Staff) alternate years, given 1978-79

366. Cosmology and Extragalactic Astrophysics—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. Observational properties and theoretical models of galaxies and galactic activity and of quasars, with emphasis on nonthermal processes. Prerequisites: Physics 221 or equivalent. (DR:X)

3 units, Spr (Petrosian) MWF 11; alternate years, given 1979-80

Observational techniques. Observations and models of galactic x-ray and EUV sources including binary x-ray stars, supernova remnants, stellar coronae, and hot subluminous stars. Extragalactic sources: active galaxies, clusters of galaxies. The diffuse background at x-ray and EUV wavelengths. Special attention will be paid to recent observational results from HEAO-1 and other satellites. Prerequisites: Consent of instructor. (DR:X)

3 units, Aut (Stern) by arrangement

CONDENSED MATTER PHYSICS

All courses (DR:X)


239. 3 units, Win (Harrison) MWF 10
240. 3 units, Spr (Harrison) MWF 10


3 units, Aut (Harrison) alternate years, given 1978–79


3 units, Aut (Harrison) MWF 10, alternate years, given 1979–80

320, 321, 322. Special Topics in Solid State Physics—Research level discussions of current topics in condensed matter physics. Content varies from quarter to quarter and from year to year, depending on the interests of staff and students. The course can be repeated.

320. Topic to be announced.
   3 units, Aut (Staff)
321. Topic to be announced.
   3 units, Win (Staff)
322. Topic to be announced.
   3 units, Spr (Staff)

   (Beasley)

354. Condensed Matter Physics Laboratory—Laboratory course in condensed matter physics. Course involves the study of selected problems in condensed matter physics from the experimental point of view. Experiments selected to represent major areas of current research interest (e.g. phase transitions, superconductivity, and amorphous materials) and so as to provide exposure to a variety of experimental and materials characterization techniques. Considerable emphasis is placed on developing sound experimental and interpretational judgment. Limited enrollment. Prerequisite: Consent of instructor.

3 units, Sum (Beasley) two labs per week by arrangement

355. Long Range Order in Solids—Magnetism and superconductivity will be discussed as prime examples of how long range order is established in solids. The microscopic mechanisms underlying magnetic and superconducting phase transitions as well as their consequences on physical properties will be developed. The similarities and differences of the phenomena will be stressed. Experimental results of a wide range of materials will be analyzed. The format will consist of two-part lectures. Prerequisites: Applied Physics 239 and 240 or consent of instructor.

3 units, Spr (Geballe, White) W 12:00-2:00 plus by arrangement, alternate years, given 1978–79

388. Many Body Problems in Condensed Matter Physics—This course will treat the application of quantum field theory methods including renormalization group theory to the study of elementary excitations and cooperative phenomena in condensed systems. Topics will include phase transitions and fluctuations in classical systems, critical phenomena, instabilities of Fermion systems.

3 units, Win (Doniach) alternate years, given 1978–79
390A. Condensed Matter Physics Seminar—Discussion of current research and literature in condensed matter physics is offered by faculty, students and outside specialists.
1 unit, Aut, Win, Spr (Beasley) Th 4

ACOUSTICS—QUANTUM ELECTRONICS—MICROWAVES
All Courses (DR:X)

3 units, Win (Auld) alternate years, given 1979–80

3 units, Win (Auld) alternate years, given 1978–79

(Chodorow)

255. Microwave Electronics—(Enroll in Electrical Engineering 326B).
(Chodorow)

256. Microwave Electronics—(Enroll in Electrical Engineer 326C).
(Chodorow)

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, CO₂, 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. Limited enrollment. Prerequisites: Electrical Engineering 231 and 232 or consent of instructor.
3 units, Win (Byer)

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 tumble dye and parametric sources are also possible. Limited enrollment. Prerequisites: Electrical Engineering 231 and 232, or Applied Physics 358A, or consent of instructor.
3 units, Spr (Byer)

ART
Emeriti: Daniel M. Mendelowitz (Professor); Victor M. Arnautoff (Assistant Professor)
Chairman: Lorenz Eitner
Professors: Keith Boyle, Elliot W. Eisner, Lorenz Eitner, Albert Elsen, Kurt W. Forster, Matthew S. Kahn, Frank Lobdell, Dwight C. Miller, Nathan Oliveira, Michael Sullivan
Associate Professors: Suzanne Lewis, Richard Randell, Isabelle Raubitschek
Assistant Professors: James N. Johnson, John-David P. LaPlante, Jan W. Molenkamp, Paul Turner
Senior Lecturer: Leo Holub
Lecturer: Robert Parker
Visiting Lecturer: Alfred Frankenstein
Principal Advisor to Undergraduate Studio Majors: Keith Boyle
Principal Advisor 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
角色在社会，以及他们与文学、音乐和其他人文学科的关系。作品在教室和工作室中的设计旨在加强学生的视觉感知艺术的正式和表达手段，并鼓励对各种技术过程的洞察力。斯坦福博物馆和斯坦福画廊的收藏品及其展览计划补充了该系的常规学术项目。

**Programs of Study**

 undergraduate students 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 advisor 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, whether they are receiving financial aid or not, to take an active part in the practical work of the Department/Museum as part of their requirements for the degree. This work, which may include classroom duties as course assistants, 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:

- 8 units from the following: Art 1, Art 2, Art 5 and Art 10.
- 40 units in art history courses above the 100 level, including one seminar or colloquium. To ensure that majors have a broad foundation in art history, they are required to take the 40 units in art history above the 100 level in at least four of the six following areas: Oriental, Ancient, Medieval, Renaissance, Baroque and Modern. This distribution still permits the student to take several courses in an area of particular interest.
- **Total units—48.** These units must be taken for a grade, and may not be taken Pass/NC. University units earned by placement tests or advanced placement work in secondary school will not be counted within the 48 units.

**Collateral Requirements:** Each undergraduate major in the history of art shall take at least one year of beginning French or German or Italian, or present proof of reading ability in one of these languages. Students who intend to apply for graduate school in art history should become proficient in two of the foregoing languages, one of which should be German. It is recommended that students who intend to apply to graduate school in Oriental art should take first year Chinese or Japanese. Each undergraduate major shall take History 1, 2, 3. Students may opt for Classics 102 and History 65, or History 91, 92, instead of two courses in History 1, 2, 3 sequence.

Recommended Courses (but which do not count toward the major): Art 40, 50 and 70.

**Master of Arts**

The Department of Art 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. The Department does not admit students who wish to work only toward the Master of Arts degree.

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 the 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 advisor shall be the committee chairman. It is the responsibility of the incoming student to contact his or her advisors 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 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 students dissertation advisor and as chairman of his or her dissertation committee. The final draft of the dissertation must be in the advisor'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 advisor. It serves primarily as a defense of the dissertation, over a wider field.

**Ph.D. Minor**—For a minor in Art History, a candidate is required to complete 24 units of graduate level art history courses (200 level or above), in consultation with a departmental advisor.

**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, Monotype, 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 Monotype:**
- 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 monotype 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, 164, 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 advisors. 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, monotype, sculpture, photography and product or graphic design.

The Graduate Program in Painting, Sculpture, Monotype, 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, 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.

Working jointly, the Departments of Art and Mechanical Engineering offer graduate degrees in the fields of product and visual design. A large new physical environment, the Design Yard, provides professional caliber studio space for each graduate student and well-equipped shops. Flexible programs may include graduate courses in fields ranging from graphic design to engineering design, typography to biotechnology, marketing to micro-computers. The program centers on a master’s project and may also include work in advanced art and design. Cross disciplinary interaction is encouraged by a four-person graduate design faculty.

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. A stamped self-addressed envelope should also be enclosed, for the return of the slides.
5. Applications and portfolios for the studio program must be submitted by February 1. No original work should be submitted unless the candidate can arrange for pickup and delivery. 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 concen-
ART 213

PROFESSIONAL: (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 (SINGLE SUBJECT—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 level. 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

All Courses (DR:H)

1. Introduction to Art—A topical introduction to the history and appreciation of architecture, sculpture, and painting.

   4 units, Aut (Elsen)

2. Ideas and Forms in Asian Art—To introduce the religious and philosophical ideas and social attitudes of India, China and Japan and to show how they are expressed in the architecture, painting, sculpture of the Orient and in such art forms as garden designing.

   4 units, Spr (Staff)

3. Introduction to the History of Architecture—A selective survey of Western architectural history, from antiquity to the 20th century. In each period, specific monuments and historical questions will be examined, as well as more general principles fundamental to an understanding of architecture.

   4 units, Spr (Turner)

5. Birth of European Art—The formation of the Classical tradition in Ancient Greece and Rome and its transformation in the Middle Ages.

   4 units, Win (Lewis, Raubitschek)

10. Important Events, Issues and Personalities in European Art, Renaissance to Modern—Main currents in the history of Western art from the Renaissance to the present.

   4 units, Spr (Miller)

20. Introduction to the Art of Asia (to 600 A.D.)—India, China and Japan from the beginnings of civilization through the 6th century A.D.

   4 units, Aut (LaPlante)

21. Introduction to the Art of Asia (7th Century-13th Century)—The art of India, South East Asia, China and Japan from the 7th century A.D. to the Mongol invasion in the 13th century.

   4 units, Win (LaPlante)

22. Introduction to the Art of Asia (14th Century Onward)—Moghuls, Mongols and Shoguns; the art of Asia from the 14th century onward.

   4 units, Spr (LaPlante)

The emphasis in these courses is upon the international relationships between the various kingdoms and empires of Asia. The dynamic interchange of ideas and styles begetting in turn reactions or modifications will indicate the rich inter-cultural nature of Asian Art.

There are no prerequisites for these courses. Although there is naturally an advantage to taking them in sequence, it is not required.

INTERMEDIATE COURSES

100A. Ancient Art I—The Pre-Hellenic Cul-
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tures: Egypt, Mesopotamia, Crete, Mycene. (DR:H)
4 units, Aut (Raubitschek)
100B. Ancient Art II—Greece from the Geometric period to the Hellenistic, with emphasis on sculpture and painting. (DR:H)
4 units, Win (Raubitschek)
100C. Ancient Art III—Rome from the Prehistoric and Etruscan periods to the early Christian. (DR:H)
4 units, Spr (Raubitschek)
101. Greek Architecture—From its origins to the Hellenistic Age, with emphasis on the Classical period. (DR:X)
4 units, (Raubitschek)
102. Neo-Classical Architecture (DR:X)
4 units, Spr (Raubitschek)

103. Byzantine Art—Art and architecture of the Byzantine Empire from the founding of Constantinople (330) to the Turkish Conquest (1452), centered on patterns of imperial patronage. (DR:X)
4 units, Win (Lewis) given 1979-80
104. Introduction to Medieval Art—Basic transformation in the forms and meaning of art during the Middle Ages, viewed within the context of the new purposes and patronage created by major medieval institutions of church and state from 4th through 14th centuries. (DR:H)
4 units, Win (Lewis) given 1979-80
105A. Medieval France—Art and architecture from the First Crusade (1095) in major monastic centers, through the formation and flowering of Gothic art at Chartres, Paris, Amiens and Reims, up to the reign of Charles V (1375). (DR:H)
4 units, Aut (Lewis) given 1979-80
105B. Medieval Britain—Art and architecture in England from the Early Saxon and Irish Dark Ages, through the Anglo-Saxon Kingdom, the Norman Conquest and Gothic period of 13th-15th centuries. (DR:H)
4 units, Aut (Lewis)
107. Medieval Architecture—Development of functional and symbolic structures within the context of major medieval institutions and patronage: monasteries, castles, cathedrals and towns of Western Europe. (DR:H)
4 units, Spr (Lewis)
108. Netherlandish Painting—Rediscovery of the visual works in the 15th century in the art of France and the Low Countries: the International Style, Van Eyck and Rogier van der Weyden, their Flemish, French and Dutch followers, and Bosch on the eve of the Reformation. (DR:H)
4 units, Spr (Lewis) given 1979-80

109A. Renaissance Society and Culture—Civic life and humanism from the 14th century to the early 16th century in Florence, Milan, Urbino, Rome and Venice. An interdisciplinary study of the age of the Renaissance, combining art, history and literature.
5 units, Win (Forster, Ryan and Spitz)
110A. Renaissance Art I—Italian art and architecture of the fourteenth and fifteenth centuries. Concentration on Tuscan art of the time of Giotto and the Lorenzetti brothers, on civic programs of the early fifteenth century in Florence (Donatello, Ghiberti, Brunelleschi), on court patronage in Milan, Mantua, (Alberti, Mantegna) and Urbino. (DR:H)
4 units, Aut (Forster)
110B. Renaissance Art II—Italian art and architecture from Leonardo and Michelangelo to Titian and Palladio. Focus on coherent programs in Medici Florence, papal Rome, Venice, and Mantua. Patronage, the beginnings of art historiography (Vasari), and the impact of Italian art in other European countries will also be discussed. (DR:H)
4 units, Win (Forster)
110C. Renaissance Art III—Art in German-speaking countries: painting, sculpture, and print-making from Schongauer and Pacher to Durer, Cranach, Grünewald and Holbein. (DR:H)
4 units, Spr (Forster)
111. Michelangelo and the Art of His Time—A study of Michelangelo's life and of his works in sculpture, painting and architecture. (DR:X)
4 units, Aut (Forster) given 1979-80
112. Renaissance Architecture—Italian architecture and urban renovation from 1300 to 1600: Brunelleschi, Alberti, Bramante, Palladio and their impact on building traditions and architectural thinking receive special attention. (DR:H)
4 units, Win (Forster), given 1979-80
113. Artists and Patrons in the Renaissance—How artists lived and worked, why their patrons commissioned art, and what maker, sponsor and public thought about it. (DR:H)
4 units, Spr (Forster)
115A. Artistic Culture in Italy During the 17th Century: Caravaggio, Bernini, Borromini, and their Contemporaries—Important developments in painting with emphasis on Rome and
Bologna; major trends of style and problems of iconography. (DR:H)
4 units, Aut (Miller)

115B. 17th Century Art in the Low Countries: The Age of Rubens and Rembrandt—Major artistic developments in the Low Countries 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, (DR:H)
4 units, Win (Miller)

4 units, Spr (Miller)

119. Political Ideology in 17th Century European Art in Court and Church.
4 units (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. (DR:H)
4 units, (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. (DR:H)
4 units, Aut (Eitner)

120C. Modern Art III—Realism and Impressionism—The origins of Impressionism in mid-nineteenth century realist art and in the work of the Barbizon School. The main masters of Impressionism, Monet, Sisley, Pissarro, are dealt with in detail, as well as the painters, such as Manet and Degas, who shared some of their goals and interests, without fully identifying themselves with Impressionism. (DR:H)
4 units, Win (Eitner)

4 units, Win (Elsen) given 1979-80

121A. Modern Art V—Twentieth Century Painting I, 1900-1920—Fauvism, Matisse, German and Austrian Expressionism, Picasso, and Cubism, Orphism, Futurism, and Abstraction. (DR:X)
4 units, Spr (Elsen) given 1979-80

4 units, Win (Elsen)

4 units, Spr (Elsen)

123. Rodin—The art of Rodin and its relation to the time in which he lived. The course lectures are supplemented by sessions in the Stanford University Museum of Art’s collection of Rodin’s art and the Legion of Honor Collection in San Francisco. (DR:H)
4 units, Aut given 1979-80

4 units, Win (Elsen) given 1979-80

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. (DR:H)
4 units, Spr (Elsen) given 1979-80

124. Picasso—This course will be given either as a colloquium or lecture course depending upon enrollment. (DR:X)
4 units, (Elsen)

125A. Indian Painting—The major expressions of painting in India beginning with the Buddhist period as seen in the wall paintings of the Ajanta Cave Temples and tracing the changes in style until the introduction of papermaking in the 16th century which permits the full bloom of the well-known Moghul and Rajput Schools of the 16th through the 18th centuries. (DR:X)
4 units, (LaPlante)

125B. The Art of India
4 units, Win (LaPlante)

125C. The Art and Architecture of Moghul India
4 units, Aut (LaPlante)

126A. Introduction to Chinese Art (DR:X)
4 units, Win (Sullivan)

126B Introduction to Chinese Painting (DR:X)
4 units, Aut (Sullivan)

126E. The Meeting of Eastern and Western Art—The interaction between the art of the Far
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Term(s)</th>
<th>Instructor(s)</th>
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</thead>
<tbody>
<tr>
<td>216A</td>
<td>Ritual Bronzes of Ancient China</td>
<td>4 units</td>
<td>Spr (Sullivan)</td>
<td></td>
</tr>
<tr>
<td>216B</td>
<td>Chinese Ceramics</td>
<td>4 units</td>
<td>Spr (LaPlante)</td>
<td></td>
</tr>
<tr>
<td>216C</td>
<td>Buddhist Art in Asia</td>
<td>4 units</td>
<td>Win (LaPlante)</td>
<td></td>
</tr>
<tr>
<td>216D</td>
<td>Architecture and Gardens of Japan</td>
<td>4 units</td>
<td>Aut (LaPlante)</td>
<td></td>
</tr>
<tr>
<td>129</td>
<td>Introduction to Japanese Painting</td>
<td>4 units</td>
<td>Spr (Staff)</td>
<td></td>
</tr>
<tr>
<td>130A</td>
<td>Art in Nineteenth Century America—Major developments and personalities in painting in 19th century America</td>
<td>4 units</td>
<td>Win (Frankenstein)</td>
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<tr>
<td>130B</td>
<td>Art in Twentieth Century America—Major developments and personalities in painting in twentieth century America</td>
<td>4 units</td>
<td>Spr (Frankenstein)</td>
<td></td>
</tr>
<tr>
<td>175A</td>
<td>Modern Architecture I</td>
<td>4 units</td>
<td>Aut, Win (Turner)</td>
<td></td>
</tr>
<tr>
<td>175B</td>
<td>Modern Architecture II</td>
<td>4 units</td>
<td>Aut (Turner)</td>
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</tbody>
</table>

### Advanced Undergraduate and Graduate Courses

**All Courses (DR:X)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Term(s)</th>
<th>Instructor(s)</th>
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</thead>
<tbody>
<tr>
<td>200A</td>
<td>Studies in Ancient Art</td>
<td>4 units</td>
<td>Aut, Win, Spr (Raubitschek)</td>
<td></td>
</tr>
<tr>
<td>201</td>
<td>Studies in Greek Architecture</td>
<td>4 units</td>
<td>(Raubitschek)</td>
<td></td>
</tr>
<tr>
<td>202</td>
<td>Studies in Neo-Classical Architecture</td>
<td>4 units</td>
<td>Spr (Raubitschek)</td>
<td></td>
</tr>
<tr>
<td>203</td>
<td>Studies in Byzantine Art</td>
<td>4 units</td>
<td>Aut (Lewis)</td>
<td></td>
</tr>
<tr>
<td>204</td>
<td>Studies in Medieval Art</td>
<td>4 units</td>
<td>Win (Lewis) given 1979-80</td>
<td></td>
</tr>
<tr>
<td>205A</td>
<td>Studies in Medieval France</td>
<td>4 units</td>
<td>Aut (Lewis) given 1979-80</td>
<td></td>
</tr>
</tbody>
</table>

205B. Studies in Medieval Britain
4 units, Aut (Lewis)

206A. Colloquium in Medieval Art
4 units, Spr (Lewis)

207. Studies in Medieval Architecture
4 units, Spr (Lewis)

208. Studies in Netherlandish Painting
4 units, Spr (Lewis) given 1979-80

210A.B.C. Studies in Renaissance Art
4 units, Aut, Win, Spr (Forster)

211. Studies on Michelangelo
4 units, Aut (Forster) given 1979-80

212. Studies in Renaissance Architecture
4 units, Win (Forster) given 1979-80

213. Studies on Artists and Patrons in the Renaissance
4 units, Spr (Forster) given 1979-80

214A. Seminar in Renaissance Art: Mantuan Court Patronage from Alberti and Mantegna to Giulio Romano.
4 units, Aut (Forster)

214B. Seminar in Renaissance Art; Art Collections of the Renaissance.
4 units, Win (Forster)

214C. Seminar in Renaissance Art: Albrecht Dürer.
4 units, Spr (Forster)

215A. Studies in Artistic Culture in Italy During the 17th Century: Caravaggio, Bernini, Borromini, and Their Contemporaries
4 units, Aut (Miller)

215B. Studies in 17th Century Art in the Low Countries: The Age of Rubens and Rembrandt
4 units, Win (Miller)

216. Studies of Six Great Artists of the Baroque: Caravaggio, Bernini, Rembrandt, Poussin, Velazquez
4 units, Spr (Miller)

217. Connoisseurship in 17th Century Italian Drawings
4 units, (Miller)

218. 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, (Miller)

4 units, Aut (Miller)

220A,B,C,D. Studies in Nineteenth Century Art
4 units, Aut, Win, Spr (Eitner, Elsen)
221. Seminar in Nineteenth Century Art  
4 units, Spr (Eitner)

221A. Studies in Twentieth Century Painting From 1900-1920  
4 units, Spr (Elsen) given 1979-80

221B. Studies in Twentieth Century Painting From 1920-1960  
4 units, Win (Elsen)

222. Studies in Contemporary Art  
4 units, Spr (Elsen)

223. Studies on Rodin  
4 units, Aut (Elsen) given 1979-80

223A. B. Studies in Modern Sculpture  
4 units Win, Spr (Elsen)  
given 1979-80

223C. Seminar in Late Nineteenth Century Art  
4 units, Aut (Elsen)

224. Colloquium on Picasso: His Life's Work in All Media  
4 units, Win (Elsen)

225A. Studies in Indian Painting  
4 units, (LaPlante)

225B. Studies on the Art of India  
4 units, Win (LaPlante)

225C. Studies on the Art and Architecture of Moghul India  
4 units, Aut (LaPlante)

226A. Studies in Chinese Art  
4 units, Win (Sullivan)

226B. Studies in Chinese Painting  
4 units, Aut (Sullivan)

226E. Studies of Meeting of Eastern and Western Art  
4 units, Spr (Sullivan)

227A,B. Seminar on Chinese Art  
4 units, Aut, Win (Sullivan)

227C. Seminar in Far Eastern Art  
4 units, (Sullivan)

228A. Studies on Ritual Bronzes of Ancient China  
4 units, Spr (LaPlante)

228B. Studies on Chinese Ceramics  
4 units, Spr (LaPlante)

228C. Studies on Buddhist Art in Asia  
4 units, Win (LaPlante)

228D. Studies on the Architecture and Gardens of Japan  
4 units, Aut (LaPlante)

230A,B. Studies in Nineteenth and Twentieth Century Painting in America  
4 units, Win, Spr (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.  
4 units, Win (Lewis)

236. Proseminar in Art Historical Bibliography and Library Methods—An introduction to important reference works in art and architectural history. Familiarity with this material will be encouraged through the frequent assignment of relevant bibliographical problems. A working reading knowledge of German, French and Italian is assumed. Primarily for art history graduate students, although junior or senior undergraduate majors who plan to continue in art history on the graduate level may enroll with the consent of the instructor.  
4 units, Win (Ross)

238. 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 "droit moral" and attempts to establish their 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. (DR:X) Course is restricted to graduate students in law, business and art history. Undergraduate senior art history majors need approval of the instructor. First class meeting on January 29, 1979 in Law School.  
5 units, Win (Elsen, Merryman)

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 instructor's approval. Chiefly for art history majors. Recommended prerequisites: Art 1 or Art 5 and 10.  
4 units, (Elsen)

240. Individual Work: Art History  
Any quarter (Staff) by arrangement

275A,B. Studies in Modern Architecture I, II  
4 units, Aut, Win (Turner)

276. Studies in American Architecture and Urbanism  
4 units, Spr (Turner)

277A,B. Seminar on Modern Architecture  
4 units, Aut (Turner)

279. Seminar on American Urbanism  
4 units, (Turner)
300. Research Project: Art History  
Any quarter (Staff) by arrangement

301. Master’s Thesis: Art History  
Any quarter (Staff) by arrangement

400. Dissertation: Art History  
Any quarter (Staff) by arrangement

RELATED COURSES

Classical Greek Sculpture and Painting—See Classics 102.

Topography and Monuments of Greece—See Classics 106.


Mycenaen Greece—See Classics 112.

Anthropology of Art—See Anthropology 134.

Chinese Aesthetic Concepts—See Asian Languages 166/266.

European, Especially Nordic, Symbolism in Literature and Art About 1900 (Ibsen, Strindberg, Munch)—See German Studies 134A/234A.

The Grotesque in Art and Literature—See German Studies 179A.

INTERDEPARTMENTAL SEMINAR

Colloquium on the Apocalypse in Medieval Art and Literature—(See Art 206A, English 266, Medieval Studies 165.)

Seminar in American Urbanism—(See Art 279, Urban Studies 100B, Political Science 192B).

COURSES IN PRACTICE OF ART (STUDIO)

All Courses (DR:X)

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.  
3 units, Aut, Win, Spr (Johnson)

51. Basic Clay Sculpture—Introduction to modeling the human head and figure.  
3 units, Aut, Win, Spr (Randell)

52. Basic Wood Sculpture—Introduction to wood carving and wood construction.  
3 units, Aut, Win (Randell)

60K,M. 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—Fundamentals of composition in black and white. Emphasis on the visual aspects of specific objects drawn separately and in a still-life context using charcoal. This course is recommended as the beginning drawing class for studio art majors. No prerequisites.  
3 units, Aut, Win, Spr (Staff)

141. Drawing II—Intermediate/advanced drawing and composition. Prerequisite: 40 or 140, or consent of instructor. May be repeated for credit.  
3 units, Aut, Win, Spr (Staff)

142. Drawing III—Advanced drawing. Emphasis on student initiative in respect to composition, color, and use of a variety of drawing materials. Work from imagination, still life, and model. Prerequisite: 40 or 140, or consent of instructor. May be repeated for credit.  
3 or more units, Aut, Win (Staff)

145. Painting I—Introduction to painting procedure. Still life and landscape studies in oil. Prerequisite: 40 or 140, or consent of instructor. May be repeated for credit.  
3 units, Aut, Win, Spr (Staff)

146. Painting II—Beginning and intermediate painting. Extended problems in pictorial organization and content, with stress on oil painting. Prerequisite: 40 or 140, or consent of instructor. May be repeated for credit.  
4 units, Aut, Win, Spr (Staff)

147. Painting III—Advanced painting with emphasis on the individual point of view. Prerequisite: Three quarters of 145, 146, or equivalent, or consent of instructor.  
3 or more units, Aut, Win, Spr (Staff)

148. Monotype—Introduction to print-making using monotype, a graphic art medium which was used by such artists as Blake, Degas, Gauguin, Pendergast, and many others. Visits to the Achenbach Foundation collection and the Editions Press in San Francisco, and the Stanford Museum will supplement this course. Prerequisite: 40 or 140. May be repeated for credit.  
3 units, Aut, Win, Spr (Staff)

150. Sculpture I—Intermediate wood carving and wood construction.  
3 units, Spr (Randell)
151. Sculpture II—Introduction to sculpture in metal. Gas and arc welding are principal techniques used. Prerequisite: 150.

3 units, Spr (Randell)

160K,M. Design I—Intermediate Design—Comprehensive design assignments in diverse media with emphasis on the relationship between professional design problems and their underlying elements and procedures. Prerequisite: 60.

3 or more units, Aut, Win or Spr (Kahn, Molenkamp)

161. Design II—Type and Symbol Design—An introduction to the principles of type and symbol design, emphasizing conceptual thinking. Prerequisite: 60.

3 units, Aut (Molenkamp)

162. Design III—Typographic Design—An introduction to typography, emphasizing the expressive use of type. Prerequisite: 161.

3 units, Win (Molenkamp)

164. Color—Comprehensive study in the theories and practice of color. Emphasis is on working with color in a variety of media. Prerequisite: 60.

3 units, Spr (Molenkamp)

166. Silkscreen Process/Textiles—Design projects in pattern as it applies to cloth, paper and other surface materials. Production emphasis is on the silkscreen printing process. Prerequisite: 160 or 161.

4 or more units, Win (Kahn)

167. Metalsmithing—Projects in jewelry and small utilitarian objects. Emphasis on design and craftsmanship in metal construction and lost wax casting. Prerequisite: 162.

4 or more units, Win (Kahn) given alternate years, 1979-80

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)

172. Non-Silver Processes—This course is designed specifically for the person wishing to explore other areas of photography. The non-silver processes will include gum-bichromate, cyanotype, xerox, photogravure, platinotype and photosilkscreening. Prerequisite: 70, 170, 171, 270 or consent of instructor. (Class limited to 10 students; priority will be given to advanced students.)

3 units, Aut (Holub and Parker)

ADVANCED UNDERGRADUATE AND GRADUATE COURSES

241. Advanced Drawing and Painting Criticism I—Prerequisite: at least two quarters of painting or drawing.

Aut, Spr (Oliveira) by arrangement

242. Advanced Drawing and Painting Criticism II—Prerequisite: at least two quarters of painting or drawing.

Aut, Win (Boyle) by arrangement.

243. Advanced Drawing and Painting Criticism III

Win, Spr (Lobdell) by arrangement

244. Individual Work: Drawing and Painting

Any quarter (Staff) by arrangement

248. Advanced Printmaking—Continuation of monotype, dealing with advanced technical and aesthetic problems in the medium. Prerequisite: 148.

Any quarter (Oliveira) by arrangement

249. Individual Work: Lithography

Any quarter (Oliveira) by arrangement

250. Individual Work: Sculpture

Any quarter (Randell) by arrangement

260. Individual Work: Design

Any quarter (Kahn, Molenkamp) by arrangement

261. Advanced Design I—Advanced Graphic Design—Design experiences in a wide range of media for communication utilizing a combination of typographic material and images. Prerequisite: any two design courses above 160.

3 or more units, Spr (Molenkamp)

262. Advanced Design II—Graphic Organization—Design experiences in visual communication through analytical approaches of visual problem solving.

3 or more units, Win (Molenkamp)

263. Advanced Design III—Design Research Projects—Advanced design research projects in visual communication with emphasis on professional practice.

3 or more units, Spr (Molenkamp)

264. Advanced Color

3 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—Evening seminar based upon elective design projects in
areas of individual specialization. Consent of instructor required.

Aut, Win, Spr (Kahn)

270. Individual Work: Advanced Photography
Aut, Win, Spr (Holub, Parker)
by arrangement

340. M.F.A Seminar: Studio
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

RELATED COURSES
Philosophy of Design—See Mechanical Engineering 214.

American Experimental Film—See Communications 210A. (Art Department credit not given towards major.)

Visual Thinking—See Mechanical Engineering 101.

Introduction to Product Design—See Mechanical Engineering 115A.

COURSES IN ART EDUCATION
All Courses (DR:X)

213. Foundations of Aesthetic Education—
(Enroll in Education 213.)
4 units, Aut (Eisner) MW 3:15-5:05

219. Artistic Development of the Child—
(Enroll in Education 219.)
4 units, Win (Eisner) MW 3:15-5:05

380. Curriculum Development in the Visual Arts—
(Enroll in Education 380.)
4 units, Spr (Eisner) W 7-10

480. Seminar for Doctoral Students in Art Education—
(Enroll in Education 480.)
(time to be arranged)

ASIAN LANGUAGES
Emeriti: S. Wing Chan, Frederic Spiegelberg (Professors)

Chairman: Makoto Ueda

Professors: Albert E. Dien, James J. Y. Liu (on leave 1978-79), David S. Nivison (on leave autumn quarter 1978), Makoto Ueda

Associate Professors: Kung-yi Kao, William A. Lyell, John C. Y. Wang

Assistant Professors: Phillip T. Harries (on leave 1978-79), Susan K. Matison (Religious Studies), Angela W. MacDonald, Jr. (History), Pauline Yu (Asian Languages, autumn quarter 1978). Acting: Paula N. Doe, Stuart Sargent

Senior Lecturers: Yin Chuang, Hiroyasu Kubota, Hiroshi Sakamoto

Lecturers: Kimie Nebrig, Dorothy Shou

CHINESE-JAPANESE LANGUAGE AND AREA CENTER

Director: Albert E. Dien


Senior Lecturers: Yin Chuang, Hiroyasu Kubota, and Hiroshi Sakamoto (Asian Languages)

Lecturers: Kimie Nebrig and Dorothy Shou (Asian Languages), Franklin B. Weinstein (Political Science)

OFFERINGS
The Department of Asian Languages offers courses in the languages, cultures, and literatures of China and Japan. The Department accepts candidates for the degrees of Bachelor of Arts, Master of Arts, and Doctor of Philosophy.
in Chinese or Japanese. 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: AL 93, C113, AL131, 132, 133, and two other content courses dealing with China at the 100 level, as approved by the Undergraduate Advisor.
2. Concentration in Japanese: AL93, J103, AL136, 137, 138, and two other content courses dealing with Japan at the 100 level, as approved by the Undergraduate Advisor.

These requirements are in addition to the University's basic requirement for the Bachelor's degree.

Honors Program in Asian Languages

Majors with an overall letter-grade average of 3.5 may apply for the Honors Program by submitting a senior thesis proposal to the Honors Committee during the Spring or Winter quarter of the junior year; the proposal will include a thesis outline, a list of all relevant courses the student has taken or plans to take, a skeleton reading list including a work or works in Chinese or Japanese, and the name of a faculty member who has agreed to act as Honors Supervisor.

If the proposal is approved, research and writing will begin in the Spring quarter of the junior year, and for the first two quarters will take the form of directed reading with the chosen supervisor; the finished essay (normally about 15,000 words) will be submitted to the committee no later than the end of the Winter quarter in the senior year. From ten to fifteen units of credit will be granted for the finished thesis.

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. Applicants should not wish merely to acquire or improve language skills but to pursue study in one of the following fields: Chinese history (premodern), Chinese linguistics, Chinese literature, Chinese philosophy, Japanese cultural history, Japanese literature.

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 or an annotated translation of a text of suitable literary or historical worth is required for the A.M. degree. Under special circumstances, a paper approved by the Graduate Advisor 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: 103, 201, 202, 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 Advisor in consultation with the student's individual advisor. Students may be exempted from 101, 102, 103 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 255 and 297; and two courses in such fields as Japanese anthropology, art, history, politics, and religion, as approved by the Graduate Advisor in consultation with
the student’s individual advisor. 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**—Students admitted with A.B. only will be evaluated by the graduate faculty during the Autumn quarter of their second year at Stanford. The evaluation will be based on written work and at least a portion of the A.M. thesis or translation. If the faculty has serious doubts about a student’s ability to work for the Ph.D., this will be conveyed to the student. During the subsequent Spring quarter, the faculty will formally decide whether a student should be admitted to candidacy for the Ph.D. or be terminated. In the case of a student who already has an A.M. in Chinese or Japanese when admitted to the department, the evaluation will take place in the Spring quarter of the student’s first year. 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 qualifications procedure must take place during the student’s first two years. The timing of the evaluation of a student admitted with an A.M. in Asian Studies will be decided on an individual basis.

Admission to candidacy does not mean that the student has fulfilled all requirements for the degree except the dissertation, but that the departmental faculty considers the student qualified to pursue a program of study leading to the Ph.D. and that, subject to continued satisfactory progress, the student’s status in this department is secure.

A candidate must fulfill the following requirements for the Ph.D.

1. He or she must demonstrate a reading knowledge of French, German, or another European language approved by the Graduate advisor before 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 or her 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 either by completing Chinese 113 or by taking Japanese 250 and subsequently passing a test on the prescribed reading list in Kambun.
4. He or she must pass a set of four comprehensive written examinations. One of these will test the candidate’s methodological competence in a discipline. The remaining three fields are to be chosen, with the approval of the Graduate Advisor in consultation with the student’s individual advisor, from the following: Chinese literature, Chinese history, Chinese philosophy, Chinese linguistics, Chinese art, Japanese literature, Japanese history, Japanese religion, Japanese art, and Japanese anthropology.

**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 advisor. 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 Univer-
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

All courses (DR:H) unless noted otherwise.

46. Philosophical Chinese—(Same as Philosophy 46.) Introduction to classical Chinese and to Chinese philosophical concepts, through study of short philosophical texts; for students who have had no previous work in a Far Eastern Language. This course is intended for students who are not yet sure they wish to invest the time needed to learn to read and speak Chinese well, but who would like to learn something of the language of early Chinese philosophy, sufficient to enable them to read translations of Chinese philosophers, and books and articles in English about them with some critical awareness of underlying language problems when a language radically unlike English is the medium of philosophical thinking. Significant Chinese texts will be examined and explicated as they are encountered, as quotations in articles or as problematic passages in translated works. Philosophers treated will include Confucius, Mencius, and Lao Tzu. This course is self-contained and does not assume that the student will do further work in the subject; a student taking the course may, however, continue study of classical Chinese by enrolling in 47 in the spring quarter and 111A the next year.

3 units, Win (Nivison) MWF 11

47. Philosophical Chinese—(Same as Philosophy 47.) Continuation of 46. Reading in Mencius and Han Fei Tzu.

3 units, Spr (Staff) MWF 11

91. Traditional East Asian Civilization—(Same as History 91 and Humanities 91.) An introduction to the development of civilization in China and Japan from earliest times to the spread of Buddhism. Lectures and discussions will cover political institutions, social and political ideas, religious currents, and artistic and literary trends. Intended for the nonspecialist. (DR:H)

5 units, Aut (Duus, Lyell, Matisoff) MWF 10

92. Traditional East Asian Civilization—(Same as History 92 and Humanities 92.) A continuation of 91 covering the period down to 1700. Open only to students who have completed 91. (DR:H)

5 units, Win (Duus, Lyell, Matisoff) MWF 10

93. Modern East Asian Civilization—(Same as History 93 and Humanities 93.) A continuation of 92 covering the period from initial Western contacts down to the present. Open only to students who have completed 92. (DR:H)

5 units, Spr (Duus, Lyell) MWF 10


5 units, Spr (Davis) MWF 1:15

119. The Taoist Tradition—(Enroll in Religious Studies 119.) The evolution of Taoist thought in relation to social and cultural changes and in interaction with Confucianism and Buddhism; Lao Tzu and Chuang Tzu; Neo-Taoism; later understandings of the Tao Te Ching.

5 units, Aut (Berling) MWF 9

plus section dhr

120. Confucianism—(Enroll in Religious Studies 120.) The evolution of the sage ideal in relation to Chinese society from Confucius through Liu Shao-Ch’i; classical Confucian thought; the Four Books; Han cosmology; the emergence of Neo-Confucianism; modern interpretations.

5 units, Win (Berling) MWF 9

plus section dhr

121. Images of the Feminine in East Asian Culture—(Enroll in Religious Studies 134.) The mysterious female; the ideal of the feminine in relation to the realities of life in religion, literature, and legend.

5 units, Win (Berling) MWF 1:15

plus section dhr

122. Chinese Buddhist Thought—(Enroll in Religious Studies 151.) Two texts in translation: one by Fa-tsang, the Hua-yen master, and one by Seng Chao, the San-lun (Madhyamika) master. Prerequisite: consent of the instructor.

5 units, Spr (Paul) TTh 4:15-6:05

125. Japanese Culture Through Novels and Films—(Same as Anthropology 125.) Explorations of Japanese social structure (family, socialization, community, work, etc.) and cultural values through novels (in translation) by
leading writers (Mishima, Natsume, Tanizaki, etc.) and feature length films by well known directors (Kurosawa, Ozu, etc.). The course will focus on the individual in the social and cultural setting of modern, changing Japan.

5 units, Win (Befu) given 1979-80

131. Chinese Poetry and Drama in Translation—Readings in traditional Chinese poetry and drama with emphasis on genre, theme, and style.

4 units, Aut (Yu) MW 11-12:30

132. Chinese Fiction in Translation—A survey of Chinese prose fiction from early times to the late Ch'ing period, with emphasis on literary and thematic discussions of major representative works available in English translation.

4 units, Win (Wang) MWF 11

133. Modern Chinese Literature in Translation—Readings in representative twentieth-century works of fiction, drama, and poetry in translation.

4 units, Spr (Lyell) MWF 11

136. Early Japanese Literature in Translation—An introduction to the major works of prose and poetry from the Nara through the Kamakura periods (c. 700-1300).

4 units, Aut (Doe) MWF 1:15

137. 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

138. 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, Spr (Nioison) MWF 1:15

151. Chinese History in Translation—(Same as History 186.) A survey of the various modes of historical literature from earliest times, the development of historical consciousness and comparisons with other traditions. (DR:A)

4 units, Win (Dien) MWF 1:15

152. Cultural History of Inner Asia—(Same as History 195.) Inner Asia as an arena of conflict between agricultural and nomadic societies and the traces of cultural diffusion. (DR:A)

4 to 5 units, Spr (Dien) MTWF 1:15

166 (266). Chinese Aesthetic Concepts—(Same as Modern Thought and Literature 166.) Comparative study of aesthetic concepts in Chinese literary criticism and art criticism. (Graduate students may enroll under 266, in which case they will be required to read texts in Chinese.)

4 units, Spr (Liu) given 1979-80

176 (276). Chinese Myths, Legends, and Folktales—A general survey of their respective forms and contents and their significance in the study of Chinese culture in general and Chinese literature in particular. (Graduate students may register under 276 in which case they will be required to do additional readings in Chinese.)

4 units, Spr (Wang) MWF 11

178 (278). Japanese poetry from Manyōshū to Shinkokinshū (759-1206)—An introduction to Japanese poetry from the earliest times to the early 13th century using English translations of major poems for detailed study. (Graduate students may register under 278, in which case they will be required to do additional readings in Japanese.)

4 units, Win (Doe) WF 2:15-3:30

179 (279). Classical Japanese Drama—The development of Japanese drama from pre-nō popular and ritual forms through nō, 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, Spr (Matisoff) given 1979-80

182 (282). Japanese Popular Religious Literature—Survey of pre-modern Japanese religious thought as reflected in non-canonical literature. Readings in translation include mythology, legends, sermons, selected nō plays, the poetry of Zen monks and more. (Graduate students may register under 282 in which case they will be required to do additional readings in Japanese.)

4 units, Spr (Matisoff) given 1979-80

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. Among the books to be discussed are Soseki's The Three-Cornered World, Kawabata's Snow Country, Tanizaki's Some Prefer Nettles, and Mishima's The Temple of the Golden Pavilion.

5 units, Aut (Ueda) given 1979-80

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, Aut (Yu) M 2:15-4:05

I. COURSES IN CHINESE

All courses (DR:H) unless noted otherwise.

1, 2, 3. First-Year Modern Chinese—Conversation, grammar, reading, elementary composition. Daily sections may be set at the beginning of the quarter to suit schedule requirements. (DR:X)

1. 5 units, Aut (Kao, Shou, Staff) Section 1 MTWThF 9
   Section 2 MTWThF 10
   Section 3 MTWThF 1:15

2. 5 units, Win (Kao, Shou, Staff) Section 1 MTWThF 9
   Section 2 MTWThF 10
   Section 3 MTWThF 1:15

3. 5 units, Spr (Kao, Shou, Staff) Section 1 MTWThF 9
   Section 2 MTWThF 10
   Section 3 MTWThF 1:15

5. Intensive First-Year Modern Chinese—Equivalent to 1, 2, and 3 combined. (DR:X)
   12 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.
   12 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. (DR:X)
   1 to 2 units, Spr (Chuang) Th 2:15-4:05

81, 82, 83. First-Year Cantonese—Conversation, grammar, reading and writing of the most commonly used Chinese dialect outside China.

81. 5 units, Aut (Tsang) MTWThF 9
82. 5 units, Win (Tsang) MTWThF 9
83. 5 units, Spr (Tsang) MTWThF 9

ADVANCED

101, 102, 103. Third-Year Chinese (Modern)—An introduction (using annotated texts) to
newspapers, documents, and belles-lettres. Prerequisite: 23 or equivalent.

101. 5 units, Aut (Chuang) MTWThF 11
102. 5 units, Win (Chuang) MTWThF 11
103. 5 units, Spr (Chuang) MTWThF 11

105. Intensive Modern Chinese—Equivalent to 101, 102, 103 combined. Prerequisite: 23 or equivalent.
   12 units, Sum (Staff) MTWThF 9-12

111, 112, 113. Third-Year Chinese (Classical)—Prerequisite: 23 or equivalent.

111. 5 units, Aut (Kao) by arrangement
112. 5 units, Win (Kao) by arrangement
113. 5 units, Spr (Kao) by arrangement

111A, 112A, 113A. Introduction to Classical Chinese—Does not require knowledge of the language. Prerequisite: 47, or J23, or consent of instructor.

111A. 3 units, Aut (Nivison) given 1979-80
112A. 3 units, Win (Nivison) given 1979-80
113A. 3 units, Spr (Nivison) given 1979-80

121, 122, 123. Advanced Conversation—Prerequisite: 23 or equivalent. (DR:X)

121. 2 units, Aut (Chuang) W 2:15-4:05
122. 2 units, Win (Chuang) W 2:15-4:05
123. 2 units, Spr (Chuang) W 2:15-4:05

131, 132, 133. Chinese for Scientists and Engineers—Prerequisite: 23 or equivalent. (DR:X)

131. 2 units, Aut (Kao) by arrangement
132. 2 units, Win (Kao) by arrangement
133. 2 units, Spr (Kao) by arrangement

199. Individual Reading in Chinese—(Asian Languages majors only). Prerequisite: 103 or consent of instructor. (DR:X)
   4 units, Aut, Win, Spr (Staff) by arrangement

GRADUATE

All Courses (DR:X)

200. Directed Reading in Chinese—Prerequisite: 213 or 223 or consent of instructor.
   Units to be arranged, Aut, Win, Spr (Staff) by arrangement

201, 202. Proseminar—Research methods in Chinese studies. Prerequisite: 113 or equivalent.

201. 5 units, Aut (Dien) W 2:15-4:05
202. 5 units, Win (Dien) W 2:15-4:05
221, 212, 213. Introduction to Modern Chinese Literature—An introduction through the use of annotated texts to: short story, essay, poem, play, and novel. Prerequisite: 103, or 113.

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: 113 or equivalent.

221. Historical Narration 4 units, Aut (Dien) MWF 1:15
222. Philosophical Texts 4 units, Win (Nivison) MWF 1:15
223. Literary Essays 4 units, Spr (Wang) MWF 1:15

243. The Philosophy of Wang Yang-ming—(Same as 143 with additional work requiring knowledge of the language.) 4 units, Spr (Nivison) MWF 1:15

260. Chinese Poetry (I)—Selected readings from the Book of Poetry (Shih-ching; ca. 11th-6th centuries B.C.) with emphasis on critical analysis. Prerequisite: 223 or consent of instructor.

4 units, Aut (Sargent) MWF 10

261. Chinese Poetry (II)—Selected readings in Han, Wei, and Six Dynasties poetry (2nd century B.C.-6th century A.D.), with emphasis on critical analysis. Prerequisite: 260 or consent of instructor.

4 units, Win (Sargent) MWF 10

262. Chinese Poetry (III)—Selected readings in T’ang and Sung poetry (7th-13th centuries A.D.) with emphasis on critical analysis. Prerequisite: 261 or consent of instructor.

4 units, Spr (Sargent) MWF 10

263. T’ang and Sung Lyrics—Selected readings in the songs (ts’u) of the T’ang, Five Dynasties, and Sung periods (8th-13th centuries A.D.), with emphasis on critical analysis. Prerequisite: 262 or consent of instructor.

4 units, Aut (Liu) given 1979-80

264. Yuan and Ming Songs—Selected readings in the songs (san-ch’ü) of the Yuan and Ming periods (13th-17th centuries A.D.), with emphasis on critical analysis. Prerequisite: 263 or consent of instructor.

4 units, Win (Liu) given 1979-80

265. Chinese Critical Texts—Readings in traditional Chinese literary criticism. Prerequisite: 223 or consent of instructor.

4 units, Spr (Sargent) TTh 2:15-4:05

266. Chinese Aesthetic Concepts—(Same as 166 with additional work requiring knowledge of the language.) 4 units, Spr (Liu) given 1979-80

271, 272. Traditional Chinese Fiction—Selected readings in short stories and longer works of fiction from early times to late Ch’ing. Prerequisite: 113 or consent of instructor.

271. 4 units, Aut (Wang) given 1979-80
272. 4 units, Win (Wang) given 1979-80

273, 274. Chinese Drama—Selected readings in dramatic works of the Yuan, Ming, and Ch’ing periods, with emphasis on literary rather than theatrical qualities. Prerequisite: 113 or consent of instructor.

273. 4 units, Aut (Wang) TTh 11-12:30
274. 4 units, Win (Wang) TTh 11-12:30

275. Early Chinese Prose Literature—Selected readings in pre-Han prose texts with emphasis on their literary value in the study of later literature. Prerequisite: 223 or consent of instructor.

4 units, Aut (Wang) given 1979-80

276. Chinese Myths, Legends, and Folktales—(Same as 176 with additional work requiring knowledge of the language.) 4 units, Spr (Wang) MWF 11

291. The Structure of Modern Chinese—Prerequisite: 23 or equivalent. Recommended: a general introductory course in linguistics.

4 units, Spr (Kao) given 1979-80

292. The Chinese Language and Current Linguistic Theories—(Same as Linguistics 292.) Prerequisite: 103 or equivalent. Recommended: a general introductory course in linguistics.

4 units, Spr (Kao) by arrangement

299. Master’s Thesis or Translation.

A total of 5 units, which may be taken in one or more quarters, Aut, Win, Spr (Staff) by arrangement

351. Seminar in Chinese Traditional Historiography—May be repeated for credit. 5 units, Spr (Dien) W 2:15-4:05

361. Seminar in Chinese Literary Criticism—May be repeated for credit. Prerequisite: 265 or consent of instructor.

5 units, Spr (Liu) given 1979-80

371. Seminar in Chinese Narrative—Thorough studies of individual texts with emphasis on theoretical applications. May be repeated for credit. Prerequisite: 272 or consent of instructor.

5 units, Aut (Wang) T 2:15-4:05
II. COURSES IN JAPANESE
All courses (DR:H) unless noted otherwise.

1, 2, 3. First-Year Modern Japanese—Conversation, grammar, reading, elementary composition. Students may attend any convenient daily section. (DR:X)

1. 5 units, Aut (Sakamoto, Nebrig)
   Section 1 MTThF 9
   Section 2 MTThF 11
   Section 3 MTThF 2:15
2. 5 units, Win (Sakamoto, Nebrig)
   Section 1 MTThF 9
   Section 2 MTThF 11
   Section 3 MTThF 2:15
3. 5 units, Spr (Sakamoto, Nebrig)
   Section 1 MTThF 9
   Section 2 MTThF 11
   Section 3 MTThF 2:15

5. Intensive First-Year Modern Japanese—Equivalent to 1, 2, and 3 combined. (DR:X)
   12 units, Sum (Staff) MTThF 8-12

21, 22, 23. Second-Year Modern Japanese—Further instruction and practice in conversation, grammar, reading, and composition. Prerequisite: 20 or equivalent.
21. 5 units, Aut (Kubota) MTThF 9
22. 5 units, Win (Kubota) MTThF 9
23. 5 units, Spr (Kubota) MTThF 9

   12 units, Sum (Staff) MTThF 8-12

27, 28, 29. Intermediate Conversation—Prerequisite: 3 or equivalent (DR:X)
27. 2 units, Aut (Sakamoto) TTh 1:15
28. 2 units, Win (Sakamoto) TTh 1:15
29. 2 units, Spr (Sakamoto) TTh 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) MTThF 11
102. 5 units, Win (Kubota) MTThF 11
103. 5 units, Spr (Kubota) MTThF 11
105. Intensive Modern Written Japanese—Equivalent to 101, 102, and 103 combined. Prerequisite: 23 or equivalent.
   12 units, Sum (Staff) MTThF 9-12
121, 122, 123. Advanced Conversation—Prerequisite: 23 or equivalent (DR:X)
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
All courses (DR:X)

200. Directed Reading in Japanese—Prerequisite: 213 or consent of instructor.
   Units to be arranged,
   Aut, Win, Spr (Staff) by arrangement

201. 5 units, Aut (Matisoff) given 1979-80
202. 5 units, Win (Harries) given 1979-80

211, 212, 213. Advanced Modern Japanese—Readings in modern Japanese scholarly, journalistic and literary prose. Each quarter may be taken separately. Prerequisite: 103 or equivalent.
211. Essays and Scholarly Articles
   5 units, Aut (Matisoff) MW 11-12:15
212. Newspaper Articles
   5 units, Win (Ueda) TTh 11-12:15
213. Fiction
   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 concentrates on basic grammar and vocabulary, while the subsequent quarters involve reading in progressively more difficult texts from the Heian and Kamakura periods. Prerequisite: 103 or equivalent.
246. 5 units, Aut (Doe) by arrangement
247. 5 units, Win (Doe) by arrangement
248. 5 units, Spr (Doe) by arrangement

250. Introduction to Kambun—Selected readings from a variety of Japanese works written in Kambun, ranging from Kaifūsō to Yoshida Shōin's diary.
   4 units, Win (Ueda) given 1979-80
251. Graduate Seminar: Japanese Historical Texts—(Same as History 498.) Medieval historical sources and research methods. The reading of documents in Kambun will be introduced.
5 units, Spr (Mass) given 1979-80

258. Major Haiku Poets—Reading and discussion of selected haiku by Bashō, Buson, Issa, and others. May be repeated for credit.
4 units, Aut (Ueda) TTh 11-12:15

259. Readings in Japanese Criticism—Selected readings of Japanese literary scholars from early to modern times, as an introduction to Japanese critical method and idiom. Prerequisite: 103 or equivalent.
4 units, Win (Harries) given 1979-80

278. Japanese Poetry from Manyoshū to Shinkokinshū (759-1206)—(Same as 178 with additional readings in the original Japanese.) Prerequisite: 247 or equivalent.
4 units, Win (Doe) WF 2:15-3:30

279. Classical Japanese Drama—(Same as 179 with additional work requiring knowledge of the language. Prerequisite: 246 or equivalent.)
4 units, Spr (Matisoff) given 1979-80

282. Japanese Popular Religious Literature—(Same as 182 with additional work requiring knowledge of the language.)
4 units, Aut (Matisoff) MW 2:15-3:30

5 units, Spr (Matisoff) W 2:15-4:05

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 quarter.
5 units, Win (Ueda) M 2:15-4:05

399. Dissertation.
(Staff) by arrangement

400. Advanced Language Training—Open only to students at the Tokyo Center. For more information, see the program description under "Inter-University Center for Japanese Studies in Tokyo." The course is offered on a Pass/No Credit basis.
15 units per quarter, (Staff)

ADDITIONAL INFORMATION
For information concerning other opportunities for study in the Asian field, see listings under the following departmental headings: Anthropology, Art, Economics, Graduate Division Special Programs, History, Law, Philosophy, Political Science, Religious Studies, and Sociology. For additional offerings in literature see Comparative Literature. Students interested in Asian languages not listed above should contact the Special Language Program, Department of Linguistics.

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 (Aeronautics and Astronautics, Applied Physics, Electrical Engineering, Geophysics, 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 15 and 25 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
The University does not offer a separate undergraduate major in astronomy. Students who intend to pursue graduate study in astronomy are encouraged to major in Physics, following the advanced sequence if possible, or in Electrical Engineering if the student has a strongly developed interest in radioscience. The course
descriptions for these basic studies are listed under the appropriate department sections. Students desiring guidance in developing an astronomy oriented course of study should contact the Chairman of the Astronomy Program Committee. Undergraduate Courses: The following courses are suitable for undergraduates interested in astronomy and are recommended to students considering advanced study in astronomy; 101—Introductory Solar Physics; 102—Astronomy Laboratory; 103—Stellar and Galactic Astrophysics; 104—Solar-Terrestrial Relations; 105—Extragalactic Astrophysics and Cosmology; 106—Planetary Exploration; 150—Advanced Astronomy Laboratory. An undergraduate seminar intended for advanced undergraduates and first year graduate students (Astronomy 193) is given each year on a topic of current interest in astronomy.

GRADUATE STUDY

Graduate programs in astronomy and astrophysics and related topics are carried out in the departments of Aeronautics and Astronautics, Applied Physics, Electrical Engineering, and Physics. Students should consult the course listings, degree requirements, and research programs of these departments for more detailed information. Opportunities for research at the graduate level in astronomy and astrophysics are also available within the Institute for Plasma Research and through the Space Science Program which are described in this bulletin.

The following courses are recommended for students planning to conduct research in astronomy and astrophysics: 356—Astrophysics Laboratory; 360—The Sun and Solar Terrestrial Relations; 362—Physical Processes in Stars; 364—Plasma Astrophysics; 365—Physical Processes in the Galaxy; 366—Cosmology and Extragalactic Astrophysics; 368, 369—Gravitation. A graduate seminar (Astronomy 370) is given each year on a topic of current interest in astronomy or astrophysics.

Students interested in the research programs involving spacecraft studies of the planets, their satellites, and their near-space environments should consider the following courses: 227—Atmospheric and Space Physics; 295—Physics of Planetary Interiors; 350—Radioscience Seminar; 352—Propagation of Waves in the Ionospheres and Magnetospheres; 354—Theory and Application of Radio Wave Scattering.

COURSES

All courses of three or more units are (DR:T) 15. Topics in Modern Astronomy—The following three quarters are addressed to students not majoring in the sciences. They are taught in different courses by different instructors but are closely related in topic. Students are advised against taking more than one of the courses.

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. No prerequisites.

3 units, Aut (Petrosian) MWF 11

Cosmic Evolution—(Enroll in Physics 15.) This course proposes to familiarize the humanities or social science student with part of modern physics. 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, but some algebra will be used.

3 units, Win (Liang) MWF 11
discussion to be arranged

Modern Astronomy—(Enroll in Applied Physics 15.) A non-mathematical examination of the components of the universe from stars to quasars including their origin, evolution and mutual relationship to the universe as a whole. Discussion will emphasize current accepted concepts and also those that are speculative. The impact of recent and ongoing research results will be reviewed. There will be opportunities for telescopic observations during the quarter. No prerequisites.

3 units, Spr (Stern) MWF 11

25. Extraterrestrial Intelligent Life—(Enroll in Applied Physics 25.) This discussion of the possible existence of extraterrestrial intelligent life, and the prospects of contact with extraterrestrial civilizations, will be based on present-day knowledge of the physical universe and on the capabilities of technology as we can now assess them. Relevant astronomical information includes galactic structure, star types, solar planets, and evidence for planets associated with other stars. This is followed by discussion of chemical and biological evolution and the development of intelligence and technology. The prospects of radio communication, interstellar
probes, interstellar travel and space colonization will be evaluated. Purported evidence (archeological, historical and current) for extraterrestrial visitation will be reviewed. No prerequisites.

3 units, Win (Sturrock) TTh 2:15-3:30


3 units, Aut (Underwood) MWF 1:15-2:05

102A,B,C. Astronomy Laboratory and Observational Astronomy—Theory and use of an optical telescope and the interpretation of basic observational data to determine the physical properties of planets, stars, and galactic systems. The course consists of individual observations with a 16-inch Cassegrainian telescope supplemented by lectures which will include discussions of basic observational techniques, astronomical catalogs and coordinate systems, and the relation of observations to astrophysical models. Laboratory programs include the photographic study of the moon, planets, nebulae, binary star systems, stellar clusters, and galaxies; photometric studies of variable stars and close binary systems; and spectral studies of selected bright objects. Students may also develop additional instrumentation for the observatory. In addition to the introductory material described above, the lecture series will emphasize a different area of astronomical research each quarter, including such topics as planetary astronomy, stellar observations and spectral classification, stellar clusters and associations, binary star systems, diffuse nebulae, the interstellar medium, and extragalactic observations. No prerequisites.

102A. 3 units, Aut (Knight) lecture M 4:15, laboratory by arrangement
102B. 3 units, Win (Stern) lecture T 4:15, laboratory by arrangement
102C. 3 units, Spr (Staff) lecture T 4:15 laboratory by arrangement

103. Stellar and Galactic Astrophysics—(Enroll in Applied Physics 103.) Introduction to stellar and galactic astrophysics: galactic structure, interstellar medium, element abundance, star formation, stellar evolution, planetary nebulae, binary and variable stars, novae, supernovae. Modern developments: pulsars, x-ray stars, black holes, x-ray bursts. Prerequisites: one year college physics at the Physics 50 series or equivalent level, or Astronomy 101.

3 units, Win (Liang) TTh 2:15-3:30


3 units, Win (Svalgaard) MWF 1:15-2:05


3 units, Spr (Petrosian) TTh 2:15-3:30

106. Planetary Exploration—(Enroll in Electrical Engineering 106.) Analysis and description of characteristics of the planets, their satellites, and near space environments, with emphasis on recent work using space probe, radio and radar methods of exploration. Comparative properties of the terrestrial and Jovian planets; planetary atmospheres, surfaces, interiors; rings of Saturn; planetary and satellite orbits and spacecraft trajectories, orbital perturbations; properties of the interplanetary gas, dust, comets, and meteorites. Origin and evolution of planetary systems. Remote sensing from spacecraft at radio, infra-red, light, and ultraviolet wavelengths. U.S. and Soviet space programs and their comparative engineering and scientific aspects. Prerequisites: one year of college engineering, mathematics, or physics.

3 units, Spr (Eshleman) MW 2:15-3:30

150A,C. Advanced Astronomy Laboratory—The purpose of this course is to train students to carry out independent research in optical astronomy using the 16-inch Cassegrainian telescope. Selected topics of study might include the photometry and astrometry of asteroids UBV photometry of pulsating stars, or the design of specialized instrumentation for the 16-inch Cassegrainian telescope. Prerequisites: Astronomy 102. Open to qualified graduates and undergraduates on consent of the instructor.

150A. 3 units, Aut (Walker) lecture T 4:15 laboratory by arrangement
150C. 3 units, Spr (Walker) lecture T 4:15 laboratory by arrangement
193. Astrophysics Seminar: X-Ray Astronomy—(Enroll in Applied Physics 193.) The study of x-rays from the sun and from galactic and extragalactic objects has opened up a new field of astronomy. This course is intended to introduce the student to this important new field of astronomy. Topics will include mechanisms of x-ray emission; experimental techniques in x-ray astronomy; the solar corona, and evidence of coronae in other stars; galactic x-ray sources; supernovae remnants, pulsars, x-ray binaries; extragalactic x-ray sources; x-ray emission from normal galaxies, quasars, Seyfert galaxies, and clusters of galaxies. Prerequisites: Astronomy 101 or 103 or 105 or consent of the instructor.
3 units, Spr (Walker) by arrangement

3 units, Aut (Kovach) by arrangement alternate years, given 1978–79

222. Classical Gravitation—(Enroll in Physics 222.)
3 units, Spr (Staff) alternate years, given 1978–79

227. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)
3 units, Aut (Spreiter) TTh 2:45–4:00 alternate years, given 1979–80

279A. Space Mechanics—(Enroll in Aeronautics and Astronautics 279A.)
3 units, Win (Powell) TTh 9:30–10:45

279B. Advanced Space Mechanics—(Enroll in Aeronautics and Astronautics 279B.)
3 units, Spr (Breakwell) MWF 10 alternate years, given 1978–79

350. Radioscience Seminar—(Enroll in Electrical Engineering 350.)
1 unit, Aut, Win (Lusignan) by arrangement

352. Wave Propagation in the Ionosphere and Magnetosphere—(Enroll in Electrical Engineering 352.)
3 units, Spr (Helliccell) alternate years, given 1978–79

354. Theory and Application of Radio Wave Scattering—(Enroll in Electrical Engineering 354.)
3 units, Spr (Tyler) by arrangement alternate years, given 1979–80

356A. Astrophysics Laboratory I—(Enroll in Applied Physics 356A.)
3 units, Sum (Walker) M 9–12 plus laboratory by arrangement

356B. Astrophysics Laboratory II—(Enroll in Applied Physics 356B.)
3 units, Sum (Walker) T 9–12 plus laboratory by arrangement

360. The Sun and Solar-Terrestrial Relations—(Enroll in Applied Physics 360.)
3 units, Aut (Sturrock) TTh 2:30 alternate years, given 1978–79

3 units, Win (Petrosian) MWF 11 alternate years, given 1978–79

364. Plasma Astrophysics—(Enroll in Applied Physics 364.)
3 units, Spr (Sturrock) alternate years, given 1979–80

365. Physical Processes in the Galaxy—(Enroll in Applied Physics 365.)
3 units, Spr (Staff) TTh 2:15–3:30, alternate years, given 1978–79

366. Cosmology and Extragalactic Astrophysics—(Enroll in Applied Physics 366.)
3 units, Spr (Petrosian) MWF 11 alternate years, given 1979–80

368, 369. Gravitation—(Enroll in Physics 368, 369.)
368. 3 units, Aut (Will) MF 11–12:30 alternate years, given 1979–80
369. 3 units, Win (Will) MF 11–12:30 alternate years, given 1979–80

Review of radiation processes. Observational techniques. Observations and models of galactic x-ray and EUV sources including binary x-ray stars, supernova remnants, stellar coronae, and hot subluminous stars. Extragalactic sources: active galaxies, clusters of galaxies. The diffuse background at x-ray and EUV wavelengths. Special attention will be paid to recent observational results from HEAO-1 and other satellites. Prerequisites: consent of instructor.
3 units, Aut (Stern) by arrangement

381. The Radiation Process—(Enroll in Applied Physics 381.)
3 units, Win (Wright) MWF 11 alternate years, given 1978–80

382. The Cloudy Sun—(Enroll in Applied Physics 382.)
3 units, Spr (Giese) MWF 11 alternate years, given 1979–80

BIOLOGICAL SCIENCES


Chairman: Robert T. Schimke
Associate Chairman: Marcus W. Feldman
Director of Undergraduate Studies: Ward B. Watt
Director of Graduate Studies: Marcus W. Feldman

Professors: Donald P. Abbott, Isabella A. Abbott, Winslow R. Briggs, Allan M. Campbell,
OFFERINGS AND FACILITIES

The Department of Biological Sciences comprises facilities and personnel housed in Herrin Laboratories, Herrin Hall, and the Jasper Ridge Preserve 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 provides a 1,000-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 Department's large collections of plants (Dudley Herbarium), fishes, reptiles, and amphibians, as well as smaller collections of birds, mammals, and invertebrates 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 to those interested in the systematics of these groups. 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.

The Falconer Biology Library in Herrin Hall contains over 1600 current subscriptions and back sets of journals, and an extensive collection of monographs and reference works. A specialized library serves the needs of the Hopkins Marine Station.

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. The Biology Bridge is a student-operated adjunct to departmental advising.

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology</td>
<td></td>
</tr>
<tr>
<td>A group of specified core courses in</td>
<td></td>
</tr>
<tr>
<td>biology or their equivalents</td>
<td></td>
</tr>
<tr>
<td>Biology 1</td>
<td>5</td>
</tr>
<tr>
<td>Biology 21</td>
<td>4</td>
</tr>
<tr>
<td>Biology 22</td>
<td>4</td>
</tr>
<tr>
<td>Biology 23</td>
<td>3</td>
</tr>
<tr>
<td>Biology 24YZ</td>
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<tr>
<td>Total</td>
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(2) Elective Courses

<table>
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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Electives</td>
<td>18</td>
</tr>
<tr>
<td>Total Core and Electives</td>
<td>40</td>
</tr>
</tbody>
</table>

Selected courses meeting Biology elective requirements are: Genetics 249, Cytogenetics; Hearing and Speech Sciences 281, Seminar in Animal Communication; Medical Microbiology 103, Bacterial Physiology and Ecology, and 204, Bacterial Genetics; Radiology 201, Biological Effects on Radiation.
Additional 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 Student Affairs Office. In completing the elective course requirement, a biology major must take approved elective courses from at least three faculty members.

Not more than 10 units from a single faculty member or in a single specialized field from "in-depth" courses, such as 169, 175H, 178, 198, 199, 199H, 253, may be applied toward the total number (40) of required biology units.

Cognate Courses
Required courses in cognate fields include:
- Introductory, organic, and physical chemistry, with laboratory.
- A half year (two quarters) of General Physics Mathematics through Calculus
- One additional course in Mathematics, Statistics, or Computer Science to be taken in third or fourth year

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
- Chemistry 35, 36, 131, 130 or 132, and 135
- Mathematics 19, 20, 21, or 41, 42
- Physics 21, 23 or 51, 53, 55
- Mathematics 44 or beyond
- Biology 141, Psychology 60, or Statistics 60 or beyond
- Computer Science 105 or 106, Industrial Engineering 140

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 foreign language.

In addition to the mathematics requirement, it is strongly recommended that students take at least one additional course in statistics and probability.

**TYPICAL SCHEDULE FOR A FOUR-YEAR MINIMUM PROGRAM**

<table>
<thead>
<tr>
<th>First Year</th>
<th>Course No.</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>A W Sp</td>
<td>Introductory Chemistry</td>
<td></td>
</tr>
<tr>
<td>R D D</td>
<td>Biology 1, Introductory Biology</td>
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</tr>
</tbody>
</table>

**Second Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tr>
<td>A W Sp</td>
<td>Biology 21, Principles of Biology</td>
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<td>3</td>
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</table>

**Third Year**

<table>
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<th>Course No.</th>
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<tr>
<td>A W Sp</td>
<td>Physics 21, 23, Introductory Physics</td>
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**Fourth Year**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tr>
<td>A W Sp</td>
<td>Electives</td>
</tr>
<tr>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>

**HONORS PROGRAM IN BIOLOGICAL SCIENCES**

An Honors Program in Biological Sciences 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 pre paramedical 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, 130 or 132, and 135 at Stanford. After a year's course in organic chemistry, Chemistry 130 or 132, and 135 are required. Transfer units are not lost, but are applied to requirements other 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’s 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 served 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. At least 33 units must be completed in a combination of biology and cognate courses, of which at least 24 must be in Biological Sciences or authorized biology equivalent courses. Students must take a substantial portion of these 24 units in biology courses rather than out-of-department equivalents. 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. A more detailed description of the Master's Degree Program may be obtained from the Student Affairs Office of the Department.

**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 and the advanced biology test of the Graduate Record Examination as part of the application. It is strongly recommended that the GRE be taken in October so that scores will be available when applications are evaluated. 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 initia-
tive 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, Structural Biology, 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 student in each of four or more Stanford faculty members. Course work to be taken will be determined in consultation with the appropriate department. A Biophysics Program is offered in this Department.

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 students. 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 4:00. 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—At the time of graduate admissions, each incoming graduate student is assigned an advising committee, consisting of three faculty members, one of whom will be as close as possible to the student's stated area of interest. The purpose of the advising committee is threefold: (1) to counsel first-year students on course work and research opportunities, (2) to evaluate progress toward qualification, and (3) to assist in organization of the dissertation committee.

As the Department requires its Ph.D.'s to have breadth of knowledge in diverse areas of biology as well as expertise in a specialized area, the advising committee is primarily responsible for assistance in assuring breadth of knowledge. The means used to judge breadth consist of (1) review of undergraduate training, (2) performance on a prescriptive examination (given before beginning of the first fall quarter), and (3) personal contact with students during the entire first year. If deficiencies are present, the advising committee may advise particular course work, directed reading, or other remedial work. Students are strongly urged to take advantage of this opportunity for continuous interaction with the faculty, not only to get feedback on progress but, equally important, to become acquainted with the opportunities of the Department.

At the end of the first year, the advising committee will evaluate student progress and recommend to the departmental faculty that the student deserves qualification to the Ph.D. program. If in the opinion of the advising committee and the student a delay in qualification is appropriate, qualification may be postponed until no later than the end of the next fall quarter.

The third function of the advising committee is to assist students in the organization of the dissertation committee, which is primarily responsible for advancement to candidacy and assistance in future training. No later than the end of the winter quarter of the second year, the student, in consultation with the dissertation committee, submits a dissertation proposal describing the area of specialization and a general outline of proposed research. The student then takes an oral examination from the dissertation committee on the proposed dissertation and on the area of specialization. Passing the oral examination, normally not to exceed two hours, automatically leads to departmental certification of candidacy. If the oral examination is not passed, it may be retaken no later than five days before the end of the next spring quarter (second year). The dissertation committee will remain active for advice and guidance during the remainder of a student's graduate training, including the period of dissertation preparation and oral defense. Work should be planned so as to complete the entire Ph.D. program within four years.
Language Requirement—A foreign language may be required by the major professor but is not required by the Department.

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.

COURSES
All courses (DR:T) if taken for three or more units unless noted otherwise.

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 M endelian 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) TTh F

   Discussions (Staff)
   M 1:15-3:05
   M 3:15-5:05
   T 1:15-3:05
   T 3:15-5:05
   W 1:15-3:05
   W 3:15-5:05
   Th 1:15-3:05
   Th 3:15-5:05
   T 7:30-9:30 p.m.
   Th 7:30-9:30 p.m.

   3 units, Win (Ehrlich, Holm) TTh 11, alternate years, given 1979-80

21.32.23. 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. An intermediate level course which expands upon material covered in Biology 1, with emphasis on biochemistry, molecular genetics, and cell biology.
   4 units, Aut (Simoni, Yanofsky)
   MTWTh lecture, F discussion 10

22. Topics in the development and physiology of plants and animals.
   4 units, Win (Green, Heller) MTWTh 9

23. Coverage at an intermediate level of population genetics, evolution, population ecology and community ecology. Applications to human populations will be included.
   3 units, Spr (Feldman, Roughgarden)
   MWF 9

24. Experimental Biology—The intent of these laboratory exercises is to familiarize the students with an experimental approach to biology and to provide a working familiarity with many of the organisms, phenomena, experimental techniques, and equipment described in various lecture courses in biology. This laboratory continues through two quarters and consists of 18 laboratory periods of four hours each and 18 two-hour discussion periods. The course is designed to be taken currently with or subsequent to Biology 21, 22, 23. Prerequisites: 1, and Chemistry 31, 33, 35, 36. Grading is mandatory Pass/No Credit.

24Y. 3 units, Win (Allen) labs and discussion
   Th 1:15-5:05, T 1:15-3:05
   Th 1:15-5:05, T 3:15-5:05
   T 1:15-5:05, Th 1:15-3:05
   T 1:15-5:05, Th 3:15-5:05
   F 1:15-5:05, W 1:15-3:05
   F 1:15-5:05, W 3:15-5:05
   W 1:15-5:05, F 1:15-3:05
   W 1:15-5:05, F 3:15-5:05
   W 1:15-5:05, Th 7:00-9:00
   W 2:15-6:05, F 3:15-5:05
   T 2:15-6:05, Th 3:15-5:05
   Th 1:15-5:05, T 7:00-9:00
24Z. 3 units, Spr (Allen) labs and discussion
Th 1:15-5:05, T 1:15-3:05
Th 1:15-5:05, T 3:15-5:05
T 1:15-5:05, Th 1:15-3:05
T 1:15-5:05, Th 3:15-5:05
F 1:15-5:05, W 1:15-3:05
F 1:15-5:05, W 3:15-5:05
W 1:15-5:05, F 1:15-3:05
W 1:15-5:05, F 3:15-5:05
W 1:15-5:05, Th 7:00-9:00
W 2:15-6:05, F 3:15-5:05
T 2:15-6:05, Th 3:15-5:05
Th 1:15-5:05, T 7:00-9:00


95. Practical Plant Biology—Introduction to botanical information and techniques applicable to horticulture, the growing of cultivated plants. Study of principles; laboratory sessions for basic botanical observations and experiments; plus practical work in greenhouse and field plot raising representative crop plants. (DR:X)
4 units Spr (Ray) TTh 11, lab
M or T 1:15-4:05 plus 3 hours per week in the field by arrangement

UPPER DIVISION COURSES

100H. Marine Algae—See Hopkins Marine Station.

105H. Subtidal Communities—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 (Jones) TTh 10-11:30

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. Organisal 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, Spr (Wessells) MWF 9

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

110L. Vertebrate Biology Laboratory—Dissection of selected vertebrates. Pass/No Credit only. Prerequisites: same as for 110. (DR:X)
2 units, Aut (Miller and Wessells) labs.
T, W, Th, or F 1:15-5:05

111H. Marine Invertebrates—See Hopkins Marine Station.

112H. Marine Invertebrates—See Hopkins Marine Station.

113H. Introduction to Oceanic Biology—See Hopkins Marine Station.

121H. Microbial Ecology—See Hopkins Marine Station.

123. Topics in Ecology—Readings and discussions in selected topics in ecology. The theme varies each year, and the course may be repeated for credit. Prerequisite: consent of instructor. (DR:X)
2 units, Win (Mooney and Roughgarden)
Th 3:15

123H. Invertebrate Biology—See Hopkins Marine Station.

124H. Special Problems in Microbial Ecology—See Hopkins Marine Station.

125. Ecosystems of California—Principles of ecosystem function with emphasis on vegetation components and on California systems. Prerequisite: 23, or Human Biology 4A.
4 units, Win (Mooney) TTh 11; field trips by arrangement

125H. Developmental Biology—See Hopkins Marine Station.

126H. Experimental Analysis of Embryonic Development—See Hopkins Marine Station.

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. Prerequisite: consent of instructor.
3 units, Win (Page) TTh 2:15-4:05

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 score of the most common genera is involved. Use of these organisms in investigation of cell biology, developmental problems, and ecology is discussed. Lectures, laboratory, and field trips (one to Hopkins Marine Station). Prerequisites: 21 and 22.

4 units, Win (Fultz) MWF 2:15, lab. T 1:15-4:05

130H. Biological Clocks—See Hopkins Marine Station.

131. Mosses and Ferns—Structure, development, evolutionary relationships of mosses and ferns. Lectures, laboratories, and field trips. Prerequisite: 22 and 23, or consent of instructor.

5 units, Aut (Thomas) WF 2:15-5:05, alternate years, given 1978–79

132. Seed Plants—Structure, development, evolutionary relationships of seed plants. Lectures, laboratories, and field trips. Prerequisites: 22 and 23.

5 units, Spr (Holm) TTh 1:15-2:05, lab. TTh 2:15-5:05

133. Plants and Civilization—Discussion of the economic uses of plants and plant substances. Food, fiber, medicinal, and structural uses will be considered from a biological and ecological point of view. Lectures and demonstrations. Prerequisites: Biology or Human Biology core, or consent of instructor.

4 units, Win (Holm, Thomas) MWF 10

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) TTh 4:15-5:05, alternate years, given 1979–80

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 7-9

140. Highlights in Photobiology—Basic principles of the action of light upon biological systems. Lectures and student reports on special topics including: photosynthesis, photoperiodism, phototropism, vision, photoinactivation and recovery. Prerequisites: 21 and 22.

3 units, Win (Briggs and Hanawalt) TTh 11, alternate years, given 1979–80

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

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) MWF 9

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 introductory organic chemistry or biochemistry.

4 units, Win (Ray) MWF 10 plus W 2:15-3:05

160H. Problems in Subtidal Ecology—See Hopkins Marine Station.

161. Topics in Evolutionary Biology—Current methods of approach to such evolutionary subjects as tempo and mode, origin of major categories, cytogenetics, hybridization. Prerequisites: 22, 23.

3 units, Aut (Holm) TTh 11, alternate years, given 1978–79

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 1979–80

163. Animal Behavior: Developmental Aspects—Roots of behavior, naive behaviors, sensitive periods; significance of early experiences on processes of socialization; reproductive behavior; parental-young bonding; development of communication. 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. Lectures and student reports. Prerequisites: 1 and 22.

3 units, Aut (Shaw) TTh 11

164. Animal Behavior: Neurobiological Aspects—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. Prerequisites:
22, or Human Biology 2A, or Psychology 107, or 108, or 109 is recommended.

4 units, Win (Wine) MWF 10, alternate years, given 1979–80

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. Prerequisite: 1.

3 units, Spr (Heller) MWF 11, alternate years, given 1978–79

165H. Experimental Neurobiology—See Hopkins Marine Station.

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

166H. Comparative Neurobiology—See Hopkins Marine Station.

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 1978–79

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.

178. Biology of Natural Populations—Introduction to independent study of natural populations. Jasper Ridge serves as an outdoor laboratory for course. Prerequisite: consent of instructor; preparatory study in 199 during previous quarter recommended. Grading is mandatory Pass/No Credit.

10 units, Spr (Mooney) by arrangement

179H. Comparative Physiology—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 instructor.

3 units, Win (Thomas) W 2:15-4:05, alternate years, given 1979–80

182. Empirical Population Genetics—The results of experimental field and human population genetics studies will be discussed. Relationship to theory introduced.

3 units, Aut (Feldman) MWF 1:15, alternate years, given 1978–79

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. 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 1979–80

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 3A and consent of instructor.

3 units, Spr (Ehrlich) M 2:15-4:05, alternate years, given 1979–80

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. Prerequisite: 23 or Human Biology 3A.

3 units, Spr (Ehrlich, Holm) M 2:15-4:05, alternate years, given 1978–79

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

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, 24Y and 24Z, high school physics.

3 units, Aut (Green) lec TTh 1:15; lab. T or Th 2:15-5:05

195. Applied Ecology—Independent studies at the Jasper Ridge Biological Preserve. Directed research on the application of ecological principles to the management of natural systems. Prerequisite: consent of instructor.

1-3 units, Aut, Win, Spr (Ehrlich, Feldman, Holm, Mooney, Roughgarden, and Thomas) by arrangement

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

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 on 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**

205. DNA Repair and Mutagenesis—Interactions of mutagens and carcinogens with DNA. Response of living systems to damaged genetic material, including molecular mechanisms for DNA repair. Enzymology of DNA modification and repair. Inducible repair responses and "error-prone" mechanisms. Human hereditary deficiencies in DNA repair. Relationships of DNA repair and mutagenesis to carcinogenesis. Prerequisite: 21 and/or consent of instructor.

3 units, Spr (Hanawalt, Friedberg, K.C. Smith) TTh 1:15,
alternate years, given 1978-79

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 1978-79 will be lower plants as materials for genetic research. Prerequisites: 166, 167 or equivalent, and consent of instructor.

2 units, Aut (Perkins) F 12-1

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,
alternate years, given 1979-80

213. Viruses—Principles of virus growth, genetics, architecture and assembly. Relation of temperate viruses and other episomes to the host cell. Prerequisite: 21.

3 units, Aut (Campbell) MWF 9

215. Biochemical Evolution—Lectures and discussion periods covering biochemical viewpoints on diverse aspects of the evolutionary process. Topics will include, but not be limited to: prebiotic biochemistry and the origins of life; adaptive organization of metabolism; enzyme polymorphisms and other biochemical aspects of population genetics; "macromolecular phylogeny" and "protein clocks." Prerequisites: 1, 21, 22, and 23, or substantial equivalents.

3 units, Win (Watt) MWF 9,
alternate years, given 1978-79

220. Advanced Concepts in Population Biology—Designed for graduate students and advanced undergraduates. Survey of population ecology, population genetics, evolutionary theory, biogeography, taxonomy, demography,
community ecology and physiological ecology. The course is a two-quarter sequence which must be completed to obtain credit. Required of all first-year graduate students in the population biology area, and recommended to graduate students in other areas who need to fulfill breadth requirements in population biology. Undergraduates require permission of committee in charge. Committee in charge for 1978-79: Ehrlich, Roughgarden. Prerequisite for undergraduates: 23.

4 units, Aut, Win (Ehrlich, Feldman, Holm, Mooney, Roughgarden, Thomas, Watt) MWF 11

251. 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, Ray) MW 1:15-3:15

248. Regulatory Biochemistry in Higher 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.

4 units, Win (Schimke) TTh 4:15

plus 1 hour by arrangement

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, Aut (Hanawalt) TTh 10 and T 7:15-10:00 p.m.


3 units, Spr (Yanofsky) TTh 9:00-10:30

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 the field of neurobiology.

8 to 15 units, Spr (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 1979-80: biophysical approaches to unit properties of excitable membranes, neurons, and synapses. Prerequisites: 152 or equivalent and elementary calculus.

3 units, Aut (Getting) by arrangement, alternate years, given 1979-80

265. Field Studies in Animal Behavior—The sociobiology of insects, fish, amphibians, birds, and mammals, free-ranging and in captivity. Individual research projects dealing with courtship, parental care, communication, social organization, and ecology. Field station on campus. Prerequisite: consent of instructor. Enrollment limited.

5-15 units, Spr (Shaw) by arrangement

266. Field Studies in Animal Behavior—as above. Prerequisite: 265.

5-15 units, Sum (Shaw) by arrangement

279. Mathematical and Computer Models of Biological Systems—Mathematical frameworks and computer techniques for constructing dynamic models of biological systems. Deterministic and stochastic models; estimation of parameters; sensitivity calculations; comparison of predictions with experimental and field data; display techniques. Examples drawn from several areas of biology, with emphasis on neural systems. Individual term projects drawn from student's field of special interest. Open to undergraduates. Prerequisites: biology core, calculus, probability or statistics, basics of computer programming, and consent of instructor.

3 units, Win (Perkel) TTh 11, additional session to be arranged

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 1979-80

283H. Bioactive Marine Natural Products—See Hopkins Marine Station.

284H. Marine and Amphibian Neurotoxins—See Hopkins Marine Station.

285. Models in Mathematical Biology—A course for advanced undergraduates and beginning graduate students in biology and mathematics. Topics will include the elements of population genetics and ecology, theory of enzyme kinetics, and introduction to models in neurophysiology.
3 units, Win (Feldman, Karlin) MWF 9 alternate years, given 1978-79

3 units, Win (Roughgarden) TTh 11 alternate years, given 1978-79

288. Empirical Topics in Population Ecology—Lectures on field studies of natural populations with special reference to vertebrates. Also included are lectures on mark-recapture methods and other techniques used in field studies of vertebrates.
3 units Win (Roughgarden) TTh 11 alternate years, given 1979-80

290. Teaching of Biological Science—Practical experience in teaching laboratory biology or serving as a course assistant in a lecture course. Open to upper division and graduate students.
Aut, Win, Spr (Staff) by arrangement

300. Research.
(Staff) by arrangement

300H. Research—See Hopkins Marine Station.

345. Seminar in Genetics and Molecular Biology—Enrollment limited to graduate students directly associated with departmental research groups in genetics or molecular biology.
1 unit, Aut, Win, Spr (Campbell, Hanawalt, Perkins, Simoni, Woodward, Yanofsky) by arrangement

346. Seminar in Regulatory Biology—Literature review of elected topics in eukaryote regulatory biology. Prerequisite: consent of instructor.
1 to 3 units, Aut, Win, Spr (Schimke) T 12-1

349. Seminar in Population Ecology of Insects—Prerequisite: consent of instructor.
1-3 units, Aut, Win, Spr (Ehrlich, Holm) by arrangement

351. Seminar in Neurobiology—Current research projects and problems in neurobiology, with particular emphasis on invertebrate neurophysiology. Prerequisite: 152 or equivalent and consent of instructor.
1 unit, Aut, Win, Spr (Getting, Perkel)
M 12:00-1:15

352. Seminar in Developmental Biology—Literature and research review of selected topics in development. Prerequisite: consent of instructor.
1 to 3 units, Aut, Win, Spr (Wessells, Green) by arrangement

354. Seminar in Population Biology—Prerequisite: consent of instructor.
1 to 3 units, Aut, Win, Spr (Ehrlich, Feldman, Holm, Mooney, Roughgarden, Thomas, Watt) by arrangement

365. Seminar in Animal Behavior—Literature and research review of selected topics in animal behavior. Oral presentation by students, faculty and guests. Discussions. Prerequisite: consent of instructor.
1 to 3 units, Aut, Win, Spr (Shaw)
W 4:15-5:05

383. 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.
1 to 3 units, Aut, Win, Spr (Feldman) by arrangement

384. Seminar in Population Ecology—Discussions of recent and classical research papers in ecology, and presentation of work in progress by seminar participants. Prerequisite: consent of instructor.
1 to 3 units, Aut, Win (Roughgarden) by arrangement

DIVISION OF MARINE BIOLOGY
HOPKINS MARINE STATION
Emeriti: Lawrence R. Blinks, Arthur C. Giese, Cornelis B. vanNiel (Professors)
Director: Colin S. Pittendrigh
Associate Director: Donald P. Abbott
Professors: Donald P. Abbott, Isabella A. Abbott, David Epel, John H. Phillips, Jr., Colin S. Pittendrigh
Assistant Professor: Stuart H. Thompson
Senior Lecturer: Charles H. Baxter
Lecturer by Courtesy: Robin D. Burnett
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 Lawrence Blinks Laboratory, the Alexander Agassiz Laboratory, the Jacques Loeb Laboratory, and the Monterey Boat Works, which houses the C. B. vanNiel Library, the Walter K. Fisher Lecture Hall, and SCUBA diving facilities. 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 93950.

AUTUMN, WINTER, AND SPRING
QUARTER COURSES

30H. Introduction to Marine Biology—A survey of the biology of marine organisms structured on an examination of local habitats. Material treated for each habitat will include an introduction to the groups of organisms, physical and ecological characteristics of the habitat, and a selection of physiological, ecological, and behavioral characteristics of the organisms. Lectures, lab, and field trips. Prerequisite: an introductory biology course.
4 units, Aut (Baxter) by arrangement

121H. 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. Lectures, laboratories, and discussion periods.
4 units, Aut (Phillips) by arrangement

123H. Invertebrate Biology—A consideration of organismal diversity by an evolutionary approach to the invertebrates. Within the systematic framework of the invertebrate groups, topics in behavior, classification, ecology, evolution, morphology, and physiology will be presented. Lectures, laboratories, and field trips. Prerequisite: background in general biology.
3 units, Win (Baxter) by arrangement

124H. Special Problems in Microbial Ecology—The focus is on the function of one or more of the major physiologic types of microorganisms in an environmental setting. Some aspect of the marine environment will generally be selected. Both the chemical changes produced by the microorganisms and their population dynamics will be investigated through individual research. Lectures and labs. Microbial Ecology 121H, is recommended but not required.
4 units, Win (Phillips) by arrangement

126H. Experimental Analysis of Embryonic Development—Lecture and laboratory course will analyze embryonic development from both a descriptive and experimental viewpoint. Lectures will review our current knowledge as learned from the analysis of development of microbes, plants, and invertebrate and vertebrate animals. Labs will utilize marine embryos to illustrate and experimentally analyze such developmental phenomena as oogenesis, egg maturation, fertilization, cleavage, gastrulation and gene action.
5 units, Aut (Epel) by arrangement

130H. Biological Clocks—The comparative physiology of innate circadian, circa-tidal, circa-lunar and circa-annual rhythmicity in organisms (unicellulars, plants, and animals). The oscillatory pacemakers that drive these rhythms function as "clocks" which the organism uses (1) to measure environmental time, and (2) to organize an internal temporal order in its physiological processes. The circadian system in Drosophilia is analyzed in detail as a model that clarifies a wide range of phenomena in other organisms, including man. Specific attention is paid to (1) the role of circadian clocks in animal navigation and the time-measurement in photoperiodic phenomena, (2) recent progress in the localization of circadian pacemakers in the nervous system, and (3) current knowledge of the genetics and molecular basis of the pacemaker. Lectures and labs.
5 units, Aut (Pittendrigh) by arrangement

166H. Comparative Neurobiology—Principles of nervous system organization are developed from the comparative study of excitability, sensory receptors, sensory and motor sys-
tions, and integrative mechanisms with the CNS. Lectures, labs and field trips.
5 units, Aut (Thompson) MWF

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, Phillips) MTWThF 8-5

179H. Comparative Physiology—An examination into the diverse ways in which animals cope with environmental stresses and with their needs for internal constancy. Emphasis is on the physiology of marine invertebrates. In the laboratory, students will be asked to do innovative work and to learn established techniques.
5 units, Win (Burnett) by arrangement

199H. Special Problems—Properly qualified undergraduate students may undertake individual work in the fields indicated under course 300H, listed 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 M.S. Program. Arrangements must be made by consultation or correspondence.
(Staff) by arrangement

284H. Marine and Amphibian Neurotoxins—The use of marine and amphibian neurotoxins as specific tools in neurobiology. The series of lectures will present the chemical nature, mechanism of action, and structure-activity relationships of several neurotoxins that are useful in explaining specific details of the function of nerves. The substances discussed will include saxitoxin, tetrodotoxin, chiroitoxin, ciguatoxin, Anemonia sulcata Toxin II, bactrochotoxin, Condylactis toxin, and pyrnnesin.
2 units, Win (Fuhrman) by arrangement

300H. Research—Graduate study involving original work may be undertaken with members of the staff in the fields indicated below.
R. Burnett: Invertebrate Biology—Field and laboratory investigations of marine invertebrates, especially crustaceans.
D. Epel: Developmental Biology—Physiology and regulation of early embryonic development.
F. Fuhrman: Physiology and Pharmacology—Toxins from marine organisms and comparative pharmacology.
C. Pittendrigh: Biological Clocks—The comparative physiology of circadian and other biological clocks.
S. Thompson: Neurophysiology—Neuronal control of behavior and mechanisms of ion permeation in membranes.

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 Academic Secretary, 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—An introduction to the marine algae of the Pacific Coast with emphasis on morphology and taxonomy; field work will introduce marine algal ecology. Lectures, laboratory, and field studies will concentrate on the conspicuous benthic algae, with some work on major phytoplankton groups. Individual research problems are encouraged. Prerequisite: elementary botany or general biology.
6 units (I. Abbott) TThS

105H. Subtidal Communities—Lectures, laboratory, and field trips treating shallow watermarine communities. Emphasis will be on local habitats and the course will introduce physical environmental parameters, commu-
nity composition, aspects of the biology of constituent species and methods for subtidal studies. Prerequisites: SCUBA certification, SCUBA equipment, ocean diving experience, and some background in biology.

6 units, (Baxter) MWF

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

125H. Developmental Biology—An in-depth lecture, discussion and laboratory examination of the modes and principles of embryonic development, especially as learned from the early development of marine animals and plants. Each summer several topics will be emphasized, utilizing the expertise of visiting faculty and special lecturers. Phenomena examined will include oogenesis, fertilization, and determination, cleavage, gastrulation and morphogenetic movements. Lectures and discussions will be followed by laboratory experiments so that each participant can examine the various phenomena, learn current techniques of study and carry out original experiments.

6 units, (Epel) by arrangement

130H. Biological Clocks—The comparative physiology of innate circadian, circa-tidal, circa-lunar and circa-annual rhythmicity in organisms (unicellulars, plants, and animals). The oscillatory pacemakers that drive these rhythms function as "clocks" which the organism uses (1) to measure environmental time, and (2) to organize an internal temporal order in its physiological processes. The circadian system in Drosophila is analyzed in detail as a model that clarifies a wide range of phenomena in other organisms including man. Specific attention is paid to (1) the role of circadian clocks in animal navigation and the time-measurement in photoperiodic phenomena, (2) recent progress in the localization of circadian pacemakers in the nervous system, and (3) current knowledge of the genetics and molecular basis of the pacemaker. Lectures and labs.

6 units, (Pittendrigh) by arrangement

165H. Experimental Neurobiology—An intensive laboratory and lecture course in cellular and organismal neurophysiology. Lectures emphasize (1) cellular processes such as membrane excitability, synaptic transmission, neuronal metabolism, and neuropharmacology, (2) the organization of sensory, motor, and integrative systems. In addition, supplemental lectures deal with practical matters concerning modern techniques and data analysis. The laboratory is the center of the course. It offers experience with several marine invertebrate preparations and with a wide range of investigative techniques. This course is offered to advanced undergraduates, graduate students, and post-doctoral students. Previous exposure to neurobiology is suggested.

6 units, (Thompson) by arrangement

199H. Special Problems—(See above, autumn, winter, and spring quarters.)

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. Prerequisites: same as for 111H, preferably also 111H.

6 units, (D. Abbott) TThS

113H. Introduction to Oceanic Biology—Introduction to the ocean as an environment; to its major categories of inhabitants, producer and consumer, benthic and pelagic, invertebrate and vertebrate; and to the functioning of the oceanic ecosystem. Prerequisite: introductory biology or general zoology.

6 units (Staff) MWF

160H. Problems in Subtidal Ecology—Group and individual studies on problems in autecology and synecology selected from local subtidal communities. Participants will normally be continuing from the first term, 105H Subtidal Communities, but some may substitute equivalent background. The course is intended for students seriously interested in designing and carrying our research studies in the SCUBA zone.

6 units, (Baxter) MWF

199H. Special Problems—(See above, autumn, winter and spring quarters.)

283H. Bioactive Marine Natural Products—The biological effects of naturally occurring substances from marine animals and plants. Lectures will present a comprehensive survey of known substances from marine organisms that have antibiotic, growth inhibiting, neurohumoral, cardiovascular or toxic effects. The chemical nature of the substances will be described, but the principal emphasis will be on
the physiological and pharmacological effects of these substances. In addition to the general survey, the following topics will be discussed in depth: general methods for isolation and bioassay of biologically active substances from marine organisms; "red tides" and paralytic shellfish poisoning; the nature of fish poisoning in man; the use of marine toxins as specific inhibitors in neurobiology.

2 units (Fuhrman) by arrangement

300H. Research—(See above, autumn, winter, and spring quarters.)

BIOPHYSICS PROGRAM

Committee on Biophysics: Philip C. Hanawalt, Professor of Biological Sciences, Chairman; Oleg Jardetzky, Professor of Pharmacology; Harden M. McConnell, Professor of Chemistry; Lubert Stryer, Professor of Structural Biology; David A. Clayton, Associate Professor of Pathology

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 any appropriate department.

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 advisors from the Committee on Biophysics.

The requirements for the Ph.D. degree include the following:
1. Training in physics or chemistry equivalent to that of an undergraduate physics or chemistry 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) Biophysics 250
   b) Biochemistry 200, 201
   c) Chemistry 131, 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.

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 advisor and at least one member from the Committee on Biophysics. The candidate will 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 field 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

250. Molecular Biophysics—(Same as Biology 250.) 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, Aut (Hanawalt and Staff)
TTh 10 and T 7:15-10:00 p.m.

300. Research.
(Staff) by arrangement

350. Seminar in Biophysics—Presentation of current research projects and topical literature by faculty, graduate students, and visiting speakers. All graduate students in Biophysics are expected to participate.

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

PROGRAM IN BRITISH STUDIES

The Committee for British Studies: George Dekker, English; Lorenz Eitner, Art;
Alexander Field, Economics; Mark Franklin, Law; Ronald Rebholz, English; Paul Seaver, History (Convenor); Peter Stansky, History; Michael Sullivan, Art

GENERAL INFORMATION

The Program in British Studies offers the opportunity for an undergraduate interdepartmental major which provides a unique understanding of British culture by encouraging the study of problems which would normally transcend the area of any single discipline. The problem-oriented focus of the program challenges students to explore the interrelationship among the social, political and artistic aspects of British culture. The structure of the program requires students to define and pursue their own area of investigation according to the rubrics of an individually designed major under the administration of the Dean’s Advisory Committee on Individually Designed Majors.

Members of the British Studies Committee are available to serve as a faculty advisory group for any student wishing to design a British Studies major. A list of appropriate courses is available in the Academic Information Center.

THE MAJOR

Although British Studies Majors are required to develop and pursue their individual programs, they are also required to be familiar with the aspects of both the Humanities and Social Sciences.

Students must adhere to the guidelines set forth by the Dean’s Advisory Committee on Individually Designed Majors published in Courses and Degrees.

In addition, the Major should include:

1. the core seminar the purpose of which is to introduce students into interdisciplinary study;
2. four courses from “The Arts and Literature” list;
3. four courses from the “Social Sciences” list, at least two of which must be chosen from a sequence selected from the History courses offered at either the Palo Alto campus or at Stanford in Britain.

All students in the British Studies major are urged to spend two to three quarters studying in Britain, either with the Stanford Program or independently, and to write a senior thesis, ideally with an interdisciplinary emphasis.

CHEMISTRY

Emeriti: Claudio Alvarez-Tostado, Paul J. Flory,

* The curriculum leading to the B.S. degree in Chemical Engineering is described elsewhere in this bulletin.
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 and/or 190; and at least three additional units from one of the following: Chemistry 136, any chemistry course numbered above 200 for which permission to register had been granted by the instructor; Biochemistry 200; or an advanced course in mathematics or physics. A reading knowledge of scientific German or Russian is strongly recommended.

**HONORS PROGRAM IN CHEMISTRY**

A limited number of undergraduates may be admitted to the Chemistry Honors Program 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 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 advisor and by the supervisor of his work in Chemistry 190. An overall 3.3 average in mathematics, physics, and chemistry is required for graduation with honors.

Students who wish to be admitted to the Honors Program should register in the Department Office at the beginning of their senior year. Those who do not meet all of the above formal requirements, may petition the Department for admission.

**TYPICAL SCHEDULE FOR FOUR-YEAR PROGRAM**

<table>
<thead>
<tr>
<th>Course No. Subject</th>
<th>First Year</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
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<tbody>
<tr>
<td>Chem. 31. Chemical Principles</td>
<td>4</td>
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<tr>
<td>Chem. 33. Structure and Reactivity</td>
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<td>4</td>
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<tr>
<td>Chem. 35. Monofunctional Compounds</td>
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<td>Chem. 36. Chemical Separations</td>
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Writing Requirement 3 3 3
German 1, 2, 3. First-Year German 5 5 5
Math. 19, 20, 21. Calculus and Analytic Geometry 3 3 3
Totals 15 15 18

**Second Year**

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<tr>
<th>Course No. Subject</th>
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<tbody>
<tr>
<td>Chem. 131. Polymolecular Compounds</td>
<td>3</td>
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<tr>
<td>Chem. 132. Qualitative Organic Analysis</td>
<td>5</td>
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<tr>
<td>Chem. 133. Special Topics in Organic Chemistry</td>
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<tr>
<td>Chem. 134. Theory and Practice of Quantitative Chemistry</td>
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<tr>
<td>Chem. 136. Synthesis Laboratory</td>
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<td>3</td>
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<tr>
<td>Math. 22, 23. Analytic Geometry and Calculus</td>
<td>3</td>
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<tr>
<td>Physics 51, 53-54. Mechanics, Sound, Electricity</td>
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<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Electives (see Note 1)</td>
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Totals 16 17 15

**Third Year**

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<tbody>
<tr>
<td>Chem. 171, 173, 175. Physical Chemistry</td>
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<td>3</td>
<td>3</td>
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<td>Chem. 174, 176. Physical Chemistry Laboratory</td>
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<td>3</td>
<td>3</td>
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<tr>
<td>Chem. 151, 153. Inorganic Chemistry</td>
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<td>3</td>
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<tr>
<td>Physics 55-56, 57-58. Light, Heat, Atomic Physics</td>
<td>5</td>
<td>4</td>
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<tr>
<td>Electives (see Note 1)</td>
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Totals 15 16 15

**Fourth Year**

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<th>Course No. Subject</th>
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<tr>
<td>Electives (see Note 1)</td>
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Totals 15 15 15

**Note I.** 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 191; Math 44, 106, 113, 130, 131, 132; Physics 110, 111, 112, Stat. 40, 110, 116; Geol. 1; Engr. 50; Appl. Earth Sci. 105; Mat. Sci. and Engl. 50; Med. Micro. 101; Biol. Sci. 1, 21, 22, 23; Biochem. 200, 201; Comp. Sci. 106, 135; Civil Engr. 170, 175, 276A.

**TEACHING CREDENTIALS**

The requirements for certification to teach chemistry in the secondary schools 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
exclusive of the thesis. Of the 12 units, at least 39 units approximately two-thirds must be in units of advanced course work in chemistry in the Department and must include at least 12 units of advanced course work in chemistry.

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 three written exams of two hours duration each in the fields of 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 majoring in biophysical chemistry must pass examination in physical chemistry, biophysical chemistry, and either organic or inorganic chemistry. 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 22, 23, 1978 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. 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 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. Filing for admission to candidacy for the Ph.D. degree must be done before June of the second year of graduate registration. 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, biophysical, 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) two additional courses (at least six 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 Chemistry 271 (or be exempted therefrom by passing a special examination administered by the professor in charge of this course); (3) take Chemistry 233 in the
second and third year (3 units); (4) take Chemistry 227 or an approved substitute; (5) take two additional courses (at least 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 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) two additional courses (at least six units) of advanced lecture courses outside of the fields of biophysical chemistry, physical chemistry, and inorganic chemistry.

All students majoring in biophysical chemistry are required to take (1) Chemistry 221 and 271 (or be exempted therefrom by passing special examinations by the professors of the courses); (2) Chemistry 287, 289, 291 and 293; (3) two additional courses (at least six units) of advanced lecture courses in fields appropriate to their research interests to be chosen in consultation with their research supervisors.

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 a minor in chemistry must complete with a grade average of B or better, 12 units of chemistry courses more advanced than those that meet the minimum requirements for a Bachelor's degree in chemistry.

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, William H. and Myrtle B. Sloan Scholarship, David L. and Lavinia F. Sloan Memorial Scholarship, John Maxon Stillman Scholarship, and the Robert M. and Katherine F. Loeser Scholarship are granted only to graduate students. The William H. Nichols Scholarships are open to graduates and undergraduates; the Frank Card Scholarship and Eastman Kodak Scholarships 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 Department of Chemistry.

COURSES

Note—Deposits required in laboratory courses, against which charges are made for breakage are a minimum of $30 per quarter.

UNDERGRADUATE COURSES

All courses (DR:T) if taken for 3 or more units.

1. The Nature of Chemistry—For non-science majors. This course will present, in non-mathematical terms, modern views of chemistry regarding chemical bonding, the structure of organic molecules; macromolecules; synthetic fibers; and materials of biochemical importance. There will be some discussion of the impact of chemistry on national and international economics and policies. The growth of modern understanding from earlier views will be emphasized, so that the history of chemistry will be dealt with in some detail, and there will be discussion of the importance of symbolic representation. No prerequisites.

3 units, Win (Hutchinson) by arrangement

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. Sign up in Chemistry Dept.

4 units, Aut (Zare, Speer, Golden, Andersen) lec (1 and 2) MWF 8; lec (3) MWF 9; lec (4) MWF 10; one recitation by arrangement


4 units, Win (Staff) lecture and recitation sections same as 31

35. Organic Monofunctional Compounds—Organic chemistry of oxygen, nitrogen aliphatic
CHEMISTRY

and aromatic compounds. Prerequisite: 33. Sign up in Chemistry Dept.

4 units, Spr (Staff) lec. (1) MWF 8, lec. (2) MW 10; lec. (3) MW 11;
one recitation section by arrangement

36. Chemical Separations—Techniques for separations of compounds; distillation, crystallization, extraction, and various chromatographic procedures. The lecture will treat the theory while the laboratory will provide practice. Prerequisites: 33 and concurrent or previous enrollment in 35. Sign up in Chemistry Dept.

3 units, Spr (Staff) lec. M or W or F 1:15; lab M,T,W,Th or F 1:15-5:05

130. Theory and Practice of Identification—Lectures on theory and interpretation of ultraviolet, infrared, nuclear magnetic resonance and mass spectral data. Laboratory involves identification of unknowns and components of a mixture using derivatives and spectra. For students in biomedical sciences. (Chemistry majors take 132.) Prerequisites: 35, 36 and concurrent registration in 131. Sign up in Chemistry Dept.

4 units, Aut (Huestis, LuValle, Staff) lec. (1) TTh 8 lab M,T,W,Th or F 1:15-4:05 or T 6:30-9:05

131. Organic Polyfunctional Compounds—This course covers the chemistry of amino acids, proteins, nitrogen compounds, natural products, dyes, purines, pyrimidines, nucleic acids and polymers. Prerequisite: 35. Sign up in Chemistry Dept.

3 units, Aut (Hodgson, Bonner) lec. (1) MWF 11, lec. (2) TTh 11:00-12:15

132. Qualitative Organic Analysis—Separation of mixtures of organic compounds and identification of the components using rational synthesis and analysis of spectral data. Required for and limited to chemistry majors; others may be admitted with consent of instructor. Prerequisites: 35, 36 and concurrent registration in 131. Sign up in Chemistry Dept.

5 units, Aut (Huestis, LuValle, Staff) lectures as under 130 plus additional dhr;
lab & MW 1:15-4:05 or TTh 1:15-4:05


3 units, Win (van Tamelen, Staff) MWF 11

134. Theory and Practice of Quantitative Chemistry—The course will deal with the theory and practice of quantitative analysis. Methods considered will include gravimetric, volumetric, spectrophotometric, and electrometric. Prerequisite: 132.

4 units, Win (Hodgson) lec (1) TTh 10, lab & MW 1:15-4:05; TTh 1:15-4:05, TTh 6:30-9:30

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: 31 and calculus.

3 units, Win (Boxer) lec. (1) MWF 11, lec. (2) TTh 11:00-12:15

136. Synthesis Laboratory—Advanced synthetic methods in organic and inorganic laboratory chemistry.

3 units, Spr (Staff) by arrangement

137. Pest Control—Technical and Political Aspects—(Same as Human Biology 152.) Technical, operational and political issues in the field of pest control in agriculture and public health. Prerequisites: Junior standing, Chemistry 33, 35. Limited to 45 students. Preregistration on special forms available from Chemistry or Human Biology Department Offices required.

5 units, Win (Djerassi) TTh 2:15-4:05

151. Inorganic Chemistry I—Systematic introduction to theories of electronic structure, stereochemistry, and symmetry properties of inorganic and organometallic molecules. Topics will include ionic and covalent interactions, electron-deficient bonding, and elementary ligand field and molecular orbital theories. Emphasis will be placed on the chemistry of the metallic elements. Prerequisites: 35 and 171.

3 units, Win (Holm) MWF 10

153. Inorganic Chemistry II—Systematic chemistry of metals and nonmetals with emphasis on synthesis, reactivity, and energetics. Topics will include structure-property relationships, acid-base behavior, oxidation-reduction, catalysis, and inorganic biochemistry. Prerequisite: 151.

3 units, Spr (Holm)

171. Physical Chemistry—Chemical thermodynamics: fundamental principles, Gibbsian equations, equilibrium conditions, phase rule, systematic deduction of equations, gases, solutions. Prerequisites: 35, Mathematics 19, 20, 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 premedical students majoring in chemistry; see under "Minimum Requirements").

3 units, Aut (Hutchinson) MWF 11
173. **Physical Chemistry**—Introduction to quantum chemistry: basic principles of wave mechanics, the harmonic oscillator the rigid rotator, infrared and microwave spectroscopy, the hydrogen atom, atomic structure, molecular structure, valence theory.

3 units, Win (Staff) MW 11:00-12:15

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 (Payer) TTh 9:15-12:15 or W 1:15-4:05


3 units, Spr (Staff) TTh 8:30-9:45

176. **Physical Chemistry Laboratory**—(Continuation of Chemistry 174.) Prerequisites: 174 and previous or concurrent enrollment in 175.

3 units, Spr (Boxer) TTh 11:15-2:15 or T 1:15-4:05 or W 1:15-4:05

Man, Molecules and Society: Chemical Revolution to Biological Revolution—(Enroll in Values, Technology and Society, VTS 145.) Traces the development of some selected problems involving interrelations between chemically and biologically based sciences and society.

3-5 units, Win (Clayton) MWF 1:15

**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: 133 and 175.

3 units, Aut (Sharpless) TTh 9:00-10:30

223. **Advanced Organic Chemistry**—Continuation of 221 with emphasis on physical methods. Prerequisite: 221 or consent of instructor.

3 units, Win (Staff) 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 (Staff) MWF 9

227. **Selected Topics in Organic Chemistry**—May be repeated for credit. Possible topics include synthetic organic chemistry, photochemistry, inorganic-organic chemistry, bioorganic chemistry, reaction mechanisms, structural chemistry of organic stereochemistry and biological molecules. Prerequisite: 225 or consent of instructor.

3 units, Aut, or Win, or Spr (Staff) by arrangement

229. **Organic Chemistry Seminar**—Attendance is required of all graduate students majoring in organic chemistry.

1 unit, Aut, Win, Spr (van Tamelen, Mosher) W 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 and 3rd 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, Mosher) by arrangement

251. **Selected Topics in Advanced Inorganic Chemistry**—May be repeated for credit. Prerequisite: one year of physical chemistry.

3 units, Aut, or Win, or Spr (Staff) TTh 11, alternate years, given 1978-79

253. **Advanced Inorganic Chemistry**—Introduction to stereochemical and electronic principles of transition metal complexes; ligand field and molecular orbital theories, electronic spectra and magnetism.

3 units, Win (Staff) TTh 11, alternate years, given 1979-80

255. **Advanced Inorganic Chemistry**—Chemical reactions of organotransition metal complexes and their role in homogeneous catalysis, analogous patterns among reactions of
transition metal complexes in lower oxidation states. Physical methods of structure determination. Prerequisite: one year of physical chemistry.

3 units, Spr (Staff) TTh 10-12

257. Research Proposals in Inorganic Chemistry—Research proposals (winter and spring quarters) will be presented in oral and written form. Writing ability and oral defense will be criticized as well as scientific content. Required of all second-year inorganic students.

1 unit, Aut, Win, Spr (Holm, Taube) 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 (Fayer) MWF 10

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 (Staff) 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, or Win, or Spr (Staff) by arrangement

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 presentation 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 (Fayer, Pecora) by arrangement

287. Biophysical Chemistry—Covers theoretical and experimental aspects of biophysical phenomena with emphasis on membrane biophysics and membrane biology. Minimal prerequisites are previous or concurrent registration in Chemistry 171 and 173, or the equivalent.

3 units, Win (McConnell) MWF 9, alternate years, given 1979–80

289. Biophysical Chemistry—Experimental methods in biophysics. Emphasis will be placed on spectroscopic techniques including magnetic resonance and optical methods. Prerequisite: Chemistry 287.

3 units, Spr (McConnell) MWF 9, alternate years, given 1979–80

291. Biophysical Chemistry—Special topics in biophysical chemistry. Minimal prerequisites are previous or concurrent registration in Chemistry 171 and 173, or the equivalent.

3 units, Win (McConnell) MWF 9, alternate years, given 1978–79

293. Biophysical Chemistry—Structural biophysical chemistry. X-ray crystallography and related techniques as used in biophysical research. Other topics include electron and optical microscopy and neutron diffraction. Prerequisite: Chemistry 291.

3 units, Spr (Staff) MWF 9, alternate years, given 1978–79

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—Research seminars and directed reading dealing with newly developing areas in chemistry and experimental techniques. Open to qualified graduate students with the consent of the major professor. May be repeated for credit. Registration re-
quired of all graduate students who have passed the qualifying examination.

2 units, Aut, Win, Spr (Staff) sec. 2 through 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.

(Staff) by arrangement, register for sec. 2-30 according to professor

CLASSICS

Emeriti: Lionel Pearson, Antony E. Raubitschek (Professors)

Chairman: Marsh H. McCall, Jr.

Professors: Mark W. Edwards, Edwin M. Good (Religious Studies and, by courtesy, Classics), Michael H. Jameson

Associate Professors: N. Gregson Davis, Andrew Devine, Marsh H. McCall, Jr., Isabelle Raubitschek (Art History and, by courtesy, Classics), Michael Wigodsky

Assistant Professors: Helene P. Foley, Stella G. Miller, John Nicols, Susan A. Stephens

Lecturers: Robert Hamerton-Kelly (Classics and Religious Studies), Bruce Rosenstock, Edward W. Spofford

Mellon Fellow: Sander M. Goldberg

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.

DISTRIBUTION REQUIREMENTS

Most courses in the Department (except the elementary language courses) fulfill the distribution requirement in Humanities, and a number of them also fulfill the requirement in Social Sciences. Students are recommended to choose courses to fulfill the requirements from those which have a common theme; suggested themes are:

I. The literature, art and life of ancient Greece (Classics (code 378) 008, 117, 118, 161, 162, 166, 174; Ancient History (code 371) 101; Ancient Art (code 372) 108, 112, 167; Art 100B).

II. The literature, art and life of ancient Rome (Classics (code 378) 008, 161, 165, 174; Ancient History (code 371) 102, 103, 115, or a course in Latin).

III. Philosophy and thought of the ancient world (Classics (code 378) 008, 165, 166; Philosophy 004, 100, 136).

IV. History of the ancient world (Classics (code 371) 101, 102, 103, 105, 115; (code 378) 008).

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.
4. A Combined Major, with emphasis divided equally between Classics and another subject, e.g. English, History, French, Philosophy, etc.

More detailed descriptions of the requirements follow. All major students will be assigned a departmental advisor, who will help them prepare a program of study; they should discuss their program with him or her at regular intervals.

1. Greek and Latin. At least 24 units in Greek courses and the same number in Latin, all at the 100 level or higher. Credit towards the Major for Second-Year courses (101, 102, 103) will be accepted only with the approval of the Undergraduate Studies Committee. If possible, students should complete the sequence of third-year courses (111, 112, 113) before taking courses in the fourth-year sequences (141-3, 151-3, 161-3 in successive years, so that a variety of authors may be studied). In addition, they should do some work in Greek and Latin Composition (Greek and Latin 175), and in Ancient History or Art or some other aspect of Classical Civilization to make up a minimum of 60 units in all. A semester at the Rome Classical Center and a summer at Stanford-in-Greece are strongly advised. This is the most exacting course of study in the department, preparing students to go on to graduate work in Classics. 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) Greek: at least 55 units, including a minimum of 30 units in Greek courses at the 100 level or higher (including a course in Greek prose composition), 2 courses in Ancient History, a course in Ancient Art or Archaeology, and either the introductory sequence (1, 2, 3, or 51, 52) or one 100-level course in Greek. The remaining courses to make up the total may be chosen from other departmental courses or (with permission of the advisor) from relevant courses in other departments (such as Art, Philosophy, Humanities, or modern languages). (Beginning courses in Greek, if required, may be counted towards the total of 55 units.) A summer at Stanford-in-Greece is strongly advised. (See note 1)

b) Latin: at least 55 units, including a minimum of 30 units in Latin courses at the 100 level or higher (including a course in Latin prose composition), 2 courses in Ancient History, a course in Ancient Art or Archaeology, and either the introductory sequence (1, 2, 3, or 51, 52) or one 100-level course in Greek. The remaining courses to make up the total may be chosen from other departmental courses or (with permission of the advisor) from relevant courses in other departments (such as Art, Philosophy, Humanities, or modern languages). (Beginning courses in Latin, if required, may be counted towards the total of 55 units.) A semester at the Rome Classical Center is strongly advised. (See note 1)

3. 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: 55 units made up of
a) 40 units in the major, including (1) 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: (2) 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.

b) A minor consisting of 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, psychol-
ogy, sociology, or political science. A summer at Stanford-in-Greece is strongly advised.

4. Combined Major. A student may divide the time equally between work in Classics and work in another department, e.g. Philosophy, English, History, or one of the modern language departments, with the consent of the Directors of Undergraduate Studies of both departments concerned. Interested students should consult both Directors for details of requirements. They may be formally enrolled as major students either in the Classics Department or in the other department. For the Classics Department part of the requirement, students should complete (a) for the degree in Greek and Latin, at least 16 units in Greek and 16 in Latin, all at the 100 level or above, and at least two courses acceptable to the Department in ancient history, literature or culture: (b) for the degree in Greek or Latin, 24 units in courses in the language, all at the 100 level or above, and at least 12 units in courses acceptable to the Department in ancient history, literature or culture, or in the other classical language: (c) for the degree in Classical Studies, at least 30 units, chosen so as to fulfill all the requirements for the major; courses in the other Department may be used to fulfill the requirement for the minor subject. The other Department may be expected to require about two-thirds of its normal major program.

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 either of the first two programs, 1) or 2). Programs 3) and 4) 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 Center is managed by Stanford University for about 50 constituent colleges and universities including Stanford. It is open to Stanford majors in Classics, History and Art History (see the Center brochure). All courses given in the Center receive full credit at Stanford which may be applied to the respective major.

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 twelve months (usually 3 quarters of course work plus 3 months' study for the thesis or examination). 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 140 level or above.

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 and/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.

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. This must include the first-year graduate program (unless the student is exempted by examination), and normally at least 12 graduate seminars acceptable to the Department, 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).

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 general written and oral examinations in the autumn term of the third year, the special author and field examinations in the winter and spring quarters of the third year, the dissertation oral examination during the fourth year. The period between the translation and general examinations will be devoted largely to seminar work and to an intensive preparation for the latter examinations, 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 French and German as soon as possible, preferably before the time of the translation examinations. Except in very special circumstances they will not be allowed to take the general examinations until the modern language requirements have been successfully completed.

4. Each candidate (not later than the end of the third year) should submit to the Chairman of the Department a statement of his or her dissertation topic as approved by examination. 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 advisor 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.

5. All students are required to undertake the equivalent of three one-quarter courses of teaching under the supervision of the Department.
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.

CLASSICS AND A MINOR FIELD

The Ph.D. in Classics may be combined with a minor in another field, such as Anthropology, History, Humanities (see below), Indo-European Linguistics (see below), Philosophy. The requirements for the minor field vary, but might be expected to involve about six graduate-level courses in the field and one written examination, plus a portion of the University oral exam. Such a program would be expected to take five years. The Department encourages such programs for especially able and well-prepared students, and will normally be able to offer one fellowship each year to support a student in the fifth year of a combined program. The following Timetable would be typical for a five-year program:

1st Year: Course Work, almost entirely in Classics. One Translation Exam possibly taken in June. One or both modern language exams taken.

2nd Year: Course Work, both in Classics and the Minor Field. Translation Exams completed. French and German Exams completed.

3rd Year: Course Work, both in Classics and the Minor Field. General examinations in Classics taken in September. Special exam in Classics taken.

4th Year: Remaining course work, both in Classics and the Minor Field. General examination in the Minor Field. Preparation for dissertation.

5th Year: Dissertation. University oral examination.

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

INTRODUCTORY COURSES

All courses (DR:X)

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 advisors to determine what course 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 (Spofford) MWF 10

2. First-Year Greek—Continuation of 1.
   4 units, Win (Spofford) MWF 10

3. First-Year Greek—Continuation of 2.
   4 units, Spr (Spofford) MWF 10

51. First-Year Greek—Accelerated course.
   5 units, Win (Rosenstock) MTWThF

52. First-Year Greek—Continuation of 51.
   5 units, Spr (Rosenstock) MTWThF

The intensive Greek course (Greek 10) offered in summer quarter prepares students to enter Greek 101 in autumn quarter.

INTERMEDIATE COURSES

101. Second-Year Greek—Reading of Plato, Crito, and other selections. (DR:H)
   4 units, Aut (McCall) MWF 10
102. Second-Year Greek—Homer, Odyssey. (DR:H)
   4 units, Win (Goldberg)

103. Second-Year Greek—Euripides, one play. (DR:H)
   4 units, Spr, (Rosenstock)

104. New Testament Greek. (DR:X)
   2 units, Aut (Hamerton-Kelly) T 10:00-12:30

111. Sophocles—One Play. (DR:H)
   4 units, Aut (Staff) MWF 9

112. Herodotus. (DR:H)
   4 units, Win, given 1979–80

113. Attic Prose. (DR:H)
   4 units, Win (Staff)

MORE ADVANCED COURSES

151-153 and 161-163 are offered in alternate years and may be taken in succession.

151. Greek Lyric Poetry. (DR:H)
   4 units, Spr, given 1979–80

152. Homer. (DR:H)
   4 units, Win, given 1979–80

153. Aristophanes. (DR:H)
   4 units, given 1979–80

160. Individual Work. (DR:X)
   By arrangement

161. Plato. (DR:H)
   4 units, Aut (Rosenstock)

162. Aeschylus. (DR:H)
   4 units, Spr (Foley)

163. Thucydides. (DR:H)
   4 units, Win (Jameson)

199. Undergraduate Theses. (DR:X)
   By arrangement

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. (DR:X)
   2 units, Aut (Stephens)

GRADUATE COURSES

All courses (DR:X)

201. Introduction to Classical Scholarship.
   1 unit, Aut, Win, Spr (Staff)

205. Greek Language and Style.
   3 units, Win, Spr (Raubitschek, Jameson)
   The above courses are offered every year. Other courses alternate or vary from year to year. In 1977–78 there were courses in the following authors or topics: Sophocles, Xenophon, Greek and Latin Phonetics. The following courses will be offered in 1978–79.

214. The Oedipus Myth: Seven against Thebes and Phoenissae.
   5 units, Win (Foley)

226. Introduction to Papyrology.
   5 units, Win (Stephens)

236. The Tradition of Greek New Comedy.
   5 units, Spr (Goldberg)

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

INTRODUCTORY COURSES

All courses (DR:X)

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 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 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 advisors 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 (Nicols) MTWTh 9
2. First-Year Latin—Continuation of 1.
   4 units, Win (Nicols) MTWTh 9
3. First-Year Latin—Continuation of 2.
   4 units, Spr (Staff) MTWTh 9
51. First-Year Latin—Accelerated course.
    5 units, Win (Devine) MTWThF
52. First-Year Latin—Accelerated course. Continuation of 51.
    5 units, Spr (Devine) MTWThF

The intensive Latin course (Latin 10) offered in summer quarter prepares students to enter Latin 101 in the autumn quarter.

INTERMEDIATE COURSES
All courses (DR:H)
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.)—Poetry and Prose of the Republic.
   4 units, Aut (Stephens) MWF 1:15

   —4 units, Win (Foley)

103. Second-Year Latin—Latin Poetry, Virgil, Aeneid. One or more books will be studied.
   4 units, Spr (Davis)

111. Horace, Odes.
   4 units, Aut (Davis) MWF 2:15

112. Virgil, Eclogues and Georgics.
    4 units, Spr (Spofford)

113. Pliny's Letters.
    4 units, Win (Stephens)

118. 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.
    4 units, Spr (Stephens)

MORE ADVANCED COURSES
The series 141-143, 151-153 and 161-163 are all at the third- or fourth-year level and will be offered in successive years.

141. Silver Latin Poetry: Juvenal, Lucan, Seneca. (DR:H)
    4 units, Spr (Staff)

142. Cicero: Letters. (DR:H)
    4 units, Aut (Devine)

143. Virgil, Aeneid. (DR:H)
    4 units, Win (Wigodsky)

151. Roman Comedy. (DR:H)
    4 units, given 1979–80

152. Petronius.
    4 units, given 1979–80

153. Roman Popular Philosophy: Horace and Seneca. (DR:H)
    4 units, given 1979–80

160. Individual Work.
    By arrangement

161. Tacitus. (DR:H)
    4 units, given 1980–81

162. Roman Elegy. (DR:H)
    4 units, given 1980–81

163. Lucretius. (DR:H)
    4 units, given 1980–81

199. Undergraduate Theses. (DR:X)
    By arrangement

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. (DR:X)
    2 units, Aut (Davis) TTh 1:15

GRADUATE COURSES
All courses (DR:X)

201. Introduction to Classical Scholarship.
    1 unit, Aut, Win, Spr (Staff)

    3 units, Aut, Win (Wigodsky, Davis)

205. Latin Language and Style.
    3 units, Win, Spr (Devine, Wigodsky)

The above courses are offered every year. Other courses alternate or vary from year to year. In 1977–78 there were courses in the fol-
following authors or topics: Virgil, Horace, Greek and Latin Phonetics. The following courses will be offered 1978–79:

211. Petronius.  
5 units, Win (Davis)

223. Vulgar Latin.  
5 units, Spr (Devine)

260. Directed Reading.  
By arrangement

263. Lucretius.  
5 units, Aut (Wigodsky)

264. Ancient Literary Criticism.  
5 units, Spr (McCall)

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.

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.

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 the 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. (DR:A)  
3 units, given 1979–80

6. Imitations and Translations of Latin Literature—The course is designed for students interested in both English and Latin literature. No knowledge of Latin is required. Reading will include Dryden’s translation of the Aeneid, Johnson’s imitations of Juvenal, Pope’s of Horace, Pound’s Homage to Sextus Propertius and excerpts from an Elizabethan translation of Ovid’s Metamorphoses. (DR:H)  
3 units, Win (Spofford)

8. Classical Politics—Lectures on the political philosophy of Plato and Aristotle and on their impact of political theory and practice in antiquity and in modern times. Reading of Plato’s Republic, Aristotle’s Politics, and related texts. (DR:A)  
3 units, Win (Raubitschek)

GENERAL COURSES

Literature

135. Classical Conventions in European Lyric—Analysis of several important “topoi” of European Lyric and their classical antecedents. Prerequisite: reading knowledge of one foreign language. (DR:H)  
4 units, Spr (Davis) given 1979–80

160. Individual Work. (DR:X)  
By arrangement

161. The Classical Epic—A comparative study of the heroic epics of Homer, Apollonius, and Virgil, with allusion to oral and written epics in other cultures and to narrative techniques later paralleled in the modern novel. (DR:H)  
3 to 4 units, Aut (Foley)

162. Greek Tragedy: Aeschylus, Sophocles, Euripides—A study of the literary and theatrical quality of the great ancient tragedies. (DR:H)  
3 to 4 units, Win (McCall)

172. Classical Influences in Modern Literature—Themes from classical myth and history in selected Renaissance and later writers; parallel readings from ancient literature. (DR:H)  
3 to 4 units, given 1979–80

174. Stage Comedy from Aristophanes to Shakespeare—(Same as English 174, Comparative Literature 174, and Drama 158.) Readings in classical comedy, including Aristophanes, Menander, Plautus, and Terence; in renaissance comedy, including Ariosto, Shakespeare,
and Jonson. Works not written in English will be read in translation. (DR:H)
5 units, Spr (Foley, Riggis)

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. (DR:H)
3 to 4 units, given 1979–80

165. Hellenistic Philosophy—Epicurus, Stoics and minor schools, their relation to earlier Greek thought, and their influence in the Roman Empire. (DR:H)
3 to 4 units, Spr (Wigodsky)

166. Socrates and the Socratic Tradition—The historical reality of Socrates in the context of the intellectual climate of the late fifth century, and the impact of Socrates upon Plato, Xenophon, and the minor Socratics.
3 to 4 units, Aut (Rosenstock)

See also Philosophy 100, 137, 199, and 236

Ancient History

These courses are accepted by the History Department for credit toward a major in History.

101. 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.). (DR:A)
4 to 5 units, Aut (Jameson) MTWTh 2:15

102. History of the Roman Republic—A survey of the history of the Roman people from the founding of Rome (c. 753 B.C.) to the death of Julius Caesar (44 B.C.) (DR:A)
3 to 4 units, Win (Nicols) MWTh 2:15

103. History of the Roman Empire—A survey from the rise to power of Augustus to the fall of the Roman Empire in the West (476 A.D.) and the advent of the Christian Middle Ages. (DR:A)
4 to 5 units, Spr (Nicols) MTWTh 2:15

105. History and Culture of Egypt—A survey of Egypt from the Old Kingdom through the Roman period with emphasis on religious, social and political development. (DR:A)
3 to 4 units, Spr (Stephens)

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). Satisfies History Department undergraduate colloquia requirement. (DR:A)
3 to 4 units, Aut (Nicols)

160. Individual Work in Ancient History. (DR:X)
By arrangement
(Courses at the 200 level are mainly for graduate students.)
All 200 courses (DR:X)

214. Panhellenic Sanctuaries—The seminar will deal with the four great Greek sanctuaries: Olympia, Delphi, Isthmia, and Nemea. The individual sites will be studied with regard to their sacred and secular buildings as well as the epigraphical and sculptural monuments. The course will cover relevant historical and political problems in addition to the athletic events themselves.
5 units, given 1979–80

227. Patronage in the Roman Empire. 5 units, Spr (Nicols)

236. Early Greek History. 5 units, Aut (Jameson)

261. Individual Work in Greek History. By arrangement

262. Individual Work in Roman History. By arrangement

See also Religious Studies 121.

Religion and Mythology

117. Greek Religion—The origins and development of Greek religious phenomena from Mycenae to Byzantium. (DR:A)
3 to 4 units, Win (Jameson)

118. Greek Mythology—Topics will include Cosmology, the Herakles legend, the Underworld, Platonic myth-making, modern survivals, and the nature of myth itself. Readings will be supplemented with material drawn from Greek art and modern Greek folklore. (DR:A)
3 to 4 units, Aut (Goldberg)

163. Comparative Mythology: Topics from Greek and Roman, Near-Eastern and African Culture—(Same as Comparative Literature 163.) (DR:A)
3 to 4 units, given 1979–80

Art and Archaeology

108. Topography and Monuments of Greece. (DR:H)
3-4 units, Aut, Spr (Raubitschek)

112. Mycenaean Greece. (DR:S)
3-4 units, Win (Miller)

167. Buildings of Classical Athens—The course will examine such sites as Troy, Mycenae, and Tiryns during the 16th to 12th centuries, B.C., the age of the Homeric heroes. (DR:H)
3-4 units, Aut (Miller)
See also Art 5, Art 100A, B, C, and Art 102; Classics 214 (above).

**Indo-European Linguistics**

153. Introduction to Indo-European Linguistics—(Same as 253.) Prerequisite: some knowledge of one foreign language, preferably Latin, a Romance language, or ancient or modern Greek.

4 units (Devine) given 1979–80

221. Greek and Latin Phonetics.

5 units (Devine) given 1980–81

252. Greek and Latin Linguistics—Introduction to Greek and Latin linguistics. The emphasis is on a general understanding of those aspects of language analysis that are relevant to literary studies.

5 units, Aut (Devine)

253. Introduction to Indo-European Linguistics—(Same as Linguistics 253.) This course is recommended 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, the Romance languages, and English.

4 units, (Devine) given 1979–80

240, 241. Elementary Sanskrit—See also Greek 221.

3 units (Devine) given 1979–80

See also Latin 223—Vulgar Latin.

**COMMUNICATION**

Emeriti: Nathan Maccoby, Wilbur Schramm, Clifford F. Weigle (Professors)

Chairman: Henry Breitrose

Director, Institute for Communication Research: Nathan Maccoby

Director, Professional Journalism Fellowship Program: Lyle M. Nelson. Managing Director: Harry N. Press


Associate Professors: William J. Paisley, Donald F. Roberts

Assistant Professors: Marion Lewenstein, Diana Tillinghast

Lecturers: John Austin, Richard C. Block, Jules Dundes, Arthur L. Mayer, Harry Press, Jack Silvey

The Department of Communications 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 or broadcasting, or in evaluation research for mass media projects in developing countries. 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 Ph.D. students.

The Professional Journalism Fellowship Program brings promising young journalists to study at the University in a non-degree 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 when the applicant is prevented from taking the tests.

**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 the advisor, to select appropriate 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 American Studies, Urban Affairs, Human Biology, and African and Afro-American Studies.

One Department degree program is offered with the opportunity to concentrate in (a) the general study of communication and the mass media from a Social Science perspective (b) preprofessional study in journalism or (c) preprofessional study in film and broadcasting. The undergraduate major is considered a preprofes-
sional 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. The burden of program development rests with students in consultation with their advisor.

To be recommended for the Bachelor of Arts degree in communication, the students must take at least 40 and may not count more than 50 units towards the A.B. degree within the department except with the prior written consent of their advisors. 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 40 to 50 units a student takes within the department, they 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
   c. Psychology 60 or Statistics 60
   d. Any two of the following Communications courses: 128, 131A, 131B, or other as agreed to by advisor
   e. One course from the journalism sequence, preferably 100-102
   f. One course from the broadcast and film sequence
   g. Psychology 60 or Statistics 60
   h. Any two courses numbered 155 through 170, or others as agreed to by advisor

2. Students concentrating in the film and broadcast sequence must complete:
   a. Communication 142
   b. Communication 203 or another Communication Theory or Research Methods course.

An alternative degree is a Bachelor of Arts degree in Social Science (Communication). Requirements for this degree are a total of 40 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.

**MASTER OF ARTS**

The Master of Arts degree is awarded by the Department in the fields of Journalism, Film, 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: candidates must be enrolled as a major in the Department for at least two quarters; they must maintain a high academic performance during their 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.

   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 normally takes three to five quarters depending on the nature of the independent 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 advisor. 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 Communication 203 or another Communication Theory or Research Methods course.

3. Students in Film and Broadcasting may concentrate in either film production or broadcast management and news. Students concentrating in Broadcasting would take Communication 242, 242A, B, C and 114. The film sequence requires Communication 223A, B, C and 224A, B, C. Courses in film aesthetics, history and criticism are also available. All students may select, in consultation with their advisors, other courses in the department or outside it. The graduate seminar, 208A, B, C is required of all Film students and is available to Broadcast students.

   Note: While the department maintains complete film production facilities for teaching and research purposes, the costs of supplies and laboratory services are the re-
responsibility of the student. These costs currently approximate $1,250 for the three quarters.

4. Students in the Journalism Master's program are required to take: Communication 200, 202, 203, 207, 220, 225A, 249, 250, 267, 275 and 290. Students with undergraduate journalism training or media experience should check with their advisors to determine which of the above departmental courses could 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 entails two-year commitment on the part of most students and includes course work in Communication and development theory (255, 256), research methods (207, 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. Since the program's goal is to train communication scientists, the program is quantitative and behavioral in nature. All students are required to complete a core program in communication theory and research, research methodology, and statistics. Subsequent to completion of the core program, students may emphasize such areas as attitude formation and change, communication and children, communication media and social change, communication and health, public affairs communication, or information sciences. 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.

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 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 Ph.D. students fulfill the following course requirements:

A. Communication 311A: Theory of Communication I
B. Communication 311B: Theory of Communication II
C. Communication 313: Computer Analysis of Communication Research Data
D. Communication 317: Doctoral Research Methods I
E. Communication 318: Doctoral Research Methods II
F. Communication 319: Doctoral Research Methods III
G. One of the following, two quarter statistics sequences (to be completed by the end of winter quarter in the first year):
   A. Psychology 60: Statistical Methods
   B. Statistics 160: Introduction to Statistical Methods I
   C. Education 205B: Statistical Analysis in Educational Research
   D. Any two equivalent courses.

Students must also complete a third course which will advance their knowledge in a broad area of statistics, preferably in analysis of variance or multivariate analysis. Each of the following courses would satisfy the requirement:
Psychology 152: Analysis of Data
Statistics 201: Introduction to Data Analysis
Statistics 205: Introduction to Nonparametric Statistics
Statistics 206: Applied Multivariate Analysis
Education 250C: Statistical Analysis in Educational Research II
Education 250D: Statistical Analysis in Educational Research
Any equivalent course agreed to by the department.

In addition, students must complete a minimum of four other advanced Communication Theory courses (numbered 313 and higher). Specification of these courses depends on (a) individual student needs in order to prepare for preliminary and area examinations, and (b) the requirements of the particular area of emphasis chosen by the student. They should be chosen in consultation with the advisor.

Finally, students must complete:
Communication 397: First-year Research Project
Communication 398: 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 311A, B, 318, and 319, 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.

MASS MEDIA INSTITUTE

During the Summer Quarter, the Department of Communication conducts a series of 8-week long workshop production courses in Film, Television and Journalism. These are designed as pre-professional training courses, and are open to students with Junior or higher standing at Stanford and other colleges and universities. Additional courses dealing with Film Aesthetics, Broadcast Writing, Magazine Writing, Public Broadcasting, Mass Media Law, Broadcast Management and Mass Communications in Society are also offered.

Information about the Mass Media Institute may be obtained by writing to Jules Dundes, Director, Mass Media Institute, Department of Communication, Stanford University, Stanford, CA 94305.

COURSES PRIMARILY FOR UNDERGRADUATES

GENERAL

1. Mass Communication and Society—An introduction to human communication theory and to mass communication and its effect on society; the responsibility and ethics of the press; the role of economics and government regulation in determining what the consumer of mass media messages receives. Open to non-majors. (DR:S) 5 units, Aut (Rogers, Staff) consult Time Schedule

70. Introduction to Media Research Methods—Surveys, experiments, content analyses, and case studies help us to understand the organizational processes of mass media as well as their social effects. This course combines class experience in conducting a survey with reading and analysis of the applications of other methods in current studies. Formulation of problems, study design, sampling, questionnaire construction, interviewing, data processing, and report writing are covered in the class survey project. Prerequisite: An introductory statistics course. (DR:S) 3 units, Spr (Paisley) M 3:15-5:05
100. Editorial Techniques I—A reporting and writing course emphasizing various forms of journalism: news, interpretation, features, opinion. Detailed criticism of writing. Communication 102 must be taken concurrently. (DR:X)

4 units, Aut, (Rivers) TTh 11
(Lewenstein) Consult Time Schedule
(Staff) Consult Time Schedule
Win (Hulteng) Consult Time Schedule
(Staff) Consult Time Schedule
Spr (Staff) Consult Time Schedule
(Staff) Consult Time Schedule

101. Film Aesthetics—Graduate students sign up for 201. (Same as Modern Thought and Literature 220.) 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 the practitioner, the critic, and the audience. (DR:H)

4 units, Aut (Breitrose MWF 10;
evening screenings 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. (DR:X)

1 unit, Aut (Todd) Consult Time Schedule
(Stephens) Consult Time Schedule
(Staff) Consult Time Schedule
(Lewenstein) Consult Time Schedule
Win (Hulteng) Consult Time Schedule
(Staff) Consult Time Schedule
Spr (Staff) Consult Time Schedule
(Staff) Consult Time Schedule

103. Precision Journalism—Undergraduate Section (Graduate students register for 203) See 203

107. Editorial Techniques II—Copy editing, headline writing, news display, and picture cropping. With laboratory that includes editing copy. Associated Press, news evaluation and page make-up. Prerequisites: 100 and 102. (DR:X)

2 units, Aut (Silvey) consult Time Schedule
Win (Staff) consult Time Schedule
Spr (Staff) consult Time Schedule

111. Humor as Communication—Seminar analyzing wit, humor, and satire in the mass media. Enrollment preference given to senior and graduate students. Consent of the instructor. Prerequisite: 100 (DR:X)

4 units, Spr (Rivers) TTh 11

112. Writing for Film—Script writing techniques for film and television. Emphasis is placed on conceptualizing and executing film ideas, as well as on preproduction preparation for films to be made in Communication 113, for which 112 is a prerequisite. The course is designed mainly for undergraduates with preprofessional concerns. (DR:X)

5 units, Aut, Win (Blaustein)
Sum (Staff) MW 2:15-4:05 and screenings by arrangement

113. 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: 112 and consent of instructor.

5 units, Win (Alexander)
Spr (Alexander)
Sum (Staff) MW 2:15-4:05
and tutorials by arrangement

114. Television Production I—Production and direction of news and documentary television programs. Prerequisite: consent of instructor.

4 units, Sum (Staff)

119. Sports Culture—Sports as an institution, relating to business, education, labor, advertising, press coverage, and entertainment. (Graduate students register for 219.) (DR:X)

2 units, Win (Koppett)

125A. Problems of the Mass Media—Visiting lecturer series. Prerequisite: any other Communication course. May be repeated once for credit. (Graduate students register for 225A)

1 unit, Aut (Rivers) T 4:15-5:15

125B. Problems of the Mass Media—Continuation of 125A. Prerequisite: 125A may be repeated once for credit. (Graduate students register for 225B)

1 unit, Win (Rivers) T 4:15-5:15, Th 4:15-6:00

128. Scientific and Technical Communication—(Graduate students sign up for 228.) Overview of the information systems of science and technology, their origins and postwar development. Analysis of "horizontal" versus "vertical" flow of scientific and technical information (STI). Communication of STI to scientists, technologists, professionals, and the public. Emphasis on political, social and cognitive factors that mediate the flow of STI. (DR:X)

4 units, Aut (Paisley) TTh 10-12

131. Media Ethics and Responsibilities—An examination of the performance of the various media of mass communication in the light of ethical standards, employing case studies, text, and discussion sessions. In addition to media ethics, the course deals with such current media
problems as the dwindling of the journalistic channels, the changing roles of the media, media accountability, and the relationships between government and the media.

4 units, Win (Hulteng)  
consult Time Schedule

139. Literature of the Press—Readings from the writings of journalists — about their lives, about their work. Several basic readings for all students; additional readings by individual students for the purpose of leading seminar discussions. Ideas to be discussed: the journalist in historical perspective; journalist as initiator or follower of political and social trends; journalist as propagandist; journalist as mediator of popular culture. Enrollment limited to 15. (DR:S)  
5 units, Win (Lewenstein)  
To be offered 1979-80

140. History of American Journalism—Evolution of the democratic mass media in their social, political, economic, technological and professional aspects, with special attention to coverage of specialized phenomena such as women, minorities, science, courts and others. (Graduate students register for 240.) (DR:S)  
4 units, Spr (Lewenstein)

141. History of Film—(Same as Modern Thought and Literature 221.) Studies in the development of the motion picture as an art form and a means of communication. Lab: Screenings of films announced in class (DR:H)  
4 units, Win (Mayer) TTh 3-5 evenings

142. Broadcast Communication—The development of American broadcasting and its contemporary problems. (Graduate students register for 242.) (DR:S)  
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. (DR:X)  
4 units, Aut (Staff) MW 11 and lab by arrangement

143. Anthropology of Film—Nature of the ethnographic film as a documentary form is examined through viewing and analysis of classical and current films; also explores uses of film and video tape as a tool for the analysis and presentation of cognitive, social and kinesic aspects of culture and as a vehicle for the anthropological research. Same as Anthropology 128. (DR:A)  
5 units, Spr (Gibbs) MW 10  
T 7:30-10

149. Communication Law—(Same as Law 149) This course introduces non-law students to mass communication law and policy, especially legal issues of importance to journalists; access to the media, libel, privacy, shield laws, trial coverage, censorship, obscenity, pornography and antitrust cases. The course will also be concerned with the regulation of the telecommunications industry by the FCC. (Graduate students register for 249.) (DR:X)  
5 units, Win (Franklin) consult Time Schedule  
Spr (Tillinghast) consult Time Schedule

150. Magazine Writing—(Graduate students sign up for 250.) Practice in writing magazine articles, with emphasis on marketing manuscripts. Conferences. Prerequisites: 100 and 102. (DR:X)  
4 units, Win (Rivers) TTh 11

155. Women and the Mass Media—This course will examine images of women in media and audience effects of media stereotyping. Employment practices and opportunities as well as strategies for dealing with media institutions will be discussed.  
4 units, Win (Time and instructor to be announced)

156. Scientific and Technical Communication—How scientific findings and technological innovations are communicated to scientists and technologists, policymakers, legislators, professionals (e.g., in medicine), and the public at large. This overview of the communication systems of science and technology covers both "horizontal" and "vertical" flows of information as affected by economic, political, social and psychological factors. (Graduate students register for 356.)  
3 units, Aut (Paisley) M 1:15-3:05

157. Public Information Programs—Emphasizing health information programs and their effects on public knowledge, attitude, and behavior, this course also examines information programs concerned with energy conservation, environmental protection, educational and occupational opportunity, consumerism, etc. The interplay of research and fieldwork will be analyzed in case studies of successful programs. (Graduate students register for Communication 357.)  
3 units, Win (Paisley) M 1:15-3:05

158. Organizational Communication—Interpersonal and organization factors affecting communication efficiency in organizations. Topes to include information processing, motivation, leadership styles, environmental uncertainty, and communication networks. (Graduate students register for 358.)  
4 units, Spr (Staff) TTh 9-11
159. 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, cultures, and nations. (Graduate students register for 359.)

4 units, Win (Staff) TTh 9-11

160. Intercultural Communication—The influence of cultural value orientations on perceptions and styles of communication between persons of different cultures. Focus will be on the cross-cultural education of context and process. Stereotyping, culture shock, learning styles and appropriate alternatives to assimilation will be explored in seminars, readings, simulations and video-tape. Cross cultural communication training theory and methodology will be developed for application in international and U.S. multicultural environments.

4 units, Win (Rogers, Clarke) T 3:15-5:05

161. Seminar in Intercultural Communication—Subjective culture theory and issues in cross-cultural research methods will be explored with a focus on interpersonal behavior. Texts, current research articles and individual or small group projects will provide material for discussion. Enrollment limited; prerequisite: Communication 160.

2 units, Spr (Clarke and Rogers) M 3-5

164. Special Topics in Communication Theory and Research I—Topic and instructor change each year.

3 units, Aut (Staff)

165. Special Topics in Communication Theory and Research II—Topic and instructor change each year.

3 units, Win (Staff)

166. Special Topics in Communication Theory and Research III—Topic and instructor change each year.

3 units, Spr (Staff)

170. 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: Communication 1 or equivalent. (DR:X)

4 units, Win (Roberts) TTh 10-12

171. Communication and Children—Continuation of 170. (DR:X)

3 units, Spr (Roberts) by arrangement

175. Reporting of Public Affairs—Coverage of traditional news beats, such as police, city hall, education and courts as well as issue-oriented coverage of policy area beats. Prerequisites: 100 and 102.

5 units, Aut (Austin) consult Time Schedule
Win (Staff) consult Time Schedule
Spr (Staff) consult Time Schedule

180. 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, strutturalist and semiological approaches. Weekly reviews will stress the meaning of the films and a lucid writing style. (Same as Modern Thought and Literature 280)

Prerequisites: 101, 141, or 142. (DR:H)

4 units, Spr (Staff)

185. Internship Experience—Professional experience in the media. Open only to Communication majors. (Graduate students register for 285.) (DR:X)

0 units for graduate students
1-4 units for undergraduate students

Aut, Win, Spr (Dundes, Lavenstein) by arrangement

194D. Media and Politics—(Same as Political Science 194D.) This seminar for the undergraduate student will examine the links between mass media and government, on the one hand, and between media and the individual citizen, on the other. Via an examination of the relevant literature, questions of the role of the "organization" of the media in the formation of "news," "biases," and the effects of media on individual "agenda," attitudes and behaviors will be explored.

5 units, Win (Brody)

199. Individual Work—Major students with high academic standing are permitted to undertake individual work. (DR:X)

1-4 units, any quarter (Staff) by arrangement

COURSES PRIMARILY FOR A.M. STUDENTS

All courses (DR:X).

200. Editorial Techniques—See 100

201. Film Aesthetics—See 101

202. Editorial Techniques I Laboratory—See 102

203. Precision Journalism—A precision journalism course on behavioral science techniques that can be used by reporters. Class project will involve doing a public opinion survey and/or content analysis of public documents. The results of the project will be used to write a series
of news stories. Prerequisite: Communication 100 or equivalent.

4 units, Spr (Tillinghast)
consult Time Schedule

204. 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 Media and Social Change A.M. program. Prerequisite: Psychology 60 or equivalent.

4 units, Spr (Tillinghast)
consult Time Schedule

207. Editorial Techniques II—See 107

208A. Seminar in Film and Broadcasting I—Limited to Film and Broadcasting A.M. students.

1 unit, Aut (Breitrose) M 4:15-6:00

208B. Seminar in Film and Broadcasting II—Limited to Film and Broadcasting A.M. students.

1 unit, Win (Breitrose) M 4:15-6:00

208C. Seminar in Film and Broadcasting III—Limited to Film and Broadcasting A.M. students.

1 unit, Spr (Breitrose) M 4:15-6:00

209S. Broadcasting News Workshop—Production and direction of news and documentary television programs. Prerequisite: consent of instructor.

9 units, Sum (Staff)

210A,B,C. Topics in Film Study—(Same as Modern Thought and Literature 210A,B,C.) Each quarter during the academic year a different aspect of film history, criticism, aesthetics, and institutional development will be examined in detail. Admission by consent of the instructor. Consult Time Schedule for 1978-79 topics. (DR:H)

216. The Broadcast Editorial—Analysis 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

219. Sports Culture—See 119

220. Mass Media in Society—The nature and social responsibilities of the media, the structure of the industry, and problems and issues in the mass media. For A.M. students.

4 units, Aut (Tillinghast)
consult Time Schedule

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 (Tillinghast)
consult Time Schedule

223A. Writing for Film I—Emphasis is placed on conceptualizing and executing ideas for the production work done jointly with 224A as well as on preproduction for that work. The course will include some introductory writing assignments. To be taken concurrently with 224A. Open to graduates only.

5 units, Aut (Blaustein, Alexander)
TTh 2:15-4:05

223B. Writing for Film II—Form and style in the construction of fiction and non-fiction scripts. Much attention will be given to script for the film to be made jointly with 224B and 224C. Writing assignments will aim at preparing the student for a full script to be written for 223C. To be taken concurrently with 224B. Prerequisite: consent of instructor.

5 units, Win (Blaustein, Alexander)
TTh 10-12

223C. Writing for Film III—Course divided between seminar in more advanced writing and individual work with instructor on student’s script. Time will also be devoted to problems revealed by work on productions for 224C. To be taken concurrently with 224C. Prerequisite: consent of instructor.

5 units, Spr (Blaustein, Alexander)
TTh 2:15-4:05

224A. 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 non-dramatic and documentary forms. Each student will be required to complete a series of exercises and to prepare for the production of a film during the next two quarters. Prerequisite: admission to the film A.M. program, and concurrent registration in 223A.

5 units, Aut (Alexander, Blaustein)
MW 2:15-4:05 and tutorials
by arrangement

224B. Film Production II—the second quarter of a three quarter continuing sequence for training in the production of motion pictures. During this term and finishing in the third quarter, each student will be expected to produce a film approximately ten minutes in length. Prerequisite: successful completion of 224A and concurrent registration in 223B.

5 units, Win (Alexander, Blaustein)
MW 2:15-4:05

224C. Film Production III—Continuing 224B. Prerequisite: successful completion of 224B,
225A, B. Problems of the Mass Media—Graduate section. (See 125A, B.)

230. International Telecommunication Agreements—Examination of the International Telecommunication Union (ITU) as a model for worldwide collaboration in resource allocation, standardization, and planning of services. Interdisciplinary focus on outcomes achieved by voluntary agreement. Case studies of ITU action, particularly in satellite communication. Lectures and study projects. Same as Engineering Economics Systems 205.

232. Public Policy Towards the Mass Media—(Same as Political Science 194C.) Seminar is an examination of the policy processes relating to the mass media; an effort to define a more coherent public policy toward communications and society. (DR:X)

240. History of American Journalism—See 140.

242. Broadcast Communication—See 142.

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 instructor.

242B. Broadcast News Techniques and Production—Writing, delivery and direction of radio and TV news. Prerequisites: 100, 102, 142, and consent of instructor.

242C. Seminar in Broadcast Management—An advanced examination of the managerial aspects of commercial and public broadcasting. Prerequisite: 242 or concurrent registration in the School of Law or Graduate School of Business.

249. Communication Law—See 149.

250. Magazine Writing—See 150.

251. Communication and Development—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.

252. Communication Theory and Social Change—This is a seminar for the Communication Media and Social Change A.M. 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.

253. Evaluation Research Methods for Mass Media Projects in Developing Countries—(Same as Education 214). Nature of evaluation and evaluation designs, 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: basic statistics, Communication 204, (or equivalents), Communication 256.

261. Literature and Film: Theory/Practice—(Same as English 261.) Interchanges between writers and film-makers, literary theory and film aesthetics. Literature, film, and theory in Russian Formalism (Mayakovsky, Eisenstein) and Surrealism (Breton, Artaud, Buñuel, Franju). Semiotics and phenomenology as orientations toward literature and film: critical texts (Barthes, Eco, Metz; Bachelard, Poulet, Bazin, Farber, Cavell) and screenings (Robbe-Grillet, Godard; Renoir, Hawks).

266. Mass Communication Media—(Same as Economics 159.) Focusing mainly on daily newspapers and television, this course examines the roles of markets and government regulation in shaping print and electronic communication media. Among topics included are public goods and economies of scale, advertising, product choice, and audience determination, inter- and intra-media monopolistic competition, the FCC demise of the metropolitan press, cable TV, policy issues and future prospects. Prerequisite: Economics 51.

267. Specialized Workshops—One or more classes will be offered in new journalism, science, business, book publishing, or other specialized skills by practicing professionals. These will be classes with writing or workshop projects oriented toward the field of specialty. Consult Time Schedule to see which specific courses will be offered 1978-79. (DR:X)
272A. See 267

275. Reporting of Public Affairs—See 175

280. Film Criticism—See 180

285. Internship Experience—See 185
0 units, Aut, Win, Spr (Dundes, Lewenstein) by arrangement

290 A.M. Project
4 units, any quarter (Staff) by arrangement

298. Thesis
6-10 units (Staff) by arrangement

299 Individual Work
1-4 units, any quarter, (Staff) by arrangement

COURSES PRIMARILY FOR
PH.D. STUDENTS

311A. Theory of Communication—Approaches to communication theory, seminar and tutorial meetings; extensive reading and papers. Required of all Communication doctoral students; others by consent of instructor.
4-5 units, Aut (Roberts) TTh 3:15-5:05

311B. Theory of Communication—Continuation of 311A. Prerequisite: 311A.
4-5 units, Win (Rogers) TTh 1:15-3:05

313. Introduction to the Use of the Computer—Specifically for social science data analysis. Includes a brief discussion of computing concepts, followed by use of WYLBUR and EDIT, text editors on SCIP and LOTS systems; SPSS; and data storage.
0-3 units, Win (Staff) by arrangement

314. Advanced Analysis of Communication Research Data—Advanced statistical programming for data analysis. Emphasis on algorithms and statistical programming in FORTRAN. Prerequisite: successful completion or 313 and consent of instructor. Not offered every year. Consult Time Schedule.
0-3 units, Spr (Staff) by arrangement

317. Doctoral Research Methods I—Application of scientific method to communication research. Logic of inquiry; conceptualization of variables; design of experiments, quasi-experiments, and nonexperiments. Previous or concurrent enrollment in statistics required.
4 units, Aut (Parker) MW 4:15-5:05

318. Doctoral Research Methods II—Continuation of 317. Sampling questionnaire design, attitude scale construction, survey administration, computer analysis of data.
4 units, Win (Paisley) MW 3:15-5:05

319. Doctoral Research Methods III—Continuation of 318. Selected multivariate models of importance to communication research, nonexperimental casual inference, other advanced topics in data analysis. Not taught every year.
4 units, Spr (Staff) MW 3:15-5:05

331. 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

333. Teaching Seminar—Discussions of effective teaching methods led by Stanford teachers from several departments. Prerequisite: graduate standing.
I unit, Aut (Rivers) T 12-1

334. Research Seminar—Discussions of research project-research design, field work, problems, etc., led by Communication teachers and advanced graduate students who are conducting research. Prerequisite: graduate standing.
I unit, Win (Rivers) T 12-1


356. Scientific and Technical Communication—See 156.

357. Public Information Programs—See 157.

358. Organizational Communication—See 158.


365. 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

370. Advanced Communication Theory and Method Seminar I—May be repeated for credit. Topic and instructor change each year. Prerequisites: 311A and 319.
3 units, Aut (Staff) by arrangement

371. Advanced Communication Theory and Method Seminar II—May be repeated for credit. Topic and instructor change each year. Prerequisite: 370.
3 units, Win (Staff) by arrangement

Transfer—Review of communication theory, communication technology, and perceptual/cognitive psychology to adduce principles of accelerated knowledge transfer, primarily in the context of scientific and technical communication.

3 units, Spr (Paisley) M 3:15-5:05

373. Persuasive Communication—Seminar on campaigns designed to change information attitudes and behavior with particular reference to health. Designed for Ph.D. students in Communication. For others, consent of instructor. Not taught every year. Consult Time Schedule.

4 units, Win (Staff) by arrangement

374. 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

385. Public Affairs Thesis Seminar—For Public Affairs Ph.D. candidates only.

1-6 units, Aut, Win, Spr (Rivers) by arrangement

386. Public Affairs Comprehensive Review—For Public Affairs Ph.D. candidates only.

1-6 units, Aut, Win, Spr (Rivers) by arrangement

388 Social Effects of Computer Communication—What will be the social effects of home computers, decentralized computing networks, public computer utilities, etc.? What research and action should be undertaken now to ensure that computer communication serves the public interest involving the literature of hardware/software development, technological diffusion, social adaptation to new communication media, etc.

3 units, Spr (Paisley) M 1:15-3:05

397. First-Year Research Project—Individual research in lieu of Master's thesis.

3-6 units, (Staff) by arrangement

398. Pre-Dissertation Research Project—Advanced research for Ph.D. candidates.

3-6 units (Staff) by arrangement

399. Advanced Individual Work

1-8 units (Staff) by arrangement

400. Dissertation Research

6-10 units, (Staff) by arrangement

COMPARATIVE LITERATURE

Committee in Charge: Herbert Lindenberger (Chairman), Joaquim F. Coelho, N. Gregson Davis, Franco Fido, Jeanne S. Martin, Kurt Mueller-Vollmer, William M. Todd III, Makoto Ueda

Professors: Jean Franco (Spanish and Comparative Literature), Gerald Gillespie, on leave 1978-79 (German Studies and Comparative Literature), Herbert Lindenberger (Comparative Literature and English), James J. Y. Liu, on leave 1978-79 (Chinese and Comparative Literature), Charles R. Lyons (Drama and Comparative Literature), N. Scott Momaday, on leave 1978-79 (English and Comparative Literature), Makoto Ueda (Japanese and Comparative Literature)

Associate Professors: Joaquim F. Coelho (Portuguese and Comparative Literature), N. Gregson Davis (Classics and Comparative Literature), David G. Halliburton, on leave winter and spring quarters 1979 (English, Comparative Literature, and Modern Thought and Literature), William M. Todd III (Slavic and Comparative Literature)

Assistant Professors: Robert Ball, on leave autumn and winter 1978-79 (Spanish and Comparative Literature), John B. Foster (English and Comparative Literature), Mary Pratt (Spanish and Portuguese 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 Chairman of
the Humanities Honors Program. Because of the rigorous 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 advisor representing 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 Humanities 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—preferable 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. The program is designed to encourage familiarity with the major approaches to literary study prevailing today.

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). The teaching requirement is the same regardless of financial support. For specific teaching requirements, see below. Although financial support is limited to four years, the time-table for the completion of requirements allows students to spread their work over five years. Students in the fifth year ordinarily apply for outside fellowships or for part-time teaching positions in the various language and literature departments 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 Greek, Chinese, or Japanese may be substituted when appropriate), if the period in which the student concentrates is earlier than
the Romantic 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.

Teaching—All Fellows, whatever their sources of financial support, are required to do three quarters of supervised teaching at half-time and one quarter at quarter time. Comparative Literature Fellows must complete whatever pedagogy courses are required by the departments in which they teach.

Minimum Course Requirements
1. Comparative Literature 369 (Major Modern Critics) and three additional seminars (or courses that assign a long paper) 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 literatures other than the student's native literature.
3. A sufficient number of courses in the student's primary field to assure his or her 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.

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 examination 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 beginning of the student's second year of graduate work (or the third quarter of the first year for students who enter with a year of previous graduate work).
2. Literary criticism, to consist of the exploration of a specific problem proposed and defined by the student. The problem must be sufficiently wide-ranging to demand the reading of critical texts from a variety of periods. 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 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, have the option of dividing the period sections into two wholly separate periods. This examination, which will normally be taken during the first quarter of the student's fourth year (or second quarter of the third year for students who enter with a year of previous 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 beginning 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 or her for admission to candidacy for the Ph.D. At this time the
student will also be recommended for the A.M. in Comparative Literature if he or she 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 quality 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**

See respective departmental listings for (DR) notations.

Courses primarily of a comparative nature are listed below:

1. **Introduction to Drama**—(Enroll in Drama 1.) Introduction to major dramatic forms, concentrating on selected masterpieces in order to develop theatrical sensibility in reading dramatic texts.
   5 units, Win (Esslin)

2. **Imitations and Translations of Latin Literature**—(Enroll in Classics 6.) The course is designed for students interested in both English and Latin literature. No knowledge of Latin is required. Reading will include Dryden's translation of the *Aeneid*, Johnson's imitations of Juvenal, Pope's of Horace, Pound's *Homage to Sextus Propertius* and excerpts from an Elizabethan translation of Ovid's *Metamorphoses*.
   3 units, Win (Spofford)

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.
   5 units, Aut (L. Martin)

40. **Drama**—(Enroll in English 40.) Principal dramatic forms; development of dramatic art, masterpieces of the theater from various periods, countries.
   5 units, Spr (L'Heureux)

50. **Poetry**—(Enroll in English 50.) An introduction, through the careful reading of poems, with emphasis on contemporary American poetry, and through the study of language and technical elements of verse. There will be opportunity for the writing of poetry.
   5 unit, Aut (B. Gelpi)

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)

62. **Christian and Secular Europe: Medieval and Renaissance**—(Enroll in Humanities Special Programs 62.) St. Augustine, Boethius, Dante, Castiglione, More, Montaigne, Marlowe, Cervantes, Molière.
   5 units, Win (Ryan, Staff)

63. **From the Enlightenment to the Present**—(Enroll in Humanities Special Programs 63.) Voltaire, Rousseau, Dostoevsky, Marx, Freud, Conrad, Faulkner. Short novels by Mann, Kafka, Gide. Selected poems by other writers.
   5 units, Spr (Guerard, Staff)

101. **The Structure of the English Language**—(Enroll in English 101. Same as Linguistics 180.) An introduction to English linguistics and applications of linguistic concepts to literary analysis. Emphasis on the phonological, syntactic, semantic and pragmatic structure of English, with some attention to regional and social dialects.
   5 units, Spr (Guerard, Staff)

114. **English Culture from the Accession of Elizabeth to the Civil War**—(Enroll in English 114. Same as History 242.)
   5 units, Spr (Riggs, Seaver)

135. **Classical Conventions in the European Lyric**—(Enroll in Classics 135.)
   4 units, (Davis) given 1979-80
140. Introduction to Methods of Literary Analysis—(Enroll in Spanish and Portuguese 140.) Designed for students with little or no background in literary analysis. Introduces basic terminology of literary criticism and examines a variety of critical approaches to literature. Specific literary texts will be discussed in detail in light of readings in literary theory and criticism. Emphasis will vary with individual instructors, but the general purpose of this course is to teach students to read, write and think about literature. Given annually. Pre-requisite: Spanish 6 or equivalent.

3-5 units, Aut (Pratt)

160B. Literature of the Holocaust—(Enroll in English 160B. Same as Modern Thought and Literature 160B.)

5 units, Spr (Felstiner)

162E. Introduction to Caribbean Poetry: English, French, Spanish—(Same as English 162E, Modern Thought and Literature 162E, and African and Afro-American Studies 162E.) Focus on the literature of the former French and British Islands.

4-5 units, Win (Davis)

167C. Introduction to Folklore—(Enroll in English 167C. Same as Modern Thought and Literature 167C.) A basic approach to the study of folklore, using examples drawn from several cultural traditions, especially English and American; genres such as folktale and folksong along with minor genres such as riddle, proverb, and charm; the role of ritual and the social functions of oral literature; folk drama; custom and popular belief; the general outlines of the history of folklore studies and methodologies and some recent structuralist work in folkloristics.

5 units, Spr (Harris)

172. Classical Influences in Modern Literature—(Enroll in Classics 172.)

3-4 units, (Staff) given 1979-80

174. Stage Comedy from Aristophanes to Shakespeare—(Enroll in English 174. Same as Classics 174 and Drama 158.) Readings in classical comedy, including Aristophanes, Menander, Plautus, and Terence; in renaissance comedy, including Ariosto, Shakespeare, and Jonson. Works not written in English will be read in translation.

5 units, Spr (Foley, Riggs)

179A. The Grotesque in Art and Literature—(Enroll in German Studies 179A.)

3 units, Win (Weisstein)

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 (Lindenberger)

Spr (Foster)

207. Sense of Identity in Modern Women Writers—(Enroll in Modern Thought and Literature 207.) An examination of female writers whose sense of identity is related to their creativity, sexuality, maternity and social class. Simone de Beauvoir, Violette Le Duc, Marguerite Duras, Sylvia Plath, Tille Olsen and others.

5 units, Win (M. Yalom)

208. Post-Classical Latin—(Enroll in Classics 118. Same as English 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.

4 units, Spr (Stephens)

212A. Medieval to Renaissance: The Development of Literary Forms—(Enroll in English 212A.)

5 units, Aut (Trimpi)

212B. Continuation of 212A—(Enroll in English 212B.)

5 units, Win (Trimpi)

226. Problems of Symbolism in Russia—(Enroll in Slavic Languages and Literatures 226.) Nineteenth-century theories of language as a means of access to myth, with application to the poetry and prose of Merezhkovsky, Ivanov, Blok and especially Bely.

4 units, Win (Anschuetz)

230. Medieval Narrative: Theory and Practice—(Enroll in English 230. Same as Medieval Studies 162.) A topical approach to narrative, using mainly (but not exclusively) medieval texts and involving a good deal of reading in recent literary theory. A reading knowledge of Middle English is a prerequisite for the course.

5 units, Spr (Harris, J. Martin)

230A. Russian Formalism and Structuralism—(Enroll in Slavic Languages and Literatures 230. Same as Modern Thought and Literature 214.) The Russian Formalists' contribution to literary criticism and theory; the relationship of Russian Formalism to critical movements in the West; the Prague School, and the Russian Structuralists. No knowledge of Russian is required, but knowledge of Russian, French, German, or Czech is highly desirable.

4 units, Spr (Brown)
234A. European, Especially “Nordic” Symbolism in Literature and Art About 1900 (Ibsen, Strindberg, Munch)—(Enroll in German Studies 234A.) The development of symbolism in Ibsen’s drama; Strindberg’s symbolic dramatic structure and his hermetic symbols, their foundation in naturalist and psychoanalytic theory, the dream-structure; Kierkegaard’s, Schopenhauer’s and Nietzsche’s influence; J. P. Jacobsen’s symbolist novels, his influence on Rilke; Strindberg’s paintings, the art of Edvard Munch on the verge of Expressionism; the close theoretical correspondence of “Nordic” with European Symbolism (Baudelaire, Yeats, Moreas, Mallarmé, Proust, Maeterlinck, Spanish modernismo, Rilke, etc.; Grandville, Böcklin, Redon, Klinger, Rossetti, Stuck, etc., in the Fine Arts) and with Naturalism—only a seeming paradox: the great impact which “The Scandinavian Poets” had on European literature in 1890-1920.

  3 units, Aut (Weber)

234F. History as Literary Art—(Enroll in English 234F. Same as Modern Thought and Literature 234F.) A close study of the art of historical reconstruction in nine narrative accounts of American history which justly may be called masterpieces of American prose. Readings, ranging from the seventeenth to the twentieth century, will include works by Bradford, Edwards, Parkman, Bancroft, Henry Adams and Norman Mailer.

  5 units, Win (Fliegelman)

235. The Impressionist and Experimental Novel—(Enroll in English 235. Same as Modern Thought and Literature 235.) A course in the critical analysis of impressionist masters (such as Conrad, Ford, Lowry, Faulkner), of major experimental novelists (Joyce, Woolf, Kafka), and of short works by several living writers. Lectures and discussions.

  5 units, Win (Guerard)

236A. The Libretti of Viennese Classicism; Haydn, The Creation; Mozart, The Magic Flute; Beethoven, Fidelio—(Enroll in German Studies 236A.) The libretti will be discussed in the framework of literary history and literary aesthetics, and in their relationship to the entire libretti production in Austria between 1780 and 1820. In coordination with musicology, a new understanding of these three works should result, which could become the standard for modern productions and should provide new impulses for libretti research. Additional readings: Haydn, The Seasons; Mozart, The Impresario, The Marriage of Figaro, Don Giovanni, Cosi fan Tutte; and Beethoven, all versions of Leonore and Fidelio.

  3 units, Spr (Zeman)

248. Contemporary Caribbean Fiction—(Enroll in Spanish and Portuguese 248.) This course will be based on a comparative analysis of the major themes of the contemporary novel in the Spanish-speaking, French-speaking and English-speaking Caribbean. The course will be taught in English; Spanish and French novels will be read in translation.

  3-5 units, Aut (Wynter)

252. Latin American Literature in a Social Context. The Mexican Revolution and the Narrative—(Enroll in Spanish and Portuguese 252. Same as Modern Thought and Literature 251.) The course will deal not only with the novel of the revolution (Azuela, Guzmán, Rulfo, Yañez) but also with texts in English (John Reed, B. Traven, Graham) as well as with oral narrative and autobiography.

  3-5 units, Spr (Franco)

255A. The Nature of Literature: Japanese and Western Views—(Enroll in Asian Languages 255A.)

  5 units, Ueda, given 1979-80

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. Graduate students in Chinese may enroll in this seminar in lieu of 361 and will be required to read original texts.

  5 units, Aut (Yu)

260. The History of Literary Theory—(Enroll in English 260.)

  5 units, Aut (Trimpol)

261. Literature and Film: Theory/Practice—(Enroll in English 261. Same as Communication 261 and Modern Thought and Literature 261.) Interchanges between writers and film-makers, literary theory and film aesthetics. Literature, film, and theory in Russian Formalism (Mayakovsky, Eisenstein) and Surrealism (Breton, Artaud, Buñuel, Franju). Semiotics and phenomenology as orientations toward literature and film: critical texts (Bartels, Eco, Metz; Bachelard, Poulet, Bazin, Farber, Cavell) and screenings (Robbe-Grillet, Godard, Renoir, Hawks).

  5 units, Win (Comito)

263B. Feminist Literary Criticism: Theory and Practice—(Enroll in English 263B. Same as Modern Thought and Literature 263B.) The development of feminist approaches to the study of literature and the practice of criticism. Prerequisite: completion of at least one English course number 100 or above.

  5 units, Spr (Middlebrook)

269B. Towards an Understanding of Modernism—(Enroll in English 269B. Same as Modern
Thought and Literature 269B.(An introduction to the general assumptions behind literary modernism, both English and European. Main topics: symbolist and mythic theories of literature; allied currents in modern thought such as psychoanalysis, existentialism, and the revolt against positivism; modernist texts drawn from Nietzsche, Mann and Proust.

5 units, Spr (Foster)

271. Solzhenitsyn—(Enroll in Slavic Languages and Literatures 271. Same as Modern Thought and Literature 271.) A study of the major work of Solzhenitsyn within its historical and social context and in its relation to contemporary American and European literature.

4 units, Spr (Brown)

284A. Joyce, Proust, Mann: I.—(Enroll in German Studies 284A.)

3 units, (Gillespie) given 1979-80

285A. Joyce, Proust, Mann: II.—(Enroll in German Studies 285A.)

3 units, (Gillespie) given 1979-80

291. The Poem Itself—(Enroll in Spanish and Portuguese 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.

3-5 units, Win (Coelho)

292. Ideology and Mass Culture—(Enroll in Spanish and Portuguese 292. Same as Modern Thought and Literature 292.)

3-5 units, (Franco) given 1979-80

295A. Literature of Anarchism and Nihilism—(Enroll in German Studies 295A. Same as Modern Thought and Literature 295A.)

3 units, (Gillespie) given 1979-80

296. Travel Literature: Study in Cultural Confrontation—(Enroll in Spanish and Portuguese 296.) The Western traveler as cross-cultural interpreter and mediator in the third world. The ideological appropriation of foreign contexts as related to developments in world history and economy. Fiction, journals, travelogues, essays, documentary and ethnographic writings, and film.

3-5 units, Win (Pratt, Benmayor)

296A. Preconditions of Literature. German Literature as an Example—(Enroll in German Studies 296A. Same as Modern Thought and Literature 296A.) The material side of literature has long been neglected by the traditional history of literature, especially in Germany. The preconditions, which make the existence of literature possible, have become now the target of intensive study and research. The course will deal with such topics as literacy and alphabets, literacy socialization (education and the literary canon), book publishing and trade, the common reader, the impact of libraries, and so on.

3 units, Spr (Frank)

300. Graduate Seminar: Russian Literature as an Institution—(Enroll in Slavic Languages and Literatures 300. Same as Modern Thought and Literature 300.) A study of literary production, dissemination, and reception in selected periods of Russian literature, from the Middle Ages to the present. Readings in social theory, literary criticism, and imaginative literature. Open to students without Russian only by permission of the instructor.

4 units, Win (Todd)

300A. Graduate Seminar: Theory of Narrative—(Enroll in Slavic Languages and Literatures 300.)

5 units (Todd), given 1979-80

302. Contemporary Approaches to Criticism—(Enroll in Drama 302.)

4 units, Win (Chioles)

306. Introduction to Literary Criticism and Theory—(Enroll in Spanish and Portuguese 306.) A graduate seminar dealing with contemporary critical theory and methods of literary analysis, with special emphasis on the theory of the narrative. Reading knowledge of Spanish and/or French required.

3-5 units, Aut (Cavallari)


5 units, (Ball) given 1979-80

308. Marxism and Aesthetics—(Enroll in Spanish and Portuguese 308. Same as Modern Thought and Literature 308.)

3-5 units, (Cavallari) given 1979-80

309. Critique of Structuralism and Poststructuralism—(Enroll in Spanish and Portuguese 309.) Selected readings in contemporary French critical theory of literature and of writing. The course will explore the possibilities and limitations of certain lines of structuralist and post-structuralist thought, seeking to elucidate their epistemological and ideological foundations.

3-5 units, (Cavallari) given 1979-80

310. Linguistics and Literature—(Enroll in Spanish and Portuguese 310.) Focuses on linguistic problems of relevance to literary analysis, such as the description of narrative discourse, metaphor, and fictional discourse;
the pragmatics of literature; the sociolinguistic status of literature.

5 units, Spr (Pratt)


5 units, Win (Bender, Riggs)

314F. Seminar: Renaissance Romance—(Enroll in English 314F) Main emphasis on Sidney's Arcadia, FQ VI, Pericles, Cymbeline, The Winter's Tale. Influence of Greek romance (Achilles Tatius, Heliodorus), pastoral romance (Longus, Sannazaro, Montemayor), and Renaissance epic (Ariosto, Tasso). Some attention may be paid to other English prose romances and/or Amadis of Gaul, and to the plays of Beaumont and Fletcher.

5 units, Aut (Comito)

315F. Seminar: The Enlightenment and Its Literary Traditions—(Enroll in English 315F. Same as Modern Thought and Literature 315F.)

5 units, Aut (Watt)

316C. Seminar: Romantic Irony—(Enroll in English 316C. Same as Modern Thought and Literature 316C.)

5 units, Spr (Mellor)


3-5 units, Spr (Ball)

326. Seminar on Baroque Poetics—(Enroll in Spanish and Portuguese 326.)

3-5 units, (Ball) given 1979-80

352. The Cosmic Dramas—(Enroll in Drama 352.) An examination of some of the attempts to write plays which would present a complete world-view or interpretation of history, e.g. for example Goethe's Faust, Krasinsky's Non-Divine Comedy, Madach's The Tragedy of Man, Karl Kraus' Die letzten Tage der Menschheit, Ibsen's Peer Gynt, Wilder's The Skin of Our Teeth, Evreinov's The Main Thing.

4 units, Spr (Esslin)

353B. Seminar in Dramatic Period: Medieval Drama—(Enroll in Drama 353B.)

4 units, Spr (Froesser)

360C. Seminar: Neoclassicism and Aesthetics: The Plotinian Construction—(Enroll in English 360C. Same as Modern Thought and Literature 360C.)

5 units, Spr (Trimpi)

361. Seminar: The Modern Tradition—(Enroll in English 361. Same as Modern Thought and Literature 361.) Studies in masters of modern thought (such as Rousseau, Marx, Freud) from 1750 to the present.

5 units, Win (Watt)

369. Seminar: Major Modern Critics—(Enroll in English 369. Same as Modern Thought and Literature 369.) An introduction to modern European and American literary criticism. Required of first-year graduate students in Comparative Literature.

5 units, Aut (Lindenberger)

371. Germanic Poetry and Its Poetics—(Enroll in German Studies 371. Same as English 351.) The seminar will discuss the basic laws of Germanic syntax, prosody, verse and rhyme; epic, gnomic and skaldic metres; Liedstil and Epenstil; the aesthetics of Skaldic Poetry and its analogue in the ornamental Viking Art; the sophisticated semantic system of kenning-style in Skaldic and OE. epic poetry, its origins in magic. Specimen of all major genres on OHG, OSax., OE. and ONorse poetry will be analyzed (some knowledge of one of these dialects is required).

3-5 units, Aut (Weber)

393. Seminar on Petrarch and the Petrarchan Lyric of Sixteenth Century Europe—(Enroll in Spanish and Portuguese 393. Same as Italian 393.)

3-5 units, (Ball) given 1979-80

395. Naturalism—(Enroll in German Studies 395.)

3-5 units, Win (Weisstein)

396. Introduction to Graduate Study—(Enroll in English 396.) A two-unit required course for first-year graduate students in English and Modern Thought and Literature and for those students in Comparative Literature who will be teaching in the Freshman English program. The course provides instruction in teaching—especially leading a section and evaluating essays and examinations—and a broad introduction to the opportunities and responsibilities of graduate study. The class will meet weekly. The instructors will assign brief readings and a short final paper. The course is offered on a Pass/No Credit basis only.

2 units, Aut (A. Gelpi, Packer)

397A. Seminar in Teaching Composition—(Enroll in English 397A.) A required course for second-year graduate students in English and Modern Thought and Literature and students in Comparative Literature who will be teaching in the Freshman English Program.

5 units, Aut (Packer)
COMPUTER SCIENCE

397B. Teachers Workshop I—(Enroll in English 397B.) A seminar for second-year graduate students who will be teaching in the Freshman English program.
5 units, Win (Bender)

397C. Teachers Workshop II—(Enroll in English 397C.) A seminar for second-year graduate students teaching the second quarter of composition.
5 units, Spr (Bender)

COURSES IN TRANSLATION

We wish to call attention to the following courses in translation within individual national literatures.

ASIAN LANGUAGES

131. Chinese Poetry and Drama in Translation
132. Chinese Fiction in Translation
133. Modern Chinese Literature in Translation
136. Early Japanese Literature in Translation
137. Japanese Literature in Translation—The Middle Period
138. Modern Japanese Literature in Translation
176. Chinese Myths, Legends, and Folktales
178. Japanese Poetry from Mayoshū to Shinkokinshū (759-1206)
179. Classical Japanese Drama
182. Japanese Popular Religious Literature

CLASSICS

161. The Classical Epic
162. Greek Tragedy: Aeschylus, Sophocles, Euripides

FRENCH AND ITALIAN

102. Writings of Simone de Beauvoir
105. The Writings of Albert Camus
114B. The Modern French Novel
115. Introduction to Existentialism

SLAVIC LANGUAGES AND LITERATURES

145. Survey of Russian Literature in English Translation I: The Rise of a Secular Literature
146. Survey of Russian Literature in English Translation II: From Realism to Symbolism
147. Survey of Russian Literature in English Translation III: The Modern Period

151. Dostoevsky's POSSESSED and the Figure of the Pretender in Russian Literature

153. Leo Tolstoy

SPANISH AND PORTUGUESE

120A. Don Quixote in Translation
121A. Spanish Drama in Translation
123A. Spanish-American Literature in Translation: Contemporary Mexican Writers
126A. Brazilian Literature in Translation

COMPUTER SCIENCE

Emeritus: Arthur Samuel (Adjunct Professor)
Chairman: Edward A. Feigenbaum
Associate Chairman: Dennis P. Brown


Associate Professors: Forest Baskett, Robert E. Tarjan

Adjunct Professor: Bruce G. Buchanan

Assistant Professors: C. Cordell Green, Joseph E. Oliger (on leave 1978-79), Gino Wiederhold, Terry Winograd, Andrew C. Yao, F. Frances Yao

Senior Research Associate: Lester D. Earnest

Lecturers: Paul Armer, Daniel G. Bobrow, Dennis P. Brown, John R. Ehrman, Robert W. Taylor

Affiliated Faculty:
Professor: Michael J. Flynn (Electrical Engineering)
Associate Professor: John T. Gill, III (Electrical Engineering)

Assistant Professors: John Hennessy (Electrical Engineering), Balasubramanian Kumar (Electrical Engineering), Susan S. Owicki (Electrical Engineering), Fouad Tobagi (Electrical Engineering), William M. van Cleemput (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, numerical analysis, computational complexity theory, and computational linguistics.

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 on page 292. 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 and to include Computer Science 106; 109A, 109B, or 111; 137A; 144A, 144B, and 155 in their course of study.

In connection with its courses, the Department makes use of the Low Overhead Time Sharing (LOTS) system. See the section “LOTS Computing Facility” in this bulletin. For some research and teaching, the Department uses the Stanford Center for Information Processing. See the section “Stanford Center for Information Processing” in this bulletin. In addition, the Department has an HP-2116 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, semantics of natural languages, symbolic computation, and related topics. It operates a time-sharing system with a PDP-10 computer; 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. A lecture series, Computer Science 200, is presented for new students at which members of the Department speak informally on their research interests and their views on the nature of computer science.

**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.

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. Well-prepared students usually require a minimum of four quarters to complete the requirements for this degree. Five and six quarter programs are common. The Comprehensive Examination is given twice a year, once in January and once in May.
MASTER OF SCIENCE IN
COMPUTER ENGINEERING

The degree of "Master of Science in Computer Science: Computer Engineering" may be conferred upon students who wish to develop a competence in the design of substantial software-hardware computer systems. The degree will be administered by the Committee on Computer Engineering, composed of faculty from the Electrical Engineering and Computer Science Departments. Present members include Edward J. McCluskey, Chairman, John Hennessy, and Gio Wiederhold.

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 five courses: E.E. 381A, E.E. 381B, C.S. 142 plus either (a) C.S. 246A and C.S. 311; or (b) two of: C.S. 143, C.S. 145, C.S. 246A.

2. At least one course in mathematical foundations for computer engineering. Acceptable courses: 150, 155, 156, or Electrical Engineering 284.

3. At least one course from two of the following areas: (a) Numerical Analysis—Computer Science 135 or 137A; (b) Finance or Accounting—GSB 210 Management Accounting I, GSB 220; Business Finance I, or I.E. 133; (c) Optimization—O.R. 153; O.R. 154; or E.E.S. 242; (d) Statistics 200; (e) Digital Integrated Circuits E.E. 313.


5. At least 3 units of seminar with a total not to exceed 6 units. Acceptable courses: C.S. 300, 319A, B, C, D, E, F, Electrical Engineering 380, 385, A, B, C, D, E, or F.

6. 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. (Courses taken under guidelines 1 through 4 should normally be taken for a letter grade.) 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. In particular, students are not expected to take courses when they have had the equivalent subject matter previously. The student should submit a written statement of individual objectives and how the program and previous preparation meet these objectives.

The 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.

Upon entrance to the program, students are expected to have proficiency at the level of C.S. 107, 111, and E.E. 182. Students lacking in one or more of these areas should enroll and complete these courses prior to entering the 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 advisor 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, to remain in the Ph.D. program, 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 (excluding summers). By the end of nine quarters (excluding summers) each student should pass a qualifying exam in the general area of his or her expected dissertation. The Department Secretary has further details.
3. As part of the training for the Ph.D., each student is required to complete two units of teaching assistant service, one unit (10 hours per week for one quarter) being required during the first two years as evidence of satisfactory progress toward the degree. In addition, research equivalent to that normally performed by research assistants is required during one or more quarters.

4. The most important requirement for the Ph.D. degree is the dissertation. After passing the qualifying examination each student must secure the agreement of a member of the department faculty to act as the dissertation advisor. (In some cases the dissertation advisor may be in another department.) 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. Each student must pass a University Oral Examination in the form of a defense of his or her dissertation. It will usually be held after all or a substantial portion of the dissertation research has been completed.

6. The student is expected to demonstrate the ability to present scholarly material orally, both in the dissertation defense and by a lecture in a departmental seminar.

7. The dissertation must be accepted by a reading committee, composed of the principal dissertation advisor, a second member from within the department and a third member chosen from within the university. The principal advisor and at least one of the other committee members must be Academic Council members.

PH.D. MINOR

For a minor in Computer Science a candidate is required to demonstrate a suitable level of competence in the departmental comprehensive examination. There are no specific course requirements. For further information see the Department Secretary.

Teaching and Research Assistantships

There are graduate student assistantships available in the Computer Science Department. Assistants receive a tuition scholar-ship for up to nine units of study per quarter during the academic year, and in addition receive stipends of at least $4215 for the nine-month year. Some may work full time in the summer for approximately $935 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. Nearly all teaching and research assistantships are held by Ph.D. students in the Computer Science Department. These positions are infrequently staffed by Masters students in the department or by students from other departments. Part-time Course Assistant (formerly grader) positions are often available, with an associated partial tuition grant.

Students with NSF fellowships and traineeships may have the opportunity to supplement their stipends by serving as graduate student assistants.

Further information may be obtained from the Associate Chairman of the Computer Science Department.

COURSES FOR UNDERGRADUATE AND GRADUATE STUDENTS

All courses (DR:T) if taken for 3 or more units.

101. Computers: Their Nature, Use, and Impact—Intended to introduce students from all departments to the world of computers and their uses. It is designed to survey for non-specialists a variety of issues relating to computers. Topics include basic concepts and vocabulary of computers and information processing; current applications of computers in education, business, music, art, medicine, science, transportation, law, law enforcement, and government; future trends in the economics of computing, technological advances, artificial intelligence; impact of computers on issues of privacy, employment, leisure, obsolescence, political and economic power, health care, and man's image of himself. Not intended for students who want to learn to program a computer. Alternates: 105, 106. No prerequisite.

3 units, Spr (Feigenbaum) MWF 2:15

103. Programming in FORTRAN—An in-
duction to FORTRAN for students with experience in programming in another high-level programming language. Prerequisite: 105, 106 or equivalent.

1 unit, Aut (Finkelstein) MWF 12,
first 4 weeks only
Win (Staff) MWF 12,
first 4 weeks only

104. Programming in PASCAL—A shortened alternative to 105 or 106, for students with previous knowledge of computer programming.

1 unit, Aut (Staff) MWF 12,
first 4 weeks only
Win (Staff) 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 3 or equivalent.

*3 or 4 units, Aut (Staff) MWF 10:00,1:15
Win (Staff) MWF 10:00,1:15
Spr (Staff) MWF 10:00,1:15
Sum (Staff) MTWTh 10

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 may be 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.

*3 or 4 units, Aut (Herriott) MWF 11:00,2:15
Win (Staff) MWF 11:00,2:15
Spr (Staff) MWF 11:00,2:15
Sum (Staff) MTWTh 9, 11

107. Systematic Programming—(Same as Electrical Engineering 180.) Introduction to systematic program design, use of a variety of data structures, manipulation of text, macro processing. Program correctness, informal verification, and testing. Modularization, scope concepts, and portability. Prerequisite: 104, 105, 106 or equivalent.

3 units, Aut (Owicki) MWF 9:00;
Enroll in E.E. 180
Win (Brown) MWF 2:15
Spr (Brown) MWF 2:15

109A. Assembly Language Programming—Based on IBM System/370. 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, or 311. Alternates: 109B, 111. Prerequisites: 105 or 106 or equivalent. Recommended: 107 (E.E. 180).

3 units, Win (Ehrman) MWF 1:15


1-3 units, (Staff) by arrangement


3 units, Aut (Tobagi) MWF 1:15
Win (Wakerly) MWF 1:15
Spr (Wiederhold) MWF 1:15

include analysis of convergence and estimation. Problems discussed in 137B include numerical differentiation, integration, solution of ordinary differential equations, matrix eigenvalue and least squares computations. Both courses will include analysis of convergence and estimation of truncation and round-off errors. Pitfalls in automatic computation and their remedies will be discussed. Assigned work will include both analytic problems and problems to be solved with the aid of a computer. Alternate: 135. Prerequisites: 105 or 106; Mathematics 113, 130 or equivalents.

137A. 3 units, Aut (Henrici) MWF 9
137B. 3 units, Win (Herriot) MWF 2:15

142. Language Features and Their Implementation—(Same as Electrical Engineering 285, which is offered Winter Quarter.) Aspects of algorithmic languages. Implementation techniques for recursion, reentrancy, protection, and sharing. Program representation and data management in a dynamic environment, garbage collection, etc. Binding, process interaction, messages and events. Module and class concepts. Prerequisites: 107 and 111 (E.E. 180 and E.E. 181).

3 units, Aut (Wiederhold) TTh 1:15
Win (Owicki) (Enroll in E.E. 285)

143. Compilers—(Same as Electrical Engineering 286.) The grammars of programming languages; lexical analyzers, parsers, code emitters and interpretation; global and peephole optimization; run time support; error management; translator writing systems. A small project will be assigned. Prerequisite: 142 (E.E. 285).

3 units, Win (Hennessy)

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. Prerequisite recommended: 107, 155.

144A. 3 units, Aut (Baskett) MWF 3:15
144B. 3 units, Win (Knuth) MWF 3:15


3 units, Win (Wiederhold) MWF 1:15

150. Introduction to Combinatorial Theory—Intended as an elementary first course in com-
binatorics. Topics include permutations, combinations, partitions; the principle of inclusion and exclusion; the elementary theory of graphs and trees; latin squares, block designs, finite fields, and finite geometries; an introduction to matroids. Prerequisite: Mathematics 44 or equivalent.

3 units, Win (Staff) 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: Mathematics 113.

3 units, Win (vanCleemput) MWF 9

154. Formal Languages—An introduction to the basic mathematical theory underlying programming languages. Regular sets, context-free languages, deterministic context-free languages. Theory of grammars and parsing algorithms. Relevant automata theory with emphasis on applications to language translation.

3 units Spr (F. Yao) MWF 10

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 (F. Yao) MWF 1:15

156. Introduction to the Mathematical Theory of Computation—This course will deal with the questions, "How does one formally specify an algorithm? What problems can be solved by algorithms? How does one show that an algorithm meets its specifications?" Aspects of logic and computability theory which bear on these questions will be covered. Familiarity with mathematical reasoning is assumed.

3 units, Aut (Manna) TTh 3:15 plus lab by arrangement

191. Software Engineering Laboratory—(Enroll in Electrical Engineering 288.) Project-oriented software or software/hardware systems design. Emphasis on the practical systems engineering and project management aspect, as well as upon design processes and design evaluation. Students are encouraged to suggest and define their own projects. Several written reports are required in keeping with good software engineering practices. Computer facilities include a PDP-11 and various microcomputers. Registration for two quarters is advised. Corequisite: 142 (E.E. 285) or consent of instructor.

3 units, Win (Allison) W 10

Spr (Allison) W 10

192. Programming Service Project—Appropriate academic credit (without financial support) will be given for volunteer computer programming work of public benefit and educational value.

1-3 units, any quarter (Staff) by arrangement

193. Digital Logic Laboratory—(Enroll in Electrical Engineering 183.) Experiments in digital logic design using TTL integrated circuits, including SSI gates, and flip-flops, MSI registers and ALU's, and LSI memories. Choice of projects, including: basic combinational and sequential circuits, various sequential machines. D/A converters and CRT displays, integrators, arithmetic processors, rudimentary stored program processors, game-playing machines. Prerequisite: 112 (E.E. 182) or 211A (E.E. 381A). Recommended: 211B (E.E. 381B).

3 units, Aut (Flynn) T 9 plus

4 hour lab by arrangement

Spr (Kumar) T 11 plus

4 hour lab by arrangement

Sum (Staff)

194. Microcomputer Laboratory—(Enroll in Electrical Engineering 281.) Introduction to a specific microprocessor such as the INTEL 8080 or the MOTOROLA M6800. Lectures covering the programming and structure of a microcomputer system, accompanied by laboratory exercises. Prerequisite: 111 (EE 181) and 112 (EE 182) or equivalents, and some hands-on experience with TTL Logic, such as 193 (EE 183).

3 units, Aut (Allison) TTh 3:15

plus lab by arrangement

Win (Gill) TTh 3:15 plus

lab by arrangement.

Sum (Staff)

199. Independent Work

Any quarter (Staff) by arrangement

COURSES INTENDED PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:T) if taken for three or more units.

200. Departmental Lecture Series—Weekly presentations by members of the department, each describing informally his or her current research interests and views of Computer Science as a whole. Limited to Computer Science
graduate students. Recommended for first-year graduate students.

1 unit, Aut (Staff) Th 2:15

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. Enrollment limited to 20.

3 units, Aut (Knuth) 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. Recommended: 107.

3 units, Aut (McCarthy) TTh 11:00-12:15
Spr (Staff) TTh 1:15-2:30

209. Topics in Computer Science—Given only when a suitable faculty member is available.

By arrangement

211A,B. Design of Digital Circuits and Systems—(Enroll in Electrical Engineering 381A,B.) A two quarter sequence devoted to principles and techniques of digital design. Topics include code for representing information, integrated-circuit logic families, logic design, MSI design, sequential circuit analysis and synthesis. Also covered are computer organization, control units and microprogramming, memory systems, arithmetic units, and input-output structures. Each student does a project involving the detailed design of an entire digital system. Prerequisite: 112 (E.E. 182).

211A. 3 units, Aut (Peterson) MWF 9
(Kumar) MWF 11
Win (McCluskey) MWF 11
211B. 3 units, Win (Kumar) MWF 11
(Peterson) MWF 1:15
Spr (McCluskey) MWF 11

219. Topics in Digital Systems—Given only when a suitable faculty member is available.

By arrangement

224. Models of Thought Processes—(Same as Psychology 224.) 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 (Staff) 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 effect 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 (Michie) TTh 1:15

226. The Representation Problem in Artificial Intelligence—Formalisms for representing what a general intelligent problem must know about the world including facts of causality, ability, knowledge. Programs for manipulating these formalisms. Prerequisite: 225.

3 units, Win (McCarthy) alternate years, given 1979–80

227. Introduction to Robotics and Machine Vision With Artificial Intelligence Approach—Comparison with psychophysics. Robot systems: representation and parts modeling as a basis for planning and Very High Level Language; survey/comparison of languages; force sensing; kinematics, dynamics, computer control; system issues: multi-processors; survey/comparison of manipulators; applications and economics. Vision Systems: Representation, three-dimensional interpretation; stereo and motion parallax, motion; interpretation of line drawings; image features, edges and regions; organization of image features, texture; illumination and reflectivity; applications; image sensors.

3 units, Aut (Binford) TTh 11

229. Topics in Artificial Intelligence—Given only when a suitable faculty member is available.

By arrangement

234. Numerical Methods of Optimization—Serves as an introduction to software and some numerical analysis aspects of algorithms used to solve unconstrained and constrained optimization problems encountered in operations research. Topics include pivotal optimization techniques, combinatorial search procedures, shortest path and other graph algorithms, dynamic programming from the software point of view. Students are expected to program algorithms discussed in class. This course is recommended as a complement to courses like Operations Research 340A. Prerequisites: Math 113; and some knowledge of computer programming.

3 units, Aut (Dantzig) TTh 9:30-10:45

235. Statistical Computing—(Same as Statistics 227.) Numerical analysis aspects of least
squares, nonlinear and robust regression, random number generation and Monte Carlo, eigenvalue computations in multivariate analysis, numerical integration and computational complexity. Emphasis on computational aspects which are relevant to practical statistical problems. Prerequisites: Statistics at the level of 219-220, matrix algebra, knowledge of a programming language.

3 units, Aut (Staff) by arrangement
alternate years, given 1979–80

237A. Advanced Numerical Analysis—Numerical approximation of functions and data, approximation theory and its applications to standard numerical analysis problems such as quadrature and the solution of differential equations. Prerequisite: 137A and 137B.

3 units, Aut (Staff)
alternate years, given 1979–80

237B. Advanced Numerical Analysis—Solution of boundary value problems for ordinary differential equations and elliptic partial differential equations by finite difference and finite element methods. Particular attention will be paid to the implementation of methods and to realistic applications. Prerequisites: 137A and 137B.

3 units, Win (Staff)
alternate years, given 1979–80

237C. Advanced Topics in Numerical Analysis—Approximate methods for initial value problems and initial boundary value problems for partial differential equations. Convergence and stability theory, analysis of methods, finite difference and finite element methods. Particular attention will be paid to the implementation of methods and to realistic applications. Prerequisites: 137A and 137B.

3 units, Spr (Staff)
alternate years, given 1979–80

238A. Advanced Numerical Analysis—Solution of linear problems, linear equations, iterative methods for large sparse systems, linear programming, linearization of nonlinear problems. Prerequisites: 137A and 137B.

3 units, Aut (Golub)
alternate years, given 1978–79

238B. Advanced Topics in Numerical Analysis—The algebraic eigenvalue problem, perturbation theory, numerical algorithms for dense and sparse matrices, error analysis, special applications, inverse problems. Prerequisites: 137A and 137B.

3 units, Win (Wilkinson)
alternate years, given 1978–79

238C. Advanced Topics in Numerical Analysis—Numerical solution of initial value problems for ordinary differential equations, convergence and stability theory, multistep methods, methods for stiff equations. Prerequisites: 137A and 137B.

3 units, Spr (Golub)
alternate years, given 1978–79

239. Topics in Numerical Analysis—Given only when a suitable faculty member is available.
By arrangement

242. Programming Language Design—(Same as Electrical Engineering 389.) Exposure to the problems of programming language design and their known solutions will be undertaken. Topics may include formal semantics, implementation considerations, extensibility, very high level languages, evaluation of language designs, and other timely topics. The innovative features of a variety of modern programming languages will be discussed. Prerequisite: 142 (E.E. 285).

3 units, Aut (Hennessy) TTh 1:15-2:30

243. Compiler Project—(Same as Electrical Engineering 383.) Lectures and discussion will explore implementation issues in depth. Topics may include error detection, correction, and recovery, compiling languages with unusual features, comparisons of alternative parsing algorithms and differing run time organizations, and evaluations of optimizations. Prerequisites: 143 (E.E. 286) and 154.

3-6 units, Spr (Hennessy)


246A. 3 units, Win (Baskett)
(Enroll in E.E. 386A)

246B. 3-6 units, Spr (Baskett)

247. Computer System Evaluation—(Same as 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. Prerequisite: 246A.

3 units, Spr (Staff) by arrangement
alternate years, given 1979–80
249. Topics in Programming Systems—Given only when a suitable faculty member is available.  
   By arrangement

   3 units, (Staff) by arrangement

   3 units, (A. Yao) alternate years, given 1979–80

   3 units, (F. Yao) alternate years, given 1979–80

253A,B. Combinatorial Algorithms—Advanced data structures. Path compression. Priority queues. Search methods on graphs. How to find minimum spanning trees, connected components, transition closure, maximum network flows. How to test planarity and graph isomorphism. Pattern matching. Related topics. Courses 253A and B are taught alternate years; 253A is not a prerequisite for 253B. Prerequisites: 144A,B or equivalent.  
   253A. 3 units, Spr (Tarjan)  
   TTh 11:00-12:15 alternate years, given 1979–80  
   253B. 3 units, by arrangement

254. 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 (Staff) alternate years, given 1979–80

256. Computability and Complexity—Mathematical models of computers and computation. Recursive and recursively enumerable sets. Turing machine complexity. Space and time hierarchies. NP-completeness. Intractible problems. Prerequisite: 156 or equivalent.  
   3 units, Win (F. Yao) TTh 11:00-12:15

   3 units, Aut (Staff) by arrangement alternate years, given 1979–80

   3 units, Win (McCarthy) alternate years, given 1978–79

259. Topics in Theory of Computation—Given only when a suitable faculty member is available.  
   By arrangement

   1-4 units, Aut (Winograd) MWF 9

266. Computational Models for the Semantics of Natural Language—(Same as Linguistics 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.  
   1-4 units, Win (Winograd) TTh 9:30-11:00 plus 1 hour to be arranged

293. Computer Laboratory—A substantial computer program is designed and implemented. A detailed written report is required. Recommended as preparation for dissertation research.  
   Any quarter (Staff) by arrangement
300. Computer Science Colloquium—Presentation of current research in Computer Science.
1 unit, Aut, Win, Spr (Staff) T 4:15

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 (Flynn) W 4:15
Win (Baskett) W 4:15
Spr (McCluskey) W 4:15

311. Advanced Computer Organization—(Same as Electrical Engineering 482, which is offered Spring quarter.) Hardware design languages (AHPL, ISP, PMS, CDL). Data representation and formats, instructions and addressing. Memory hierarchies, multiple computers, reliability. Examples of microcomputers, computer families, mini-computers, vector computers, parallel computers, stack computers, pipelined computers. Prerequisites: 111, 112 or 211B or equivalents.
3 units, Aut (McCluskey) MWF 11
Spr (Flynn) (enroll in E.E. 482)

319A. Digital Reliability Seminar—(Enroll in Electrical Engineering 385A.) Student-faculty discussions of research problems in the design of reliable digital systems. Specific areas include modeling and evaluation of multiprocessor and redundant architectures as well as testing and diagnosis theories. Emphasis is placed on student presentations and Ph. D. thesis research.
1 to 4 units, Aut, Win, Spr, Sum
(McCluskey) M 3:15-5:05

319B. Computer Systems Analysis Seminar—(Same as Electrical Engineering 385B.) Student faculty discussions on modeling and analyzing the performance of computer systems and computer system components. Prerequisite: consent of the instructor.
1 to 4 units, Aut, Win, Spr (Baskett, Kumar, Wiederhold) by arrangement

319C. Computer Architecture Emulation Seminar—(Enroll in Electrical Engineering 385C.) Student-faculty discussion of research problems in micro-programming, computer organization, memory hierarchy, microprogram representation, machine representation and the emulation of both conventional and abstract machines. Students will use the Emulation Laboratory facilities and will write interpreters for specific machines.
1 to 4 units, Aut, Win, Spr (Flynn) by arrangement

319D. Design Automation Seminar—(Enroll in Electrical Engineering 385D.) Student/Faculty discussions on digital design automation techniques and applications, including computer hardware description languages, logic simulation, fault-test generation, integrated circuit and printed circuit layout, design verification. Prerequisite: consent of instructor
1 to 4 units, Aut, Win (vanCleemput)

319E. Concurrent Programming Seminar—(Enroll in Electrical Engineering 385E.) Student/Faculty discussions of research problems in the design and verification of concurrent programs, parallel programming languages, and applications of concurrency. Prerequisite: 246A (E.E. 386A) or equivalent.
1 to 3 units, Aut, Win, Spr (Owicki)

319F. Distributed Computing and Computer Communication Seminar—(Enroll in Electrical Engineering 385F.) Continued informal presentations and discussions concerning advances in distributed computing and computer communication, with emphasis on packet protocols.
1 to 3 units, Aut, Win, Spr (Metcalfe)

320. Artificial Intelligence Seminar
1 to 3 units, any quarter (Staff)
by arrangement

330. Numerical Analysis Seminar
1 to 3 units, Aut (Golub) W 4:15
Win, Spr, Sum
by arrangement

340. Programming Systems Seminar
1 to 3 units any quarter (Staff)
by arrangement

341. Computer-Aided Design of Digital Systems—(Enroll in Electrical Engineering 481.) An up-to-date survey of design automation techniques for digital hardware designers. Digital design languages; system-level simulation; register-transfer-level description and simulation; gate-level simulation; partitioning, placement and routing for printed and integrated circuits; fault simulation and test generation; automated documentation; integrated design systems. Hands-on experience on an actual design automation system. Prerequisites: 211A (EE 381A), some familiarity with basic programming concepts. Corequisite: 211B (EE 381B)
3 units, Spr (vanCleemput)

343. Topics in Concurrent Programming—(Enroll in Electrical Engineering 483.) Current research topics in the design and verification of concurrent programs of the sort that occur in
operating systems, networks, distributed systems, etc. Subjects that may be covered include programming language features, formal models, specification and verification, and system design. Prerequisite: 246A (E.E. 386A).

2 to 4 units, Spr (Owicki)
alternate years, given 1978-79

344. Computer Communication Networks—(Enroll in Electrical Engineering 484.) An introduction to packet-switched networks (land based point-to-point networks, satellite networks, and ground radio networks) is given. Experience with existing networks (the ARPANET, SATNET, and PRNET) is discussed and the operational procedures are presented. Design issues and modeling techniques are examined. Prerequisite: Statistics 116.

3 units, Spr (Tobagi)
alternate years, given 1978-79

350. Theory of Computation Seminar
1 to 3 units, any quarter (Staff)
by arrangement

365. Seminar in Computational Linguistics—(Same as Linguistics 365.)
3 units, Spr (Winograd) by arrangement

390. Advanced Reading and research.
Any quarter (Staff) by arrangement

The following courses offered in other departments may be of special interest to students of computer science:

Data Processing—See Industrial Engineering and Engineering Management 141, 144, 160, 240, 244.

Data Processing in Business Problems—See Business 366, 368, 369.

Information and Communication Theory—See Electrical Engineering 278, 279, 376A,B, 378A,B, 379, 479.

Mathematical Logic—See Philosophy 160A,B, 161, and Mathematics 292A, 293A,B.


Mathematical Programming—See Operations Research courses.


Recursion Theory—See Mathematics 292A.


Statistical Methods of Econometrics—See Economics 272, 273.


DRAMA

Emeriti: H. Donald Winbigler, Helene Blattner, Elisabeth Buckingham (Associate Professors); Evelyn M. Draper (Adjunct Professor); Naomi Wrage (Assistant Professor)

Chairman: Charles R. Lyons

Professors: Wendell Cole, Martin Esslin, Charles R. Lyons; Drama and Comparative Literature: Eleanor Prosser, Douglas A. Russell, Helen W. Schrader

Assistant Professors: William S. Eddelman, John Chioles, John Cochran

Senior Lecturers Patricia Ryan

Lecturers: Michael Ramsaur, Sheila Weber

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. For example, a student may elect an emphasis in acting, directing, and design. Students are encouraged to declare their major in their sophomore year.

The core program required of all majors:

1. Acting. Fundamentals of Acting, Drama 120A.

2. Literature and Criticism. Three courses to be chosen from the following: Drama 59, Drama 151-157

3. Theatre History. History of the Theater. Drama 160 or Drama 161

4. Design and Production. Introduction to Design and Production. Drama 30 and Drama 31; and one of the following courses: 130A, 131A, 132A, 133A.

5. Performance. Each major must complete a minimum of 8 units in laboratory courses in departmental theater productions to be divided between Drama 29 and Drama 39 with a minimum of 6 units acquired in Drama 39; 2 units each in sets, costumes and lighting.

6. Electives. A program of 15 units of elective courses in Drama to be worked out in consultation with major advisor.

The core program required of all majors: 2 units each in sets, costumes and lighting.

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.

Dramatic Literature. Three courses from the sequence Drama 151-157.

Electives in literature, history, design, or acting to total at least eight units at undergraduate level or at graduate level with the consent of the 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.”

MASTER OF ARTS—TEACHING (DRAMA)

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 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

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 direction; 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 (300, 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. Two years in the series in directing. Students in criticism/directing must complete the first-year and second-year workshop in directing (370A, B, C and 371A, B, C) 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 in 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 quarters of supervised teaching at half-time and one quarter at quarter time, 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 period 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. The core reading list of dramatic texts for each period is available. Each student, however, is to submit a critical bibliography to his/her advisor for approval the quarter prior to the quarter in which the examination is taken. 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 with 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. Procedures for applying for financial aid are included in the admission packet. The appropriate financial aid application must be filed by January 15.

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 Drama—Introduction to major dramatic forms, concentrating on selected masterpieces in order to develop theatrical sensibility in reading dramatic texts. (DR:H)
   5 units, Win (Esslin) MWF 9

2. Introduction to Theatrical Style—An introductory course in the development of theatrical style and in the major periods of western culture presented through slides, lectures, and discussions. (DR:H)
   4 units, Aut (Russell) MWF 11

20. Introduction to Acting—Exercises and improvisations to develop ease, freedom, and expressiveness on stage in preparation for the
study of acting fundamentals. Sections reserved for Freshmen. (DR:X)

25. Voice and Speech for the Actor. (DR:X)
3 units, Aut, Win, Spr (Ryan) MWF 10

27A, B, C. Movement for Actors. (DR:X)

27A. Basic movement knowledge and skills for the actor. Improvisation will be stressed. No prerequisites.
3 units, Aut (Valenzuela) TTh 4:15-6:05

27B. Styles of theater dance in America and their techniques. Ballet, ballroom, jazz, primitive and/or ethnic, volk, and modern. Prerequisite: 27A.
3 units, Win (Valenzuela) TTh 4:15-6:05

27C. Emphasis on creating a role through movement, text, music (song), costume and props. Prerequisites: 27A, 27B.
3 units, Spr (Valenzuela) TTh 4:15-6:05

29. Theater Performance: Acting—Students who have been cast in departmental productions may receive credit for their participation as actors; two units for Graduate Directing Workship projects and 1-3 units for major production (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. (DR:X)
1 to 3 units, any quarter (Staff)
by arrangement

30. Introduction to Theatrical Design—A lecture-laboratory course to introduce the undergraduate to the theatrical arts and crafts of stage design, costume design, and stage production. (DR:H)
5 units, Aut, Spr (Eddelman) MWF 1:15
plus lab. by arrangement

31. Introduction to Stagecraft and Lighting Design—A lecture-laboratory course in practical aspects of theatrical production. Emphasis will be given to a survey of production processes and standard production techniques. (DR:X)
4 units, Aut (Ramsaur) TTh 10-12
and lab. by arrangement

32. Costume Construction—The basic craft of planning and constructing costumes. May be repeated for credit. (DR:X)
4 units, Aut, Win, Spr (Cleveland, Russell) TTh 1:15-3:05 plus lab. dhr

33. Design Graphics for the Theater—An introductory course in drafting and rendering used by designers and technicians in the theater. The class will also deal with the visual aesthetics of the theater space. (DR:X)
3 units, Aut (Staff) MWF 10-12

39. Theater Performance: Crew—Students may receive credit for the participation in the design and technical areas of departmental productions (set and costume construction, lighting, properties). The number of units received is determined by the instructor. Prerequisite: consent of instructor. May be repeated for credit. (DR:X)
1 to 5 units, any quarter (Howell)
by arrangement

59. Shakespeare (Same as English 73) (DR:H)
5 units, Spr (Prosser) MTWF 10

INTERMEDIATE COURSES

Courses number 100-199 are intermediate courses designed primarily for the major but open to all undergraduates who have the necessary prerequisites.

120A, B, C. Fundamentals of Acting—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 (DR:X)

120A. 4 units, Aut (Cochran, Ryan, Weber) TTh 10-12, TTh 1:15-3:05,
MW 2:15-4:05, and TTh 3:15-5:05
4 units, Win, Spr (Cochran, Ryan,
Weber) TTh 3:15-5:05

120B. 4 units, Win (Cochran, Ryan, Weber) TTh 10-12, TTh 1:15-3:05,
MW 2:15-4:05 and TTh 3:15-5:05
Prerequisite: 120A or consent of instructor

120C. 4 units, Spr (Ryan, Weber) TTh 10-12
and MW 2:15-4:05.
Prerequisite: 120B

121A, B, C. Acting Workshop—Training in the problems of the actor as a theatrical instrument and the extension of these techniques to the level of interpretation. May be repeated for credit. Prerequisites: 120A, B, C or consent of instructor. (DR:X)

121A. Shakespearean Acting.
4 units, Aut (Friedlander)
MW 2:15-4:05

121B. Acting Workshop: Verse Drama for the Actor.
4 units, Win (Prosser) TTh 10-12

121C. Voice Workshop.
4 units, Spr (Ryan) TTh 10-12

122. Advanced Scene Study—Prerequisite: Consent of instructor. (DR:X)
4 units, Spr (Weber) TTh 2:15-4:05

123. Audition Techniques. (DR:X)
4 units, Aut (Ryan) MWF 11
128A, B. Theatrical Makeup. (DR:X)

128A. Fundamentals of Theatrical Makeup.
2 units, Spr (Cleveland, Russell) F 1:15-3:05

130A. Theatrical Design I—Visual analysis of historical styles as interpreted for the modern theater and developed throughout various presentation media. Specific problems in spatial perceptions and compositions and the relationship between costuming and scenic design. (DR:H)
4 units, Win (Eddelman) MWF 11
plus lab. by arrangement

130B. Theatrical Design II—Advanced work in theatrical design with an emphasis on complex theatrical presentations involving new materials and visual aesthetics. Prerequisite: Drama 130A and 133. (DR:X)
4 units, Spr (Eddelman) MWF 11
plus lab. by arrangement

131A, B, C. Lighting Design. (DR:X)

131A. Stage Lighting Mechanics—A lecture-lab course dealing with all practical aspects of lighting: electricity, light sources, instrumentation, control, and design process.
4 units, Win (Ramsaur) TTh 10-12
and lab. by arrangement

131B. Stage Lighting Aesthetics—A laboratory discussion course concentrating on the aesthetic principles of lighting design: interpretation, concept, process, and practice. Lighting designers for departmental one-acts, dorm shows, and community productions will be assigned from this class. Prerequisite: Drama 131A.
4 units, Spr (Ramsaur) TTh 10-12
and lab. by arrangement

131C. Advanced Stage Lighting Design—The course will include projects in lighting mechanics and lighting design resolved through experimentation, class discussions and written report, and through practical application in dorm shows and other community productions. Lighting designers for major departmental productions will be assigned from this class. Prerequisite: Drama 131A and 131B.
1-4 units, Aut, Win, Spr (Ramsaur)
by arrangement

132A, B, C. Costume Design—Visual analysis of historical styles of costume design interpreted for the modern theater and developed by the student in various presentation media.
132A. Costume Design—A discussion-laboratory course in basic techniques of designing and historical stage costumes. (Weekly design assignments.) (DR:H)
4 units, Aut (Russell) T 9-11 and Th 9
132B. Costume Design—A course in the aesthetics of costume design with weekly design assignments. (DR:X)
4 units, Win (Russell) T 9-11 and Th 9
132C. Advanced Costume Design—Advanced design projects with an emphasis on more complex costume design problems presented weekly for analysis and discussion. (DR:X)
4 units, Spr (Russell) by arrangement

133A, B, C. Technical Production. Prerequisite: Drama 31. (DR:X)

133A. Stagecraft—A lecture-lab course in basic production practices. The student will have the opportunity to learn and practice the theory and use of standard tools and materials used in stage scenery construction.
4 units, Win (Staff) MWF 9-11

133B. Technical Production—A lecture-discussion course on the problems of realizing a scenic design, with emphasis on both standard production practices and utilization of modern technology. Prerequisite: Drama 133A.
4 units, Spr (Staff) MWF 9-11

133C. Advanced Technical Production—Projects in advanced technical production practices, resolved with experimentation, drawings, and written reports. Technical Directors for major departmental productions will be assigned from this class. Prerequisite: Drama 133A and 133B, or consent of instructor.
1-5 units, any quarter (Staff)
by arrangement

135. Project in Design and Technical Theater—Project in stage design, costume design, lighting design, or stage managing. Prerequisite: consent of instructor. (DR:X)
1 to 5 units, any quarter (Staff)
by arrangement

151. Greek Tragedy. (DR:H)
5 units, Win (Chioles, McCall) MWF 9:00

152. Medieval and Renaissance Drama. (DR:H)
5 units, (Prosser) given alternate years

153. Neoclassic Drama. (DR:H)
4 units, given alternate years

154. Romantic and Early Realistic Drama. (DR:H)
5 units, Aut (Chioles) MWF 9

155. Modern Drama (1880-1918). (DR:H)
4 units, given alternate years

156. Modern Drama from 1918. (DR:H)
5 units, Spr (Esslin) MWF 10

157. American Drama from 1920. (DR:H)
5 units, Aut (Cole) MWF 11
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Time</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>158A.</td>
<td>German Drama Since Brecht—(Same as German 172.)</td>
<td>5</td>
<td>Win (Esslin) MWF 11</td>
<td></td>
</tr>
<tr>
<td>158B.</td>
<td>Stage Comedy From Aristophanes to Shakespeare—(Same as English 174.)</td>
<td>5</td>
<td>Spr (Foley, Riggs)</td>
<td></td>
</tr>
<tr>
<td>160.</td>
<td>History of Theater—Classical Greece to the Eighteenth Century. (DR:H)</td>
<td>4</td>
<td>MWF 9</td>
<td></td>
</tr>
<tr>
<td>161.</td>
<td>History of the Theater—Nineteenth and Twentieth Centuries. (DR:H)</td>
<td>4</td>
<td>Win (Edelman) MWF 9</td>
<td></td>
</tr>
<tr>
<td>162.</td>
<td>History of Costume and Fashion—A lecture-survey course in the history of dress in the Western World from ancient times to the present. (DR:H)</td>
<td>4</td>
<td>Spr (Russell) MWF 1:15</td>
<td></td>
</tr>
<tr>
<td>170.</td>
<td>Introduction to Directing—Preequisites: 120A,B,C or consent of instructor. (DR:X)</td>
<td>4</td>
<td>TTh 4:05-6:05</td>
<td></td>
</tr>
<tr>
<td>190.</td>
<td>Special Research—Individual project in the work of a playwright, period, or genre. Pre-requisite: consent of instructor. (DR:X)</td>
<td>1 to 5</td>
<td>any quarter (Staff)</td>
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<td></td>
<td></td>
<td></td>
<td>by arrangement</td>
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</tbody>
</table>

**ADVANCED COURSES**

All courses (DR:X)

Courses numbered 200-299 are designed for advanced undergraduates and graduates.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Time</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>235.</td>
<td>Projects in Design and Technical Production.</td>
<td>1-5</td>
<td>any quarter (Staff)</td>
<td></td>
</tr>
<tr>
<td>251.</td>
<td>Greek Tragedy</td>
<td>5</td>
<td>Win (Chioles, McCall) MWF 9:00</td>
<td></td>
</tr>
<tr>
<td>252.</td>
<td>Medieval and Renaissance Drama.</td>
<td>5</td>
<td>Spr (Prosser) given alternate years</td>
<td></td>
</tr>
<tr>
<td>253.</td>
<td>Neoclassic Drama.</td>
<td>5</td>
<td>given alternate years</td>
<td></td>
</tr>
<tr>
<td>254.</td>
<td>Romantic and Early Realistic Drama.</td>
<td>5</td>
<td>Aut (Chioles) MWF 9</td>
<td></td>
</tr>
<tr>
<td>255.</td>
<td>Modern Drama (1880-1918).</td>
<td>5</td>
<td>given alternate years</td>
<td></td>
</tr>
<tr>
<td>256.</td>
<td>Modern Drama from 1918.</td>
<td>5</td>
<td>Spr (Esslin) MWF 10</td>
<td></td>
</tr>
<tr>
<td>257.</td>
<td>American Drama from 1920.</td>
<td>5</td>
<td>Aut (Cole) MWF 11</td>
<td></td>
</tr>
<tr>
<td>285A.</td>
<td>German Drama Since Brecht—(Same as German 172).</td>
<td>5</td>
<td>Win (Esslin) MWF 11</td>
<td></td>
</tr>
<tr>
<td>260.</td>
<td>History of Theater—Classical Greece to the Eighteenth Century.</td>
<td>4</td>
<td>Aut (Cole) MWF 9</td>
<td></td>
</tr>
<tr>
<td>261.</td>
<td>History of Theater—Nineteenth and Twentieth Centuries.</td>
<td>4</td>
<td>Win (Edelman) MWF 9</td>
<td></td>
</tr>
<tr>
<td>262.</td>
<td>History of Costume and Fashion.</td>
<td>4</td>
<td>Spr (Russell) MWF 1:15</td>
<td></td>
</tr>
<tr>
<td>270.</td>
<td>Independent Project in Directing—Prerequisite: Drama 170 and approval of Department of Drama curriculum and academic policy committee.</td>
<td>2 to 5</td>
<td>any quarter (Staff) by arrangement</td>
<td></td>
</tr>
<tr>
<td>290.</td>
<td>Special Research—Individual project in the work of a playwright, period, or genre. Requirement for department honors.</td>
<td>1 to 5</td>
<td>any quarter (Staff) by arrangement</td>
<td></td>
</tr>
</tbody>
</table>

**GRADUATE COURSES**

Courses numbered 300 and above are primarily for graduates but are open to advanced undergraduates with permission. All courses (DR:X)

**PH.D. COURSES**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
<th>Time</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300.</td>
<td>Research Methods.</td>
<td>4</td>
<td>TTh 10-12</td>
<td>Aut (Prosser)</td>
</tr>
<tr>
<td>301.</td>
<td>History of Dramatic Criticism.</td>
<td>4</td>
<td></td>
<td>Chioles given alternate years</td>
</tr>
<tr>
<td>302.</td>
<td>Contemporary Approaches to Criticism.</td>
<td>4</td>
<td>Spr (Chioles) TTh 10-12</td>
<td></td>
</tr>
<tr>
<td>330A,B,C.</td>
<td>Design Workshop—Advanced course in design for the theatre.</td>
<td>4</td>
<td></td>
<td>Eddelman, Ramsaur, Russell by arrangement</td>
</tr>
<tr>
<td>331.</td>
<td>Design Project—Design of a full-length production in conjunction with directing project (Drama 372).</td>
<td>4</td>
<td>any quarter (Eddelman, Ramsaur, Russell) by arrangement</td>
<td></td>
</tr>
<tr>
<td>350.</td>
<td>Seminar: Tragedy.</td>
<td>4</td>
<td></td>
<td>Lyons given alternate years</td>
</tr>
<tr>
<td>351.</td>
<td>Seminar: Shakespeare.</td>
<td>4</td>
<td></td>
<td>Prosser given alternate years</td>
</tr>
<tr>
<td>352.</td>
<td>Seminar in Comparative Drama: Cosmic Dramas</td>
<td>4</td>
<td></td>
<td>Eddelman, Ramsaur, Russell by arrangement</td>
</tr>
<tr>
<td>355.</td>
<td>Seminar in Greek Tragedy.</td>
<td>4</td>
<td></td>
<td>Esslin MWF 2:15-4:05</td>
</tr>
<tr>
<td>353A.</td>
<td>Seminar in Medieval Drama.</td>
<td>4</td>
<td></td>
<td>Chioles MW 2:15-4:05</td>
</tr>
<tr>
<td>353B.</td>
<td>Seminar in Medieval Drama.</td>
<td>4</td>
<td></td>
<td>Spr (Esslin) MW 2:15-4:05</td>
</tr>
</tbody>
</table>
354. Seminar in a Special Critical, Aesthetic, or Historical Problem: Visual Aesthetics in 20th Century Theater.
4 units, Spr (Eddelman) TTh 2:15-4:05

355. Seminar in National Drama.
4 units, given alternate years

370A,B,C. Directing Workshop I—Investigation of basic directional problems in scenes, using a multi-form theatre space, designing actor/audience relationships and composing modular scenic units. Performances limited to class. Prerequisite: consent of instructor.
370A. 4 units, Aut (Eddelman) Lyons, Ramsaur, Russell MWF 4:15-6:05
370B. 4 units, Win (Ranelli) MWF 4:15-6:05
370C. 4 units, Spr (Lion) MWF 4:15-6:05

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 multif orm 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.
1-4 units, any quarter (Staff) by arrangement

399. Dissertation Research.
Any quarter (Staff) by arrangement

INTER-PERSONAL AND SMALL GROUP COMMUNICATION

All courses (DR:X)
The following courses provide experience-based learning in inter-personal communication in small interacting groups. The members of the group learn a methods 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, 1:15
Spr (Schrader) MWF 11

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

CENTER FOR EAST ASIAN STUDIES

Director: Peter Duus


Art: John LaPlante, Michael Sullivan


Business: Richard T. Johnson, William Ouchi

Economics: John G. Gurley, Lawrence Lau (on leave 1978-79)

Education: David Grossman, Douglas P. Murray

Food Research Institute: Dennis Chinn, Ramon Myers (Hoover Institution)

History: Peter Duus, John K. Emmerson (Hoover Institution), Harold L. Kahn, Mark I. Mancall, Jeffrey Mass (on leave 1978-79), Angus W. McDonald, Jr. (Visiting), Lyman P. Van Slyke (on leave 1978-79)

Law: Victor H. Li

Philosophy: David S. Nivison (on leave autumn quarter)

Political Science: Harry Harding, Jr., Nobutaka Ike, (on leave autumn quarter), John W. Lewis, Robert C. North, Daniel Okimoto, Robert E. Ward, Franklin B. Weinstein

Religious Studies: Judith A. Berling (Visiting), Winston B. Davis, Diana M. Y. Paul (on leave autumn and winter quarters), Lee H. Yearley (on leave 1978-79)

In addition, a number of other Stanford faculty have some teaching or research interests related to East Asia: Takeshi Amemiya (Economics) John C. Bock (Education), Walter P. Falcon (Food Research), Robert D. Hess (Education), Bruce F. Johnston (Food Research), Dudley Kirk (Food Research), Robert B. Textor (Education), Sylvia Yanagisako (Anthropology), Pan A. Yotopoulos (Food Research)

The Center for East Asian Studies coordinates all University instructional, research, and
special activities related to China and Japan. Faculty and students who share a common interest in the study of East Asia are brought together by the Center from a broad range of academic concerns covering nearly every discipline and historical period. In addition to supporting a wide variety of academic and extracurricular activities on the Stanford campus, the Center is also involved in programs which link the University's resources on China and Japan with civic groups, secondary schools, and local colleges in the San Francisco Bay Area. The Stanford-University of California (Berkeley) Joint NDEA East Asia Language and Area Center sponsors programs which provide opportunities for East Asian Studies faculty and students on the two campuses to meet and work with one another.

For further information concerning East Asian Studies at Stanford, please contact the Center for East Asian Studies, Room 200, Lou Henry Hoover Building, Stanford University, Stanford, California 94305; (415) 497-3362.

**DEGREE PROGRAMS**

**UNDERGRADUATE MAJOR IN EAST ASIAN STUDIES**

The undergraduate major in East Asian Studies is designed to enable students who are committed to the study of China and/or Japan to pursue a program combining language training and interdisciplinary coursework. The structure of the major is intended to guide the student in a course of study which will present a broad exposure to East Asia as a cultural area through a combination of courses in several departments. The student will have an opportunity to develop a disciplinary focus which is the core of his or her study of East Asia.

Students who are thinking about declaring a major in East Asian Studies should carefully consider whether it truly meets their interests and long-range academic and career plans. In some cases, the student's needs might be better met through a major in Asian languages (Chinese or Japanese) or through an informal concentration on China or Japan within a regular departmental major. Even within the interdisciplinary major in East Asian Studies, students are encouraged to take as much language work as possible and to take some basic theoretical or methodological coursework in the discipline in which they are most interested in order to enrich the conceptual framework of their study of China and Japan.

The basic requirements for the A.B. Degree in East Asian Studies are as follows:

**A. Prerequisite**

Students who plan to declare a major in East Asian Studies must first complete satisfactorily either 10 units of East Asian History or 10 units of Chinese or Japanese language. These 10 units count toward the total requirements for the major. History 91-92-93, "Traditional East Asian Civilization" and "Modern East Asian Civilization," provide a very convenient vehicle for students to fulfill this prerequisite early in their undergraduate careers; however, other history or language courses may also be used to meet the prerequisite requirement.

**B. Course Requirements**

The undergraduate major in East Asian Studies must complete a minimum of 70 units of course work treating China and/or Japan. These units are to be distributed as follows:

1. **Language Requirements:** 30 Units. Completion of at least first- and second-year courses in either Chinese or Japanese language. (Students are encouraged to undertake further language training, but additional language coursework will not count toward the requirements for the major.)

2. **History Requirement:** 10 Units. Completion of one of the following course sequences:
   a) History 91, 92, 93, East Asian Civilization
   b) History 192A, B, C, China
   c) History 194, 194A, B, Japan

   One of the quarters in the 91, 192, or 194 sequences may be credited to the fulfillment of either the substantive concentration or the elective distribution requirements below.

3. **Substantive Concentration:** 20 Units of coursework reflecting a disciplinary focus, an interdisciplinary thematic focus, or a historical focus, or a combination of the three. This concentration may not include language courses, but literature courses may be counted. Where possible, this concentration should include coursework in at least two departments. Examples of substantive concentrations include:
   - traditional Chinese culture
   - modern Japanese culture
   - traditional Japanese society
   - modern Chinese society
   - contemporary East Asian culture

   These examples are merely illustrative and do not exhaust the possible concentrations which would be considered appropriate for this major.

4. **Elective Distribution Requirement:** 10 Units of coursework, other than language. This falls outside the substantive concentration in that it treats different disciplinary, historical,
or geographic subjects than those reflected in the concentration.

C. Senior Paper

The student must submit a paper treating China and/or Japan as a senior thesis in East Asian Studies. In the usual case, this paper would be written for one of the courses or seminars included within the units offered for the substantive concentration; it may also be written under a directed reading supervised or approved by the student's major advisor, in which case some units of directed reading may be credited toward the fulfillment of the substantive concentration.

CO-TERMINAL DEGREE IN EAST ASIAN STUDIES

The Center for East Asian Studies will admit a limited number of undergraduates to work for a co-terminal A.M. in East Asian Studies. 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 are expected to meet the same general standards as those seeking admission to the A.M. program: they must submit a written statement of purpose; a Stanford transcript; three letters of recommendation, at least two of which should be from members of their department of concentration; a list of the courses they intend to enroll in to fulfill degree requirements. The decision on admission rests with the A.M. Admissions Committee of the Center for East Asian Studies. Students must meet all requirements for both A.B. and A.M. 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.

MASTER OF ARTS IN EAST ASIAN STUDIES

The A.M. program in East Asian Studies is designed primarily for students who plan to complete a Ph.D., but who have not yet decided on the particular discipline in which they prefer to work, or students who have chosen such a discipline, but wish to do work in intensive language and area studies before beginning a doctoral program. Applications will also be considered from persons seeking to gain a strong background in East Asian Studies in connection with a career in nonacademic fields such as business, law, education, journalism, or government service. However, it should be stressed that a Master's degree in East Asian Studies alone is often insufficient preparation for work in many professions, and students who are considering such careers are strongly advised to plan for professional training in addition to or in place of the A.M. degree in East Asian Studies.

The Master's degree program is intended to allow students a great deal of flexibility in combining language training, interdisciplinary area studies, and a disciplinary concentration. The Director of the Center serves as faculty advisor to all students. Other members of the staff and faculty are available for academic and career planning. The A.M. program is normally completed in two academic years, but students may shorten this time by receiving credit for prior language work or by attending summer sessions. Because of the limited availability of the Center's financial resources, students admitted to this program with aid are urged to complete the degree requirements in less than two years if their background makes that possible.

Applicants for this program must take the Aptitude Test of the Graduate Record Examination and have the results sent to the Office of Graduate Admissions. Applications for admission and financial aid may be obtained by writing to the Office of Graduate Admission, Old Union, Stanford University, Stanford, California 94305. The deadline for applications for admission and financial aid for 1979–80 is January 15, 1979.

The basic requirements for the A.M. degree in East Asian Studies are as follows:

Language Requirement: The student must complete the equivalent of the first three years of language training in either Chinese or Japanese. Students entering the program without any language preparation should complete 30 units of Chinese or Japanese (first- and second-year) within the first year of residence at Stanford. This may necessitate completion of a summer language program.

The language requirement may be satisfied in part or in full by receiving credit for courses taken at other institutions. Students who fulfill the minimum three-year language requirement before completing other requirements are encouraged to continue language study or take courses in which Chinese or Japanese are used for as long as they are in the program. Language courses completed in addition to the third-year level may be applied to the Area Studies Courses requirement discussed below.

Students in the A.M. program are eligible to apply for the Inter-University Language Programs in Taipei and Tokyo. Work completed in one of these programs may be counted toward completion of the A.M. degree's language requirement. Students may also petition to have this work counted for a maximum of three out of
the nine area courses required for the degree. For further information see the sections on the Inter-University Programs elsewhere in this Bulletin.

Area Course Requirement: Students must complete a minimum of nine courses (numbered 100 or above) related to East Asia beyond the courses used to fulfill the third-year level language requirement. Three core courses must be within a single department; of these, one must be a seminar in which a research paper on China or Japan is written. The six additional area courses may be taken in departments of the students’ choosing. Some theory-oriented or methodological courses may be used to meet part of these requirements provided they are demonstrably useful for understanding East Asian problems. Except in unusual circumstances, credit toward the area course requirement will not be given for courses taken prior to entering the A.M. program. Students in this program may, however, take courses for exchange credit at the University of California, Berkeley, with the approval of their advisor and the Dean of Graduate Studies.

JOINT DEGREE PROGRAMS

East Asian Studies and Law: This joint program grants an A.M. degree in East Asian Studies and a Doctor of Jurisprudence (J.D.) degree. It is designed to train students interested in a career in teaching, research, or the practice of law related to East Asian legal affairs. Interested students must apply separately to the East Asian Studies A.M. Program and to the Stanford School of Law and be accepted by both. Completion of this combined course of study requires approximately four academic years depending upon the student’s background and level of training in Chinese of Japanese.

East Asian Studies and Education: This joint program grants an A.M. degree in East Asian Studies and a secondary school teaching credential in social studies. To be eligible for this program, students should apply first to the A.M. program in East Asian Studies and then apply to the Stanford Teacher Education Program during their first year at Stanford. Completion of this program requires two years including at least one summer of study when beginning the education component of the program.

DOCTORAL PROGRAMS

Stanford does not offer a Ph.D. in East Asian Studies. However, there are more than a hundred doctoral students in various departments and schools of the University with a specialization on China or Japan. The departments which offer an East Asian concentration are: Anthropology, Art, Asian Languages, Comparative Literature, Economics, History, Linguistics, Philosophy, Political Science, and Religious Studies. It is also possible to specialize in East Asia within some of the doctoral programs of the professional schools of Business, Education, and Law, and the Food Research Institute. Inquiries about these doctoral programs should be directed to the individual department or school concerned.

FINANCIAL AID

Graduate students specializing in East Asia may apply for University Fellowships at the time of their initial applications for admission. Students in A.M. or Ph.D. programs who plan to do work in Chinese or Japanese language or language-related area courses may be eligible for Foreign Language and Area Studies (FLAS) Fellowships and are encouraged to apply for these fellowships at the time of their application to Stanford. For further information about FLAS Fellowships, contact Center for Research in International Studies, Room 200, Lou Henry Hoover Building, Stanford University, Stanford, California 94305.

COURSES

See listings under the respective department for (DR) notations.

The courses listed below all deal primarily with China and/or Japan. There are many other theoretical and methodological courses within the various departments at Stanford which are taught by faculty who are East Asian specialists; these courses often have a substantial East Asian component and may be found under the departmental listings in this catalog. For a fuller description of the courses below, also refer to the individual departmental listings.

ANTHROPOLOGY

117. Chinese Culture and Society. 5 units, Aut (Skinner) MWF 9
118. Communist Chinese Society. Prerequisite: 117 5 units, Win (Skinner), given 1979-80
121. Japanese Society and Culture. (Befu), given alternate years
123. Seminar on Japan (Befu), given alternate years
125. Japanese Culture Through Novels and Films. 5 units (Befu), given alternate years

ART

2. Ideas and Forms in Asian Art. 4 units, Spr (Staff)
20. Introduction to the Art of Asia—Prehistory to the 7th Century A.D.
   4 units, Aut (LaPlante)

   4 units, Win (LaPlante)

22. Introduction to the Art of Asia (14th Century Onward).
   4 units, Spr (LaPlante)

125B. The Art of India.
   4 units, Win (LaPlante)

125C. The Art and Architecture of Moghul India.
   4 units, Aut (LaPlante)

126A. Introduction to Chinese Art.
   4 units, Win (Sullivan)

126B. Introduction to Chinese Painting.
   4 units, Aut (Sullivan)

126E. The Meeting of Eastern and Western Art.
   4 units, Spr (Sullivan)

128A. Ritual Bronzes of Ancient China.
   4 units, Spr (LaPlante)

128B. Chinese Ceramics
   4 units, Spr (LaPlante)

128C. Buddhist Art in Asia
   4 units, Win (LaPlante)

128D. Architecture and Gardens of Japan
   4 units, Aut (LaPlante)

129. Introduction to Japanese Painting
   4 units, Spr (Staff)

228A. Studies on Ritual Bronzes of Ancient China.
   4 units, Spr (LaPlante)

ASIAN LANGUAGES

Courses Not Requiring Knowledge of an Asian Language

46. Philosophical Chinese—(Same as Philosophy 46.)
   3 units, Win (Nivison)

47. Philosophical Chinese—(Same as Philosophy 47.)
   3 units, Spr (Staff)

91,92. Traditional East Asian Civilization
   10 units, Aut, Win (Duus, Lyell, Matisoff) MWF 10

93. Modern East Asian Civilization—(Same as History 93 and Humanities 93.)
   5 units, Spr (Duus, Lyell MWF 10

131. Chinese Poetry and Drama in Translation.
   4 units, Aut (Yu) MW 11-12:30

   4 units, Win (Wang) MWF 11

133. Modern Chinese Literature in Translation.
   4 units, Spr (Lyell) MWF 11

   4 units, Aut (Doe) MWF 1:15

   4 units Win (Matisoff) MWF 1:15

   4 units, Spr (Ueda) MWF 1:15

143. The Philosophy of Wang Yang-ming (1472-1529).
   4 units, Spr (Nivison) MWF 1:15

151. Chinese History in Translation—(Same as History 196.)
   4 units, Win (Dien) MWF 1:15

152. Cultural History of Asia—(Same as History 195.)
   4-5 units, Spr (Dien) MTWF 1:15

166 (266). Chinese Aesthetic Concepts—(Same as Modern Thought and Literature 166.)
   4 units, Spr (Liu), given 1979-80

   4 units, Spr (Wang) MWF 11

178 (278). Japanese Poetry from Manyoshu to Shinkokinshu (759-1206)
   4 units, Win (Doe) WF 2:15-3:30

   4 units, Spr (Matisoff), given 1979-80

   4 units, Aut (Matisoff) MW 2:15

255A. The Nature of Literature: Japanese and Western Views—(Same as Comparative Literature 255A.)
   5 units, Aut (Ueda) given 1979-80

255B. Chinese and Western Theories of Literature—(Same as Comparative Literature 255B.)
   5 units, Aut (Yu) M 2:15-4:05

I. Courses in Chinese

1,2,3. First-Year Modern Chinese.

1. 5 units, Aut (Kao, Shou, Staff)
   Section 1 MTWThF 9
   Section 2 MTWThF 10
   Section 3 MTWThF 1:15

2. 5 units, Win (Kao, Shou, Staff)
   Section 1 MTWThF 9
   Section 2 MTWThF 10
   Section 3 MTWThF 1:15
3. 5 units, Spr (Kao, Shou, Staff)
Section 1 MTWThF 9
Section 2 MTWThF 10
Section 3 MTWThF 1:15

5. Intensive First-Year Modern Chinese.
12 units, Sum (Staff) MTWThF 8-12

21, 22, 23. Second-Year Modern Chinese.
21. 5 units, Aut (Chuang) MTWThF 9
22. 5 units, Win (Chuang) MTWThF 9
23. 5 units, Spr (Chuang) MTWThF 9

12 units, Sum (Staff) MTWThF 8-12

51. Chinese Calligraphy.
1 to 2 units, Spr (Chuang) Th 2:15-4:05

81, 82, 83. First-Year Cantonese.
81. 5 units, Aut (Tsang) by arrangement
82. 5 units, Win (Tsang) by arrangement
83. 5 units, Spr (Tsang) by arrangement

ADVANCED

101,102,103. Third-Year Chinese (Modern).
101. 5 units, Aut (Chuang) MTWThF 11
102. 5 units, Win (Chuang) MTWThF 11
103. 5 units, Spr (Chuang) MTWThF 11

105. Intensive Modern Chinese.
12 units, Sum (Staff) MTWThF 9-12

111,112,113. Third-Year Chinese (Classical)—Prerequisite: 23.
111. 5 units, Aut (Kao) by arrangement
112. 5 units, Win (Kao) by arrangement
113. 5 units, Spr (Kao) by arrangement

111A. 3 units, Aut (Nivison) given 1979-80
112A. 3 units, Win (Nivison) given 1979-80
113A. 3 units, Spr (Nivison) given 1979-80

121,122,123. Advanced Conversation
121. 2 units, Aut (Chuang) W 2:15-4:05
122. 2 units, Win (Chuang) W 2:15-4:05
123. 2 units, Spr (Chuang) W 2:15-4:05

131,132,133. Chinese for Scientists and Engineers—Prerequisite: 23 or equivalent.
131. 2 units, Aut (Kao) by arrangement
132. 2 units, Win (Kao) by arrangement
133. 2 units, Spr (Kao) by arrangement

199. Individual Reading in Chinese.
4 units, Aut, Win, Spr (Staff) by arrangement

GRADUATE

200. Directed Reading in Chinese.
Number of units to be arranged,
Aut, Win, Spr (Staff) by arrangement

201,202. Proseminar.
201. 5 units, Aut (Dien) W 2:15-4:05
202. 5 units, Win (Dien) W 2:15-4:05

211,212,213. Introduction to Modern Chinese Literature
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.
221. Historical Narration
4 units, Aut (Dien) MWF 1:15
222. Philosophical Texts
4 units, Win (Nivison) MWF 1:15
223. Literary Essays
4 units, Spr (Wang) MWF 1:15

243. The Philosophy of Wang Yang-ming—
(See as 143 with additional work requiring knowledge of language.)
4 units, Spr (Nivison) MWF 1:15

4 units, Aut (Sargent) MWF 10

261. Chinese Poetry (II).
4 units, Win (Sargent) MWF 10

262. Chinese Poetry (III).
4 units, Spr (Sargent) MWF 10

263. T'ang and Sung Lyrics.
4 units, Aut (Liu) given 1979-80

264. Yüan and Ming Songs.
4 units, Win (Liu) given 1979-80

4 units, Spr (Sargent) TTh 2:15-4:05

266. Chinese Aesthetic Concepts—(Same as
166 with additional work requiring knowledge of the
language.)
4 units, Spr (Liu) given 1979-80

271. 4 units, Aut (Wang) given 1979-80
272. 4 units, Win (Wang) given 1979-80

273,274. Chinese Drama.
273. 4 units, Aut (Wang) TTh 11-00-12:30
274. 4 units, Win (Wang) TTh 11-00-12:30

4 units, Aut (Wang) given 1979-80

276. Chinese Myths, Legends, and Folktales—(Same as
176 with additional work requiring knowledge of the
language.)
4 units, Spr (Wang) MWF 11

291. The Structure of Modern Chinese.
4 units, Spr (Kao) given 1979-80

4 units, Spr (Kao) by arrangement

299. Translation.
5 units (Staff) by arrangement

351. Seminar in Chinese Traditional Historiography.
5 units, Spr (Dien) 2:15-4:05
361. Seminar in Chinese Literary Criticism  
   5 units, Spr (Liu) given 1979-80

   5 units, Aut (Wang) T 2:15-4:05

399. Dissertation.  
   (Staff) by arrangement

II. Courses in Japanese

1,2,3. First-Year Modern Japanese.
   1. 5 units, Aut (Sakamoto, Nebrig)  
      Section 1 MWTWThF 9  
      Section 2 MWTWThF 11  
      Section 3 MWTWThF 2:15
   2. 5 units, Win (Sakamoto, Nebrig)  
      Section 1 MWTWThF 9  
      Section 2 MWTWThF 11  
      Section 3 MWTWThF 2:15
   3. 5 units, Spr (Sakamoto, Nebrig)  
      Section 1 MWTWThF 9  
      Section 2 MWTWThF 11  
      Section 3 MWTWThF 2:15

   12 units, Sum (Staff) MTWThF 8-12

   21. 5 units, Aut (Kubota) MTWThF 9  
   22. 5 units, Win (Kubota) MTWThF 9  
   23. 5 units, Spr (Kubota) MTWThF 9

   12 units, Sum (Staff) MTWThF 8-12

27,28,29. Intermediate Conversation.  
   27. 2 units, Aut (Sakamoto) TTh 1:15  
   28. 2 units, Win (Sakamoto) TTh 1:15  
   29. 2 units, Spr (Sakamoto) TTh 1:15

ADVANCED

101,102,103. Modern Written Japanese.  
   101. 5 units, Aut (Kubota) MTWThF 11  
   102. 5 units, Win (Kubota) MTWThF 11  
   103. 5 units, Spr (Kubota) MTWThF 11

   12 units, Sum (Staff) MTWThF 9-12

121,122,123. Advanced Conversation.  
   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.  
   4 units, Aut, Win, Spr (Staff) by arrangement

GRADUATE

   Number of units to be arranged,  
   Aut, Win, Spr (Staff) by arrangement

201,202. Proseminar  
   201. 5 units, Aut (Matisoff) given 1979-80  
   202. 5 units, Win (Harries) given 1979-80

211,212,213. Advanced Modern Japanese.  
   211. 5 units, Aut (Matisoff) MW 11  
   212. 5 units, Win (Staff) MW 11  
   213. 5 units, Spr (Matisoff) MW 11

   246. 5 units, Aut (Doe) by arrangement  
   247. 5 units, Win (Doe) by arrangement  
   248. 5 units, Spr (Doe) by arrangement

250. Introduction to Kambun.  
   4 units, Win (Ueda) given 1979-80

251. Graduate Seminar: Japanese Historical Texts.  
   5 units, Spr (Mass) given 1979-80

258. Major Haiku Poets.  
   4 units, Aut (Ueda) TTh 11:00-12:15

   4 units, Win (Harries) given 1979-80

   4 units, Win (Doe) WF 2:15-3:30

   4 units, Spr (Matisoff) given 1979-80

299. Master’s Thesis or Translation.  
   5 units, (Staff) by arrangement

   5 units, Spr (Matisoff) W 2:15-4:05

396. Seminar in Modern Japanese Literature.  
   5 units, Win (Ueda) M 2:15-4:05

399. Dissertation.  
   (Staff) by arrangement

ECONOMICS

120. Marxian and Radical Tradition.  
   5 units, Aut (Gurley)

121,221. Economic Development in China.  
   5 units, Win (Gurley) MTWThF

HISTORY

91. Traditional East Asian Civilization.  
   5 units, Aut (Duus, Lyell, Matisoff)

92. Traditional East Asian Civilization.  
   5 units, Win (Duus, Lyell, Matisoff)

93. Modern East Asian Civilization.  
   5 units, Spr (Duus, Lyell, Matisoff)

192A. China from Earliest Times to the 9th Century.  
   4-5 units. Aut (Kahn)
192B. China from the 9th to the 19th Centuries.
5 units, Win (Kahn)

192C. Modern China: 19th and 20th Centuries.
4-5 units, Spr (McDonald)

194. Early and Medieval Japan to 1336.
4-5 units (Mass) given 1979-80

194A. Medieval and Early Modern Japan, 1336-1800.
5 units (Mass) given 1979-80

4-5 units, Win (Duus)

195. Cultural History of Central Asia—(Same as Asian Languages 152.)
4-5 units, Win (Dien)

196. Chinese History in Translation—(Same as Asian Languages 151.)
4 units, Win (Dien)

290S. Undergraduate Seminar: Class Alignments in the Chinese Revolution
5 units, Spr (McDonald)

292. Undergraduate Colloquium: Topics in Chinese Economic History
5 units, Spr (Kahn)

293. Undergraduate Colloquium: Imperialism in China—Social and Economic Consequences.
5 units, Win (Hershatter, Honig, Stross)

390A,B. Graduate Colloquium: Topics in Late Traditional and Modern Chinese History.
10 units, Aut, Win (Kahn, McDonald)

395A. Graduate Colloquium: Japan to 1600
5 units, (Mass) given 1979–80

395B. Graduate Colloquium: Medieval and Early Modern Japan, 1600–1800
5 units (Mass) given 1979-80

395C. Graduate Colloquium: Modern Japan 1890–1945.
5 units, Spr (Duus)

5 units (Mass) given 1979–80

490A,B. Graduate Seminar: Modern China.
10 units, (McDonald) given 1979–80

495A,B. Graduate Seminar: Modern Japan.
10 units, Aut, Win (Duus) by arrangement

5 units (Mass) given 1979–80

PHILOSOPHY

46. Philosophical Chinese—(Same as Asian Languages 46.)

47. Philosophical Chinese—(Same as Asian Languages 47.)
3 units, Spr (Nivison)

122. Chinese Philosophy from Han through Sung.
4 units, (Nivison) given 1979–80

123. The Philosophy of Wang Yang-ming (1472–1579)
4 units, Spr (Nivison)

POLITICAL SCIENCE

5 units, Spr (Harding)

120. Seminar: Rebellion and Revolution.
5 units, Spr (Lewis)

122. Seminar: Modernization and Democracy in Asia.
5 units, Spr (Ike)

137. Seminar: World of the Superpowers.
5 units, Spr (North, Ike, Triska)

137W. Underdevelopment and Foreign Policy.
5 units, Win (Weinstein)

138A,B. Seminar: Arms Control and Disarmament
5 units, Spr (Lewis)
10 units, Win, Aut (Lewis, Barton)

138W. Seminar: Strategic Doctrines and Security in East Asia.
5 units, Aut (Weinstein)

139. Chinese Foreign Policy.
5 units, Win (Harding)

139A,B. Japanese Foreign Policy.
139A. 5 units, Aut (Okimoto)
139B. 5 units, Win (Okimoto)

141L. Seminar Workshop on United States-China Relations.
5 units, Spr (Harding)

147. Seminar: China in the International System.
5 units, Win (North)

214A,B. Seminar: The Origins of Fascism and Militarism in Prewar Japan.
214A. 5 units, Win (Okimoto)
214B. 5 units, Spr (Okimoto)

5 units Spr (Okimoto)

LAW

3 semester units, Spr (Li)
222. Colloquium in Comparative Politics: Japan.
   5 units, Spr (Ward)

225. Colloquium in Chinese Politics.
   5 units, Win (Harding)

   5 units, Win (Ward)

235L. Seminar: China’s International Behavior.
   5 units, Aut (Li, Lewis, Staff)

RELIGIOUS STUDIES

1A. Comparative Religious Communities.
   3 units, Spr (Davis)

1C. Comparative Religious Thought.
   3 units (Yearley) given 1979–80

13(113). Hinduism.
   3-5 units, spr (Paul)

14(114). Buddhism.
   3-5 units, Aut (Berling)

   3-5 units, Aut (Davis)

16(116). Japanese Buddhism.
   3-5 units, Spr (Davis)

18(118). Ch’an and Zen Buddhism.
   3 units (Paul) given 1979–80

19(119). Taoism.
   3 units, Aut (Berling)

20(120). Confucianism.
   3-5 units, Win (Berling)

34(134). Images of the Feminine in East Asian Culture.
   3-5 units, Win (Berling)

   5 units, Spr (Berling)

151. Chinese Buddhist Thought.
   5 units, Spr (Paul)

152. Chuang Tzu.
   5 units (Yearley) given 1979–80

   5 units (Yearley) given 1979–80

319. East Asian Religions.
   (Berling, Davis, Nivison, Paul) by arrangement

ECONOMICS

Emeriti: Moses Abramovitz, Bernard F. Haley, Tibor Scitovsky, Edward S. Shaw (Professors)

Chairman: Bert G. Hickman


Associate Professors: Michael J. Boskin, Duncan K. Foley, Robert T. Michael, John H. Pencavel, John B. Shoven. Visiting: Michael Block, David P. Levine, Michael Magill


Acting Instructors: James N. Dertouzos, Cathy L. McHugh, Raymond T. Olszierski, Owen R. Phillips

Affiliated Faculty:

Professors: Roger W. Gray, Bruce F. Johnston, Timothy E. Josling, (Food Research Institute), Henry Levin (School of Education), Alan Manne (Operations Research), 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: Carl Gotsch, Reynaldo Martorell, Scott R. Pearson (Food Research Institute), James L. Sweeney (Engineering-Economic Systems)

Assistant Professors: Dennis L. Chinn, Omar Davies, (Food Research Institute), James E. Hodder (Industrial Engineering), Tetteh A. Kofi (Food Research Institute), Harold S. Luft (Family, Community and Preventive Medicine), Anne E. Peck (Food Research Institute), David J. Teece (Graduate School of Business)

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 re-
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search. 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 undergraduate courses are also conducted by the Institute.

BACHELOR OF ARTS

To be recommended by the Department of Economics for the degree of Bachelor of Arts in Economics, the student must 1) have completed a minimum of 65 units of course work, at least 45 of which must be in Economics, and 2) upon declaring an Economics major, have submitted to the Economics Department office a prospective program form signed by the student's advisor.

Course Work Requirements:

1. Economics 1, 51, and 52 or their equivalents. Economics 51 and 52 should, wherever possible, be completed by the end of the sophomore year.

2. Thirty (30) 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, 118, 141, 145, 148, 157, 165.
   (b) Courses 212A, B and 214 in Engineering-Economic Systems and courses numbered 205 and above in the Food Research Institute will count as Economics courses in satisfying these requirements.

3. Ten (10) units of quantitative course work. All courses taken to satisfy this requirement must be approved in writing by the student's Economics department advisor. Advisors will automatically approve courses from among the following: Economics 90, 91, 170, 171, 172, 180, 181; any mathematics courses numbered 5 or above; any Operations Research or Statistics courses. With advisor's approval, other quantitatively oriented courses may be used to satisfy this requirement.

4. Ten (10) units of course work taken for the purpose of adding depth or breadth to the student's knowledge of Economics. All courses taken to satisfy this requirement must be approved in writing by the student's Economics Department advisor. Advisors will automatically approve courses in the Economics Department at the 100-level or above, and any quantitative courses listed in (3) above. With the advisor's approval, courses in other fields of study, which are both complementary to the student's work in economics and beyond the introductory level, may be used to satisfy this requirement.

Other Requirements:

5. Courses taken at other universities may be given credit for as many as 50 of the required 65 units. At least two courses from the list in (2a) above must be taken at Stanford. 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 economic course at another university will normally be required to take Economics 51 and 52.

6. No courses receiving Economics Department credit under headings 1 and 2 above may be taken Pass/No Credit. No more than 10 units of course work for Economics Department credit under headings 3 and 4 above may be taken Pass/No Credit.

7. An average grade of "C" or better shall have been received for all units completed at Stanford in Economics.

8. No course may be counted more than once in satisfying these requirements.

9. Courses taken by declared majors without the listed prerequisites will not be given credit toward the A.B. in Economics, unless approved by the Director of Undergraduate Studies for the Economics Department.

10. Students are responsible for seeing that all grades of "incomplete" are cleared within one year after the grade was given. If the "incomplete" grade is not cleared within that time, no credit will be given for the course toward the A.B. in Economics.

The requirements above apply to all students declaring Economics as a major after July 1, 1977 or who have 90 or fewer units of college
credit as of the end of the Summer Quarter 1977. Students who declared an Economics major at Stanford before July 1, 1977, or who had earned more than 90 units of college credit by the end of the Summer Quarter, 1977, are exempt from requirements (3) and (4) above and do not have to complete a prospective program form.

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. In particular a year of calculus is strongly recommended. A list of recommended courses in Mathematics, Statistics, Operations Research, and Computer Science is available in the Economics Department Academic Office.

**HONORS PROGRAMS 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, with course and research work of exceptional distinction.

The Honors Program I entails an in-depth study of an appropriate question and completion of a thesis of very high quality.

The 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 two term papers of very high quality, written at any point in the student's course work. A student should always save graded term papers for possible use in the Honors Program II.

Both Programs require completion of all requirements of the Bachelor of Arts in Economics.

Additional requirements of the Honors Program I are:

1. An average grade in economics courses of at least 3.5
2. Submission of an honors thesis of very high quality. This thesis will normally be written under the direction of a member of the Economics Department (or a member of some closely related department). Honors students may take up to 10 units of directed reading for purposes of completing their thesis project.

Additional requirements for 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. Grade average in economics of at least 3.7.
3. Submission of two term papers of very high 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. The original papers must be submitted.

Prospective candidates of Honors Program I should advise the Departmental Director of the Honors Program of their interest and plans at least three quarters before their graduation. At that time, or subsequently, the Director will assist students, if necessary, in finding appropriate thesis advisors. 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 inform the Departmental Director of the Honors Program 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 second full week of the quarter in which the student will graduate. Potential applicants are responsible for saving copies of high-quality term papers for submission with the applications.

**CO-TERMINAL A.B./A.M. PROGRAM**

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. A student admitted to the Co-Terminal A.M. program is expected to initiate the study plan immediately. A student's co-terminal status will be terminated if the student elects to receive the A.B. degree prior to completion of all requirements for the A.M. degree.

**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.
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 economies 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 Studies, who together with his administrative assistants and the Graduate Studies Committee, of which he is chairman, has departmental responsibility for administering the graduate program. Students approaching their dissertation research are obliged to seek among the regular members of the Economics Department faculty a principal advisor who will supervise that research. Officers and members of the Graduate Economics Society 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 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 in economics. Students who have been advanced to Ph.D. candidacy in other departments of the University may, however, be admitted to the A.M. program in economics. 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, and mathematical competence equivalent to one year of college calculus 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 Studies before filing the Application for Candidacy for the Degree of Master of Arts at least four 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 may not be counted toward the 45 units required. The
program must include at least 40 units of economics taken in the Department of Economics, including Economics 202, one course in the series Economics 210-211-212, and at least one additional graduate level course. Courses which are listed simultaneously with two numbers (e.g., 51 and 151, 121 and 221) may count towards the 45 units only at the level of the lower number. Courses in subjects closely related to economics may be included with the approval of the Director of Graduate Studies in Economics. Economics 1, 51, and 52, which are required for the A.B. degree in economics, cannot be used to satisfy the basic 45 units. Likewise, no more than three courses from among 111, 118, 141, 145, 148, 157, and 165 can be used to satisfy the basic 45 units. Nor can seminar courses numbered 300 or above.

2. Training in statistics equivalent to the level of Economics 170 is required.

3. 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.

4. 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 advisors and the Director of Graduate Studies, 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 four 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 four fields 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
However, students are required to choose at least one field from outside of Econometrics, Mathematical Economics, and Theory of Choice.

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. It is also possible to arrange a special minor in fields where no formal minor program is offered by the relevant department.

2. Distribution Requirement. To achieve a balanced program, students without a minor subject are required to show proficiency in at least two fields other than those in which they will take comprehensive exams under option A. Normally, a total of three five-unit graduate lecture courses offered exclusively at the 200 or above level by the Economics Department, 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 also elect Economics 200. 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 advisors 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 Economics 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 required to serve as a teaching assistant in the department for at least one quarter. The department considers teaching experience an essential part of the Ph.D. program. It is not recommended that the teaching-assistant requirement be satisfied during the candidate's 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 advisor, the Director of Graduate Studies 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.

Qualification for the Ph.D.—Current University regulations require that each department shall establish procedures for qualifying students for the Ph.D. As a result of the qualification procedure, a student shall be either (1) qualified for the Ph.D., or (2) explicitly terminated from the Ph.D. program. If a student is adjudged by his department that he is qualified for the Ph.D., he will be recommended by his department for admission to candidacy for the Ph.D. Thus "Qualification for the Ph.D." should be considered synonymous with "Recommendation for Admission for Candidacy for the Ph.D." The University further requires such qualification procedure for a graduate student to take place no later than at the end of six quarters of graduate work at Stanford (quarters of nine units or more, excluding the summer quarters). There may be occasional exceptions to this rule, e.g., a graduate student who changes department after his first year, but all such exceptions must be approved in advance by the Dean of Graduate Studies.

The qualification procedure of the Department of Economics normally takes place at the end of the spring quarter of the graduate student's second year. Based on his performance in the program up to that time, the Graduate Studies Committee will make a judgment as to his qualifications to complete the Ph.D. program successfully. If adjudged to be so qualified, the Department will recommend the student for admission to candidacy for the Ph.D. The student should then complete the University form "Application for Candidacy for Degree of Doctor of Philosophy," which has to be signed by him, by the Director of Graduate Studies, and by his principal dissertation advisor, if one has been selected by that time. If the Graduate Studies Committee judges the student not qualified to complete the Ph.D. program successfully, the student will normally be terminated from the Ph.D. program, 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. Candidacy, once approved by the University Committee on Graduate Studies, remains valid for five years from date of approval (if it has not been terminated earlier by the 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 department. Admission to candidacy does not imply that the student has completed all requirements for the Ph.D. except the dissertation. Rather, it implies that the department has made a careful review of the progress of the student and has decided that he is qualified to complete the Ph.D. program.

The Department of Economics recognizes that there will be differences in academic programs of the students and not all students will have proceeded in the same order or at the same rate. A representative minimum program on which the Graduate Studies Committee can make a judgment regarding qualification at the end of the spring quarter of the student's second year is outlined below. Many students should expect to exceed this standard. A student who cannot meet this standard because of exceptional circumstances should consult the Director of Graduate Studies as early as possible during his second year.

Representative Minimum Program for Qualification


2. For students without a minor subject, successful completion of comprehensive examinations in at least two other fields of study: for students with a minor subject, successful completion of comprehensive examinations in at least one other field of study and fulfillment of most of the minor requirements.

3. Qualification in Mathematics.

4. Qualification in Econometrics or in Economic History.
"Distinction" Requirement—In addition to the successful completion of the minimum program outlined above, a student to be qualified is expected to have shown "distinction" in some important aspect of his graduate program. The Graduate Studies Committee will determine what constitutes "distinction." In the past, a grade of A— or better in one or more of the comprehensive examinations has been accepted as an indicator of "distinction." This does not preclude a student from demonstrating "distinction" in some other way, e.g., writing and publishing an article in a scholarly journal.

The Dissertation—By the end of his third year, normally encompassing the two dissertation seminars and remaining course work, students will have selected an advisor and a dissertation subject or area. A short dissertation prospectus written by the student and signed by his advisor will be placed on file with the Director of Graduate Studies. The prospectus is not binding on either party, but advisors should be informed of major changes in research directions.

As soon as a firm thesis proposal is agreed upon between student and advisor, the second and third members of a reading committee are to be selected with the advisor's approval. The principal advisor 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 advisor'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. 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.

Completed forms for graduate application should be filed before January 15 at the Office of Graduate Admissions.

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 $2730 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 $3555 plus an allowance for tuition. In the case of teaching assistants, students are currently receiving $3555 per academic year, in addition to a tuition allowance. In each case the appointments are for half-time. Entering students are not normally considered for research or teaching assistantships.

Information for applying for financial aid is included with the admissions packet.

COURSES

All courses (DR:S) unless noted otherwise.

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 May for information about the exact times at which courses will be given in 1978–79. If students do not have Economics courses prerequisites for cross-listed courses, they may register under the cross-listed department number but will not receive credit toward the economics major.
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 (Boskin, Muth, 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 (Cogan) MTWThF  
Win (Avrin, Olszewski)  
Spr (W. Johnson) MTWThF  

51A. Same as Economics 51 except that differential calculus will be used in the exposition. Prerequisite: a first course in differential calculus.  
5 units, Aut (Miyazaki) 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 (Avrin, Olszewski)  
Spr, (Johnson) 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.) Prerequisite: 90 or IE-133.  
3 units, Win, Spr (Deakin) MTWThF  

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 accounting course may not enroll. (May be taken as 191 by graduate students.) Prerequisite: 90 or IE-133.  
3 units, Spr (Deakin) MTWThF  

100. Economic Theory in Historical Perspective—This course studies the historical development of economic theory from several perspectives. The main focus is on the progress of analytical clarification and elaboration, although some attention is given to the influence of contemporary economic and political categories with which different economists worked, as well as the relation of the development of economic theory to concurrent developments in European political and social thought. Special emphasis will be placed on the following topics: Mercantilist thought and the Physiocratic model; the Classical school, including Smith, Malthus, Ricardo, Mill, and Marx; the marginalist revolution and the development of partial and general equilibrium analysis, the Austrian theory of capital and interest, Keynesian developments in macroeconomics and the revival of interest in growth models, and recent controversies in capital theory. Prerequisites: Economics 51 and 52. (DR:A)  
5 units, Aut (Weisskopf) MTWThF  

104. Economic Inequality and Public Policy—Addresses the measurement and sources of inequality of income and wealth as well as the evaluation of alternative policies for reducing inequalities and alleviating poverty. Prerequisite: 51  
5 units, Spr (Levin) 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. Prerequisites: 51, 52, for economics majors.  
3 units, (Staff)  

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 extreme, influence, and importance of speculation in commodity futures. Prerequisite: 1, for economic majors  
3 units, Aut (Gray) MW 4:15-6:05  

107B. Workshop in Commodity Price Analysis—(Same as Food Research Institute 305.) Students will prepare a discussion and a paper which analyzes some aspect of a com-
modity's market and/or price behavior. Prerequisites: 107A or 128 or equivalent.

3-5 units, Spr (Gray, Peck) by arrangement

111. Money and Banking—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, Foley) MTWThF

112. Analysis of Financial Decisions—(Same as Industrial Engineering 231) This course will focus on theoretical models and techniques in financial decision analysis under uncertainty. Topics covered will include capital budgeting and present worth analysis, portfolio theory, market efficiency hypotheses, and the Capital Asset Pricing Model. The effects of taxation and uncertain inflation will be analyzed within the context of specific models. Prerequisites: 51, and Statistics 116 or consent of instructor.

3 units, Aut (Rodder) TTh 2:45-4:00

113. Technology and Modern Industrial Society—(Same as Values, Technology and Society 107.) The interrelationships between technology and the nature and form of industrial societies over the past 200 years. Technological change as a socio-economic process illuminating the history of industrial societies. Factors in the rate and direction of technological change and diffusion. Implications for economic structure and the growth of large-scale organizations. The impact of these changes on modern industrial man as producer and consumer. (DR:S) Prerequisites: 51 and 52.

4 units, Win (Rosenberg)

114. Technology and Work—(Same as Values, Technology and Society 171.) Seminar on the relationship between changing technologies and the changing nature of work. Historical and theoretical examination of: the role of technology and other social forces in structuring the work process; the changing character of the work experience. Critical evaluation of relevant literature including Marx and Braverman.

4 units, Spr (Cohen)

115. European Economic History—(Same as History 104A.) Survey of growth and development in Western Europe from 1750 to World War II. Comparative 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. Prerequisites: 51 and 52.

5 units, Spr (Field)

116. American Economic History—(Same as History 104B.) This course covers the history of the American economy, concentrating on the period from 1790 to 1940. Treated as a case study in economic development, with stress on the application of economic analysis to historical problems. Consideration is also given to topics in political economy, such as the economic bases for regional conflict and the Civil War; the causes and effects of farmer and worker discontent; and the analysis of government behavior in the Progressive and New Deal periods. Prerequisites: 51 and 52.

5 units, Aut (Abramovitz) MTWThF

117. Modern Economic Growth in Capitalist Countries—(Graduate students enroll in 217.) (Same as History 104C.) Theoretical and historical approaches to the long-term growth experience of leading industrialized countries. Emphasis on forces controlling the pace of growth and accompanying structural change. Prerequisites: Economics 51 and 52.

5 units, Win (Abramovitz)

118. The Economics of Development—(Same as Food Research Institute 118.) The state of underdevelopment and the process of development are at the heart of the international and within-countries conflict between the rich and the poor. This course presents the economic theory and operational analysis of development within an historical and cross-country perspective. The development process is analyzed sequentially in a comparative statics framework, in a dynamic framework, and as a process of development disequilibrium. The course deals with mechanisms, determinants and consequences of capital accumulation, employment-creation, technical change, international trade, imperialism and dependency. The discussion is organized around specific hypotheses and is buttressed with the empirical evidence pertaining to various aspects of development and underdevelopment. Prerequisites: 51 and 52 for economics majors.

5 units, Aut (Yotopoulos) MW 3:15-5:05

120. The Marxian and Radical Tradition—The economic theories of Marx, Lenin, and Mao, and the application of the theories to current economic problems. Prerequisite: 1. (DR:A)

5 units, Aut (Gurley) MTWThF

121. Economic Development in China—The economic development of China during the 19th and 20th centuries, with emphasis on the Communist period. (Graduate Students enroll in 221.) Prerequisite: 1

5 units, Win (Gurley) MTWThF

122. The Theory of Capitalist Development—This course is concerned with theoreti-
cal and historical analysis of the process of capitalist development: the emergence of the system of capitalist economic relations of exchange and production, the ongoing reproduction and expansion of that system, the determinants and limits of its expansion, and the different stages in the overall process of development. Attention is focussed upon analysis of the mechanisms, determinants, and consequences of capital accumulation and technical change, the formation of a labor supply, the role of international trade and investment, and the uneven character of the development process. Various theoretical approaches to the analysis are examined, with emphasis on the Marxist theory and the recent elaborations and extensions of that theory. Prerequisites: 51 and 52.

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 22e.) Prerequisites: 51, 52 for economics majors.

5 units, Spr (Harris)

127. Economic Development Problems of Third World Economics With Colonial Heritage—(Same as Food Research Institute 133.) 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 noneconomies, 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 from Neo-classical and Marxist points of view. Prerequisites: Economics 1 and 51.

5 units, Win (Kofi) MW 3:15-5:05

128. Marketing, Consumption, and Price Analysis—(Same as Food Research Institute 120.) Survey of a variety of approaches used in the analysis of commodity price behavior. Topics include consumer demand analysis, spatial and temporal aspects of prices, market structure considerations, and complete commodity models. Links to microeconomic theory are drawn and emphasis is placed on a policy context within which the analyses are meaningful. Discussion uses agricultural examples from both developing and developed agriculture. Prerequisite: 51 for economics majors.

3 units, Win (Peck)

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 in developing countries. The focus will be on applications rather than on mathematically sophisticated methodology. Topics considered will include formal investment criteria, the differences between commercial and social appraisal, appropriate discount rates, shadow pricing, and the treatment of the income distribution aspects of projects. Prerequisite: Economics 1 for economics majors.

3 units, Win (Chinn) MW 10:00-11:30

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 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 51.

5 units, Win (Sanderson) MTWTh 10

131. Population Problems—(Same as Food Research Institute 135 and Sociology 132.) Analysis of U.M.S. and world population growth. Economic and social causes and consequences of trends in births, death, and migration. Population in relation to food and development; population theories and policies; national family planning programs. Prerequisite: 51, 52 for economics majors.

5 units, Win (Kirck) MTWTh 10

132. Application of Mathematical Programming to Agricultural Systems—(Same as Food
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, Win (W. Johnson) MTWThF

141A. Public Finance and Fiscal Policy—Content same as 141 except some differential calculus will be used in the exposition. Prerequisite: Economics 51, 52 and a first course in differential calculus.

5 units, Spr (Starrett) MTWThF

142. European Agricultural Policy—(Same as Food Research Institute 146.) An analytical approach to the development of agricultural policy in Europe, with particular reference to the Common Agricultural Policy of the European Community, and its relationship to agricultural and food problems of member states. The importance of European policy will be studied in relation with policy of other advanced countries, the developing world, and with the Mediterranean area. Agricultural policies will be discussed in the context of general economic, political, and institutional development. Prerequisite: 51, 52 for economics majors.

3 units, (Josling) given 1979–80

144. Economics of Agriculture: Structure and Policy—(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. Prerequisite: 1, for Economics majors.

5 units, Aut (Falcon) MWF 9


5 units, Win (MacCurdy)


5 units, Spr (Cogan) 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: 51.

5 units, Spr (Muth) MTWThF

151. Economic Analysis I—See 51.

152. Economic Analysis II—See 52.

153. Comparative Economic Systems—The analysis of economic systems: market oriented versus command economies, private property versus socialization of the means of production, labor managed firms, Russia, Hungary and Yugoslavia provide quite different socialist prototypes; whereas Japan and the United States represent dominantly capitalist prototypes, with Western European economies being somewhere in between. How economies function in practice rather than alternative systems of economic thought or doctrine. Term paper required. Prerequisites: 51 and 52. Open to non-majors.

5 units, Spr (Levine) MTWThF

155. Economics of Natural Resources—Application of tools of economic analysis to the allocation of natural resources, including environmental resources, depletible mineral resources and renewable resources population. Particular emphasis on analyzing the ability of market mechanism to make socially rational decisions especially in the light of the importance of intertemporal considerations, uncertainty and other market imperfections. Prerequisite: 51 and a first course in differential calculus.

5 units, Spr (Sweeney)

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. (Graduate Students enroll in 256.) Prerequisite: Preparation in micro theory and some statistics desirable. Prerequisite: 51 plus some background in math or statistics. 5 units, Win (Cogan)

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, Aut (Flaherty) 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, Win (Phillips) MTWThF

159. Mass Communication Media—(Same as Communications 266.) Focusing mainly on daily newspapers and TV, this course examines the roles of markets and government regulation in shaping print and electronic communication media. Among topics included are public goods and economies of scale, advertising, product choice and audience determination, inter- and intra-media monopolistic competition, the FCC, demise of the metropolitan press, cable TV, policy issues and future prospects. Prerequisite: Economics 51. 5 units, Spr (Dertouzos)

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 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). The above topics will be analyzed from Neo-classical and Marxian points of view. Contemporary theories of dependency economics and economic theories of imperialism and their relationships to development and underdevelopment will form an integral part of the course. 3 to 5 units, Win (Kofi) TTh 3:15-5:05

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. Prerequisites: 1, 51, in addition 52 for economics majors. 5 units, Win (Cuddington)

165A. International Economics I—Content same as 165 except some differential calculus will be used in the exposition. Prerequisite: Economics 51, 52 and a first course in differential calculus. 5 units, Spr (Cuddington) MTWThF

166. International Trade and Investment Policy—(Same as Food Research Institute 166.) This course is concerned with the formulation, implementation, effects and possible improvement of selected governmental policies affecting international trade and foreign investment. Topics include policies affecting international trade in energy resources, influences of domestic agricultural policies on international commodity trade, issues underlying the international negotiation of reductions of barriers to trade, governmental responses to competition from imports, international implications of environmental control, special trade and investment arrangements for developing countries, and domestic and international impacts of multinational corporations. With respect to each topic, initial attention is focused on existing institutions and practices, and policy analysis is then carried out to suggest improvements in current regulations. Prerequisite: Economics 165 or consent of instructor. 5 units, Spr (Pearson) MW 11:00-12:30

167. The Firm in the International Economy—(Same as Industrial Engineering 237.) The response of firms to international economic forces. Exposure to exchange rate movements, trade barriers, and international taxation. Implications for accounting, financial, and produc-
165. 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. Prerequisites: 1, 165 for majors.

3 units, Win (Meier)

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. (DR:C)

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. Prequisite: 170. (DR:C)

5 units, Win (McCurdy)

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. (DR:C)

5 units, Spr (Cuddington) 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. (DR:C)

5 units, Aut (Miyazaki) MTWThF

181. Optimization and Economic Analysis—The development of optimization techniques, including calculus, linear and nonlinear an introductory statistics course. (DR:C)

5 units, Win (Hart)

190. Introduction to Accounting—See 90.

191. Introduction to Cost Accounting—See 91.

Undergraduate Seminars in Economics—Courses 192 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.

192. Economics of Information.

5 units, Win (Flaherty)

194. Theories of Production and Capital.

5 units, Spr (Foley)

195. Law and Economics.

5 units, Aut (Block)

196. Theories of Macroeconomics.

5 units, Spr (Miyazaki)

197. Empirical Studies in Marxist Economics

5 units, Aut (Gurley)


5 units, Win (Levine)

199D. Directed Reading—Honors. Entails an in-depth study of an appropriate question and completion of a thesis of very high quality. This thesis will normally be written under the direction of a member of the Economics Department (or a member of some closely related department). (See description of Honors Program I.) (DR:X)

1-10 units total (Staff)

(Register for at least 1 unit for at least 1 quarter)

COURSES PRIMARILY FOR GRADUATE STUDENTS

350. A.M. Thesis. by arrangement

400. Ph.D. Dissertation. by arrangement

A. CORE THEORY CURRICULUM

202. Price and Allocation Theory I—Consumer demand theory with attention to the implications of constrained utility maximization.
Uses of the indirect utility and expenditure functions. The state preference approach to uncertainty. Models of the firm in competitive and monopolistic markets. Input supply functions. Partial equilibrium analysis of the market. Cobweb models. Open to advanced undergraduates with consent of instructor. Prerequisites: a thorough understanding of the elements of differential calculus.

5 units, Aut (Pencavel)

203. Price and Allocation Theory II—Different forms of competitive and monopolistic behavior; their effect on efficiency of economic organization. Prerequisite: 202.

5 units, Win (Rosse)


5 units, Spr (Kurz)

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 (Johnson)
211. 5 units, Win (Evans)
212. 5 units, Spr (Hall)

301A,B,C. Seminar in Microeconomics.
10 units (Staff) by arrangement

310A,B,C. Seminar in Macroeconomics.
10 units (Staff) by arrangement

B. ALTERNATIVE APPROACHES TO ECONOMIC ANALYSIS

200. Topics in the History of Economic Thought—This course will focus upon the development of economic thought in the classical school, beginning with Adam Smith and running through John Stuart Mill and Karl Marx. Brief attention will be given to both the predecessors and the successors of the classical economists, and to issues in the philosophy of science. Primary attention will be devoted to the development of the corpus of classical economic analysis in relation to the economic conditions of the period as well as to difficulties inherent in the nature of economic analysis itself.

5 units, Win (Levine)

219. Value, Distribution, and Growth—A discussion of some conceptual and analytical problems concerning the determination of value, price, distribution, and accumulation in the capitalist economy. These problems are shown to be the fundamental basis of contemporary controversies in economic theory, and their background in the development of economic thought is considered. This is the starting point for a systematic examination of the meaning, significance, and possible analytic solutions of these problems. Some relevant elements of Marxist economic theory are developed and compared with the approaches of Neo-Keynesian and Neoclassical theories.

5 units, Win (Harris)

220. Marxian Economic Theory—A systematic examination of Marxian economic theory, with regard to the analysis of value and surplus value, prices and profits, and circuits of capital, reproduction, accumulation, technical change, and economic crises. Recent elaborations, extensions, and applications of the theory are presented and discussed.

5 units, Spr (Harris)

395A,B,C. Seminar in Alternative Approaches to Economic Analysis.
10 units (Staff) by arrangement

C. ECONOMIC DEVELOPMENT

215. 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, Win


5 units, Win

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 (Staff) by arrangement

D. ECONOMIC HISTORY

217. (See Economics 117.)—Graduate students may take the course at graduate level as it will be
one of the courses included in the comprehensive field examination.

226. Problems in American Economic History—This course covers the history of the American economy from colonial times to the present, with focus on the period 1790 to 1940. It stresses the role of economic history as a distinctive intellectual approach to the study of economics. Topics include Slavery and the Southern Economy, Labor Scarcity and Technological Progress, the Emergence of Oligopoly, and the Coming of the Great Depression.

5 units, Win (Sanderson, Rosenberg)

227. European Economic History—Economic growth and development in Western Europe from the eleventh to the twentieth centuries, with primary emphasis on the period from the Industrial Revolution to the First World War. The course will concentrate on the experiences of Britain, France, Germany, and other continental countries, roughly with that order of emphasis. Special emphasis will be placed on the interrelations between the growth and distribution of output, demographic trends, technological and organizational changes in the agricultural and manufacturing sectors, and the changing formal and informal institutions governing political and economic activity.

5 units, Spr (Field)

325A,B-C. Seminar in Economic History.
10 units, (Staff) by arrangement

E. MONETARY THEORY AND INSTITUTIONS


230. Monetary Theory—Advanced topics in monetary theory with special reference to policy criteria and control techniques. Prerequisites: 211 and 265.

5 units, Spr (Evans)

Students are encouraged to undertake further preparation in the field of finance and the behavior of stock markets—in the Graduate School of Business or within the Economics Department.

10 units, (Staff) by arrangement

335. Workshop on Microeconomics of Inflation.
10 units, (Johnson, Pencavel, Shoven, Starrett) 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.

241. 5 units, Win (Starrett)
242. 5 units, Aut (Boskin)

341A,B,C. Seminar in Public Finance—Prerequisite: 241 or consent of instructor.
10 units, (Staff) by arrangement

G. ECONOMICS OF LABOR


5 units, Aut (MacCurdy)

247. Labor Economics II—Economics of the family; marriage, fertility, schooling, migration, family labor supply and consumption; the personal distribution of earnings, income and wealth; social mobility; growth in real wages, aggregate production functions and the functional distribution of income.

5 units, Win (Michael)

345A,B,C. Seminar in Labor Economics.
10 units, (Staff) by arrangement

H. URBAN ECONOMICS

249. Urban Economic Analysis—Cities as open regions in a larger economy; urban spatial structure and urban transportation systems; segregation, slums and local land-use controls; federal policy toward urban areas. Prerequisite: 204 or Engineering-Economic Systems 212.

5 units, Aut (Muth)

250. The Urban Public Sector—The economic effects of property and other local taxes, principles and problems of local public expenditure; the influence of government on income distribution; education and labor market programs, housing programs, and income maintenance. Prerequisite: 204 or Engineering-Economic Systems 212; 249 recommended.

Given 1979-80

349A,B,C. Seminar in Urban Economics.
10 units, (Staff) 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, Win (Miyazaki)

258. Economics of Industry II—Models of imperfect competition; behavioral models of the firm; advertising, innovation, and information; measures of concentration; anti-trust economics, law, and cases; regulation of public utilities; public policy problems.

5 units, Spr (Flaherty)


10 units, (Staff) by arrangement

J. INTERNATIONAL ECONOMICS

265. International Finance—Exchange rates and use of national monies in international trade. Hedging and speculation. Balance of payments adjustments. Monetary and fiscal policies in open economies. Prerequisites: 204 and 212 or consent of instructor.

5 units, Aut (McKinnon)

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 (McKinnon)

267. Special Topics in International Economics—Monetary and customs unions. Eurocurrencies and the international capital market. The multinational corporation and technology transfer. Labor migration. Tax harmonization, and other topics of current research interest. Prerequisites: 265 and 266.

Given 1979-80

365A, B, C. Seminar in International Economics.

10 units, (Staff) 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. Other topics in the statistical analysis of time series. Prerequisite: 272.

5 units, Win (Anderson)

274. Selected Topics in Econometrics—We shall discuss certain advanced topics in econometrics. For each topic we shall investigate the situations in which various models arise, the kinds of data that are available to estimate the models, the derivation and theoretical properties of the estimators, and some empirical examples of the estimators. Topics will be selected from the following list: nonlinear regression models; probit, logit, tobit methods; unobserved variables; missing observations and grouped observations; spectral analysis) Bayesian analysis; pooling cross-section and time series data; random coefficients and regression models; varying-parameter regression models; prediction and control; autoregressive-moving average models; choice of regressors, choice of models.

Given 1978-79

370A, B, C. Seminar in Econometrics.

10 units, (Staff) by arrangement

L. MATHEMATICAL ECONOMICS*

Field I: Theory of Choice

280. 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, Aut (Starrett)

281. 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.

Given 1979-80

282. Theory of Information and Organization—This course will examine the role of information in the design of various economic organizations, including teams and markets, among others; problems of coordination and incentives under incomplete information; search, signaling, and related phenomena.

5 units, Spr (Wilson) MW 3:15-5:05

*Under Field I and Field II, among the courses listed any two courses plus a term paper satisfy the comprehensive requirement.
5 units, Aut (Hart) MW 1:15-3:05

284. Dynamic Economics—Introduction to the theory of optimal control and applications in Economics. Advanced capital theory and principles of efficient and optimal allocation over time. Prerequisites: Mathematics 45, 113, and 114 or equivalent. Recommended: 283 and Mathematics 130.
5 units, Win (Magill)

285A,B,C. Seminar in Mathematical Economics.
10 units, (Staff) by arrangement

5 units, Aut (Kurz) MW 1:15-3:05

288. Special Topics—The topic for 1978-79 will be “Theory of Information.” It will provide a comprehensive treatment of the mathematical theory of information. May be substituted for Economics 281.
5 units, Win (Weiss)

289. Selected Topics in Game Theory and its Applications—Topics will be chosen from: bargaining theory, repeated games, games without side payments, games in extensive form, games with incomplete information, games with a continuum of players, and others. Prerequisites: consent of instructor.
3 units, Spr (Hart)

ENGLISH

Emeriti: Robert W. Ackerman, John W. Dodds, Newell F. Ford, Albert H. Grommon, Paul H. Kocher, Herbert D. Meritt, George F. Sensabaugh, Wallace E. Stegner, Virgil K. Whitaker (Professors)

Chairman: George D. Dekker

Director of the Creative Writing Center: John L’Heureux


Adjunct Professor: Larry Friedlander

Assistant Professors: Terry Comito, Jay Fliegelman, John B. Foster (English and Comparative Literature), John L’Heureux, Jeane S. Martin, Susan J. Morgan

Lecturers: Barbara Charlesworth Gelpi, Ronald Hansen, Alan Shapiro, Brett Singer, Robert Stone, Stephen Tracy, Cory Wade

Visiting Professors: Henri Coulette, M. J. C. Hodgart

Visiting Assistant Professor: Loy D. Martin, Clyde Taylor, Robert von Hallberg

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.

PROGRAMS OF STUDY

BACHELOR OF ARTS

Preparation for the Major

Before declaring an English major, students should have satisfied the University writing requirement. Those whose prior training in the reading of the various kinds of literature is deficient are strongly urged to take one or more of the following courses: English 30, 40, 50. Students should also have begun preparing to fulfill the Department’s requirement of proficiency in a foreign language. (Information on how to satisfy this requirement should be obtained from the Department office.)
The following Departmental requirements are in addition to the University's basic requirement 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, but students intending to go to graduate school should weigh the fact that a grade of pass will provide little evidence of their abilities.

All students majoring in English, except those electing programs 4 or 5 (below), are required to pass a prerequisite three-quarter course on English and American Literature, English 10, 11, and 12 (optional for students with senior status as of autumn quarter 1977-78). Students should normally take this course in sequence beginning in the autumn quarter of their freshman or sophomore year. Students who declare an English major at a later stage should enroll in this course during their first quarter as a major. Students who are exceptionally well-prepared (as evidenced by equivalent course work) may be permitted to substitute 100- or 200-level courses for part of all of this requirement. To make such substitutions students should apply in advance to the Director of Undergraduate Studies.

Major in English

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.

Because the English Department recognizes that the needs and interests of literature students are extremely various, it has approved several major programs of study in English. Each of these majors has different objectives and requirements; students will wish to consider carefully which major corresponds most closely to their own personal and professional objectives.

1. MAJOR IN ENGLISH AND AMERICAN LITERATURE

This program provides for the interests of students who wish to understand the full variety and historical development of English and American literature over the centuries. It is strongly recommended to prospective candidates for admission to graduate schools of English. Of particular value to such students are courses with broad historical perspectives on language, literature, and also more concentrated courses on the great major figures, notably courses on writers like Chaucer, Shakespeare, Milton, Pope, Wordsworth, Dickens, and Joyce. A course from division a) will prove more useful if taken sooner rather than later. Students are required to take one course from each of divisions a through f:

- g) Students are required to take at least three additional courses from those offered by the English Department numbered 100 and above (though only one may be chosen from those numbered 90, 92, 162B, 190, 191, 192, 291, 293, 390, and 392). In place of one of these courses students may choose one course in a foreign literature read in the original.

2. MAJOR IN ENGLISH WITH A CREATIVE WRITING EMPHASIS

This major is designed for students who wish to gain a basic knowledge of the English literary tradition as a whole and at the same time develop skills in the writing of poetry or fiction. A course from division a) will prove more useful if taken sooner rather than later. Students are required to take one course from each of divisions a through f:

g) Students with this major are also required to take 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), one course in poetry, to be approved by the person in charge of the poetry program of creative writing, plus two quarters of Directed Writing of Poetry (English 192), or of a more advanced course, all with grades of B or better.

3. MAJOR IN ENGLISH WITH INTERDISCIPLINARY EMPHASIS

This is a major of broad educational value intended for students who wish to combine study of the literature of the Medieval and Renaissance periods, the Renaissance and Enlightenment periods, or the Modern period (English and/or American), with an interdisciplinary program of courses relevant to that literature. Students are required to take courses from the three following categories:

a) During their freshman or sophomore years, all students planning to major in this program must elect two courses in the history or thought of Europe. One of these should be concerned chiefly with the period before the Enlightenment (e.g. Humanities 61, 109A, History 1, or History 65); the other, chiefly with the period since the Enlightenment (e.g. Humanities 63, History 2 or 3, or Political Science 168A or 168B).

b) Six English Department courses numbered 100 and above in Medieval and Renaissance literature; or Renaissance and Enlightenment literature; or English and American literature since the Enlightenment.

c) Six courses related to the literature of the chosen period from such disciplines as Anthropology, the Arts (including the practice of one of the arts), Classics, Comparative Literature, European or other literature, History, Modern Thought and Literature, and Political Science. These six courses should form a coherent program, approved by the student's advisor.

4. 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.

5. 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 or Spanish-American Literatures—Candidates for the A.B. in this major must complete eight courses in English, including one from each of the six divisions, and a coherent program of four courses in Spanish or Spanish-American literature, totaling at least twenty units and read in the original. The pro-
gram of each student must be approved by the Departments involved as specified above.

6. **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 autumn quarter of their junior year. 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 fundamental questions of critical theory and practice. 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 the close reading of a literary text or series of texts.

In their senior year, students will write a Senior Honors Essay (197) under the guidance of a faculty advisor. 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:

- **English 10, 11, 12**
- **Area requirements (a through f)—six courses**
- **Junior and Senior Seminars—two courses**
- **Senior Essay—10 units**

The Director of the Honors Program may, in special cases, modify these requirements.

Students electing the major in English with Interdisciplinary Emphasis will substitute the Junior Honors Seminar for one of the courses in (b) and the Senior Honors Seminar for one of the courses in (c) and will write the Senior Honors Essay. 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.

7. **HONORS PROGRAMS 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 Admissions Office, Stanford University 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.

**TEACHING CREDENTIALS**

1. **Single Subject Teaching Credential (Secondary).** For information concerning the requirements for this credential, consult the School of Education. 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.

2. **Community College Instructor Credential.** Candidates who successfully complete the requirements for the A.M. degree will thereby qualify for the State of California Community College Instructor Credential.

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.

Candidates for the Master of Arts in Teaching may also qualify for the State of California Community College Instructor Credential by completing additional units of academic work at the graduate level. For further information consult the Office of Credentials, Room 25, School of Education, early in the autumn quarter.

**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 and American 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 for the Master's degree in English and American literature should consult the advisor designated by the Director of Graduate Studies during the first two weeks of the first quarter. The student and the advisor will then draw up a three-quarter plan of courses. Normally, the student should take one course each from the following five fields: Medieval; Renaissance; Eighteenth Century and Romantic; Victorian and Modern; American. With the approval of the committee, the student may write off one field on the basis of evidence of substantial work done in that field during the student's senior year. The program should contain a mixture of survey and specialized courses chosen to guarantee familiarity with a reasonable proportion of works on the Reading List for Doctoral Studies Committee. Normally, no more than two courses taken outside the Department may be counted toward the degree, but the Graduate Studies Committee will consider exceptions.

Candidates may earn the Master's degree in English and American literature by satisfying the following requirements:

1. **Successful completion (B average) of 9 courses (normally 45 units) 101 and above, including at least one graduate seminar. Ordinarily graduate students enroll in courses numbered 200 and above. They may take no more than three courses numbered 101-199 without the permission of the Director of Graduate Studies.**

2. **Demonstration of reading knowledge of one foreign language.**

3. **Submission of an A.M. essay of at least 5000 words (about 20 typewritten pages). No essays will be accepted after September 1 (May 1 for a June degree). A.M. essays needing further revision may be resubmitted once, within three months of their return to the student.**

4. **Passage of a one-hour oral examination on the student's program, taken during the last regular week of spring quarter. The examination will be based only on reading lists from courses taken by the student at Stanford. Students may take up to 5 units of English 398 during the spring quarter for the purpose of review. Students who fail this examination may retake it once, during pre-registration week of the following autumn quarter.**

Candidates for a coterminous Master's degree must fulfill all requirements for the Master of Arts in English, as well as General Requirements and Major Requirements for the A.B. or B.S. See description of programs under Degrees section of this bulletin.

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.

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 97 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 advisor.
3. A two-unit course introducing the new graduate student to the various opportunities and responsibilities of the Department and a five-unit course on teaching composition.
4. Students are encouraged to take an advanced course in literary theory or criticism.
5. A minimum of 60 additional units of graduate courses and seminars (excluding 396, 396A, 397, and 399) distributed according to the advisor's judgment and the candidate's needs. A student may receive graduate credit for three courses numbered 101-199 in the offerings of the English Department.
6. A student must have the consent of the advisor to have courses taken outside the English Department count toward the requirement of 90 units.
7. 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 advisor 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 advisors 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.

8. 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 advisor; subject to the approval of the Departmental Graduate Studies Committee) and (2) plans for the dissertation based upon a prospectus approved by the advisor.

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 advisor. A student may receive graduate credit for three courses numbered 101-199 in the offerings of the English Department.
3. A two-unit course introducing the new graduate student to the various opportunities and responsibilities of the Department and a five-unit course on teaching composition.
4. Students are encouraged to take an advanced course in literary theory or criticism.
5. A student must have the consent of the advisor to have courses taken outside the English Department count toward the requirement of 90 units.
6. Qualification: (See paragraph 6 under requirements of the Ph.D. program in English literature.)
7. 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 advisor.

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, one of which 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 6 under requirements of the Ph.D. program in English literature.)

   For qualifications 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 two-unit course introducing the new graduate student to the various opportunities and responsibilities of the Department and a five-unit course on teaching composition.

4. A knowledge of one foreign language comparable to that demanded under the basic program and an advanced reading knowledge of a second language.

5. 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. A student may receive graduate credit for three courses numbered 101-199 in the offerings of the English Department.

6. 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.

7. 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 advisor, 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 advisor. 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 advisor. The advisor will request the Chairman to appoint a committee to supervise the dissertation. Candidates should take this crucial step as early in their graduate careers as possible. 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 advisor, 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 restate their candidacy by passing the written qualifying examination again.

The dissertation must be submitted to the advisor 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 Ian Watt in the English Department.

COURSE NUMBERING SYSTEM

Freshman Writing Courses: 1-9
English Language Courses: 101-109, 200-209, 300-309
English Period Courses: 10-19, 110-119, 210-219, 310-319
American Period Courses: 20-29, 120-129, 220-229, 320-329
Drama: 40-49, 140-149, 240-249, 340-349
Poetry: 50-59, 150-159, 250-259, 350-359
Topic Courses: 60-69, 160-169, 260-269, 360-369
Author Courses: 70-79, 170-179, 270-279, 370-379
Overseas Campus Courses: 80-89, 180-189
Writing Courses, Workshops, Individual Study, etc.: 90-99, 190-199, 290-299, 300-399

COURSES NUMBERED 1 THROUGH 99 ARE INTRODUCTORY COURSES

DESIGNED PRIMARILY FOR STUDENTS WHOSE MAJOR IS UNDECLARED OR IS NOT IN ENGLISH

All courses (DR:H) unless noted otherwise.

Drop-In Tutorials—A no-credit service to any student, undergraduate or graduate, who wants help with writing. Available on a next-day basis through the Freshman English Office.

0 units, Aut, Win, Spr (Staff)

1A, 2A. Writing Workshops: Thematic—These courses focus on a subject matter which reflects the instructor's special interest or expertise. The writing will be largely based on discussions arising from a body of reading on the subject matter. (DR:W)

3 units, Aut-Win, Win-Spr (Staff)

1B, 2B. Writing Workshops: Prose Writing—These courses focus directly on student writing with special texts used as examples of different kinds of writing. (DR:W)

3 units, Aut-Win, Win-Spr (Staff)

1C, 2C. Writing Workshops: Tutorial—Each week students meet with a group to discuss general writing problems and individually with
the instructor to discuss their own writing. (DR:W)

3 units, Aut-Win, Win-Spr (Staff)

3A, 3B. Directed Writing—For students who have been exempted from the Writing Requirement and wish further work in writing. Taught partly by the tutorial method, tailored to the individual student’s needs.

3 units, Aut, Spr (Staff)

Freshman Seminars—Freshman Seminars taught by English Department faculty fulfill the University Writing Requirement.

10, 11, 12. English and American Literature—Designed to develop the interpretive skills necessary for close, rewarding engagement with some of the world’s greatest drama, poetry, and prose fiction. The sequence will also offer an extended historical perspective on the changing world-views reflected in over ten centuries of English and American literature. Lectures and weekly sections will be focused on an in-depth study of a comparatively small number of crucial texts rather than on a rapid survey of many.

10. The Beginnings—An introduction to literary criticism and to early English literature. For the first half of the quarter, basic forms, methods, and functions of literature are discussed, and representative works that well exemplify the poem, the short story, the drama, and the novel are read. In the second portion of the quarter, a literary historical examination of the origins of English literature is done by reading and comparing works of the Anglo-Saxon and Middle English periods.

5 units, Aut (Brown, Friedlander)

11. Renaissance and Neoclassical—Through a study of representative Renaissance and Neoclassical works (among them Shakespeare’s King Lear, Milton’s Paradise Lost, Swift’s Gulliver’s Travels, and Pope’s The Rape of the Lock) the course will demonstrate how certain themes and forms present in Medieval literature manifest themselves in varying ways in the period 1500 to 1800.

5 units, Win (Fifer, Riggs)

12. Romantic and Modern—The course will feature readings in crucial and representative prose and poetry of the last two centuries in English and American literature, focussing on the centrality in the modern era of imagination as cognitive process and on the meaning and importance of art and the artist in modern society. Students will study the revolution of style and feeling which defines literary romanticism and its heritage through poems by Blake, Wordsworth, Keats, Whitman, Dickinson, Stevens, and others and fiction by Dickens, Lewis Carroll, James Joyce, and others.

5 units, Spr (Middlebrook, Polhemus)

20. Studies in American Literature—A study of selected masterpieces of American literature, including poetry, drama, the essay, the novel.

5 units, Spr (Fliegelman)

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.

5 units, Aut (L. Martin)

40. Drama—(Same as Comparative Literature 40.) Principal dramatic forms; development of dramatic art, masterpieces of the theater from various periods, countries.

5 units, Spr (L’Heureux)

50. Poetry—(Same as Comparative Literature 50.) An introduction through the careful reading of poems, with emphasis on contemporary American poetry, and through the study of language and technical elements of verse. There will be opportunity for the writing of poetry.

5 units, Aut (B. Gelpi)

51. Imitations and Translations of Latin Literature—(Same as Comparative Literature 51.) 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.

5 units, Aut (B. Gelpi)

55. Introduction to Folklore—(Same as Comparative Literature 167A.) A basic approach to the study of folklore, using examples drawn from several cultural traditions, especially English and American; genres such as folktale and folklore with minor genres such as riddle, proverb, and charm; the role of ritual and the social functions of oral literature; folk drama; custom and popular belief; the general outlines of the history of folklore studies and methodologies and some recent structuralist work in folkloristics. (English majors enroll in 167C.)

5 units, Spr (Harris)
73. Shakespeare—(Same as Drama 59.) 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, Spr (Prosser)

90. Narration—Basic problems of narrative and imaginative writing. Prerequisite: completion of the writing requirement.
5 units, Aut, Win, 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, Win, Spr (Staff)


COURSES NUMBERED 100 THROUGH 199 ARE MAINLY BASIC UNDERGRADUATE SURVEYS, SEMINARS, AND WORKSHOPS

All courses (DR:H) unless otherwise noted.

Note: Graduate students may receive graduate credit for 3 courses numbered 101-199.

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 I, 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: Comito, Fifer, Fliegelman, Guerard, Hodgart, L. Martin, Morgan, Moser, Ruotolo, Thomas, von Hallberg.) Consult the Time Schedule for specific openings.
5 units, Aut, Win, Spr

101. The Structure of the English Language—(Same as Comparative Literature 101 and Linguistics 180.) An introduction to English linguistics and applications of linguistic concepts to literary analysis. Emphasis on the phonological, syntactic, semantic and pragmatic structure of English, with some attention to regional and social dialects.
5 units, Aut (Traugott)

102. The History of the English Language—Studies in the evolution of the English language as a medium of literary expression.
5 units, Spr (Traugott)


113. The Renaissance.
5 units, Aut (Thomas)

114. English Culture from the Accession of Elizabeth to the Civil War—(Same as Comparative Literature 114 and History 242.)
5 units, Spr (Riggs, Seaver)

115. The Neoclassic Period.
5 units, Win (Morgan)

5 units, Win (Foster)

121. American Literature to 1855—(Same as Modern Thought and Literature 121.)
5 units, Aut (Fliegelman)

122. Modern Literature, 1855-1917—(Same as Modern Thought and Literature 122.)
5 units, Win (Ilas)

151. The Ballad.
5 units, Spr (Hodgart)

160B. Literature of the Holocaust—(Same as Comparative Literature 160B and Modern Thought and Literature 160B.) See 60B.

161. Afro-American Literature—(Same as Modern Thought and Literature 161.)
5 units, Aut (Taylor)

161C. Black Folklore and Afro-American Literature—(Same as Modern Thought and Literature 161C.)
5 units, Win (Taylor)

162B. Creative Writing for Bilingual Students—(Same as Spanish and Portuguese 162B.) A basic fiction and narrative writing course in which students will be encouraged to draw from their bicultural, bilingual experience. Knowledge of Spanish and familiarity with barrio dialects essential. (Not open to graduate students or freshmen.) (DR:X)
5 units, Win (Ilas)

162E. Introduction to Caribbean Poetry: English, French, Spanish—(Same as African
and Afro-American Studies 162E, Comparative Literature 162E and Modern Thought and Literature 162E.) Focus on the literature of the former French and British islands.

5 units, Win (Davis)

162F. Comparative Themes in Caribbean Fiction—(Enroll in African and Afro-American Studies 248.)

5 units, Aut (Wynter)

163A. Feminine/Masculine in Literature—
( Same as Modern Thought and Literature 163A.) See 63.

164. Critics of America—(Same as American Studies 203 and Modern Thought and Literature 164.)

5 units, Spr (Chace)

165. Culture and Society—(Same as Modern Thought and Literature 165.) Readings in nineteenth- and twentieth-century prose and fiction (and some poetry), based on Raymond Williams’s *Culture and Society* as a kind of annotated index.

5 units, Win (W. Stone)

167B. Modern British Comic Writers—(Same as Modern Thought and Literature 167B.) Reading and discussion of writers such as Lewis Carroll, Wilde, Shaw, Beerbohm, Joyce, Beckett, Burgess, Pinter.

5 units, Spr (Felstiner)

167C. Introduction to Folklore—(Same as Comparative Literature 167C and Modern Thought and Literature 167C.) See 67.

171. Chaucer—The *Troylus* and a selection of The *Canterbury Tales*.

5 units, Aut (Ryan)

172. Chaucer—The minor poems (lyrics and dream visions) and a selection of The *Canterbury Tales*. Can be taken as a sequence to 171 but can also be taken alone. The selection of *Canterbury Tales* in 171 and 172 will not overlap.

5 units, Win (J. Martin)

173A. Shakespeare—Intensive study of eight plays: Richard III, Henry IV (Part 1), *The Merchant of Venice*, As You Like It, Julius Caesar, Hamlet, King Lear, The Winter's Tale. Students may take any or all of the 173 series in any order.

5 units, Aut (Ryan)

173B. Shakespeare—Midsummer Night’s Dream, Romeo and Juliet, Henry IV (Part 1), Twelfth Night, Troilus and Cressida, King Lear, Othello, Antony and Cleopatra.

5 units, Win (Friedlander)


5 units, Spr (Bender)

174. Stage Comedy from Aristophanes to Shakespeare—(Same as Classics 174, Comparative Literature 174, and Drama 158B.) Readings in classical comedy, including Aristophanes, Menander, Plautus, and Terence; in renaissance comedy, including Ariosto, Shakespeare, and Jonson. Works not written in English will be read in translation.

5 units, Spr (Foley and Riggs)

190. Directed Writing: Fiction—Intermediate course. May be taken twice. Prerequisite: 90.

5 units, Aut, Win, Spr, Sum (Staff)

191. Prose Writing—Advanced course dealing with problems of writing expository prose. Prerequisite: fulfillment of Writing Requirement.

5 units, Win, Spr (Staff)


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 one quarter. English 195 may not be used to fulfill Departmental area or elective requirements without permission.

Any quarter, by arrangement

196A. Junior Honors Seminar—Required of all juniors in the English Honors Program.

5 units, Win (Polhemus)

196B. Senior Honors Seminar—Required of all seniors in the English Honors Program.

5 units, Aut (Mellor)

197. Senior Honors Essay.

10 units (during 2 quarters)

Aut, Win, Spr (Staff)

198. Individual Work—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
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and/or English 195 in any one quarter. English 198 may not be used to fulfill Departmental area or elective requirements without permission. Group seminars are not considered appropriate to English 198. (DR:X)

Any quarter, by arrangement

199. Senior Independent Study—Open, on approval by the Department, to seniors majoring in English who wish to work throughout the year on a critical or scholarly essay of about 10,000 words (See “Note” under “Honors Program in English”). Applicants should submit (1) a sample of their expository prose and (2) a proposed topic for independent study to the secretary of the Department before preregistration in May of their junior year. Each student who is accepted will be assigned to an instructor, with whom he or she will prepare an appropriate reading list before the end of the spring quarter.

10 to 15 units (for the entire year)

Aut, Win, Spr (Staff)

COURSES NUMBERED 200-299 ARE MAINLY COURSES ON SPECIFIC TOPICS AND AUTHORS: FOR UNDERGRADUATE AND GRADUATE STUDENTS

All courses (DR:X)

Note—Graduate students in other departments who wish to broaden their programs will find many of these courses useful.

205. Old English—Elements of Old English grammar; critical reading of short poems and selected prose in Old English.
5 units, Aut (Brown)

208. Post-Classical Latin—(Same as Classics 118.)
5 units, Spr (Stephens)

211. Readings in Middle English.
5 units, Win (J. Martin)

212A. Medieval to Renaissance: The Development of Literary Forms—(Same as Comparative Literature 212A.)
5 units, Aut (Trimpi)

212B. Continuation of 212A—(Same as Comparative Literature 212B.)
5 units, Win (Trimpi)

213. Literature of the Sixteenth Century.
5 units, Spr (Comito)

226. American Literature of the 1930's—(Same as Modern Thought and Literature 226.)
5 units, Win (von Hallberg)

230. Medieval Narrative: Theory and Practice—(Same as Comparative Literature 230 and Medieval Studies 162.) A topical approach to narrative, using mainly (but not exclusively) medieval texts and involving a good deal of reading in recent literary theory. A reading knowledge of Middle English is a prerequisite for the course.
5 units, Spr (Harris and J. Martin)

231. English Fiction and Prose.

231A. The English Novel through the Eighteenth Century—(Same as Modern Thought and Literature 231A.) Study of the most significant novels, with emphasis on development of the form.
5 units, Aut (Morgan)

231B. The English Novel in the Nineteenth Century—(Same as Modern Thought and Literature 231B.) Study of the most significant novels, with emphasis on development of the form.
5 units, Aut (W. Stone)

231C. The Twentieth-Century English Novel—(Same as Modern Thought and Literature 231C.)
5 units, Spr (W. Stone)

234. American Fiction and Prose.

234B. American Romanticism—(Same as Modern Thought and Literature 234B.)
5 units, Aut (A. Gelpi)

5 units, Win (Moser)

234F. History as Literary Art—(Same as Comparative Literature 234F and Modern Thought and Literature 234F.) A close study of the art of historical reconstruction in nine narrative accounts of American history which justly may be called masterpieces of American prose. Readings, ranging from the seventeenth to the nineteenth century, will include works by Bradford, Edwards, Parkman, Bancroft, Henry Adams and Norman Mailer.
5 units, Win (Fliegelman)

235. The Impressionist and Experimental Novel—(Same as Comparative Literature 235 and Modern Thought and Literature 235.) A course in the critical analysis of impressionist masters (such as Conrad, Ford, Lowry, Faulkner), of major experimental novelists (Joyce, Woolf, Kafka), and of short works by several living writers. Lectures and discussions.
5 units, Win (Guerard)

239. American Short Fiction—(Same as Modern Thought and Literature 239.) The-
matic and formal approaches to novellas and stories by such writers as Hawthorne, Melville, James, Faulkner, Williams, Porter, Tillie Olsen.

5 units, Spr (Fields)

250. The English Lyric—An examination of some poems, English and American, from Wyatt to the present, which exhibit the structures, forms, and prosodies that constitute the short poem in English.

5 units, Win (Coulette)


253C. Later Eighteenth-Century Poetry—(Same as Modern Thought and Literature 253C.) The meditative, lyric, and descriptive poetry of Dyer, Thomson, Young, Akenside, Gray, Collins, Goldsmith, Cowper, and Burns; the ballad revival; the early poems of Coleridge and Wordsworth.

5 units, Aut (Dekker)


254B. Romantic Poetry as Myth-Making—(Same as Modern Thought and Literature 254B.) 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, Spr (Mellor)

254C. Victorian and Early Modern Poetry—(Same as Modern Thought and Literature 254C.)

5 units, Spr (Morgan)

254D. Major Romantic Poets—(Same as Modern Thought and Literature 254D.)

5 units, Aut (Morgan)

255. Twentieth-Century British Poetry—(Same as Modern Thought and Literature 255A.)

5 units, Aut (von Hallberg)


256B. American Poetry, 1900–1945—(Same as Modern Thought and Literature 256B.)

5 units, Win (A. Gelpi)

256C. American Poetry, 1945 to the Present—(Same as Modern Thought and Literature 256C.)

5 units, Aut (von Hallberg)

260. The History of Literary Theory—(Same as Comparative Literature 260 and Modern Thought and Literature 260.)

5 units, Aut (Trimpi)

261. Literature and Film: Theory/Practice—(Same as Communication 261, Comparative Literature 261, and Modern Thought and Literature 261.) Interchanges between writers and film-makers, literary theory and film aesthetics. Literature, film, and theory in Russian Formalism (Mayakovsky, Eisenstein) and Surrealism (Breton, Artaud, Bunuel, Franju). Semiotics and phenomenology as orientations toward literature and film: critical texts (Barthes, Eco, Metz; Bachelard, Poulet, Bazin, Farber, Cavell) and screenings (Robbe-Grillet, Godard, Renoir, Hawks).

5 units, Win (Comito)

262A. Russian Formalism and Structuralism—(Enroll in Slavic Languages and Literatures 230.)

4 units, Spr (E. Brown)

263B. Feminist Literary Criticism: Theory and Practice—(Same as Comparative Literature 263B and Modern Thought and Literature 263B.) The development of feminist approaches to the study of literature and the practice of criticism. Prerequisite: completion of at least one English course numbered 100 or above.

5 units, Spr (Middlebrook)

269B. Towards an Understanding of Modernism—(Same as Comparative Literature 269B and Modern Thought and Literature 269B.) An introduction to the general assumptions behind literary modernism, both English and European. Main topics: symbolist and mythic theories of literature; allied currents in modern thought such as psychoanalysis, existentialism, and the revolt against positivism; modernist texts drawn from Nietzsche, Mann, and Proust.

5 units, Spr (Foster)

270A. Beowulf—Reading and critical analysis of Beowulf. Prerequisite: 210, or 205 with instructor's permission.

5 units, Spr (Brown)

273. Advanced Study of Shakespeare.

5 units, Win (Comito)


5 units, Win (Trimpi)

277A. Dryden and Pope.

5 units, Win (Hodgart)

281A. Dickens and Trollope—(Same as Modern Thought and Literature 281A.)

5 units, Win (Polhemus)

281D. The Brontës and Elizabeth Gaskell—(Same as Modern Thought and Literature 281D.) Reading the works of the three Brontë sisters and a selection from Elizabeth Gaskell's works will serve as the means by which to con-
sider the milieu of the Victorian woman novelist: the social pressures she experienced, the literary forms and themes available to her, the expression literature provided her for exploration of women's lives.

5 units, Aut (B. Gelpi)

285B. Twain and James—(Same as Modern Thought and Literature 285B.)

5 units, Aut (Moser)

288A. Joyce—(Same as Modern Thought and Literature 288A.)

5 units, Win (Chace)

288B. Virginia Woolf—(Same as Modern Thought and Literature 288B.)

5 units, Spr (Ruotolo)

288C. James Joyce: Finnegans Wake—Prerequisite: English 288A or equivalent and permission of instructor.

5 units, Spr (Polhemus)

288E. Yeats and T. S. Eliot—(Same as Modern Thought and Literature 288E.)

5 units, Win (Lindenberger)

288F. Joseph Conrad—(Same as Modern Thought and Literature 288F.)

5 units, Aut (Watt)

293. Workshop in Verse Translation—An introduction to practice and theory, followed by work on individual projects. See instructor during previous quarter.

5 units, Win (Felstiner)

COURSES NUMBERED 300 THROUGH 399 ARE GRADUATE SEMINARS AND WORKSHOPS: OPEN ALSO TO QUALIFIED UNDERGRADUATES

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.

302. Pedagogical Seminar in Old English—The purpose of the course is to help Ph.D. candidates prepare to teach Old English language and literature. Each student will be required to attend the weekly meeting and to produce the syllabus and lesson plan of his prospective Old English course. Prerequisite: 205 or equivalent knowledge of Old English.

2 units, Spr (Brown and Harris)

312. Seminar: Piers Plowman.

5 units, Spr (J. Martin)

313. Methods and Materials for the Study of Renaissance Literature.

5 units, Aut (Evans)

314. Literary Problems of the Renaissance—Prerequisite: 113 or 213 or 214, or equivalent.


5 units, Win (Bender and Riggs)

314F. Seminar: Renaissance Romance—(Same as Comparative Literature 314F.) Main emphasis on Sidney's Arcadia, FQ VI, Pericles, Cymbeline, The Winter's Tale. Influence of Greek romance (Achilles, Tatius, Heliodorus), pastoral romance (Longus, San nazaro, Montemayor), and Renaissance epic (Ariosto, Tasso). Some attention may be paid to other English prose romances and/or Amadis of Gaul, and to the plays of Beaumont and Fletcher.

5 units, Aut (Comito)

315. Literary Problems of the Restoration and Eighteenth Century—Prerequisite: 115 or equivalent.

315B. Seminar: Eighteenth-Century Satire—(Same as Modern Thought and Literature 315B.)

5 units, Spr (Hodgart)

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 the Romantic period.

316C. Seminar: Romantic Irony—(Same as Comparative Literature 316C and Modern Thought and Literature 316C.)

5 units, Spr (Mellor)

351. Germanic Poetry and Its Poetics—(Enroll in German 271/371.)

3 to 5 units, Aut (Weber)

360C. Seminar: Neoclassicism and Aestheticism: The Plotinian Construction—(Same as Comparative Literature 360C and Modern Thought and Literature 360C.)

5 units, Spr (Trimpi)

361. Seminar: The Modern Tradition—(Same as Comparative Literature 361 and Modern Thought and Literature 361.) Studies in masters of modern thought (such as Rousseau, Marx, Freud) from 1750 to the present.

5 units, Win (Watt)
365. Topics in American Literature.
365B. Seminar: American Historical Romance—(Same as Modern Thought and Literature 365B.)
5 units, Spr (Dekker)

366. Seminar: Imagism and Its Development—(Same as Modern Thought and Literature 366.) A study of Pound, Williams and H. D. as they developed from early Imagist lyrics to later experiments in extended open-form poems. The discussion will include some consideration of poetic theory, of other Imagist poets, and of the impact of the visual arts on poetic theory and practice.
5 units, Win (A. Gelpi)

369. Seminar: Major Modern Critics—(Same as Comparative Literature 369 and Modern Thought and Literature 369.)
5 units, Aut (Lindenberger)

370A. Seminar: Beowulf—The scholarship on and criticism of Beowulf. Prerequisite: 210.
5 units, Spr (Brown)

376. Seminar: Milton.
5 units, Spr (Evans)

388. British Authors of the Nineteenth and Twentieth Centuries.
388C. Seminar: James Joyce: Finnegans Wake—(Same as Modern Thought and Literature 388C.)
5 units, Spr (Polhemus)

388E. Seminar: The Bloomsbury Group—(Same as Modern Thought and Literature 388E.)
5 units, Win (W. Stone)

390. 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.
3-5 units, Aut (L'Heureux)
Win (Guerard)
Spr (R. Stone)

391. Advanced Work in Writing and Criticism.
Any quarter, by arrangement

392. The Writing of Poetry—Primarily for students seriously interested in the composition of poetry. May be repeated for credit. Prerequisite: consent of instructor.
3-5 units, Aut (Fields)
Win (Coulette)
Spr (Fields)

395. 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.

396. Introduction to Graduate Study—A two-unit required course for first-year graduate students in English and Modern Thought and Literature and for those students in Comparative Literature who will be teaching in the Freshman English program. The course provides instruction in teaching—especially leading a section and evaluating essays and examinations—and a broad introduction to the opportunities and responsibilities of graduate study. The class will meet weekly. The instructors will assign brief readings and a short final paper. The course is offered on a Pass/No Credit basis only.
2 units, Aut (A. Gelpi, Packer)

397A. Seminar in Teaching Composition—A required course for second-year graduate students in English and Modern Thought and Literature and students in Comparative Literature who will be teaching in the Freshman English Program. The course will be conducted both as an apprenticeship program and as a seminar. Each student will be assigned as an apprentice to an experienced teacher. At the beginning of the quarter, the apprentice will sit in on classes, conferences, tutorials; at the end, the apprentice may be given responsibility for conducting a class, grading papers, holding conferences. In addition, students must attend the weekly class meetings to discuss composition and the problems of teaching. Readings will be assigned in rhetoric and pedagogy. Each student will design a two-quarter syllabus in preparation for teaching English 1 and English 2. The course is offered on a Pass/No Credit basis only.
5 units, Aut (Packer)

397B. Teachers Workshop I—A seminar for second-year students who will be teaching composition. (Second-year students are advised to enroll in this course and to take during their first quarter of teaching only one literature course.) The course has a strong pragmatic emphasis: discussion of writing assignments, evaluation of essays, coordination of reading and writing, conduct of conferences. Occasionally experienced teachers of composition will be invited to discuss particular problems in teaching. No written work will be required. The class meets one hour a week, at noon.
5 units, Win (Bender)

397C. Teachers Workshop II—A seminar for second-year students teaching the second quarter of composition. The focus of discussion will be the second-quarter syllabus. Students will
share good assignments, problems, solutions they have encountered in their teaching. 5 units, Spr (Bender)

398. Research Course—Student pursues a special subject of investigation under supervision of some member of the Department. Thesis work not to be registered under this course. Any quarter, by arrangement

399. Thesis. Any quarter, by arrangement

COURSES REGULARLY OFFERED, BUT NOT DURING 1978–79

60A. American Jewish Writing.
61A. Afro-American Fiction.
61B. Afro-American Poetry.
65. Medieval Culture: An Interdisciplinary Introduction.
66. The English Bible as Literature.
68. American Indian Mythology, Legend, and Lore.
76. Fitzgerald and Hemingway.
77. William Faulkner.
78. Robert Frost.
110. The Earliest English Literature.
111. Middle English Literature.
117. Romantic and Victorian.
125. American Literature, 1917 to the Present.
128. The American Condition in the Twentieth Century.
136. Trends in Modern Fiction.
137. Development of the Short Story.
138. The Autobiographical Narrative.
147. Twentieth-Century Theater.
160A. American Jewish Writing.
161A. Afro-American Fiction.
161B. Afro-American Poetry.
162A. Chicano Literature.
162C. Contemporary Mexican Writers (In Translation).
163B. Modern Women Writers: Mary Wollstonecraft to Adrienne Rich.
166. The English Bible as Literature.
167A. The Literature of Fantasy.
177. William Faulkner.
200A. Old Norse.
200B. Advanced Old Norse.
201. Old Saxon.
209. Paleography and Codicology.
210. Old English Heroic Poetry.
214. Literature of the Seventeenth Century.
217A. The Bloomsbury Group.
227. Modern Southern Writers.
234. American Fiction and Prose.
234A. Colonial American Prose.
234C. American Fiction: Romance to Realism.
234G. American Literary Critics.
236. Forms of the Modern Novel.
237A. Eighteenth-Century Prose.
237B. Romantic Prose.
238. Culture and Society from Coleridge to T.S. Eliot.
240. Medieval Drama.
242. Elizabethan and Jacobean Drama.
243. Jacobean and Caroline Drama.
245. Drama of the Restoration and Eighteenth Century.
248. Modern British Drama.
253A. Some Eighteenth-Century Poets.
253B. Poetry and Ideas: Johnson to Blake.
256A. American Poetry Before 1900.
258. Twentieth-Century Neo-Romantic British and American Poetry.
259A. Symbolist Poetry, French and American.
262. Nietzsche and the Literary Imagination.
263A. The Existential Hero in Modern Literature.
264A. The Reciprocal Vision.
265. Literature of the American West, 1850 to the Present.
266A. Medieval Romance in Text and Image.
266B. Chaucer's England.
267. Marxism and the Study of Literature.
268. The Storyteller and His Art.
269A. Toward an Understanding of Romanticism.
270B. German Heroic Poetry.
271. Chaucer: Troilus and Minor Poems.
274. Donne and the Metaphysicals.
276. Milton.
277. Swift and Pope.
278. Johnson and His Circle.
279. Blake.
280A. Wordsworth and Coleridge.
280B. Byron, Shelley, and Keats.
283. Pater and the Pre-Raphaelites.
284C. Hawthorne and Melville.
285C. Edgar Allan Poe.
287. Conrad and Faulkner.
288D. W. B. Yeats.
289A. Ezra Pound's Cantos.
289B. Eliot and Neruda.
291. Workshop in Creation and Criticism.
301. Seminar: Language and Literature.
314. Literary Problems of the Renaissance—Prerequisite: 113 or 213 or 214, or equivalent.
314B. Seminar: Seventeenth-Century Poetry.
314C. Seminar: Spenser and the Renaissance.
314D. Seminar: Seventeenth-Century Prose and Intellectual History.
315. Literary Problems of the Restoration and Eighteenth Century—Prerequisite: 115 or equivalent.
315A. Seminar: Eighteenth-Century Fiction.
315C. Seminar: Johnson and His Circle.
315E. Seminar: Lyric Poetry of the Eighteenth Century.
315G. Seminar: Eighteenth-Century Literature of Travel.
316. Literary Problems of the Romantic Period—Prerequisite: 117 or 216, or equivalent treatment of Romantic Period.
316A. Seminar: Studies in Romanticism.
326. Seminar: American Literature of the 1930's.
355B. Seminar: British Poetry Since Hardy.
358A. Seminar: American Poets of the Twenties and Thirties.
360A. Seminar: History of Literary Theory: Ancient.
360B. Seminar: History of Literary Theory: Medieval/Renaissance.
362. Seminar: Literature and Psychology.
364. Topics in British Literature.
364A. Seminar: Capitalism and Literature in the Nineteenth Century.
365. Topics in American Literature.
365A. Seminar: The Landscape in American Literature.
365B. Seminar: American Historical Romance.
365C. Seminar: Culture and Society in the 1840s.
366. Topics in Criticism.
368B. Seminar: American Critics.
371. Seminar: Chaucer's Troilus.
373. Seminar: Shakespeare.
380. Interdisciplinary Research Seminar—Sponsored by Chicano Fellow Program/English Department.
385. American Authors of the Nineteenth and Twentieth Centuries.
   385A. Seminar: Emerson, Whitman, Dickinson.
   385B. Seminar: Wallace Stevens.
   385D. Seminar: Henry James.
   385E. Seminar: Richard Wright and His Circle.

388. British Authors of the Nineteenth and Twentieth Centuries.
   388A. Seminar: James, Conrad, and Ford.
   388B. Seminar: Virginia Woolf.
   388D. Seminar: Jane Austen.
   389B. Seminar: Eliot and Neruda.

FOOD RESEARCH INSTITUTE

Emeriti: William O. Jones, S. Daniel Neumark, Vernon D. Wickizer, Holbrook Working (Professors)

Director: Walter P. Falcon
Associate Director: Scott R. Pearson

Professors: Walter P. Falcon, Roger W. Gray, Bruce F. Johnston, Timothy E. Josling, Dudley Kirk, Clark W. Reynolds, Pan A. Yotopoulos

Associate Professors: Carl H. Gotsch, Reynaldo Martorell, Scott R. Pearson

Assistant Professors: Dennis L. Chinn, Tetteh A. Kofi, Anne E. Peck, Todd E. Petzel

Librarian: Charles C. Milford

Affiliated Faculty:
Professors: Ramon Myers (Hoover Institution), Keith B. Taylor (Medicine)

OFFERINGS AND FACILITIES

The Food Research Institute, a research and teaching unit in the School of Humanities and Sciences, was founded in 1921 to study problems of food supply, distribution, and consumption on a world-wide scale. The range of its investigation 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 70,000 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, published three times a year, reflects the research interests of 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 Institute requirements.

MASTER OF ARTS

The Master of Arts degree may be awarded to students who complete at least 25 units of work in the Food Research Institute with an average grade of B or better, and who complete 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. The Master’s program of coursework is designed at the outset of the program to equip students with specific skills and is not encouraged for those desiring a Ph.D. from the Food Research Institute.

Qualified graduate students from other Schools and Departments may apply for an A.M. degree within the Food Research Institute. For such candidates, the same regulations prevail as for the regular A.M., except that the four-quarter rule may be waived. Applications should be made to the Chairman, Graduate Instruction Committee.

CO-TERMINAL A.B./MASTER OF ARTS PROGRAM

The Food Research Institute offers a limited number of co-terminal degrees for undergraduate students in Economics (and occasionally other Departments). For admission a student must have a minimum grade-point average of 3.2. Prerequisites for admission include Economics 51 and 52 and, typically, one course in quantitative methods. Students are strongly urged to seek admission to the program prior to the end of the third quarter of their junior year.
Application should be made to the Chairman of the Institute's Graduate Instruction Committee. In addition to meeting the requirements for the Bachelor of Arts, students are required to complete the requirements for the Master of Arts as stated above.

**DOCTOR OF PHILOSOPHY**

The first two years of the program for doctoral students consist of a series of required and elective courses totaling about 90 units. Economics 202, 203 (Price and Allocation Theory), Economics 210 (Macroeconomic Theory), either Economics 171 or Business 403 (Quantitative Methods) are required. Food Research 200 (Applications of Macroeconomics) and Food Research 201 (Applied Econometrics) are also normally a part of a student's program. In addition, students prepare through courses, seminars, and directed reading and research three fields for written examinations that are administered by the end of the second year. Normally these are chosen from the following Institute fields: Food Consumption and Nutrition; Economics of Production; Commodity Price Analysis; Agricultural Development and Economic Growth; International Agricultural Policy; and Demography. A student wishing to offer a field outside this list or outside the Institute must secure approval from the Graduate Instruction Committee.

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.

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 of the relevant language department.

At least two years (6 full quarters) of graduate registration in the Institute program is required of each Ph.D. candidate.

**MINOR**

Qualified doctoral candidates in other Schools and Departments may apply for a minor in Food Research. Requirements for this option include successful completion of two Institute fields, plus approval by the Chairman of the Graduate Instruction Committee of the overall program of work.

**FELLOWSHIPS**

The Food Research Institute has available a limited number of University fellowships for qualified students, ranging in amount of support to approximately $2730 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. Instructions for applying for financial aid are included in the admissions packet. The financial aid application must be filed by January 15.

**COURSES**

See respective department listings for (DR) information.

**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 (Staff) 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 on 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

**118. The Economics of Development**—(Same as Economics 118.) (May be taken as 219 by graduate students not in Economics or Food Research.) The state of underdevelopment and the process of development are at the heart of the international and within-countries conflict between the rich and the poor. This course presents the economic theory and operational analysis of development within an historical and cross-country perspective. The development process is analyzed sequentially in a compara-
pective statics framework, in a dynamic framework, and as a process of development disequilibrium. The course deals with mechanisms, determinants, and consequences of capital accumulation, employment-creation, technical change, international trade, imperialism, and dependency. This discussion is organized around specific hypotheses and is buttressed with the empirical evidence pertaining to various aspects of development and underdevelopment. Prerequisites: Economics 51 and 52.

5 units, Aut (Yotopoulos) MW 2:15-4:05

130. Marketing, Consumption, and Price Analysis—(Same as Economics 129.) (Graduate students see Food Research 220.) Survey of a variety of approaches used in the analysis of commodity price behavior. Topics include consumer demand analysis, spatial and temporal aspects of prices, market structure considerations, and complete commodity models. Links to microeconomic theory are drawn and emphasis is placed on a policy context within which the analyses are meaningful. Discussion uses agricultural examples from both developing and developed agriculture.

3 units, Win (Peck) TTh 1:15-3:05

129. Analytical Techniques for Development Planning—(Same as Economics 129.) (May be taken by graduate students.) This course will emphasize benefit/cost analysis as a method for evaluating projects and sectoral programs in developing countries. The focus will be on application rather than on theory, and on technique rather than on mathematically sophisticated methodology. Topics considered will include formal investment criteria, the differences between commercial and social appraisal, appropriate discount rates, shadow pricing, and the treatment of the income distribution aspects of projects. Prerequisite: an introductory course in microeconomic theory.

3 units, Win (Chinn) MW 10:00-11:30

130. Application of Mathematical Programming to Agricultural Systems—(Same as Economics 132.) (May be taken as 230 by graduate students.) After a brief review of programming theory, the course concentrates on the actual construction and solution of models for different types of agricultural (crop and livestock) systems. Simple one-period micro models are extended to include multi-period, mixed integer and sector models. The latter part of the course also deals with the incorporation of risk and uncertainty into programming exercises. During the course students will be assisted in constructing and solving a model from his or her own data or from data obtained from the instructor. Manipulation of models for policy purposes (e.g., price and resource mapping) and agricultural data problems will be stressed throughout.

3-5 units, Win (Gotsch) MW 1:15-3:05

133. Economic Development Problems of Third World Economies with Colonial Heritage—(Same as Economics 127.) (May be taken as 233 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 from Neo-classical and Marxist points of view. Prerequisites: Economics 1 and 51.

5 units, Win (Kof) MW 3:15-5:05

135. Population Problems—(Same as Economics 131 and Sociology 132.) (May be taken as Food Research 235 or Sociology 232 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 10

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.

5 units, Aut (Falcon) MWF 9

146. European Agriculture Policy—(Same as Economics 142.) (May be taken by graduate
students as 246.) An analytical approach to the development of agricultural policy in Europe, with particular reference to the Common Agricultural Policy of the European Community, and its relationship to agricultural and food problems of member states. The importance of European policy will be studied in relation with policy of other advanced countries, with the developing world, and with the Mediterranean area. Agricultural policies will be discussed in the context of general economic, political, and institutional development.

3 units, (Josling) given 1979-80

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). The above topics will be analyzed from Neo-classical and Marxian points of view. Contemporary theories of dependency economics and economic theories of imperialism and their relationships to development and underdevelopment will form an integral part of the course.

3 to 5 units, Win (Kofi) TTh 3:15-5:05

166. International Trade and Investment Policy—(Same as Economics 166.) (May be taken as 266 by graduate students.) This course is concerned with the formulation, implementation, effects, and possible improvement of selected policies affecting international trade and foreign investment. Topics include governmental responses to competition from imports, policies affecting international trade in energy resources, issues underlying international negotiation of reduction of barriers to trade, influences of domestic agricultural policies on international commodity trade, multination commodity agreements and cartels, special trade and investment arrangements for developing countries, and domestic and international impacts of multinational corporations. With respect to each topic, initial attention is focused on existing institutions and practices, and policy analysis is then carried out to suggest improvements in current regulations. Prerequisite: Economics 165 or consent of the instructor.

5 units, Spr (Pearson) MW 11:00-1:00

COURSES PRIMARILY FOR GRADUATE STUDENTS

200. Empirical Research in Macroeconomics and Finance—Analytical techniques will be used to study the interaction of real and financial stocks and flows, in the process of employment, income determination, growth, and distribution. Methodologies evolved in the study of developing countries will be employed, together with conventional social accounting techniques, to study the process of growth, stability, and structural change in economics at varying levels of wealth. Applications will also be made to patterns of regional economic change, including the study of interrelated trade, financial, and migratory flows. The relationship between real and financial markets will be studied applying a number of alternative value theories based on the works of Ricardo, Marx, and Mill through Pareto, Heckscher, Schumpeter, Kuznets, and other leading contemporary thinkers. Prerequisite: Economics 210 or consent of instructor.

5 units, Spr (Reynolds) MW 3:15-5:05

201. Seminar: Applications of Research Methods—Focus on the uses of econometric methods in the analysis of agricultural problems. Particular attention will be given to problems commonly encountered in these applications both through lectures and through student papers. Prerequisite: Economics 171 or Business 403 and consent of the instructor.

5 units, Spr (Petzel) MW 1:15-3:05

205. Commodity Futures Markets and Prices—See 105.

218. Economic Development in Latin America—(Same 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

219. The Economics of Development—See 118.

220. Marketing, Consumption, and Price Analysis—See 120.

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. Pre-
requisite: one course in microeconomic theory and econometrics.
5 units, Aut (Gotsch, Yotopoulos, Petzel) TTh 1:15-3:05

224. Empirical Investigations in the Economics of Development—The course concentrates on empirical propositions in the theory of economic development. It surveys recent empirical research, and 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, Aut (Yotopoulos) TTh 3:15-5:05

229. Analytical Techniques for Development Planning—See 129.

230. Applications of Mathematical Programming to Agricultural Systems—See 130.

233. Economic Development Problems of Third World Economies with Colonial Heritage—See 133.


244. Economics of Agriculture: Structure and Policy—See 144.

246. European Agricultural Policy—See 146.

250. Nutritional Problems of Developing Nations—(Same as Anthropology 250.) The various malnutrition syndromes common in developing countries will be described, with emphasis upon protein-calorie malnutrition, nutritional anemias, and vitamin A deficiency. Methods and techniques of nutritional assessment applicable for use in developing nations will be reviewed. Detailed consideration will be given to effects of malnutrition throughout the life cycle, from fetal growth to fertility, with assessment of societal cost of malnutrition and its effects on learning, productivity, and other aspects of national development. Prerequisite: permission of instructor.
5 units, Win (Josling) TTh 10:00-11:30

251. Food and Nutrition Strategies and Development—This course examines major policy issues related to raising food consumption levels and improving nutritional status of populations in developing countries, assessing both production- and consumption-oriented policies and programs, and problems of determining an appropriate balance between income-generating activities and social services. The principal focus will be on the low-income developing countries. Economic, technical, institutional, and political factors that influence design and implementation of food and nutrition strategies will be discussed, including problems of restructuring growth to achieve broad participation of rural populations in gains in productivity and income. Attention will also be given to the interrelationships between "patterns" of agricultural development and of population growth and to integrated nutrition, health, and family planning programs. (It is recommended, but not required, that this course follow Food Research 250.)
5 units, Aut (Johnston, Martorell) given 1979-80


266. International Trade and Investment Policy—See 166.

267. International Agricultural Policy—This course will discuss the major continuing and contemporary problems in the world agricultural economy, with emphasis on the economic analysis of such problems and of the variety of proposed and possible solutions. The implications of the domestic policies of the major trading countries on agricultural markets will be treated in depth, in particular as regards staple food products. Issues of food security, trade liberalization, and international market regulation will be analyzed, and the role of international institutions discussed.
5 units, Win (Josling) TTh 10:00-11:30

285. Population Perspectives in the Third World—(Same as Sociology 222.) Differing demographic situations of selected major less developed countries and regions in relation to food and development. Population prospects. Political, cultural and socio-economic factors governing policies and means of restricting population growth. Each student will be expected to lead a seminar and write a research paper. Prerequisite: 135/235 or consent of instructor.
5 units, Spr (Kirk) MW 1:15-3:05

286. Demographic Methods—(Same as Sociology 284.) Methodology of population analysis, including actuarial procedures, fertility measurement, stable population analysis, cohort analysis, population projection, and construction of demographic models. This course stresses aspects of demographic research methods that have found wide usefulness in the social sciences, especially in sociology, anthropology, and economics; however, examples will be discussed for other fields of study as well.
3-5 units, given 1979-80
305. Seminar: Commodity Price Analysis—
(Same as Economics 107B.) Students will prepare a discussion and a paper which analyzes some aspect of a commodity's market and/or price behavior. Prerequisites: Food Research 105/205 and Food Research 120/220 or their equivalent.
3-5 units, Spr (Gray, Peck) TTh 3:15-5:05

3 units per quarter (Yotopoulos, Chinn)
by arrangement

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 (Gotsch, Petzel)
by arrangement

3 units, Spr (Falcon, Josling, Pearson)
by arrangement

371,372,373,374. Directed Reading and Research.
371. Aut (Staff) by arrangement
372. Win (Staff) by arrangement
373. Spr (Staff) by arrangement
374. Sum (Staff) by arrangement

401,402,403,404. Dissertation Reading and Research.
401. Aut (Staff) by arrangement
402. Win (Staff) by arrangement
403. Spr (Staff) by arrangement
404. Sum (Staff) by arrangement

FRENCH AND ITALIAN

Emeriti: Roberto B. Sangiorgi (Professor); Jessie E. Smith (Assistant Professor)
Chairman: Alphonse Juilland

FRENCH DIVISION

Associate Professor: Marc Bertrand
Adjunct Professor: John G. Barson
Assistant Professor: Brigitte Cazelles
Senior Lecturers: Marguerite Bauer, Clio P. Dorr, Jacqueline Ollivier
Lecturers: Nélée Langmuir, Michelle Morran

ITALIAN DIVISION

Professor: Franco Fido
Assistant Professor: John Ahern
Senior Lecturer: Annamaria Napolitano
Lecturers: Maria Devine, Leda S. Mussio, Emily Olmsted, Leopoldina Viggiano

The Department accepts candidates for the degrees of Bachelor of Arts and Master of Arts in French and in Italian, 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 specializing in literature or language 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 three 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 six 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 Prononciation et Phonétique
- Civilization I—Du siècle de Louis XIV à la Révolution
- Civilization II—de la Révolution à l’époque contemporaine
- French Historical Grammar

SPECIALIZATION IN FRENCH STUDIES

The aim of this program is to enable students to pursue a broadly based major by combining
the study of French language, culture, and literature with such fields as Art, Communication, Drama, Economics, History, Linguistics, Music, Philosophy and Political Science.

Requirements: a) 32 units of French courses beyond French 120; b) a coherent program of 28 units of approved courses outside the department which contain a significant component of French material. Study programs are formulated in quarterly consultation with a designated advisor who will help students choose from approved courses in the various fields indicated above. The advisor may also approve courses offered at the Stanford Program in Paris, as well as at Tours. Students are strongly encouraged to participate in at least one Stanford Overseas Program in France.

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 advisor'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.

EXCHANGE WITH THE ECOLE NORMALE SUPERIEURE

The department has an annual exchange with the Ecole Normale Superieure. Every year one of the French doctoral candidates spends the academic year at the Ecole in Paris.

LA MAISON FRANCAISE

The "Maison Francaise" located at 610 Mayfield, is an undergraduate residence which offers a wide variety of opportunities for students to expand their knowledge, understanding and appreciation of French language and culture. In-house seminars on French culture, arts and civilization are offered when possible. Assignment is made through the regular undergraduate housing draw.

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 "Humanities Special Program" section.

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.

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, graduate students, 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 March 31. Forms and information may be obtained from the Overseas Studies office.
INTENSIVE LANGUAGE WORK AT STANFORD IN FRANCE

Students attending Stanford in France, in Tours, have the opportunity to take courses in French language, literature, conversation, and civilization. All students will be required to take a language course for the first quarter, and possibly the second quarter of the session overseas. All courses in language bear the designation French 70, 80, or 90. Assignment to a particular level is made by the Director 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 advisor, 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 in French 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>
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<tr>
<th>Units</th>
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<tr>
<td>French 210. Problèmes de l'expression écrite</td>
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<tr>
<td>French 211. Prononciation et phonétique</td>
</tr>
<tr>
<td>French 212. Histoire de la langue française depuis le Moyen Age</td>
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<tr>
<td>French 289. Methodology</td>
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<tr>
<td>One course from the Civilization series</td>
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<tr>
<td>French 290. Du Siècle de Louis XIV à la Révolution</td>
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<td>or</td>
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<tr>
<td>French 291. De la Révolution à l'époque contemporaine</td>
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<tr>
<td>Four literature courses numbered above 200</td>
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<td>Total</td>
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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, on occasion, 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 A.M. 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 ac-
according to the advisor'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; for example, 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. Ph.D. Candidates, whatever their sources of financial support, are expected to demonstrate pedagogical proficiency by teaching under supervision three quarters at one-half time and one quarter at one-quarter time. Students are encouraged 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 advisor(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.

PROGRAMS OF STUDY 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 equivalent courses taken at the Florence center), students wishing to concentrate in Italian Studies may under the guidance of a departmental advisor, select a course of study best suited to their individual needs and cultural interests.

At least 45 additional units of courses are required, including:
a) 32 units of Italian courses beyond the 52 level. Students are required to take one course on Dante, as well as at least one course in each of the following areas: Middle Ages, Renaissance, Eighteenth and Nineteenth Centuries, Twentieth Century.

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 advisors. 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 toward the fulfillment of the requirements for combined majors.

Students are encouraged to structure their program individually in consultation with a departmental advisor.

**MASTER OF ARTS IN ITALIAN (TERMINAL PROGRAM)**

The Master of Arts in Italian provides a combination of language, literature, civilization and general courses designed to prepare secondary school, junior college, or college teachers. Applicants should be undergraduate majors in Italian or in a related field. Knowledge of a second Romance language is desirable.

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.

The basic course program is as follows:

9 graduate courses in Italian, including Italian 290 (The Italian Language). One course may be in a related field. There is the option of substituting a Master's thesis for two literature courses.

Total units ................................................ 36

Reading knowledge of a second Romance language, to be demonstrated by passing an examination, is required. Recommended: French.

Requirements for the completion of the A.M. include a comprehensive exam to be taken at the end of the Spring quarter.

Candidates are encouraged to develop teaching skills by participating in supervised teaching of language courses.

Limited financial aid is available in the form of teaching assistantships (usually in the Winter quarter).

Applications for admission with financial aid must be received by January 15, without financial aid by May 15.

**LA CASA ITALIANA**

La Casa Italiana, located at 562 Mayfield, is an undergraduate residence which offers students a wide variety of opportunities to expand their knowledge, understanding, and appreciation of Italian language and culture. Assignment is made through the regular undergraduate housing draw.

**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 AND ACCELERATED WORK AT STANFORD IN ITALY**

Students attending Stanford in Italy, in Florence, have the opportunity to take courses in Italian language, literature, conversation, and civilization. All students will be required to take a language course for the first quarter, and possibly the second quarter of the session overseas. All courses in language bear the designation Italian 70, 80, or 90. Assignment to a particular level is made by the Director and language faculty at the campus.
FRENCH DIVISION

GENERAL COURSES

The courses in this section are open to all students and do not require a knowledge of any language other than English.
All courses (DR:H) unless noted otherwise.

102. Writings of Simone de Beauvoir—A study of her fictional, philosophical, autobiographical and political writings, with stress on the radicalization of a feminine consciousness in contemporary French bourgeois society.
4 units, Aut (Giraud) TTh 2:15-4:05

105. The Writings of Albert Camus.
4 units, Aut (Cohn) given at Tours

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 1980-81

110. Contemporary French Literature and Thought—(Same as French 209.) Modern linguistics; Saussure; Barthes, Levi-Strauss; Robbe-Grillet; Goldmann; Sarraute; Butor; Sartre; Neo-Marxists; Artaud; Bataille; Beckett; Lacan; Derrida. Lectures in English, readings in English and optional readings in French.
4 units, (Cohn) given 1979-80

114A. The 19th Century French Novel—The major novelists of the century, including Stendhal, Balzac, Hugo, Flaubert, Huysmans, and Zola.
4 units, (Giraud) given 1980-81

114B. The Modern French Novel—Significant modern French authors: Proust, Gide, Malraux, Sartre, Camus, etc. Lectures, readings in English.
4 units, Win (Cohn)

4 units, (Newman-Gordon) given 1978-79

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, Celine, and Malraux. Readings in French, discussion in English.
4 units, Aut (Fulland) by arrangement

Students interested in languages not listed by a specific language department should contact the Special Language Program, Department of Linguistics.

FIRST- AND SECOND-YEAR

Language Courses

(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 22, 25, 27, October 2 and November 21 (for Autumn Quarter); January 3 and 4 and February 22 (for Winter Quarter); April 2 and 3 (for Spring Quarter); May 21 (for Summer and Autumn Quarters). The placement test is not given in the summer.

1. First-Year French (First Quarter)—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 the instructor and students. Multiple approach: listening-comprehension, oral expression, original oral and written composition. (DR:X)
5 units, Aut, Win, Spr (Staff) MTWThF

1R. First-Year French (1st quarter accelerated)—A first-quarter French course for students who have some previous knowledge of the language, but who must begin their study of French over again. Equivalent to French 1. Language Laboratory required. (DR:X)
3 units, Aut, Win, Spr (Staff) MWF 12

2. First-Year French (2nd quarter)—Continuation of the Français 1. Présentation du système verbal simple. Augmentation du vocabulaire de la vie quotidienne. Compositions orales et écrites. (DR:X)
5 units, Aut, Win, Spr (Staff) MTWThF

2S. First-Year Conversation (2nd quarter)—(Supplément du Français 2.) Cours de conversazione au niveau linguistique du Français 2. Prerequisite: 1 or equivalent.
2 units, Aut, Win, Spr (Staff)

2R. First-Year French (3rd quarter)—Continuation du Français 2. Conclusion de l'étude de la grammaire élémentaire. Acquisition de tournures idiomatiques. Expression individuelle orale et écrite. Quelques lectures d'extraits littéraires. (DR:X)
5 units, Aut, Win, Spr (Staff) MTWThF
22. Second-Year French (1st quarter)—
Développement des moyens linguistiques
Language Laboratory required. (DR:H)
to students who have just completed French 3.
reevaluated and placed accordingly. Not open
upon completion, students will be

21R. Grammar Review—
Grammar Review—
Basic French grammar with specific emphasis on written expression with some training in speaking. Offered for students with previous training in French either in high school (3-5 years) or in other universities, but who place below their level on the Departmental Placement Test, and whose progress would be best served by a concentrated review. Upon completion, students will be reevaluated and placed accordingly. Not open to students who have just completed French 3. Language Laboratory required. (DR:H)
3 units, Aut (Staff) MWF 9

22. Second-Year French (1st quarter)—
Développement des moyens linguistiques
Language Laboratory required. (DR:H)
4 units, Aut, Win, Spr (Staff) MTWTh
33. The Theatre—Plays by Molière, Racine, Sartre, Camus, Ionesco. Prerequisite: placement in French 23 and consent of the instructor. (DR:H)
4 units, Win (Staff) given in 1979–80

34. Poetry—Representative French poets from Ronsard to Yves Bonnefoy. Prerequisite: placement in French 24 and consent of the instructor. (DR:H)
4 units, Spr (Staff) given in 1979–80

60. French House Seminar—Course on French civilization and culture, from the Gallic era to modern times. In addition to textbook, slides, recordings, French TV programs are used. Prerequisite: 22.
3-4 units, Win (Staff)

70-80-90. Intensive and Accelerated French—Given only at Stanford in France (DR:X)
5 or more units, Aut, Win, Spr (Staff)

111. Pronunciation et phonétique—(Same as French 211.) (DR:X)

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. (DR:X)
3 units, Aut, Win, Spr (Staff) TTh

123. Composition, grammaire et étude de textes—Langue orale et écrite, grammaire descriptive, analyse stylistique, composition, explication de textes. Prerequisite: 24 or equivalent. (DR:H)
4 units, Aut, Win, Spr (Staff) TTh 12:50-2:05

124. Langue, style et écriture—Continuation du Français 123. Le commentaire littéraire, les styles de la critique, composition. (DR:H)
4 units, Aut, Win, Spr (Staff)

125. Cours avancé de français—Exercice de style, traduction et explication de texte: enrichissement du vocabulaire. Prerequisites: 123 and 124 or equivalent. (DR:H)
4 units, Aut, Win (Staff)
Spr (Cazelles) TTh 12:50-2:05

Literature Courses
For literature courses in English, see also General Courses section.

129. Littérature féminine en France—Lectures de Mme de Lafayette (La Princesse de Clèves), George Sand (Indiana), Colette (La Vagabonde) et Simone de Beauvoir (Une Mort très douce). La lecture d’une étude thématique (La femme, de la belle Hélène au mouvement de libération des femmes) permettra d’enrichir les perspectives au sujet de la femme-écrivain, sur le plan historique et humain. (DR:H)
4 units, Spr (Newman-Gordon)

130. De l’enthousiasme à la mélancolie—Etude générale de la littérature française de l’époque médiévale jusqu’à l’essor philosophique de la Renaissance (Chanson de Roland, Chrétien de Troyes, poètes du 16ème siècle, Rabelais, Montaigne). Prerequisite: 24 or equivalent. (DR:H)
4 units, Aut (Cazelles) TTh 11:00-12:15

131. La Liberté, la volonté et la passion—Etude générale de la littérature française de la tragédie classique jusqu’au roman romantique du 18e siècle (Corneille, Racine, Molière, Diderot, Rousseau). Prerequisite: 24 or equivalent. (DR:H)
4 units, Win (Hester)

132. Mise entre parentheses et mise en question—Etude générale de la littérature française de la Révolution romantique du 19e siècle à l’époque contemporaine (Baudelaire, Verlaine, Rimbaud, Mallarmé, Giraudoux, Flaubert, Malraux, Ionesco, Beckett, Camus.) Prerequisite: 30 or 82 through 86 or equivalent. (DR:H)
4 units, Spr (Giraud)

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. Les poètes lyonnais (Sceve, Labbé), la Pléiade (Ronsard, Du Bellay), Rabelais. (DR:H)
4 units, Spr (Weinstein) given 1979-80

141. Baroque et engagement littéraire et social—Scepticisme et angoisses religieuses. Les poètes baroques (d’Aubigné, Sponde), Montaigne. (DR:H)
4 units, Spr (Hester)

150. Romanciers et Prosateurs du 17ème siècle; la crise morale—Scarron, Le Roman comique (extraits), Mme de la Fayette, La Princesse de Clèves, La Bruyère, Caractères et La Rochefoucauld, Maximes. Pascal, Pensées. (DR:H)
4 units, (Weinstein) given 1979-80

151. 17th Century Literature—(Course to be announced)
4 units, (Staff) to be announced
4 units, (Giraud) given 1980-81

171. Le Roman au 19ème siècle—Lecture et discussion des principaux romanciers du siècle: Stendhal, Balzac, Flaubert, Zola. (DR:H) 
4 units, Win (Giraud) 
also given 1979-80 (Weinstein)

173. Symbolism—Baudelaire, Mallarmé, Rimbaud, Verlaine. Lectures in English, readings in French. (DR:H) 
4 units, Aut (Cohn) given at Tours

175. Le Théâtre au 19ème siècle—Lectures principales: Duman père, Hugo, Vigny, Musset, Dumas fils, Augier, Becque, Rostand. (DR:H) 
4 units, (Weinstein) given 1980-81

180. La Poésie française—XX siècle—Valéry, Claudel, Apollinaire, Eluard, Prévert, Michaux, René Char, Boris Vian, Yves Bonnefoy. Etude de thèmes, d’images de métaphores obsédantes et de structures. (DR:H) 
4 units, (Newman-Gordon) given 1979-80

4 units, (Newman-Gordon) given 1979-80

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. (DR:H) 
4 units, (Giraud) given in 1980-81

198. Language Specials—With special permission of the Department only. (DR:X) 
1-3 units, (Staff)

199. Individual Work—Open only to majors in French and with special permission of the Department. May be repeated for credit. See instructor for section number. (DR:X) 
1-3 units, any quarter (Staff) 
by arrangement

ADVANCED UNDERGRADUATE AND GRADUATE COURSES

209. Contemporary French Literature and Thought—(Same as French 110.) (DR:H) 
4 units, Aut (Bertrand) MWF

4 units, Aut (Bertrand) MWF

211. Prononciation et phonétique—(Same as French 111.) Etude théorique et travaux correctifs articulation, rythme, intonation, timbre, quantité, graphie traditionnelle et voixelle instable liaison et enchaînement, graphie phonétique. (DR:H) 
4 units, Win (Juillard)

213. Old French Language—Elements of Old French grammar; reading and interpretation of selected Old French texts. (DR:H) 
4 units, Win (Cazelles) TTh 2:15-4:05
also given 1979-80

214. Old Provençal Language—Reading and interpretation of selected medieval texts written in the langue d’oc, with special emphasis on troubadour lyric poetry. Prerequisite: 213 or equivalent. (DR:H) 
4 units, (Cazelles) given 1980-81

215. French Historical Phonology—The evolution of vowels and consonants from Latin to Modern French through Vulgar Latin and Old French. (DR:H) 
4 units, Win (Juillard)

250. 17th Century Literature—(Course to be announced.) 
4 units, (Staff) (to be announced)

269. Le Roman au 18ème siècle—Auteurs étudiés; Montesquieu, Prevost, Crebillon fils. Voltaire, Rousseau, Diderot, Laclos. (DR:H) 
4 units, (Weinstein) given 1979-80

271. The Symbolist Poets—(Same as Comparative Literature 271.) Baudelaire, Mallarmé, Verlaine, Rimbaud, Yeats, George, etc. Lectures and discussions in English, readings in original language and/or bilingual editions. (DR:H) 
4-5 units, (Cohn) given 1979-80

282. Le Roman 1898-1950—Lectures de Prosper, Alain Fournier, Gide, Malraux, Celine, Sartre, Camus. (DR:X) 
4 units, Win (Newman-Gordon)

285. Voltaire—Stress will be laid on development of Voltaire’s political, social, philosophical and metaphysical thought in the context of contemporary European culture. (DR:H) 
4 units, (Giraud) given 1980-81

287. Rousseau—Psychologically oriented study of Rousseau’s social and political thought in the major self-revelatory works. (DR:H) 
4 units, Win (Giraud)

288. Le Surrealisme—(Apollinaire . . . Breton et le groupe surréaliste.) Définition du Sur-
réalisme à travers les *Manifestes* d'André Breton. Étude de poèmes et de romans surréalistes par A. Breton, Soupault, Eluard, Aragon, J. Gracq. (DR:X)
4 units, Spr (Newman-Gordon)

289. Methods of Teaching French—(Same as Education 293.) 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) W 10:00

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. (DR:H)
4 units, Aut (Bertrand) 11:00-12:15

291. De la Révolution à l'époque contemporaine. (DR:H)
4 units, (Bertrand) given 1979-80

**GRADUATE COURSES**

311. Old French Literature
4 units, (Cazelles), given 1979-80

342. La Renaissance en France I—Les Pro- sateurs; Rabelais et Montaigne.
4 units, (Hester) given 1980-81

343. La Renaissance en France II—Les poètes de la Pléiade et les poètes baroques de la fin du 16ème siècle.
4 units, (Hester) given 1979-80

350. Graduate Seminars.
Les Vies de Saints
4 units, (Cazelles)

Les Toubadours
4 units, (Cazelles)

Chrétien de Troyes
4 units, (Cazelles)

Les Fabliaux
4 units, (Cazelles)

Rabelais
4 units, Aut (Hester) TTh 11:00

Balzac
4 units, (Weinstein) given 1979-80

Pascal
4 units, (Staff) to be announced

Flaubert
4 units, Aut (Giraud) W 2:15-4:05

Baudelaire
4 units, Win (Cohn)

Valéry
4 units, Spr (Cohn)

351. 17th Century Literature—(Course to be announced.)
4 units, (Staff) to be announced

353. Le Théâtre classique français—Corneille, Molière, Racine.
4 units, (Weinstein) given 1979-80

355. Les Chansons de geste—Prerequisite: 213 or equivalent.
4 units, (Cazelles) given 1979-80

356. L'Amour courtois—Prerequisite 213 or equivalent.
4 units, (Weinstein) given 1980-81

378. Théories critiques au 19e siècle—Des doctrines romantiques aux "sciences humaines": Hugo; Stendhal; Stael; Baudelaire; Sainte-Beuve; Taine; Brunetièr; Lanson et l'histoire littéraire.
4 units, (Bertrand) given 1979-80

379. La Doctrine de l'art pour l'art et la littéra- ture sociale au 19ème siècle.
4 units, (Giraud) given 1980-81

380. La Grande Génération—Proust, Gide, Péguy, Claudel, Romain Rolland, Valéry.
4 units, Aut (Newman-Gordon) F 2:15-4:05

381. Proust.
4 units, Win (Newman-Gordon)

382. Théories du Roman: du Naturalisme à 1945—Zola; Bourget; Proust; Gide; Martin du Gard; Mauriac; Malraux; Sartre; Camus.
4 units, Win (Bertrand)

388. Apollinaire—Alcools et Calligrammes.
4 units, (Newman-Gordon) given 1979-80

389. Points de vue critiques au 20e siècle, de Valéry à la Nouvelle Critique—Valéry; Bachelard; Ch. Mauron; Sartre et Lucien Goldmann; G. Poulet; J.P. Richard; J. Starobinski; Roland Barthes; G. Genette; T. Todorov.
4 units, (Bertrand) given 1979-80

390. Théories du Roman: le "Nouveau Roman" et après—(Same as Comparative Literature 390.) Beckett; Robbe-Grillet; Butor; Sarrault; Simon; Dayrol; Le Clézio; Michel Tournier.
4 units, Spr (Bertrand)

398. Tutorials—Initiated by a professor. Tuto- rials 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. See instructor for section number.
4 units, Aut, Win, Spr, by arrangement

399. Individual Work—Exclusively for graduate students in French working on thesis
or engaged in special work. See instructor for section number.
1-12 units, any quarter (Staff)
by arrangement

ITALIAN DIVISION
All courses (DR:H) unless noted otherwise.

GENERAL COURSES
The courses in this section are open to all students and have no prerequisites. All readings and discussions are in English.

130. The Divine Comedy I: Vita Nuova and Inferno—An analysis of Dante’s poem as a conversion narrative. Hell as an anti-image of human life. Sin as the paralysis of love and action. The relation of the Comedy to his earlier works and the thought of the Middle Ages.
4 units, Win (Ahern) MW 11:00-12:30

131. The Divine Comedy II: Purgatorio and Paradiso—Conversion as the recovery of innocence and language. Biological, psychological and ethical redefinitions of love. The failure of language and the vision of God.
4 units, Spr (Ahern) MWF 10

133. Boccaccio’s Decameron—Ars narrandi as ars vivendi. A study of individual tales within the context of larger narrative structures. Il ben parlare as the embodiment of a highly civilized way of life, il nobilmente vivere.
4 units, Aut (Fido) TTh 2:15-4:05

FIRST- AND SECOND-YEAR

Language Courses
Note—Students registering the first time in a first- or second-year course must see their Italian instructor for proper placement if they have had any training in Italian before entering Stanford.

1. First-Year Italian (First quarter)—(DR:X) 5 units, Aut, Win, Spr (Staff)
   MTWThF plus one dhr
2. First-Year Italian (Second quarter)—(Continuation of 1.) (DR:X) 5 units, Aut, Win, Spr (Staff)
   MTWThF plus one dhr
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. May be taken concurrently with Italian 2. Prerequisite: Italian 1. (DR:X)
   3 units, Aut, Win, Spr (Staff) MWF
3. First-Year Italian (Third quarter)—(Continuation of 2.) A grammatical and linguistic approach to Italian through contemporary readings (short stories or novels). (DR:X) 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. (DR:X) 9 units, Sum (Staff)
   MTWThF 10-12 plus 2 dhr

30. Italian Conversation—This course is geared to students returning from Florence. For those students who did not go to Florence, minimum prerequisite is Italian 3. May be repeated for credit up to three times. (DR:X)
   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 (Olmsted) MTWF 11

52. Second-Year Italian—Logical progression of Italian 51 with more emphasis on written work. Prerequisite: 51 or consent of instructor.
   3 units, Win (Mussio) MWF 11

53. Second-Year Italian—Sequential progression of 51 and 52. Prerequisite: 52 or consent of instructor.
   3 units, Spr (Ahern) MWF 11
   Note: Italian 51, 52, 53 are offered for 3 units. May be taken for 4 units by arrangement with instructor.

70-80-90. Intensive and Accelerated Italian—Given only at Stanford in Italy. (DR:X) 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 advisor.

THIRD- AND FOURTH-YEAR

Language Courses
   4 units, Win (Olmsted) MWF
115. Advanced Grammar and Translation—(Continuation of 114.)
   4 units, Spr (Staff) MWF
116. Advanced Reading and Grammar for Graduate Students—Rapid review of grammar
with emphasis on acquisition of proficiency in reading and translating Italian. Designed for graduate students in History, Literature, Music and Fine Arts. Prerequisite: one year of college-level Italian, or the equivalent.

4 units, Sum (Staff)

**Culture and Civilization**

120. Il folklore nell'Italia del Sud—Un'analisi antropologica, sociale e culturale delle sue manifestazioni: pratiche magico-religiose, "fatte" esorcismi, festival religiosi, formule e gesti rituali, contesti letterari.

4 units, Win (Napolitano)


4 units, Aut (Mussio)

122. I canti popolari italiane— Uno studio tematico e regionale delle canzoni folkloristica italiane, compresi canti rituali sociali e di lavoro, canzoni narrative e a ballo, serate e ninne nanne.

4 units, Spr (Olmsted)

127. Italian Culture and Civilization—Aspects of Italian culture and civilization seen through a historical perspective: literary, artistic and social changes and achievements from the Fall of the Roman Empire (476) to 1948.

4 units, Win (Napolitano)

128. Opera Lirica Italiana—(DR:H) if taken for 3 or more units.

2-3 units, Aut (Frulla)

**Literature Courses**

140. La Divina Commedia I: Vita Nova e Inferno—Introduzione alla Commedia nel contesto delle altre opere dantesche, e della cultura medioevale.

4 units, Win (Ahern) MW 11-12:30

141. La Divina Commedia II: Purgatorio e Paradiso.

4 units, Spr (Ahern) MWF 10

143. Il Decameron di Boccaccio—Ars narrandi e ars vivendi. Analisi delle varie novelle nel contesto delle giornate e della cornice. Il ben parlare e il nobilmente vivere.

4 units, Aut (Fido) TTh 2:15-4:05

160. The Renaissance—An introduction to the early Cinquecento. Fortuna, virtù and amore in Macchiavelli’s Il principe, Guicciardini’s I ricordi, and Castiglione’s Il cortegiano.

4 units, Aut (Ahern) MW 11-12:30


4 units, Win (Ahern) MW 2:15-4:05

170. Goldoni and the Italian Theater of the Eighteenth Century—An analysis of selected plays as instances of theatrical language and organization, as mirrors of particular historical and social situations, and contributions to the great philosophical debate of the Enlightenment.

4 units, Spr (Fido) TTh 2:15-4:05

180. Leopardi and Manzoni on Truth and Happiness—Leopardi’s Canti and Operette morali; Manzoni’s Inni sacri, Tragedie and I promessi sposi against the literary and ideological background of early Romanticism.

4 units, Win (Fido) TTh 2:15-4:05

183. Contemporary Literature: Italo Calvino (1945-75)—The Racconti, I nostri antenati, La nuvolà di smog, and Le cosmacomiche against the background of post-war European intellectual life: the Resistance, the debate on Marxism and culture, ecology, science fiction, structuralist theories of narrative.

4 units, Aut (Ahern) MW 2:15-4:05

185. Verga and Pirandello—A seminar for advanced undergraduates and graduate students. Fiction and theater form the “real” Sicily of Verga’s vinti to the existentialist wasteland of Pirandello’s personaggi.

4 units, Spr (Fido) W 2:15-5:05

199. Individual Work—Open to all students with special permission of the Department. See instructor for section number. May be repeated for credit.

1-3 units, any quarter (Staff) by arrangement

**GRADUATE COURSES**

240. La Divina Commedia I: Vita Nova e Inferno—(See 140.)

4 units, Win (Ahern) MW 11-12:30

241. La Divina Commedia II: Purgatorio e Paradiso—(See 141.)

4 units, Spr (Ahern) MWF 10

243. Il Decameron di Boccaccio—(See 143.)

4 units, Spr (Ahern) MWF 10

260. The Renaissance—(See 160.)

4 units, Aut (Ahern) MW 11-12:30

265. Ariosto’s Orlando Furioso—(See 165.)

4 units, Win (Ahern) MW 2:15-4:05

270. Goldoni and the Italian Theater of the Eighteenth Century—(See 170.)

4 units, Spr (Fido) TTh 2:15-4:05
280. Leopardi and Manzoni on Truth and Happiness—(See 180.)
   4 units, Win (Fido) TTh 2:15-4:05

283. Contemporary Literature: Italo Calvino (1945-75)—(See 183.)
   4 units, Aut (Ahern) MW 2:15-4:05

285. Verga and Pirandello—(See 185.)
   4 units, Spr (Fido) W 2:15-5:05

290. The Italian Language—Analytical introduction to pronunciation, grammar and history of Italian. In English.
   4 units, Spr (A. Devine)

292. Research Seminar on Dante—(Enroll in Spanish 392. Same as Comparative Literature 392.) Topics of theoretical and methodological interest from the Vita Nuova, Convivio, and Commedia.
   3-5 units, (Ball) given 1979-80

299. Individual Work—Exclusively for graduate students in Italian working on theses or engaged in special work. See instructor for section number.
   1-12 units, any quarter (Staff) by arrangement

GERMAN STUDIES

Emeriti: Helmut R. Boeninger, Kurt F. Reinhardt, Gertrude L. Schuelke, F. W. Strothmann (Professors)

Chairman: Walter F. W. Lohnes


Associate Professor: Orrin W. Robinson III

Adjunct Professor: Gertrude Mahrholz

Assistant Professor: David Wellbery (on leave Spring 1978-79)

Lecturers: Peter Frank, Ulrike Lieder, Marikka Rypa, Kathryn Strachota

OFFERINGS AND FACILITIES

The Department offers a variety of programs in German language and linguistics, literature, culture, and thought. Courses are open not only to majors but to all interested students.

The Department accepts candidates for the degrees of Bachelor of Arts, Master of Arts, and Doctor of Philosophy.

By carefully planning their programs, students may fulfill the A.B. requirements for a double major in German Studies and another subject. An extended undergraduate major program in English and German literatures is available, as are co-terminal programs for the A.B. and A.M. degrees in German Studies, and joint programs for the Ph.D. degree with Graduate Humanities, Comparative Literature, Modern Thought and Literature, and Linguistics. The Department also maintains a separate program in Translation and Interpretation.

Special collections and facilities at Stanford offer possibilities for extensive research in German studies and related fields pertaining to Central Europe. Facilities include the undergraduate and graduate libraries and the Hoover Institution on War, Revolution and Peace. Special collections include the Hildebrand Collection (texts and early editions from the 16th to the 19th century), and the Austriaca Collection (with emphasis on source material of the time of Maria Theresa and Joseph II, The Napoleonic wars, and the Revolution of 1848), and the Stanford Collection of German, Austrian, and Swiss Culture. The Hoover Institution on War, Revolution and Peace has a unique collection of historical and political documents pertaining to Germany and Central Europe from 1870 to the present. The Department also has its own reference library. Extensive use is made of the Language Laboratory in the Undergraduate Library as well as of the Department’s own audio-visual equipment, films, tapes, slides.

In 1976 the Republic of Austria endowed a chair in Austrian Studies at Stanford, and a similar chair in German Studies was initiated in 1977. Both these chairs rotate on a yearly basis through several departments.

A University residence, Haus Mitteleuropa, housing approximately 30 students is devoted to developing an awareness of the culture of Central Europe.

The Department also houses the Institute for Basic German, formerly at the University of Pittsburgh. Professor J. Alan Pfeffer, the founder of the Institute, serves as its director. The Institute holds a unique corpus of data on the contemporary German language, which is available for research to graduate students and faculty.

PROGRAMS OF STUDY

BACHELOR OF ARTS

Majors in German Studies formulate their plans in quarterly consultation with an undergraduate major advisor. All undergraduate major advising is coordinated by Professor Orrin Robinson.

After completion of the basic courses, majors
normally select at least two German courses per quarter. The total requirement for the Bachelor of Arts degree in German is a minimum of 50 units of work beyond the basic courses (1 through 51 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 courses exclusively to that area:

1. German Language and Linguistics

Students choosing this area of concentration must take 203 (History of the German Language), 211 (Syntax of Modern German), 212 (Linguistics and the Analysis of German) and one linguistics colloquium (usually 219). Further coursework may fall into any one of the following fields or a combination of them: (a) Contrastive linguistics and language pedagogy (teaching methods, curricular problems, error analysis). (b) Historical German and Germanic linguistics (Old High German, Middle High German, Old Saxon, Old Norse, etc.). (c) Theoretical linguistics and the analysis of modern German (phonology, syntax, dialectology, etc.). Appropriate courses in the English and Linguistics Departments may also be taken. (Students interested in languages not listed in this Department should contact the Special Language Program, Department of Linguistics.)

2. German Literature

Students concentrating in German Literature must take 150 and the complete 160 series, in sequence if possible. Additional courses may be selected from the 150 series, which focuses on various genres, or from the 170 series, which provides possibilities for studying specific developments and topics of German literature and culture in depth. In addition, students are encouraged to take a seminar in literature on the 200 level.

3. German Thought

Students who are concentrating in German Thought must take the Geistesgeschichte series (241-243) and a seminar in the 200 group. Normally, 150 should be taken. Students may want to organize their elective courses around certain themes or sets of problems according to their own interests and choose from among the offerings of German, English, French, Philosophy, History, Religious Studies, and other appropriate disciplines.

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 30 units of German courses beyond the 51-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 normally participate in at least one Stanford Overseas Program.

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 candidate will submit an essay representing six to nine units of academic work. This essay will be on a topic chosen in consultation with a faculty member of the Department.

EXTENDED MAJOR IN ENGLISH AND GERMAN LITERATURES

Students may enter this program with the consent of the chairmen of both departments. See description under English in this bulletin.

CO-TERMINAL PROGRAMS

Students may elect to combine programs for the A.B. and A.M. degrees in German Studies. For details, see statement on Degrees in this bulletin.

OVERSEAS STUDIES

Detailed information on the centers in Vienna and Berlin are given in the bulletin Overseas Studies. These programs cover a great variety of courses in language, literature, culture, and other fields of Central European Studies. Most credits earned in Vienna and Berlin 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., but students in other disciplines are also eligible if space permits. To participate, applicants must demonstrate proficiency in German. Students can complete specific course requirements as well as a number of electives, chosen from courses offered by the University of Bonn. A.M. and Ph.D. candidates may take part in the program.
PROGRAM IN TRANSLATION AND INTERPRETATION

Study leading to the award of a certificate in translation or interpretation may be combined with degree programs (A.B. or A.M.) in any department. The program provides students with an ancillary skill in the practice of their professions. The requirements for the Certificate in General Translation (A.B. level) may be met by completing all translating courses through the 200T series. Each student will participate in at least one Stanford Overseas Program. In the final year, the student will produce an original translation of a literary or documentary work.

The requirements for the Certificate in Advanced Translation or Interpretation (A.M. level) include the above as well as the 300T series.

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

This program is designed for those students who do not intend to continue their studies through the Ph.D. degree. 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. The program must include:

201 and 202. Language and Style
300. Proseminar
302. Methods of Teaching German

A minimum of four courses, with at least one course in each of the three areas of concentration: language and linguistics, literature, and 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 Art History.

Students concentrating in German Studies should choose these related courses in the Central European field, in such departments as Political Science, Economics, Anthropology, or History.

All A.M. candidates must take an individual oral examination toward the end of their last quarter.

MASTER OF ARTS IN TEACHING

The degree of Master of Arts in 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 advisor. For a statement of requirements other than German see the section, School of Education, in this bulletin.

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. Students in medieval studies must also have a reading knowledge of Latin, and a reading knowledge of French is highly recommended.

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. It accommodates both those students who complete their studies with the A.M. and those who go on to the Ph.D. An individual oral examination is taken by both groups at the end of the Spring Quarter. Those who continue in the Ph.D. program should devote the summer to writing a qualifying paper, which will be evaluated by the advisor and members of the A.M. examination committee in the following Autumn Quarter. Approval of the qualifying paper constitutes departmental admission to candidacy. Students who do not qualify for the Ph.D. may continue through the second year.

The qualifying paper, although ordinarily not meant to represent an original contribution to scholarship, should demonstrate the candidate's ability to grasp a sufficiently complex subject matter with competence, to organize materials, and to present arguments in a clear and concise manner commensurate with scholarly standards. The necessary research and the writing of the paper should be completed by the beginning of the Autumn Quarter. Procedural details are available from the Department.

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. The Department expects all Ph.D. candidates to demonstrate teaching proficiency in German; 302 (Methods of Teaching German) is required. The teaching requirement is six quarters during the second and third years of study. All graduate students are also strongly advised to start developing skill in the teaching of literature by participating in the teaching of 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
planning to continue through the Ph.D. take essentially the same core program, as shown in the following specific suggestions of appropriate work in Language and Linguistics, Literature, or German Thought. This flexibility permits students to change direction at some later stage, as they develop their intellectual identity on the basis of actual experience.

Under any concentration, electives chosen from graduate level courses in German or approved courses in related fields must be added to accumulate the 36 units of study required for the A.M.

INTERDISCIPLINARY PROGRAMS

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.

Also, students may work toward a Ph.D. in German Studies with minors in such areas as Comparative Literature, Modern Thought and Literature, Medieval Studies, or Linguistics. Students who are obtaining a Ph.D. in such combinations may require additional training or work.

AREAS OF CONCENTRATION FOR THE PH.D.

1. Language and Linguistics

Students choosing this concentration should take the general survey courses 203 (History of the Language), 311 (Syntax of Modern German) and 312 (Linguistics and the Analysis of German) or their equivalents. In their further studies, students may choose courses in contrasting English-German linguistics, methods of teaching German, historical Germanic dialects and comparative German linguistics, modern German syntax, phonology and dialectology, theoretical synchronic and diachronic linguistics. Students are also encouraged to take related courses in other departments, especially in English and Linguistics.

During the first year, students normally take the following program:

201 and 202. Language and Style
203. History of the German Language or
312. Linguistics and the Analysis of German
313. The Transformational Grammar of German or
314. The Phonology of German
304. Gothic or 305. Old Norse or
306. Old High German or 307. Old Saxon
300. Proseminar

Three courses in German Literature and in German Thought, with at least one course in each.

2. 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 the first year, will require research papers.

During the first year, students normally take the following program:

201. and 202. Language and Style
203. Introductory Middle High German
311. Syntax of Modern German
241. Deutsche Geistesgeschichte I
242. Deutsche Geistesgeschichte II
300. Proseminar

Two courses in German Literature and one in German Language and Linguistics; one seminar.

3. German Thought

Course requirements are a minimum of two courses or seminars per quarter for at least four of the six quarters following the first year, to include four courses or seminars in the 340 and 400 series and four courses or seminars in the 351-390 series. Lectures and colloquia will require final examinations but not term papers. Seminars, of which the student is expected to take a minimum of two after the first year, will require research papers. Students are advised to take some electives outside the Department, related to their field of interest.

During the first year, students normally take the following program:

201 and 202. Language and Style
203. History of the German Language or
311. Syntax of Modern German or
313. The Transformational Grammar of German
241. Deutsche Geistesgeschichte I
242. Deutsche Geistesgeschichte II
243. Deutsche Geistesgeschichte III
300. Proseminar

Three courses in German Literature, one of which should be from the 351-359 series, and one from the 360, 370, or 380 series. One seminar in German Thought (349, 449).

COURSES

OVERVIEW OF COURSES

A. General Courses (given in English)
B. Introductory Courses (1-99)
C. Intermediate Courses (100-199)
  Language (100-109)
  Culture (130-139)
  Literature (150-179)
D. Translation and Interpretation:
  Junior level (121T-124T)
  Senior level (221T-223T)
  Graduate level (321T-326T)
E. Courses for Advanced Undergraduates and Graduates:
Language: Skills and older dialects (201-210). Special topics in linguistics (211-219; 311-319)
Culture and Civilization (230-239; 330-339)
Thought and Literary Theory (240-249; 340-349)
Literature: Literature and Culture I-IX (251-259 or 351-359), Major authors (260 or 360), Genres (270 or 370), Major works (280 or 380), Special topics (290 or 390)
Proseminar (300)
F. Courses for Advanced Graduate Students (400-499)
Seminars and colloquia on special topics; interdepartmental courses
G. Independent Study:
Undergraduates (199)
Graduates (298)
A.M.-level qualifying paper (301)
Dissertation research (400)

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.

31A-33A. German Culture and Civilization I-III—These courses survey geography, people, and institutions of the German-speaking areas of Central Europe: the contemporary situation and its origins in history. Topics include: governmental structure of the BRD, the DDR, Austria, and Switzerland; population; stability and migration; the Gastarbeiter problem; social structure of East and West Germany; the educational system; communications systems; urbanization and its consequences since World War II; government and the arts. Extensive use of films, slides, etc.

31A. Culture and Civilization I. (DR:A)
3 units, (Staff) given 1979-80

32A. Culture and Civilization II. (DR:A)
3 units, (Staff) given 1979-80

33A. Culture and Civilization III. (DR:A)
3 units, (Staff) given 1979-80

134A. European, Especially "Nordic" Symbolism in Literature and Art about 1900 (Ibsen, Strindberg, Munch)—(Same as 234A: Comparative Literature 234A). The development of symbolism in Ibsen's drama, Strindberg's symbolic dramatic structure and his hermetic symbols, their foundation in naturalist and psychoanalytic theory, the dream-structure; Kierkegaard's, Schopenhauer's and Nietzsche's influence; J.P. Jacobsen's symbolist novels, his influence on Rilke; Strindberg's paintings, the art of Edvard Munch on the verge of Expressionism; the close theoretical correspondence of "Nordic" with Symbolism (Baudelaire, Yeats, Morea, Mallarmé, Proust, Maeterlinck, Spanish modernismo, Rilke etc.; Grandville, Böcklin, Redon, Klinger, Rossetti, Stuck, etc., in the Fine Arts) and with Naturalism—only a seeming paradox; the great impact which "The Scandinavian Poets" had on European literature in 1890-1920.

3 units, Aut (Weber)

135A. The Austrian Mind as Seen Through the Development of (Austrian) Literature—(Same as 235A.) An historical survey of culture and civilization in Austria from the beginnings of the Reformation to the late Habsburg Monarchy. Literature will be the central focus, including the development of literary styles and genres and the influence of literature on public life.

3 units, Win (Zeman)

136A. The Libretti of Viennese Classicism: Haydn, The Creation, Mozart, The Magic Flute, Beethoven, Fidelio.—(Same as 236A: Comparative Literature 236A.) The libretti will be discussed in the framework of literary history and literary aesthetics, and in their relationship to the entire libretti production in Austria between 1780 and 1820. In coordination with musicology, a new understanding of these three works should result, which could become the standard for modern productions and should provide new impulses for libretti research. Additional readings: Haydn, The Seasons, Mozart, The Impresario, The Marriage of Figaro, Don Giovanni, Cosi fan tutte, and Beethoven, all versions of Leonore and Fidelio.

3 units, Spr (Zeman)

137A. The Political System of the German Federal Republic—(Same as Political Science 111V.) Introductory course dealing with: the formation of the two German states, the political culture in Germany, parties, elections, interest groups, elite recruitment and the institutions of the system (parliament, government and administration, the constitutional court and federalism).

3 units, Win (von Beyme)
137B. Comparative Politics: The Political Systems of Western Europe—(Same as Political Science 112V.) Introduction to the West European systems not by a country-by-country approach, but rather analyzing in a systematic way the differences in nation building and political culture, the systems of interest articulation and aggregation and the parliamentary systems. The second half of this course should deal with the output of the system in the most important policy areas such as economic policy, educational policy, social policy.

5 units, Spr (von Beyme)

179A. The Grotesque in Art and Literature—(Same as Art and Comparative Literature 179A). Readings from German, American, French, Italian and Russian literature in the light of various definitions of the grotesque and related verbal and visual phenomena furnished by Wolfgang Kayser and other scholars.

3 units, Win (Weisstein)

191A. German Cinema: Modern Germany on the Big Screen—(Same as Modern Thought and Literature 211.) This course is intended as an introduction to the development of the cinema in Germany. Films of historical and artistic significance will be viewed and discussed in class. Readings on such topics as cinematic theory (Arnheim, Benjamin), cinema and society (Krakauer), cinema and the other arts (Lotte Eisner), and cinema and politics (Brecht) will be used to relate individual films to their cultural context.

3 units, (Staff) given 1979-80

196A. Preconditions of Literature. German Literature as an Example—(Same as 296A; Comparative Literature 296A; Modern Thought and Literature 269A.) The material side of literature has long been neglected by the traditional history of literature, especially in Germany. The preconditions, which make the existence of literature possible, have become now the target of intensive study and research. The course will deal with such topics as literacy and analphabetsim, literary socialization (education and literary canon), book publishing and trade, the common reader, the impact of libraries, and so on.

3 units, Spr (Frank)

234A. European, Especially "Nordic" Symbolism in Literature and Art About 1900 (Ibsen, Strindberg, Munch)—(Same as 134A; Comparative Literature 234A).

3 units, Aut (Weber)

235A. The Austrian Mind as Seen Through the Development of Austrian Literature—(Same as 135A.)

3 units, Win (Zeman)


3 units, Spr (Zeman)

273A. European Novel I: Renaissance Heritage.—(Same as Comparative Literature 373A.) Theory and practice of prose fiction in Europe from Rabelais and Cervantes to the Enlightenment period; study of the evolution of form, subject matter, and terminology in the romance and novel; special attention to the humoristic, encyclopedic, picturesque, querry, and adventure modes in British, French, German, Spanish, and Italian literature.

3-5 units, (Gillespie) given 1980-81

274A. European Novel II: Sentiment, Education, and the Crisis of Development—(Same as Comparative Literature 374A.) The emergence of psychological and confessional models from Mme de La Fayette to Goethe; special attention to the novel as vehicle for the concept of Bildung (formation, education) in such major authors as Fielding, attacks on eighteenth-century norms by radicals such as de Sade, pre-Romantic anxieties as experienced by Rousseau and others, and the revolution of fiction in Sterne.

3-5 units, (Gillespie) given 1980-81

275A. European Novel III: The Romantics—(Same as Comparative Literature 375A.) Readings from American, English, French, German, and Italian romantic authors. Romantic theory and practice of the novel, with special emphasis on genres and modes (sentimental, confessional, educational, arabesque, gothic, horrific, etc.) in relation to major concepts (antihero, artist problem, ego, "double," oversoul, romantic irony, etc.)

3-5 units, (Gillespie) given 1980-81

284A. Joyce, Proust, Mann I—(Same as Comparative Literature 284A.) Themes, structures, and mythopoetic dimensions of the novel in the context of Modernism. Views on Joyce, Proust, and Mann as synthesizers and interpreters of the historical situation ("decline of the West," contending -isms, etc.), forms of consciousness (Bergson, Nietzsche, Freud, Jung, et al.), and artistic expressions (opera, painting, etc.) of their age. (DR:X)

3 units, (Gillespie) given 1979-80

285A. Joyce, Proust, Mann II—(Same as Comparative Literature 285A.)

3 units, (Gillespie) given 1979-80
291A. Literature of Decadence—(Same as Comparative Literature 391A; Modern Thought and Literature 291A.) Symbolist, fin de siècle, and modernist understandings of the evolution of civilization; the themes of intellectual and spiritual crisis, the "decline of the West," and "art for art's sake" in European poetry, drama, and fiction during the decades 1880-1930; the impact of Decadence on modern art and thought ("art nouveau," "Jugendstil," neo-Rosicrucianism, Wagnerism, "dissociation of sensibility," "superman," etc.) (DR.X)
3 units, (Gillespie) given 1981-82

295A. Literature of Anarchism and Nihilism—(Same as Comparative Literature 295A; Modern Thought and Literature 295A.)
3 units, (Gilkspie) given 1979-80

296A. Preconditions of Literature. German Literature as an Example—(Same as 196A; Comparative Literature 296A; Modern Thought and Literature 296A.)
3 units, Spr (Frank)

300A. Introduction to German Studies—Bibliographical research is a time-consuming task until one acquires the necessary skills to find, to know and to handle the essential bibliographies, reference works, etc. in the vast field of German Studies—culture, literature, history, political science, and so on. It is the aim of this course to enable students to find all facts and information needed for study and research by themselves and in the shortest possible time.
2 units, Aut (Frank)

INTRODUCTORY COURSES
(1-99)

First- and second-year language courses are under the direction of Gertrude Mahrholz. Note—Students registering for the first time in a first- or second-year course must take a placement test if they have studied German before entering Stanford.

FIRST-YEAR COURSES
All courses (DR.X)

1,2,3. German Language and Culture—These comprehensive courses provide a balanced introduction to listening and speaking as well as reading and writing.
5 units, Aut, Win, Spr (Staff)

2C. Conversational German—This course aims to enable the student to understand, and to express himself in, simple spoken German. Especially recommended for students going to Vienna or Berlin. Prerequisite: at least one quarter of first-year German.
2 units, Aut, Win (Staff)

1P,2P,3P. Individually Programmed Beginning German—These courses are particularly suited to students who wish to complete more or less than five units a quarter, or have a spotty background in German, or have scheduling conflicts, or simply prefer to work independently. Students proceed at their own pace, working on their own with the text and tapes. The instructor is available for consultation on a regular basis. Conversation classes may be attended for listening and speaking practice.
1-15 units, Aut, Win, Spr (Staff)

1D,2D,3D. Beginning Dutch—Introduction to written and spoken Dutch/Flemish (Algemeen Beschaafd Nederlands).
1D. 4 units, Aut (Robinson)
2D. 4 units, Win (Robinson)
3D. 4 units, Spr (Staff)

II. Elementary Conversational Icelandic—Students sign up for Linguistics 080A (Autumn), 080B (Winter), and 080C (Spring).
4 units, Aut, Win, Spr (Staff)

1N. Elementary Conversational Norwegian—Students sign up for Linguistics 080A (Autumn), 080B (Winter) and 080C (Spring).
4 units, Aut, Win, Spr (Staff)

18. Elementary Conversational Swedish—Students sign up for Linguistics 080A (Autumn), 080B (Winter) and 080C (Spring).
4 units, Aut, Win, Spr (Staff)

1DN. Elementary Conversational Danish—Students sign up for Linguistics 080A (Autumn), 080B (Winter) and 080C (Spring).
4 units, Aut, Win, Spr (Staff)

4. Review of First-Year German—For those who need to solidify their basic command of the language and/or have not had contact with the language for a considerable amount of time.
3 units, Aut (Staff)

5. Intensive First-Year German—Equivalent of 1, 2, and 3 combined. Enrollment limited. Summer Quarter only.
12 units, Sum (Staff) MTWThF 8:00-9:30 and 10:30-12:00

10. Elementary German for Seniors and Graduate Students—This intensive course is designed for students who need to acquire reading ability in German for the Ph.D. and/or for advanced research in their own field. No auditors permitted.
4 units, Win (Mahrholz) MTWTh 9 Sum (Staff) MTWThF 9

SECOND-YEAR COURSES
All courses (DR.X) unless noted otherwise.

51. Intermediate German—Continues the
balanced approach of 1, 2, and 3 and aims at improving mastery of all four skills. This is the final course in the comprehensive introductory sequence. Suggested continuations: 51C, 101, 130 series, 150 series. (DR:H)

5 units, Aut, Win, Spr (Staff)

51C. Intermediate Conversation—This course builds on the skills developed in 2C. Students are encouraged to develop fluency in expressing their own thoughts in German. Suggested continuation: 100C.

2 units, Aut, Win, Spr (Staff)

70,80,90. Intensive German—Given only in Vienna and Berlin.

Aut, Win, Spr, Sum

INTERMEDIATE COURSES

(100-199)

100C. Advanced Conversation—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: 51C or equivalent. (DR:X)

2 units, Aut, Win (Staff)

101. Reading and Writing Modern German—Modern short literary prose works are read and discussed. Students write short essays in German on the works studied. Prerequisite: 51 or consent of instructor. (DR:H)

3 units, Win (Staff)

102. Reading and Writing Modern German—Continuation of 101. (DR:H)

3 units, Win (Staff)

121T-123T. Translation of Texts in the Social Sciences—This series concentrates on the translation of current non-literary materials, selected from German newspapers, periodicals, government publications, etc. During each of the three quarters, different fields within the social sciences are emphasized. Throughout this sequence, as well as in 221T, occasional sessions are devoted to the interpretation of bilingual conversations and negotiations (Verhandlungsdolmetschen). General aspects of the theory of translation, as well as lexicography, are also discussed.

Students not participating in the Translators program may enroll in the individual courses if space permits. Prerequisites: 51 plus 101 and 102 (or equivalent) and consent of instructor. (DR:H)

4 units, Win (Shacter)

151-155. Courses in the 150 series introduce the student to German literature in various genres. Prerequisite: 51 or equivalent.


4 units, (Staff) given 1979-80
exemplify various trends in modern poetry such as Symbolism (George, Rilke), Expressionism (Trakl, Heym, Benn), Dadaism (Arp); consideration of the poem as a political weapon (Brecht, Enzensberger). Evaluation of the development of poetry in East and West Germany since World War II (Celan, Bobrowski, Heissenbüttel, and others). (DR:H)

153. Contemporary Drama—Examples of the theatre of the absurd, the influence of Brecht’s epic theatre in East and West, the documentary drama; Frisch, Dürrenmatt, Grass, Hochhuth, Walser, Weiss, Hacks, Strittmatter, the modernist theatre of Peter Handke. (DR:H)

154. Modern Short Prose—Study of short works of fiction by contemporary writers as well as selected essays, commentaries and letters which document the political and cultural climate of the times. Readings by such writers as Thomas Mann, Brecht, Böll, Grass, Kafka, Peter Weiss, Jakov Lind, and others. (DR:H)


157. Orpheus in Germany: Lyric Poetry from the Middle Ages to the Present—This course provides an introduction to the history of lyric poetry in Germany. The great poets will be viewed in relation to one another as well as to their cultural contexts. Topics to be discussed (in addition to the individual poets): the nature of poetic language; love poetry, political poetry, experimental poetry; the varieties of poetic forms; the changing function of poetry; techniques of interpreting poetry. Guest lectures by specialists will be combined with discussion sessions. Exercises in reading poetry aloud, translation, and interpretation will be included. (DR:H)

161-163. 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. Prerequisites: 51 plus 2 additional courses or consent of instructor.
century to the early 20th century (e.g., Storm and Stress, Classicism, Realism, Naturalism); discussion of characteristic themes, various theories of the drama, and experimental forms which influenced the development of modern drama. Readings by Goethe, Schiller, Kleist, Büchner, Grabbe, Hebbel, Hauptmann, Wedekind, and others. (DR:H)

4 units, (Mommsen) given 1979-80

172. Drama Since Brecht—(Same as Drama 158A.) Trends of modern German drama, including plays by Frisch, Dürrenmatt, Weiss, Hacks, Handke, Botho Strauss, Bauer, Bernhard, Krötz, and others. (DR:H)

3-5 units, Win (Esslin)

173. Modern Fiction—(Same as Modern Thought and Literature 173.) Reading and interpretation of short stories and novels by modern writers such as Thomas Mann, Kafka, Böll, Grass, Hesse, Uwe Johnson, Christa Wolf, Thomas Bernhard, and others. Discussion of characteristic styles, themes and heroes of modern fiction. (DR:H)

4 units, (Staff) given 1979-80

179. Special Topics—These courses explore the possibility of interdisciplinary studies and research in areas of special interest: e.g., women authors, social satire, political speeches, Freud and literature. Literature in the German Democratic Republic. (DR:H)

4 units, (Staff) given 1979-80

199. Individual Reading—Enrollment only by special permission of the Department. Thirty-six hours of reading per unit, weekly conference with instructor. May be repeated for credit. Prerequisite: 51 or consent of instructor. (DR:X)

1-2 units, Aut, Win, Spr (Staff)

by arrangement

COURSES FOR ADVANCED UNDERGRADUATES AND FOR GRADUATE STUDENTS (200-299)

All courses (DR:X)

201. Language and Style I—Writing exercises on different levels of style; discussion of grammatical problems; introduction to literary stylistics. Prerequisite: qualifying examination.

2 units, Win (Lohnes)

202. Language and Style II—Continuation of 201.

2 units, Spr (Lohnes)

203. History of the German Language—(Same as Medieval Studies 203.) 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)

204. Gothic—(Same as 304.) Introduction to grammar and texts of the Gothic language. The grammar of Proto-Germanic will also be treated.

3-5 units, Spr (Robinson)

205A. Old Norse—(Same as 305A; English 200A.) Presentation of Old Norse grammar and selected readings from E. V. Gordon's An Introduction to Old Norse. Discussion and reports on the growth of prose literature in Iceland and Norway.

5 units, (Andersson, Harris) given 1979-80

205B. Advanced Old Norse—(Same as 305B; English 200B.)

5 units, (Andersson, Harris) given 1979-80

206. Old High German—(Same as 306.) Introduction to the grammar and documents of the earliest attested stage of High German.

3-5 units, (Robinson) given 1980-81

207. Old Saxon—(Same as 307; English 201.) Introduction to the grammar and documents of the earliest attested stage of Low German.

3-5 units, (Robinson) given 1979-80

208. Introductory Middle High German—Presentation of grammar and selected readings from the epic, lyric, and didactic writers represented in Els Oksaar's Mittelhochdeutsch.

3-5 units, (Andersson) given 1979-80

211. Syntax of Modern German—(Same as 311.) Contrastive analysis of English and German syntax.

3-5 units, Aut (Lohnes)

212. Linguistics and the Analysis of German—(Same as 312; Linguistics 284.) An introduction to linguistic theory and analysis with special emphasis on the analysis of modern German.

3-5 units, (Robinson) given 1979-80

213. The Transformational Grammar of German—(Same as 313; Linguistics 283.) Study of the syntactic mechanisms of German within the framework of transformational grammar.

3-5 units, (Robinson) given 1979-80

214. The Phonology of German—(Same as 314; Linguistics 288.) Systematic treatment of the German sound system, especially within the framework of generative phonology.

3-5 units, Win (Robinson)

219. Linguistics Colloquium—(Same as 319, Linguistics 289.) Topics in German linguistics. Although specific topics are determined by stu-
dent interest, the general field of study will alternate as follows: synchronic German linguistics in years when 212 is taught, diachronic German and Germanic linguistics in years when 203 is taught.

221T-223T. This sequence represents the final year of the Translators Program at the undergraduate level. Upon completion of 223T, students are eligible for the Certificate in General Translation.

A special one-unit course on a note-taking system for students interested in the interpreters courses (324T-326T) is offered as part of the 220 series upon request only.

221T. Translation of Texts in the Social Sciences—Continuation of 123T. Texts to be translated are selected largely from the fields covered in the 120 series, but will pose greater difficulty in style and content. Verhandlungsdolmetschen will be continued. Students not participating in the Translators Program may enroll in this course if space permits. Prerequisite: 123T or consent of instructor.

3 units, Aut (Staff)

222T. Translation Workshop I—During this two-quarter workshop, each student is expected to produce independently an original translation of a literary or documentary work from his or her major field of interest. The work to be translated should not exceed 100 pages and should be chosen in consultation with the student’s major advisor. Open only to students enrolled in the Translators Program. Prerequisite: 221T.

3 units, Win (Staff)

223T. Translation Workshop II—Continuation of 222T. Upon completion of this course, and upon acceptance of the translation by the Department, the Certificate in General Translation is awarded.

3 units, Spr (Staff)

224T. Internship for Translators—An internship in the translation department of a major bank. Prerequisite: 221T or higher. Details and application forms available in Room 242N.

3 units, Aut, Win, Spr, Sum (Staff)

235A. The Austrian Mind as Seen Through the Development of (Austrian) Literature—(Same as 135A.)

3 units, Win (Zeman)


3 units, Spr (Zeman)

241-243. The series is designed to acquaint students with the history of German thought from 1750 to the present and its significance for an understanding of modern culture. Authors to be studied include Herder, Hegel, Schiller, Marx, Nietzsche, Freud, Husserl, Wittgenstein, Marcuse, and Adorno.


3-5 units, Aut (Wellbery)


3-5 units, Win (Wellbery)


3-5 units, Spr (Mueller-Vollmer)

244. Philosophy of Religion—(Same as Religious Studies 42/242.) Contemporary and traditional issues.

3-4 units, Spr (Harvey)

245. Nineteenth Century European Religious Thought—(Same as Religious Studies 144/244.)
Interpretations of religious conceptions of deity and human nature in such thinkers as Hegel, Newman, Kierkegaard. Prerequisite: consent of instructor.

4-5 units, Win (Harvey)

251-259. German Literature and Culture—
(Same as 351-359.) These courses treat the major periods of German literature from the early Middle Ages to the present. See descriptions under 351-359. Open to undergraduates by consent of instructor only.

251. German Literature and Culture I—
Topics in Germanic Philology. (Same as 351.) Topics in Old Norse language and literature, medieval Carolingian literature, Germanic religion and mythology, Germanic heroic poetry, Middle High German literature.
3-5 units (Andersson) given 1979–80

253. German Literature and Culture III—
(Same as 353.) Introduction to New High German literature from the waning of the Middle Ages through the Renaissance and Reformation period (circa 1350-1600).
3-5 units (Gillespie) given 1980–81

255. German Literature and Culture V—
(Same as 355.) Eighteenth Century (1750–1800.)
3-5 units (Mommensen) given 1979–80

256. German Literature and Culture II—
(Same as 356.) Romanticism.
3-5 units (Mommensen) given 1979–80

257. German Literature and Culture VII—
1830–1900.—(Same as 357.)
3-5 units, Win (Mommensen)

258. German Literature and Culture VIII—
1900–1945—(Same as 358.)
3-5 units, Spr (Mommensen)

259. German Literature and Culture IX—
1945 to the Present—(Same as 359.)
3-5 units (Staff) given 1979–80

260-269. Major Authors—In-depth study of a major writer in his literary creativity, relation of his age, or special achievements and significance. Courses will deal with such writers as Walther von der Vogelweide, Grimmelshausen, Wieland, Lessing, Goethe, Novalis, Tieck, Kleist, Fontane, Nietzsche, Hofmannsthal, Thomas Mann, Kafka, Brecht, etc.

263. Goethe—(Same as 363.) Unser Berücksichtigung der neueren Forschung.
3-5 units, Aut (Mommensen)

264. The Stories of E.T.A. Hoffmann—
(Same as 364.)
3-5 units, Spr (Weisstein)

270-279. Genres—These courses treat the development, contents, and formal characteristics of such kinds of writing as lyric poetry, epic drama, novel, Novelle, tale, short story, essay, etc., in various authors or periods. Focuses on such matters as medieval drama, baroque "metaphysical" poetry, the diary as a literary form, autobiography.

271. Germanic Poetry and Its Poetics—
(Same as 371, Comparative Literature 371: English 351; Medieval Studies 271; Modern Thought and Literature 351.) All Germanic poetry, whether Beowulf, Mersenburger Zauberspruch, Hildebrandshied, Edda or Skaldic strophic poems like Ynglingatal, is developed from one basic structure, the alliterative four-stressed verse, already used circa 415 A.D. on the Gallehus drinking horn in the line EK EEWAGASTIR HOLTHJAR/ HORNÁ TAWIDO "I, Hlewagastir of Holt/the horn made." The seminar will discuss: the basic laws of Germanic syntax, prosody, verse and rhyme; epic, gnomic and skaldic metres; Liedstil and Epenstil; the aesthetics of Skaldic Poetry and its analogue in the ornamental Viking Art; the sophisticated semantic system of kenning-style in Skaldic and OE. epic poetry, its origins in magic. Specimens of all major genres on OHG, OSax., OE. and ONorse poetry will be analyzed (some knowledge of one of these dialects is required).
3-5 units, Aut (Weber)

276. Deutsche Marchendichtung und Märchen der Weltliteratur—(Same as 376.)
3-5 units, (Mommensen) given 1979–80

277. Moderne Lyrik—(Same as 377; Modern Thought and Literature 277.)
3-5 units, Aut (Mueller-Vollmer)

290-299. Special Subjects and Problems—
Variable topics.

292. Heine und das Junge Deutschland—
(Same as 392.)
3-5 units, (Mueller-Vollmer) given 1980–81

293. Adalbert Stifter, Gottfried Keller, Theodor Fontane, Eduard Graf von Keyserling—(Same as 393.)
3-5 units, (Mommensen) given 1980–81

294. Poets of Infinity: Hölderlin, Novalis, Keats, Baudelaire, Leopardi, and Bécquer—(Same as 394; Comparative Literature 394.)
3-5 units (Gillespie) given 1981–82

295. Naturalism—(Same as 395; Comparative Literature 395.)
3-5 units, Win (Weisstein)

296A. Preconditions of Literature. German Literature as an Example—(Same as 196A; Comparative Literature 296A; Modern Thought and Literature 296A.)
3 units, Spr (Frank)
298. 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.
1-15 units, each quarter (Staff)

GRADUATE COURSES
(300-399)

All courses (DR:X)

3-5 units, Aut (Wellbery)

300A. Introduction to German Studies—Bibliographical research is a time-consuming task until one acquires the necessary skills to find, to know and to handle the essential bibliographies, reference works, etc., in the vast field of German Studies—culture, literature, history, political science, and so on. It is the aim of this course to enable students to find all facts and information needed for study and research by themselves and in the shortest possible time.
2 units, Aut (Frank)

301. Individual Work—Exclusively for work on the A.M.-level qualifying paper.
Units by arrangement (Staff)

302. Methods of Teaching German—(Same as 292.)
2 units, Spr (Lohnes)

303. Curricular Problems—Given on request only.
3 units, (Lohnes) by arrangement

304. Gothic—(Same as 204.) Introduction to grammar and texts of the Gothic language. The grammar of Proto-Germanic will also be treated.
5 units, Spr (Robinson)

305A. Old Norse—(Same as 205A; English 200A.) Presentation of Old Norse grammar and selected readings from E. V. Gordon's *An Introduction to Old Norse*. Discussion and reports on the growth of prose literature in Iceland and Norway.
5 units, (Andersson, Harris) given 1979–80

305B. Advanced Old Norse—(Same as 205B; English 200B.)
5 units, (Andersson, Harris) given 1979–80

306. Old High German—(Same as 206.) Introduction to the grammar and documents of the earliest attested stage of High German.
3-5 units, (Robinson) given 1980–81

307. Old Saxon—(Same as 207; English 201.) Introduction to the grammar and documents of the earliest attested stage of Low German.
3-5 units, (Robinson) given 1979–80

311. Syntax of Modern German—(Same as 211.) Contrastive analysis of English and German syntax.
3-5 units, Aut (Lohnes)

312. Linguistics and the Analysis of German—(Same as 212; Linguistics 284.) An introduction to linguistic theory and analysis with special emphasis on the analysis of modern German.
3-5 units, (Robinson) given 1979–80

313. The Transformational Grammar of German—(Same as 213; Linguistics 283.) Study of the syntactic mechanisms of German within the framework of transformational grammar.
3-5 units, (Robinson) given 1979–80

314. The Phonology of German—(Same as 214; Linguistics 288.) Systematic treatment of the German sound system, especially within the framework of generative phonology.
3-5 units, Win (Robinson)

319. Linguistics Colloquium—(Same as 219; Linguistics 289.) Topics in German linguistics. Although specific topics are determined by student interest, the general field of study will alternate as follows: synchronic German linguistics in years when 312 is taught, diachronic German and Germanic linguistics in years when 203 is taught.
3-5 units, Spr (Robinson)

321T-323T. Advanced Translation—This series leads, with the completion of 323T, to the Certificate in Advanced Translation. Courses include: Practice translations of difficult texts; critical comparisons of accepted translations with the originals; *Verhandlungsdolmetschen*.

321T. Advanced Translation—Translation of difficult texts from modern German newspapers, periodicals, etc. The areas from which texts are chosen will reflect, to the greatest extent possible, students' fields of study. Prerequisite: 223T or equivalent, or consent of instructor.
3 units, Aut (Staff) by arrangement

322T. Advanced Translation—Continuation of 321T.
3 units, Win (Staff) by arrangement

323T. Advanced Translation—Continuation of 322T. Upon successful completion of this
course students will be eligible for the Certificate in Advanced Translation.

3 units, Spr (Staff) by arrangement

324T-326T. Interpretation—This sequence introduces the student to the two principal techniques used in interpretation: simultaneous and consecutive. Various aspects of the field, such as ethics, parliamentary procedure, conference and escort interpreting, will be discussed.

3 units, Aut (Staff) by arrangement

324T. Interpretation—Interpretation of conversations and negotiations; introduction to consecutive and simultaneous interpretation; conference terminology; writing of reports and précis.

3 units, Win (Lieder) by arrangement

325T. Interpretation—Continuation of 324T.

3 units, Spr (Lieder) by arrangement

326T. Interpretation—Continuation of 325T. Upon completion of this course, the Certificate in Interpretation is awarded.

3 units, Spr (Staff) by arrangement

349. Seminars

349A. Humboldt and Structuralism—(Same as 449A; Comparative Literature 449; Modern Thought and Literature 349A.)

3-5 units, (Mueller-Vollmer) given 1980–81

349B. Language Theories of the Romantic Movement—(Same as 449B; Comparative Literature 449B; Modern Thought and Literature 349B.) Against the background of 18th century epistemology the Romantic writers and poets developed a new creative concept of language which in many cases can serve as a key to their literary productions. The seminar will attempt to delineate the common semantic and ideational field for the different language theories of the period and at the same time focus on some of the important statements. Authors to be studied include Rousseau, Herder, Fichte, A.W. and F. Schlegel, Humboldt, Mme de Stael, Novalis, Baudelaire, Wordsworth, Coleridge, and Emerson.

3-5 units, (Mueller-Vollmer) given 1981–82

349C. Textthermeneutik—(Same as 449C; Comparative Literature 349C; Modern Thought and Literature 349C.)

3-5 units, (Mueller-Vollmer) given 1981–82

349D. Semiotics and Literature—(Same as 449D; Comparative Literature 449D; Modern Thought and Literature 349D.)

3-5 units, (Mueller-Vollmer) given 1980–81

349F. Surreal Elements in German Fiction (from Romanticism to Kafka and Beyond)—(Same as 449F.)

3-5 units, Spr (Weisstein)

350. Methods 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

351-359. German Literature and Culture I-IX—These courses treat the major periods of German literature from the early Middle Ages to the present. They are intended to convey to the student a sense of the developing traditions that have shaped German literature. By focusing on a specific period, the literary and non-literary (cultural, social, political, philosophical) contexts can be established within which individual authors, works, and movements are situated.

351. German Literature and Culture I—

(Same as 251.) Topics in Germanic Philology. Topics in Old Norse language and literature, medieval Carolingian literature, Germanic religion and mythology, Germanic heroic poetry. Middle High German literature.

3-5 units, (Andersson) given 1979–80

353. German Literature and Culture III—

(Same as 253.) Introduction to New High German literature from the waning of the Middle Ages through the Renaissance and Reformation period (circa 1350–1600). Readings in 15th- and 16th-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, (Gillespie) given 1981–82

354. German Literature and Culture IV—

From Baroque through Enlightenment (circa 1600–1750). Readings in literary renewal, experimentation, and theorizing of the 17th 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, mannerist, baroque, neoclassical, rococo) on the threshold of the Enlightenment, the establishment of Enlightenment tastes, generic expectations, and language.

3-5 units, (Gillespie) given 1981–82

355. German Literature and Culture V—

Eighteenth Century (1750–1800) (Same as 255.) The course of the Enlightenment from Gottsched to Lessing and Wieland, major

3-5 units, (Mommsen) given 1980–81


3-5 units, (Mommsen) given 1979–80

357. German Literature and Culture VII—Nineteenth Century 1830–1900. (Same as 257.) Classical-romantic traditions in the drama, Novelle, and novel from the Biedermeier to poetic Realism (e.g., Grillparzer, Stifter, Keller). Büchner, Heine, the Young Germans, and the Vormärz movement. Social thought in literary theory and journalism; the influence of Hegel and Feuerbach. Fontane and problems of European Realism. Developments of literary theory and the drama of Naturalism in its European context (Holz, Hauptmann).

3-5 units, Win (Mommsen)

358. German Literature and Culture VIII—Modern Period (1900–1945). (Same as 258.) Fin de siècle; literary theories and manifestoes. Philosophical influences (e.g., Nietzsche). Symbolism from George to Böll; "poetic revolution" from Holz to Dadaism. Essays and diaries as reflections of the cultural-political climate of the Wilhelminian Era and the Weimar Republic. The development of Expressionist drama; Brecht and the epic theatre. Aspects of the modern novel (Mann, Kafka, Döblin). Ideology of Third Reich Schriftum; German literature in exile.

3-5 units, Spr (Mommsen)

359. German Literature and Culture IX—1945 to the Present. The Group 47: antifascist traditions and problems of post-war literary language. The absurd and the grotesque in the novel (Böll, Grass) and drama; Brecht and the epic theatre in East and West (e.g., Frisch, Hack). Classicism and Modernism; problems of DDR cultural politics and literature. Reevaluations of socialist literary theory and political practice in documentary literature and journalism (e.g., Weiss, Enzensberger, The Group 61). Theories of media and literature from Benjamin to Heisenbüttel. Medium language: Handke and the Wiener Gruppe.

3-5 units, (Staff) given 1979–80

360-369. Major Authors—In-depth study of a major writer in his literary creativity, relation to his age, or special achievements and significance. Courses will deal with such writers as Walther von der Vogelweide, Grimmshausen, Wieland, Lessing, Goethe, Novalis, Tieck, Kleist, Fontane, Nietzsche, Hofmannsthal, Thomas Mann, Kafka, Brecht.

363. Goethe—unter besonderer Berücksichtigung der neueren Forschung. (Same as 263.)

3-5 units, Aut (Mommsen)


3-5 units, Spr (Weissstein)

370-379. Genres—These courses treat the development, contents, and formal characteristics of such kinds of writing as lyric poetry, epic, drama, novel, Novelle, tale, short story, essay, etc., in various authors or periods. Focuses on such matters as the following: medieval drama, baroque "metaphysical" period, the diary as a literary form, autobiography.

371. Germanic Poetry and Its Poetics—(Same as 271; Comparative Literature 371; English 351; Medieval Studies 271; Modern Thought and Literature 351.)

3-5 units, Aut (Mueller-Vollmer)


3-5 units, (Mommsen) given 1979–80

377. Moderne Lyrik.—(Same as 277; Modern Thought and Literature 277.)

3-5 units, Aut (Mueller-Vollmer)

390-399. Special Subjects and Problems.

391. Goethe, Schiller und das Problem der Weimarer Klassik.

3-5 units, (Mueller-Vollmer) given 1980–81
392. Heine und das Junge Deutschland—
(Same as 292.)
3-5 units, (Mueller-Vollmer)
given 1980–81

393. Adalbert Stifter, Gottfried Keller, Theodor Fontane, Eduard Graf von Keyserling—(Same as 293.) Realistische Erzählkunst in Österreich, der Schweiz und Deutschland.
3-5 units, (Mommsen) given 1980–81

394. Poets of Infinity—(Same as 294, Comparative Literature 394.) Inquiry into the vision of cosmic, evolutionary, historical, and psychological time in selected lyrics by such major romantic poets as Novalis, Hölderlin, Keats, Shelley, Leopardi, Bécquer, and Baudelaire. Readings in the original language and/or bilingual texts.
3-5 units, (Gillespie) given 1981–82

395. Naturalism—(Same as 295; Comparative Literature 395.) Following a brief survey of nineteenth-century doctrines of Realism and of Zola's theoretical writings, the course will focus on European drama of the period 1885-1900 (including plays by Ibsen, Strindberg, Hauptmann, Holz/Schlaf, Tolstoy and Gorki). Prose narratives by Giovanni Veraga and Frank Norris will also be considered.
3-5 units, Win (Weisstein)

ADVANCED GRADUATE COURSES
(400-499)

400. Dissertation Research—Exclusively for graduate students in German working on dissertations.
1-12 units, Aut, Win, Spr, Sum (Staff)
by arrangement

449. Seminars

449A. Humboldt and Structuralism—(Same as 349A; Comparative Literature 449A; Modern Thought and Literature 349A.)
3-5 units, (Mueller-Vollmer)
given 1980–81

449B. Language Theories of the Romantic Movement—(Same as 349B; Comparative Literature 449B; Modern Thought and Literature 349B.) Against the background of 18th century epistemology the Romantic writers and poets developed a new creative concept of language which in many cases can serve as a key to their literary productions. The seminar will attempt to delineate the common semantic and ideational field for the different language theories of the period and at the same time focus on some of the important statements. Authors to be studied include Rousseau, Herder, Fichte, A. W. and F. Schlegel, Humboldt, Mme de Staël, Novalis, Baudelaire, Wordsworth, Coleridge, and Emerson.
3-5 units, (Mueller-Vollmer)
given 1981–82

449C. Seminar: Textermeneutik—(Same as 349C; Comparative Literature 349C; Modern Thought and Literature 349C.)
3-5 units, (Mueller-Vollmer)
given 1980–81

449D. Semiotics and Literature—(Same as 349D; Comparative Literature 449D; Modern Thought and Literature 349D.) The seminar is intended to explore and investigate the historical roots and foundations of modern semiotic concepts as found in theory and practice, and to provide both orientation and frame of reference for the student of literature and the humanities who has become aware of the importance and potentialities of the rapidly growing field of semiotic inquiries. Authors to be discussed include: Condillac, Lessing, Rousseau, A. W. Schlegel, Humboldt, de Saussure, Peirce, Morris, Ogden and Richards; Barthes, Bense, Eco, and Klaus. Reading knowledge of either French or German desirable.
3-5 units, (Mueller-Vollmer)
given 1980–81

449F. Surreal Elements in German Fiction (from Romanticism to Kafka and Beyond)—
(Same as 349F.) Eingehendes Studium von Texten der letzten zweihundert Jahre ("Bonaventura", Arnim, Kubin, Meyrink, Kafka, Max Frisch) aus der Perspektive der Manifeste des Surrealismus.
3-5 units, Spr (Weisstein)

456. German Literature and Culture VI—
German and European Romanticism—(Same as 356, Comparative Literature 356.)
3-5 units, (Mueller-Vollmer)
given 1980–81

HISTORY
Emeriti: Thomas A. Bailey, William C. Bark, Carl F. Brand, Claude A. Buss, John J. Johnson, George H. Knoles, Anatole G. Mazour, John C. Miller, Wayne S. Vucinich, Gordon Wright (Professors); Rixford K. Snyder (Associate Professor)
Chairman: Gordon A. Craig
Professors: Gordon A. Craig, Alexander Dallin (on leave 1978–79), Carl N. Degler, Peter Duus, Don E. Fehrenbacher (on leave Autumn), Gavin I. Langmuir, Richard W. Lyman, Richard M. Morse, Peter Paret, Lewis W. Spitz, Peter Stansky (on leave...

Associate Professors: Barton J. Bernstein, Frederick P. Bowser (on leave Spring), Terence Emmons, Harold Kahn, David M. Kennedy, Kennell A. Jackson, Jr., Carolyn C. Lougee (on leave Spring), Mark I. Mancall, Jeffrey Mass (on leave 1978-79) Paul Robinson, Paul S. Seaver


Acting Assistant Professor: Norris Pope (Winter)
Lecturer: Ronald Schatz (Mellon Fellow)

Modern Europe Program Teaching and Research Fellows: James Briscoe, Karen Burke, Miriam Eliav-Feldon, Thomas Glas-Hochstettler, Glen McDougall, Daniel Moran, Elizabeth Muenger, Richard Teichgraebner

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 at least two small-group courses—undergraduate colloquium (reading and discussion involving an explicit historical research), and (3) must complete at least ten courses in history with a minimum of three units each, and passed with a letter grade of "C" or higher. A minimum of five courses must be taken from members of the Stanford History faculty. Directed reading and undergraduate research may not count toward the ten required courses in history and are given only for Pass/No Credit.

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. Colloquia and seminars meet the field requirement.

All History majors will be expected to know a foreign language. (In lieu of a language, the History major may take the Computer Science/Statistics Series). These courses may be taken: Pass/No Credit.

All students planning to major in History must enroll at the History Department Office, where detailed information on requirements is available.

HONORS PROGRAM IN HISTORY

For a limited number of undergraduate majors, the Department offers a special program leading to Honors in History. Students accepted for this program, in addition to fulfilling the general requirements stated above, will complete an honors 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. 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 advisor and the Director of the Honors Program will take into account the student's general preparation in the field of the project, and will expect at least a B average in the student's previous work, both in history and in the University. Prospective Honors students are urged to take an undergraduate seminar sometime in the junior year. Students satisfactorily completing the program will be eligible for Honors in History, depending upon the quality of their work. To enter the Honors program, apply at the History Department Office.

James Birdsall Weter prizes are awarded each year for the outstanding Honors essay.

HISTORY IN THE SECONDARY TEACHER'S CREDENTIAL

Applicants for the Single Subject Teaching Credential (Secondary) 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 are expected to meet the same general standards as those seeking admission to the A.M. program; they must submit a written statement of purpose, a transcript, and three letters of recommendation, at least two of which should be from members of the History Department faculty. The decision on admission rests with the Graduate Study Committee. Students must meet all requirements for both degrees. They must complete 15 full-time quarters (or the equivalent) or 3 full-time 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. In 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 A.M. 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 after completing three quarters of work.

MASTER OF ARTS

The Department requires the completion of nine courses (totalling not less than 36 units) of graduate work; 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 may be counted for a maximum of 10 units. A candidate whose undergraduate training in history is deemed inadequate, must complete nine courses of graduate work in the History Department. The Department does not recognize for credit toward the A.M. degree any work that has not received the grade of A, B, P, or +.

TERMINAL A.M. PROGRAM

The Department admits applicants who do not wish to continue beyond the A.M. 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 A.M. 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 Department Office. 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 a member of the department designated as an advisor and should plan the Ph.D. program in consultation with this advisor. 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.

Admissions 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 second quarter of enrollment in graduate work at Stanford. Early in the third quarter, a committee of the
Department will determine either that the applicant shall be admitted to the Ph.D. program or that he/she terminate his/her 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 advisor, 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
- 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) to 1865
- The United States since 1850

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. Each student, in consultation with his or her advisor, defines a secondary field. This requirement may be met in one of three ways: (a) a field selected from the list below; (b) a European national history of sufficiently long time to span chronologically two or more major fields—for example, students may elect to offer the history of France from about 1000 to the present; (c) a 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
  - Middle East to 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

Secondary field (a) may be satisfied either by completing two graduate courses relevant to the field or completing one such graduate course and passing a written examination. Secondary field (b) may be satisfied by completing two graduate courses relevant to the field and taught by faculty outside the major field. Secondary field (c) may be satisfied by completing one relevant graduate course taught by faculty outside the major field and writing a comparative essay of approximately 6,000 words approved by two faculty members representing different major fields (see below). The secondary field must be completed before students may take the general examination in the major field.

5. Students should plan in consultation with the advisor 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 take History 300A. Preparation for teaching and to teach two quarters.

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 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, 1474–1700, 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.

See the Time Schedule for changes in course offerings each quarter.

**INTRODUCTORY COURSES**

1. Modern Europe: From the Renaissance to the Age of Absolutism—An exploration of the waning of the Middle Ages, the civilization of the Renaissance, the Protestant and Catholic Reformations, the scientific revolution, and the crisis of the seventeenth century. Students will read primarily literary and philosophical texts, but unlike the proposed "Western Culture" seminars, this course will firmly embed the history of western thought and culture in the socioeconomic and political development of early modern Europe. Three lectures and one two-hour section per week. (DR:A)
   5 units, Aut (Lougee, Staff) Lectures plus Sections

2. Modern Europe: From the Ancien Regime to Industrialized Society—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 nineteenth 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. (DR:A)
   5 units, Win (Paret, Staff) Lectures plus Sections

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. (DR:A)

5 units, Spr (Craig, Staff) Lectures plus Sections

35. How Nations Deal With Each Other—(Same as Political Science 35.) (DR:A)

5 units, Aut (George, Staff)

65. Medieval Culture: An Interdisciplinary Introduction—(Same as Medieval Studies 65.) (DR:A)

5 units (A. Bernstein, G. Brown) given alternate years

91. Traditional East Asian Civilization—(Same as Asian Languages 91 and Humanities 91.) An introduction to the development of civilization in China and Japan from earliest times to the spread of Buddhism. Lectures and discussions will cover political institutions, social and political ideas, religious currents, and artistic and literary trends. Intended for the nonspecialist. (DR:A)

5 units, Aut (Duus, Lyell, Matisoff)

92. Traditional East Asian Civilization—(Same as Asian Languages 92 and Humanities 92.) A continuation of History 91, covering the period down to 1700. Open only to students who have completed History 91. (DR:A)

5 units, Win (Duus, Lyell, Matisoff)

93. Modern East Asian Civilization—(Same as Asian Languages 93, and Humanities 93.) A continuation of 92 covering the period from initial Western contacts down to the present. Open only to students who have completed 92. (DR:A)

5 units, Spr (Duus, Lyell, Matisoff)

ADVANCED COURSES

All courses (DR:S) unless noted otherwise. Courses numbered 100 through 199 are primarily lecture courses designed for advanced undergraduates.

103. History of Education—(Same as Education 200.)

3-4 units, Win (Gross)

105A.B. History of Socialisms and Marxisms—Disimilarities and similarities in development at different times in different parts of the world. Marx’s thought, as well as that of his interpreters, on art, aesthetics, law, and politics.

10 units, Aut, Win (Mancall)

THE ANCIENT WORLD

See Classics, Ancient History Section, courses H101 (History of Greece), H102 (History of the Roman Republic), H103 (History of the Roman Empire), H105 (History and Culture of Egypt), H115 (Historiography and Ancient History), all of which are accepted for credit toward a major in history.

MEDIEVAL AND RENAISSANCE EUROPE

107A. Medieval Europe, 1050–1200—Urban and rural economies; class structure; German, English, and French monarchies; Italian city-states; monasticism, the papacy and the Church; heresy and other expressions of non-conformity; 11th- and 12th-century commerce and the Crusades. (DR:A)

5 units, Win (A. Bernstein)

107B. 13th Century Europe—Demographic developments, social structure, secular monarchies, the Church; principles of government and maintenance of order; changes in religious sensibility (reform, heresy, the Crusades, the Inquisition); universities; formal speculation and literary expression, new modes of perception and persistence of old views. (DR:A)

5 units, Spr (A. Bernstein)

109A. Renaissance Society and Culture—(Same as Humanities 109A, Art History 109A.)

5 units, Win (Spitz, Ryan, Forster)

110. The Christian Humanist, Lutheran, Calvinist, Catholic, and Radical Reformations—The religious phenomenon in the general setting of European developments during the 16th century, relating the Reformation to the urban setting and the economic and social forces of the rising national states.

5 units, Spr (Spitz)

EUROPEAN POLITICAL AND DIPLOMATIC HISTORY

111V. The Political System of the German Federal Republic—(See Political Science 111V.)

5 units, Win (von Beyme)

112V. Comparative Politics: The Political Systems of Western Europe—(See Political Science 112V.)

5 units, Spr (von Beyme)

113K. The Balance of Power, 1815-1914.

4 to 5 units, Spr (Bourne)
**EASTERN EUROPE AND RUSSIA**

117. Slavic Civilization—(Same as Slavic Languages and Literatures 117.) 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, stressing similarities, differences, and continuing tensions. (DR:A)
5 units, Win (Vucinich)

120A. Russia to Peter the Great, 1689.
5 units (Atkinson) given 1979–80

120B. Russia From Peter the Great to the Great Reforms, 1689–1856.
5 units (Atkinson, Emmons) given 1979–80

120C. 20th Century Russia, 1856–1930—A survey of Russia from an agrarian-rural to an industrial-urban society (from the abolition of serfdom to the Soviet Five-Year Plans) and the Russian Revolution of 1917 considered in this broader context.
4 to 5 units, Spr (Emmons)

123A. The Soviet Union: Politics and Society Since 1917—(Same as Political Science 119A.)
5 units (Dallin) given 1979–80

123B. International Communism—(Same as Political Science 132.)
5 units (Dallin) given 1979–80

124A. Politics and Society in 18th Century Russia.
5 units, Aut (Confino)

124B. Politics and Ideologies in 19th Century Russia.
5 units, Win (Confino)

126. Eastern Europe Since 1914.
4 to 5 units (Vucinich), given alternate years

**WESTERN EUROPE**

130. France in the Age of Absolutism, 1610–1774
5 units (Lougee) given 1979–80

131. The Cultural Background of French History
4-5 units, Spr (Wylie)

135. Diplomatic Revolution of Our Time—(Same as Political Science 135.) Problems raised by the collapse of the traditional system of Western diplomacy as a result of two world wars; expansion of the diplomatic community and breakdown of its internal homogeneity; new dimensions resulting from technology and domestic political pressures of the 20th century. Prerequisite: History 35 or Political Science 35.
5 units, Win (Craig, George)

136. The Age of Reason and Enlightenment: European Intellectual History in the 17th and 18th Centuries—(DR:A)
5 units (Lougee), given 1979–80

136A. European Intellectual History in the 19th Century—Great thinkers and major movements of the 19th century, particularly Romanticism, Liberalism, Marxism, and the origins of modern irrationalism; seminal writings of Burke, Mill, Marx, Ruskin, and Nietzsche.
5 units, Win (Robinson)

136B. European Intellectual History in the 20th Century—Conceptions of human nature and society will be stressed; Freud, Jung, Weber, Lenin, Wittgenstein, Sartre, Lévi-Strauss, and Marcuse are among the figures examined. (DR:A)
5 units, Spr (Robinson)

138A. Arms Control and Disarmament—(Same as Political Science 138A.)
5 units, Win (Lewis, J. Barton, Staff)

**BRITAIN**

140. England to 1460—A study of medieval England: the formation of the most successful example of a major form of social organization—the nation-state—and the background for the study of English literature and later English history.
5 units, Aut (Langmuir)

141. Yorkist and Tudor England—An analysis of late medieval English society and the changes leading to the new conservatism of the Elizabethan regime.
4 to 5 units, Aut (Seaver)

142. Stuart England, 1603–1688—Civil wars and revolution, overthrow of the English monarchy in the mid-17th century, the Restoration and return to status quo ante; the socio-economic and ideological framework in which these political changes took place.
4 to 5 units, Win (Seaver)

143. Britain, 1688–1851.
5 units, (Stansky) given 1979–80

**AFRICA**

147. Kingdoms of Africa: Societies and History—From the kingdoms of the Sudan in the 8th through 12th centuries to the confronta-
tions with European colonialism in the 18th and 19th centuries; individuals, ideologies, symbolism, and politics will be surveyed.

5 units, Win (Jackson)

147A. Rebellions in Colonial and Post-Colonial Africa.
5 units, Spr (Jackson)

148A. History of West Africa—State building, effects of the trans-Atlantic slave trade, European imperial domination, tendencies toward one-party and military regimes in the 1960's.
5 units, Aut (Irwin)

148B. Colonial Africa—Sub-Saharan Africa under European domination and problems of political, social and economic change; decline of old elites and the rise of new ones; reformulation of belief systems; development of nationalism and decolonization.
5 units, Win (Irwin)

THE UNITED STATES

150. Rise of the American Colonies.
4 to 5 units, Macphail) given 1979–80

152A. The Making of Urban America—Creation of urban environments through uncoordinated individual actions and through planning; decisions regarding urban planning and architecture and their effect on the urban populace; the extent of reinforcement of social inequities and possible alternatives to past patterns of urban development.
5 units, Spr (Carson)

152B. U.S. Urban Life and Culture—The effects since the 1850's on city dwellers of immigration/migration, culture, ethnicity, socio-economic stratification, bosses and machine politics, politics, poverty, and urban reform movements, and the impact of such institutions as labor unions, education and welfare.
5 units, Win (Camarillo)

5 units (Carson) given 1979–80

158. History of Education in the United States—(Same as Education 201.)
3 units, Spr (Tyack)

160. The American South, 1815–1980
5 units (Degler) given 1979–80

161. Civil War and Reconstruction—The sectional controversy over slavery, the secession crisis, the Civil War; emancipation and reconstruction, 1846–1877: the conflict of interpretations and the culture heritage.
5 units, Spr (Fehrenbacher)

162. Labor in American History.
4 to 5 units, Win (Schatz)

164. History of Chicanos in the United States: 19th-Century Roots and 20th Century Developments—Socio-economic, political and cultural forces which have shaped the contemporary Chicano reality will be examined, including the themes of migration, labor conflict, resistance, accommodation, assimilation, and urbanization.
5 units, Aut (Camarillo)

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.
5 units, Aut (Macphail)

165B. 19th-Century America.
5 units, Win (Degler)

165C. The United States in the 20th Century—1890 to the Present.
5 units, Spr (D. Kennedy)

167. History of California—Development of California from the Spanish period to the present with emphasis on the years since 1850.
4 units, Win (Fehrenbacher)

169. American Social History Since 1900—The impact of industrialization and urbanization; the relations of classes, races, and ethnic groups; the sources of imperialism and anti-radicalism; changing roles of education and the intellectuals; national culture and changing social institutions.
4-5 units, (B. Bernstein) given 1979–80

171. Development of American Law—(Same as Humanities 171 and Political Science 174F.) The growth and development of American legal institutions with particular attention to crime and punishment, slavery and race relations, the role of law in developing the economy, and the place of lawyers in American society from colonial times to the present.
5 units, Aut (Friedman)

172A. Postwar America Since 1945—An analysis of America that emphasizes foreign policy and politics, intellectual history, social themes and the political economy.
4-5 units, (B. Bernstein) given 1979–80

173A,B. History of Women in America—The roles and activities of American women form the
colonial period to the 20th century; the variety of female life experiences (by class, race and ethnicity); relationships to the family, the economy and political changes; definition and reality of "womanhood."

8-10 units, Aut, Win (Freedman)

174. Reflections on the American Condition in the 20th Century—(Same as English 128.) (DRA)
5 units, (Kennedy, Chace) given 1979–80

LATIN AMERICA

176. Latin America to 1825—From the Spanish conquest to political independence early in the 19th century; the relationships between colonial developments and modern conditions and problems.
4-5 units, Aut (Bowser)

177. Modern Latin America—From the Latin American wars of independence to the present.
4-5 units, Win (Morse)

178. Urban Culture of Modern Latin America.
4-5 units, Spr. (Morse)

180B. Modern Brazil, 1750-Present—With its huge size, multi-racial society, mixed economy and pragmatic foreign policy, Brazil's drive for great-power status and its neocapitalist model of development distinguish it from its Spanish-speaking neighbors in both Latin-American and world contexts.
5 units, Spr (Wirth)

182. Latin America and the African—The contributions of the African to Latin American civilization from the beginnings of Iberian colonization to the present; the institution of slavery, partial assimilation, evolution of race relations and the status of Latin Americans of African descent after abolition.
4-5 units, Win (Bowser)

MIDDLE EAST

186. The Ottoman Empire—Its origins and founding; conquests in Europe, Asia and Africa; expansion and decline in the 16th century; international complications of the "Eastern Question"; reforms; the emergence of the modern Turkish state; its legacy in today's southeastern Europe and the Near East.
4-5 units, Aut (Vucinich)

EAST ASIA

190. Family and Bureaucracy in Chinese History.
4 to 5 units, Win (McDonald)

192A. China from Earliest Times to the 9th Century—Geo-historical origins to the Tang period: the first 4,000 years of social formations and historical transformations of ancient and early medieval China. (DRA)
4-5 units, Aut (Kahn)

192B. China from the 9th to the 19th Centuries—(192A recommended as a prerequisite.) From the late Tang to the Opium War. Emphasis on socio-economic rather than political history to expose students to a sophisticated society very different from their own. (DRA)
5 units, Win (Kahn)

192C. Modern China: 19th and 20th Centuries—192A, B recommended as prerequisites.) The background up to 1911 and the overthrow of the last imperial dynasty; the Republican period to 1949, and the Peoples Republic of China to the present.
4-5 units, Spr (McDonald)

194. Early and Medieval Japan to 1336—Prehistoric origins of the people and culture, emergence of the first polity, Chinese influences, flowering of the native culture, the samurai, and feudal government.
4-5 units (Mass) given 1979–80

194A. Medieval and Early Modern Japan, 1336-1800—From the end of the Kamakura era to the mid-Tokugawa period; localism and feudalism; cultural development; rewelding of the country in the 16th century; the move away from "medievalism."
5-units (Mass) given 1979–80

194B. The Rise of Modern Japan—The transformation from feudalism to the first non-Western modern nation; its effects on the Japanese people; imperialism, rapid economic and political change, war with China and the United States; the emergence of "Japan, Inc."
4-5 units, Win (Duus)

195. Cultural History of Asia—(Same as Asian Languages 152.)
4-5 units, Spr (Dien)

196. Chinese History in Translation—(Same as Asian Languages 151.)
4 units, Win (Dien)

UNDERGRADUATE SEMINARS AND COLLOQUIA

During 1978–79, 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 1978–79. 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 litera-
ture. The student, in writing a research paper
based on 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 investiga-
tion, analysis, and writing. “How do you know?”
becomes more important than “What do you
know?”

Courses numbered 200 through 299 (under-
graduate seminars and colloquia) are designed
primarily for juniors and seniors majoring in
history. Admission to seminars and colloquia
involve permission of the instructor.

All courses (DR:S) unless noted otherwise.

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<td>5</td>
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257A. Undergraduate Colloquium: Afro-American Politics in the 1960s.
5 units, Spr (Carson)

259. Undergraduate Colloquium: The Presidency from Washington to Lincoln.
5 units (Fehrenbacher) given 1979–80

5 units, Aut (Schatz)

262. Undergraduate Colloquium: Chicano History.
5 units, Win (Camarillo)

263. Undergraduate Colloquium: Women in America.
5 units, Spr (Degler)

264A. Undergraduate Colloquium: The American West.
5 units, Aut (Camarillo)

265S. Undergraduate Seminar: Minorities and Women.
5 units, Aut (Degler)

5 units, Win (Freedman)

5 units, Aut (B. Bernstein)

270. Undergraduate Colloquium: Politics and Culture of Technology and Science in Modern America—(DR:A)
5 units, (B. Bernstein) given 1979–80

272. Undergraduate Colloquium: 19th-Century U.S. Social History—(DR:A)
5 units, (Freedman) given 1979–80

279. Undergraduate Colloquium: Themes in The Comparative History of the Americas—(DR:A)
5 units, Aut (Morse)

281. Undergraduate Colloquium: Comparative History of Manchester, São Paulo, Chicago.
5 units, Win (Wirth)

286. Undergraduate Colloquium: Topics in Byzantine Civilization—(DR:A)
5 units (Vucinich) given alternate years

287. Undergraduate Colloquium: Topics in Islamic Civilization—(DR:A)
5 units, Aut (Vucinich, Pappas)

289S. Undergraduate Seminar: Russia in the Near East.
5 units, (Vucinich) given 1979–80

290S. Undergraduate Seminar: Class Alignments in the Chinese Revolution.
5 units, (Dallin) given 1979–80

292A. Undergraduate Seminar: Topics in Chinese Economic History.
5 units, Spr (Kahn)

293. Undergraduate Colloquium: Imperialism in China—Social and Economic Consequences.—Theories of imperialism; rural economy and peasant movements; history of Chinese women; treaty ports.
5 units, Win (Hershatter, Honig, Stross)

GRADUATE COURSES
All courses (DR:X)

300A. Preparation for Teaching—(Required of all Ph.D. candidates.)
1 unit, Spr (Staff)

300W. Graduate Directed Reading.
Units by arrangement (Staff)

301. Graduate Colloquium on the Historiography of American Education—(Same as Education 301.)
3-5 units, Aut (Tyack)

302. Graduate Colloquium: History of American Urban Education—Same as Education 302.)
4-5 units, Sum (Tyack)

304A,B. Historiography of Colonial Latin America.
10 units, Aut, Win (Bowser)

307. Graduate Core Colloquium: Medieval History.
5 units, Aut (A. Bernstein)

308. Graduate Colloquium: The Religious Crisis of the 11th and 12th Centuries.
5 units, Spr (Langmuir)

311K. Graduate Colloquium: Problems in the Diplomatic History of Europe.
5 units, Spr (Bourne)

313. Graduate Colloquium: The Administration of Death in Medieval Europe.
5 units, Spr (A. Bernstein)

321B. Graduate Colloquium: The Russian Intelligentsia.
5 units, Aut (Confino)

322. Graduate Colloquium: Topics in Russian History.
5 units, Aut (Emmons)

324. Graduate Colloquium: Nationalism and Communism in Eastern Europe.
5 units Win (Vucinich)

326. Graduate Colloquium: Problems in Soviet History and Politics—(Same as Political Science 126B.)
5 units (Dallin) given 1979–80
327. Graduate Colloquium: Topics in Modern European History.  
5 units, Win (Craig)

329. Graduate Colloquium: Military Thought, Institutions and Policies.  
5 units, Spr (Paret)

330A. Graduate Colloquium: Old Regime Social History.  
5 units (Lougee) given 1979–80

5 units, Win (Lougee)

341B. Graduate Colloquium: Topics in Social History in Pre-Industrial England.  
5 units, Aut (Seaver)

346A. Graduate Colloquium: Anthropology and History—(Same as Anthropology 246)  
5 units, Win (Jackson, R. Rosaldo)

348A. Graduate Colloquium: Religion and Social Protest in Colonial Africa.  
5 units, Win (Irwin)

349B. Graduate Colloquium: White Administrators and the Black Elite in Colonial Africa.  
5 units, Spr (Irwin)

350. Graduate Colloquium: Quantification for Social Historians.  
5 units, Win (Macphail, Carson)

351A,B,C,D,E,F. Joint Graduate Colloquium in American History.  
30 units, Aut, Win, Spr (B. Bernstein, Camarillo, Carson, Fehrenbacher, Freedman, D. Kennedy, Macphail, Schatz, Tyack)

360. Graduate Colloquium: Comparative Reading in 19th Century British and American Labor History.  
5 units, Win (Schatz)

378. Graduate Colloquium: Cultural and Intellectual History of Latin America.  
5 units, Win (Morse)

386. Graduate Colloquium: Topics in Byzantine Civilization.  
5 units (Vucinich) given alternate years

387. Graduate Colloquium: Topics in Islamic Civilization.  
5 units, Aut (Vucinich, Pappas)

390A,B. Graduate Colloquium: Topics in Late Traditional and Modern Chinese History.  
10 units, Aut, Win (Kahn, McDonald)

395A. Graduate Colloquium: Japan to 1600.  
5 units (Mass) given 1979–80

395B. Graduate Colloquium: Medieval and Early Modern Japan, 1600–1800.  
5 units (Mass), given 1979–80

395C. Graduate Colloquium: Modern Japan, 1800–1945.  
5 units, Spr (Duus)

5 units (Mass) given 1979–80

ADVANCED GRADUATE COURSES

Courses numbered 400-499 are intended primarily for second- and third-year graduate students, but other qualified students may be admitted by consent of instructor.

400X. Graduate Research.  
Units by arrangement (Staff)

408. Graduate Seminar: Medieval History.  
5 units, Win (Langmuir)

410A,B. Graduate Seminar: Topics in the Renaissance and Reformation.  
10 units, Win, Spr (Spitz)

421A,B. Graduate Seminar: Russian History 10 units Win, Spr (Emmons)

422. Graduate Seminar: Soviet Nationalities.  
5 units, (Vucinich) given 1979–80

423. Graduate Seminar: Russian Anarchism.  
5 units, Win (Confino)

429B. Graduate Seminar: Art, Politics, and Society.  
5 units, Aut (Paret)

10 units, Win Spr (Seaver)

444A. Graduate Seminar: Problems in Modern British History 5 units, (Stansky) given 1979–80

447. Graduate Seminar: The Structure of Colonialism in East Africa.  
5 units, Spr (Jackson)

10 units, Win, Spr (D. Kennedy)

5 units, Spr (Degler)

473. Graduate Seminar: Women's, Family, and Sexual History.  
5 units, Spr (Freedman)

478. Graduate Seminar: Cultural and Intellectual History of Latin America.  
5 units Spr (Morse)

489. Graduate Seminar: Russia in the Near East.  
5 units (Vucinich) given 1979–80
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490A,B. Graduate Seminar: Modern China. 10 units (McDonald) given 1979–80

495A, B. Graduate Seminar: Modern Japan 10 units, Aut, Win (Duus)

498. Graduate Seminar: Japanese Historical Texts—(Same as Asian Languages 251.) Medieval sources and research methods. The reading of documents in Kambun will be introduced. 5 units (Mass) given 1979–80

PROGRAM IN THE HISTORY OF SCIENCE

Faculty: Noel Swerdlow, Associate Professor

Committee-in-Charge: Clayborne Carson (History), Francis Everitt (Hansen Labs), Alexander Fetter (Physics), Ian Hacking (Philosophy), Peter Paret (History), Halsey Royden (Mathematics), Patrick Suppes (Philosophy), Noel Swerdlow (History), Walter Vincenti (Aeronautics and Astronautics)

The Program in the History of Science, beginning in 1978–79, is in part a consolidation of activities already in progress at Stanford and in part a new venture of considerable breadth. The object of the program is to provide a variety of courses suitable to both undergraduate and graduate instruction, to the more general historical studies within the humanities and social sciences and to the more technical demands of the sciences, engineering, and specialization in the history of science. Fields represented in the program reflect the interests of the participating faculty, and at present include the physical sciences, the exact sciences, engineering and technology, and more philosophical subjects in so far as they can be examined through the history of science. The chronological period is extensive, reaching from antiquity through the twentieth century. Since the program has just been formed, the precise course offerings and cross listings with other departments are not yet certain. Please consult the Time Schedule for detailed information.

PROGRAM IN HUMAN BIOLOGY

Chairman: Merton Bernfield

Faculty: Jack D. Barchas (Psychiatry), Philip Berger (Psychiatry), Merton Bernfield (Pediatrics), John P. Bunker (Community and Preventive Medicine), Luigi Cavalli-Sforza (Genetics), Peter Corning (Engineering-Economic Systems), Herbert Dengler (Human Biology), James H. Dewson, III (Surgery), Carl Djerassi (Chemistry), Sanford M. Dornbusch (Sociology); William H. Durham (Anthropology), Franklin C. Ebaugh (Medicine), Alain Enthoven (Business), S. Shirley Feldman (Psychology), Margaret Gruter (Human Biology), John Gurley (Economics), Albert H. Hasting (Psychology), Leo E. Hollister (Psychiatry), Melbourne Howell (Medicine), Bruce F. Johnston (Food Research), Henry S. Kaplan (Radiology), Herant Katehodourian (Undergraduate Studies), Donald Kennedy (Biological Sciences, on leave), Sidney Liebes (Genetics), William Lowrance (Human Biology), Donald Lunde (Law), Reynaldo Martorell (Food Research), Dyane V. Mistick (Psychology), Ingram Olkin (Statistics), Carl D. Rhodes, Jr. (Biochemistry), David Spiegel (Psychiatry), John Taurek (Philosophy), Keith B. Taylor (Medicine), Ned Weinsenker (Human Biology), Jeffrey Wine (Psychology), Arthur P. Wolf (Anthropology)

Director of Advising and Career Counseling: Audrey Bernfield

Student Advisors: Susan Acevedo, Inta S. Berzins, Edward Castro, Robert L. Dorit, Janet Liming, Alison Ross, Jon Schechter, Marie Villa

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, the mechanism by which these factors relate to his biological and behavioral evolution, and the ways in which such knowledge can be brought to bear on the design of public policy.

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 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 and policy 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 the equivalent of seven 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 either 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 requires approximately 61 to 64 units in the major. The major consists of three parts: 1) the Fundamental Program (Core courses) involves six required courses (24 units). These units will apply toward satisfying the University Distribution Requirements in the Social Sciences and the Natural Sciences. 2) Additional lower division work consists of two parts: a) the Workshop (4 units), an independent project; b) one of the two Human Biology policy courses (4 units) on health issues or environmental issues. 3) Upper division work consists of two parts: a) an area of concentration having a theme or title. This is a 20-unit, individually designed, integrated program of in-depth study in either the social/behavioral sciences, or the natural sciences, or public policy; b) three upper division Human Biology "specials" that are interdisciplinary or policy-oriented. A list of the "specials" can be found in the Human Biology office. Detailed guidance should be sought at the Program office so that the individual student's course of study can be developed to fit her/his particular needs and career goals. Faculty advisor approval is required at least once each year to ensure that a coherent program of study is developed and followed.

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 2 through 6 in the Fundamental or "Core" Program. In addition, majors must elect one of two junior-year policy courses, one emphasizing health issues, the other environmental issues. These courses must be taken for a grade by majors, with the exception of the workshop. It is advised that the 2 through 4 sequence be initiated in Autumn Quarter of the Sophomore year. Courses 2 through 4 are open to non-majors; however, they should be taken in sequence by all students.

FUNDAMENTAL PROGRAM

Note: The Human Biology "core" courses (2A and 2B, 3A and 3B, and 4A and 4B) are designed to introduce the biological sciences, the social sciences, and most importantly, the relationships between the two. The courses utilize two class periods (9-10:50) and meet MWF throughout the year. Students are required to register for both the A and the B series, but there will be separate examinations for the courses; 4 units will be credited to the biological sciences (A) and 4 units, to the social sciences (B).

2A, B. Human Evolution: Culture and the Cell—2A is devoted to the basic principles of evolution, molecular genetics, and cell biology; 2B is devoted to human evolution, primate studies, archaeology, and the rise of culture. The theme of the courses will be human evolution with special attention given to the combined biological and social aspects of such topics as sociobiology, recombinant DNA, genetic diseases, and inbreeding and the incest taboo.
2A. Human Evolution: Culture and the Cell. (DR:T)
4 units, Aut (Bernfield, Staff) MWF 9

2B. Human Evolution: Culture and the Cell (DR:S)
4 units, Aut (Wolf, Staff) MWF 10

3A,B. The Human Organism: Principles of Social-Psychological and Physiological Regulation and Integration—3A concentrates on developmental reproductive biology, neurophysiology, endocrinology, and organ physiology; 3B stresses three themes: the development of the social bond among humans; the individual's perception of the social world; and social control and differentiation. The relation between 3A and 3B will be explored in a series of special topics, such as perception or puberty.

3A. The Human Organism. (DR:T)
4 units, Win (Bernfield, Staff) MWF 9

3B. The Human Organism. (DR:S)
4 units, Win (Dornbusch, Staff) MWF 10

4A,B. Populations and Societies: Ecosystems and Social Ecology—The A course focuses on adaptation, population biology, and plant ecology; the B course matches this emphasis with economics, demography, and human ecology. The theme is the interaction between society and the environment with integration of the biological and the social sciences in such areas as agriculture and food resources, environmental policy, and man's modification of ecosystems.

4A. Populations and Societies. (DR:T)
4 units, Spr (Bernfield, Staff) MWF 9

4B. Populations and Societies. (DR:S)
4 units, Spr (Durham, Staff) 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. (DR:X)
4 units, (Liebes) by arrangement

40. Health and Public Policy—This course uses case studies to examine the role of the individual and of society in setting policies that affect health. Students will be organized into small task forces to respond to specific policy challenges, drawn from one of two general subject areas. Consideration will be given to underlying social, ethical, legal, and economic implications. For example, in the area of contraception, a possible challenge would be to establish a feasible policy to encourage the development of new methods of male contraception. The course will draw widely from the lower division courses in the Human Biology core, and those students who have not taken the core should present comparable knowledge of the biological and social sciences. (DR:X)
4 units, Win (Lowrance, Staff) MWF 11

41. Issues in Environmental Policy—This course focuses on the analysis of significant environmental policy issues, drawing upon the perspectives developed in the Human Biology Core. The course will explore the environmental impact of human activities and the current efforts to develop ecologically sound environmental policy. Students who have not taken the Human Biology Core should have comparable knowledge of the biological and social sciences. (DR:C)
4 units, Spr (Lowrance, Staff) MWF 11

OTHER COURSES

10. Human Sexuality—This course is intended to provide a broad perspective in human sexuality. The first part deals with the biological aspects of sex: anatomy, physiology, endocrinology, pregnancy, contraception, and diseases of the sexual organs. The second part focuses on sexual behavior: its development, patterns, variations and malfunction. In the final portion, the realtionship of sex and society is examined in western and cross-cultural contexts. The erotic in art, literature and film receive specific attention.

This is a lecture course supplemented with panel discussions. There are no discussion sections. The emphasis of the course is on information not advice. Grade is based on final exam. (DR:C)
3 units, Win (Katchadourian) MWF 1:15

19. Scientific Thinking for Human Biologists—A general introduction to ways of thinking about problems and research in the biological and behavioral sciences. The course will emphasize styles of thought and investigation, with their potential pitfalls, and will de-emphasize statistical or mathematical methods. We hope that it will make reports of research findings in courses more understandable, and that students will be encouraged to increase their analytic skills. (DR:X)
2-3 units, (Dornbusch, Bernfield) T 7:30-9:30 p.m.

20. Scientific Method and Data Analysis—(Same as Statistics 20.) This course introduces the student to the elements of quantitative thinking in biology and the behavioral sciences. Emphasis is on the foundations of scientific reasoning and statistical methodology including
the use of computers for data analysis and the critical reading of quantitative data in scientific papers. Topics covered will be: a) probability models; b) statistical inference; c) design of sample models; d) linear models and analysis of variance; e) contingency tables; f) regression and correlation; and g) multivariate procedures. Concurrent laboratory of data analysis, use of calculators and computers. Prerequisite: elementary high school algebra. (DR:T)

5 units, Win (Cavalli, Olkin) MWF 1:15-3:05

**ADVANCED COURSES**

Note: A major in Human Biology is expected to take approximately 30 units of upper division credit. 20 of these units must be in one of the following three fields: (1) the natural sciences; (2) the social-behavioral sciences; (3) the policy sciences. The selection should reflect a unity directed toward the ultimate goal of the student. The remaining 10 units should be selected from the upper division, interdisciplinary offerings of the Program. The student's individual design of this advanced program must have approval from a Program faculty advisor. At the student's discretion one upper division course in the area of concentration and one "special" may be taken for pass/no credit.

Students who plan to pursue graduate work should be aware of admission 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 nonmajors with the proper prerequisites. Human Biology majors will have preference where the number of students must be restricted.

**103. The Natural History of the San Francisco Bay Area**—The course will consider the influence of physical factors on the development of the major plant associations characteristic of the region and the faunas associated with them; the impact of human activity on these natural communities will also be discussed. Two one hour lectures per week plus field trips to be arranged. Limited to 25 students. (DR:C)

3 units, Aut (Dengler) MW 9

**110. Introduction to Biological Chemistry**—This elective course is designed for students with limited backgrounds in chemistry and biology, and those who elect not to take courses offered by the Departments of Chemistry and Biochemistry. Concepts of general, organic and physical chemistry will be briefly presented in a biochemical context. Subsequent topics will deal with the structure and function of enzymes and other molecules of biological interest, pathways and regulation of intermediary metabolism, and mechanism and control of genetic transcription and translation, and inborn errors of metabolism. Prerequisites: high school chemistry, college level introductory biology. (DR:T)

4 units, Spr (Rhodes) TTh 7:30-9:00 p.m.

**120. Human Nutrition**—An introduction to human nutrition including the metabolic basis of nutritional requirements, dietary requirements, biogeographic aspects, socio-economic determinants of dietary problems, specific deficiency diseases, and global aspects of malnutrition. Prerequisite: Human Biology core or consent of instructor. (DR:C)

4 units, Win (Martorell, Staff) MWF 10

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 well-being will be discussed briefly. The last part of the course will examine the world food economy in global perspective. (DR:C)

3 units, Spr (Staff) MWF 10

**122. Selected Topics in Food Technology With Emphasis on Food Additives**—This course will present the rationale for development of new food technology. In particular, it will focus on the technical and risk/benefit questions associated with food additives. A review of the regulatory process (including safety evaluation) in the U.S. and foreign countries which controls new technology in this field will be presented. Alternatives to the present food processing chemicals and methods will be discussed. Several outside specialists will participate in the lecture series. Either individual or group research papers will be required. Limited to 25 students with at least junior standing and having had Chemistry 33 and/or 35. (DR:T)

4 units, Spr (Weinshenker, Parkinson) to be arranged

125. Obesity: Causes, Costs, and Control—Obesity will be studied from behavioral epidemiological, and physiological perspectives. Topics will include the situational determinants of over-eating, social class and obesity, physiological studies of adipose tissue, and the behavioral treatment of obesity. Limited to 40 students. (DR:C)

4 units, Aut (Hovell) T 3:15-6:00
127. Communication and Language: Biological and Social Aspects—A survey and synthesis of the variety of communicative behaviors observed across species. Emphasis will be given to unified views of animal and social interaction which will include human non-verbal communication as well as language in man, and language-like behaviors in other animal species. (DR:T)

3 units, Aut (Dewson) W 3:15-5:05


4 units, Aut (Cavalli-Sforza) MTh 2:15

134. Seminar on Cultural Ecology—(Same as Anthropology 164.) This seminar focuses on the cultural adaptations of human societies to their environments. Major theories relating cultures and ecosystems will be evaluated in light of examples from diverse habitats (e.g. tropical rainforests, deserts and oases, the arctic, high altitudes, etc.). Selected topics in ecological anthropology, including human population dynamics and regulation, energetics, niche analysis, and resource management, will also be considered. Prerequisite: Anthropology 1 or consent of instructor. (DR:S)

5 units, Spr (Durham) TTh 3:15-4:50

135. Culture and Biology—(Same as Anthropology 135.) This course examines the relationship between human biology and culture in both the evolutionary past and ethnographic present. Following a review of the major contending viewpoints including the controversial field of "sociobiology," the focus shifts to a consideration of the biological and cultural evolution of human beings as interdependent, mutually complementary processes. Both theoretical and practical implications of this "coevolutionary" view are discussed. (DR:C)

5 units, Win (Durham) MWF 11

137. Seminar in International Aspects of Environmental Disruption—(Same as Political Science 147C.) 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 range of man-environment interactions, with particular concern for how these impinge upon the relationships between nations. Emphasis will be given to water resources problems. (DR:C)

5 units, Spr (Corning) T 2:15-4:05

138. Neurobiology of Learning and Memory—This course will examine the physical basis of learning and memory from an interdisciplinary perspective, drawing on work in Psychology, Ethology, Physiology, Anatomy, and Biochemistry. The perspective of each discipline and its particular contributions and limitations will be emphasized. The course work will be approximately equally divided among studies of behavior, clinical studies of memory disorders, and physiological models of learning, with somewhat less emphasis on biochemical work. Special topics to be examined will include models of mental retardation and the effects of nutrition on learning abilities. (DR:S)

4 units, Spr (Mistick) to be arranged.

144. Decisions about Risks to Humans—Drawing upon numerous examples concerning foods, drugs, radiation, consumer goods, engineered structures, and natural diseases, and disasters, this course will discuss decision-making as philosophy, craft and science. Although it will focus on problems that become public issues because of their element of risk, the course also will give attention to the elements of efficacy, benefit, cost, fairness, and ethicality. Both scientific appraisal and normative judgment of risk issues will be covered. Special topics will include the problem of scientific consensus; perception of risks; life valuation; intercomparison of risks; and legislative, regulatory, and legal approaches to managing hazards. (DR:S)

4 units, Spr (Lowrance) MW 2:15-4:05

145. The Relevance of Sociobiology for Law—This course, taught in seminar format, will examine the development of "law" in the broadest sense. The seminar will focus on 1) the fundamental conflict between individual rights and the interest of the group; 2) the tension between the need for change and the need for continuity within the social and legal orders; 3) how, in our rapidly changing society, legisla-
tion and adjudication are dependent upon various branches of science, in order to make rational decisions. (DR:S)

4 units, Win (Gruter) alternate years, given 1979–80

150A,B. Biosocial Aspects of Birth Control—(Same as Chemistry 130A,B.) 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 subject matter therefore represents a perfect case of illustrating how many components ought to enter into major policy decisions. The course will deal with a critical evaluation of the logistic aspects of human fertility control and will include lectures on "hardware" as well as "software" aspects of birth control. Groups of five to eight 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 first quarter will consist predominantly of lectures, of selecting the population groups and task forces and of individual discussions with each task force. The second quarter will be dedicated to library and field work, the completion of written task force reports and oral presentations to the class. The selection of students admitted to this class will be based on the desire to create a multidisciplinary student group (approximately equally divided between males and females) 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, Economics, Political Science, Psychology, etc.) who will focus on specific logistic aspects of a common topic in the birth control field. Limited to 45 students. Prerequisites: At least junior standing, registration for both quarters. Each course (DR:C)

5 units, Aut, Win (Djerassi) MW 2:15-4:05; given 1980–81

152. Pest Control—Technical Aspects—(Same as Chemistry 137.) This course will focus on technical, operational and especially policy issues in the field of pest control in agriculture and public health. Among topics to be considered will be the following: history of chemical pest control including chemical and biological rationales for these developments; present research on biorational alternatives with emphasis on insect hormones and sex attractants; economic and political factors that affect pest control practices; measuring the costs and benefits of chemical controls; 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 related problems and will be given in part with the aid of outside specialists. In the second part of the course task forces consisting of four to six students will investigate a particular pesticide problem using the type of multidisciplinary approach that is being employed in Human Biology 150 (see corresponding course description). Limited to 45 students with at least junior standing and having had Chemistry 33 and/or 35. Consent of instructor is required for students lacking these course requirements. Preregistration prior to the Winter quarter is essential, using special preregistration forms available from the Human Biology or Chemistry Department offices. (DR:C)

5 units, Win (Djerassi) TTh 2:15-4:05

154. The Biosocial Aspects of Cancer—Same as Radiology 154.) This course is concerned with various aspects of cancer as a biological phenomenon and as a clinical, emotional and societal problem. The diagnosis and treatment of human neoplasms, their psychosocial and economic impact, and the organization of cancer care and research will be discussed. There will be detailed consideration of the specific control mechanisms operative in vitro and/or in vivo and delineation of their influence in an attempt to characterize the differences between normal and malignant growth. (DR:C)

3 units, Spr (Kaplan, Brown, Hahn, Weissman) W 7:30-9:30 p.m.; alternate years, given 1979–80

162. Policy Aspects of Mental Health—The course will examine public policy issues raised in the process of diagnosing and treating mental illness. Psychological, political, philosophical, and legal dimensions of problems will be considered. A variety of techniques will be used to examine the complex relationship between clinical experience and broader social and political pressures. (DR:C)

3 units, Win (Spiegel) W 9-11

163. Psychobiology: Biological Basis of Psychiatric Disorders—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 senior students. Prerequisite: Human Biology core. (DR:C)

3 units, Aut (Berger) T 3:15-5:05
164. Human Aggression—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. Cultural factors will include effects of crowding, status conflicts, television, alcohol and drugs. 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 or consent of instructor. (DR:S)

3 units, Win (Lunde) by arrangement

165. Aspects of Recreational Drug Use—This course will examine the pharmacological and social consequences of licit and illicit drug use in a series of lectures and discussion sessions. Topics to be covered will include caffeine, tobacco, alchoholic beverages; and cannabis, sedatives, stimulants, opiates, and hallucinogens. (DR:T)

3 units, Win (Hollister, Staff) to be arranged

166. Biosocial Aspects of Cardiovascular Disease. (DR:T)

4 units (Staff) to be arranged

171. Adolescence—The changes that occur during adolescence will be viewed from a variety of perspectives including anthropological, sociological, psychological and psychiatric. Topics include physical and physiological development, cognitive growth, identity, peer group, generation gap, impact of the school, vocational development, among others. Prerequisite: Human Biology core of Psychology 111. (DR:S)

4 units, Spr (S. Feldman) TTh 1:15-2:45; alternate years, given 1979–80

173. Ethical Problems in Medicine—(Same as Philosophy 78.) Discussion of ethical problems arising in medicine. (DR:X)

4 units, Win (Taurek) MW 10

176. Economic and Political Aspects of the Life Cycle: The Aged and the Handicapped—The course will explore the “interface” between the biological processes of development, adulthood and aging, including individual differences, various hereditary and congenital problems, and correlated economic and political/legal practices and policies. Emphasis will be on societal treatment of elderly and handicapped persons. Certain current policy issues will be treated in depth. Cross-cultural comparisons will be included. Prerequisites: Human Biology Core. Limited to 20 students. (DR:S)

4 units, Win (Corning) T 2:15-4:05

177. Physical and Psychosocial Aspects of Handicap—This course will attack the issues and problems faced by the Handicapped with a three-pronged approach. We will study the biological basis of various handicaps together with the psychosocial problems and stigmas associated with them. In addition, we will discuss the legal and political issues concerning the handicapped. (DR:S)

4 units, Win (Hastorf, Staff) to be arranged

178. Problems of Aging—Aging will be discussed from the following points of view: (a) the prevention of premature aging of the respiratory and cardiovascular systems; (b) the cellular and immunological aspects of aging; (c) problems in mentation, psychosocial behavior and sexuality; (d) aging of various additional organ systems. There will be field trips to representative health care systems for the elderly and a discussion of drug use by the elderly. (DR:C)

4 units, Spr (Ebaugh, Staff) TTh 2:15-4:05

180. Public Policy Analysis of Health Care—(Same as Business 391 and FCPM 204.) The purposes of the course include informing students interested in health care management about the financial and public policy context in which the health care system operates, and informing public management students with the issues in public policy in controlling one of the largest and fastest growing items of public expenditure. The course examines the main issues relating to financing and organization for delivery of health care in the United States, how various existing and proposed financing and organizational arrangements affect the allocation of resources, fee-for-service practice and health maintenance organizations,  institutional and environmental health; diagnostic screening (e.g. for medical diseases, cancer, and cardiovascular disease); medical and surgical technology; and drug abuse and addiction control. Analytical techniques from the biological and social sciences will be used. Limited to juniors and seniors who have completed the Human Biology Core courses. (DR:S)

4 units, Spr (Bunker, Staff)

TTh 3:15-5:05
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 advisor 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 advisors in the Program in Human Biology for explicit requirements for the Honors Program. (DR:X) (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. (DR:X) Any quarter (Staff) 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), Kurt Mueller-Vollmer (German Studies and Humanities), Lawrence V. Ryan (English and Humanities)
Assistant Professor: John M. Taurek (Philosophy and Humanities)

Humanities Special Programs include:
1. Experimental Courses
2. Honors Program in Humanities
3. Master of Arts Program in Humanities
4. Graduate Program in Humanities
5. American Studies
6. Medieval Studies

EXPERIMENTAL COURSES

91. Traditional East Asian Civilization—
(Same as Asian Languages 91 and History 91.) An introduction to the development of civilization in China and Japan from earliest times to the spread of Buddhism. Lectures and discussions will cover political institutions, social and political ideas, religious currents, and artistic and literary trends. Intended for the non-specialist. (DR:A)
5 units, Aut (Duus, Lyell, Matisoff) MWF 10

92. Traditional East Asian Civilization—
(Same as Asian Languages 92 and History 92.) A continuation of Asian Languages/History/Humanities 91 covering the period down to 1700. Open only to students who have completed Asian Languages/History/Humanities 91. (DR:A)
5 units, Win (Duus, Lyell, Matisoff) MWF 10

93. Modern East Asian Civilization—
(Same as Asian Languages 93 and History 93.) A continuation of 92 covering the period from initial Western contacts down to the present. Open only to students who have completed 92. (DR:A)
5 units, Spr (Duus, Lyell, Matisoff) MWF 10

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 Venice. An interdisciplinary study of the age of the Renaissance combining art, history, and literature.
5 units, Win (Ryan, Forster, Spitz) MTWTh 1:15; sections by arrangement

HONORS PROGRAM IN HUMANITIES

Committee in Charge: Lawrence V. Ryan (Director), John B. Foster, Jr., Diane B. Ghirardo, Herbert Lindenerberger, Kurt Mueller-Vollmer, Paul Robinson, John M. Taurek

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 the 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. 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 Comparative Literature (see p. 273).
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. 274.)
2. Two different 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
All courses (DR:H) unless noted otherwise.

61, 62, 63. Western Thought and Literature—An introduction to fundamental ideas of the past; lectures, discussions, readings of selected masterpieces.

61. The World of Classical Antiquity—Homer, Aeschylus, Sophocles, Euripides, Plato, Aristotle, Cicero, Virgil, Seneca, Ovid. 5 units, Aut (A. Raubitschek, Staff) MWF 11; two hours by arrangement
62. Christian and Secular Europe: Medieval and Renaissance—St. Augustine, Boethius, Dante, Castiglione, More, Montaigne, Marlowe, Cervantes, Molière. 5 units, Win (Ryan, Staff) MWF 11; two hours by arrangement
63. From the Enlightenment to the Present—Voltaire, Rousseau, Dostoevsky, Marx, Freud, Conrad, Faulkner. Short novels by Mann, Kafka, Gide, selected poems by other writers. The course will include interdisciplinary study of a moment of social change and political crisis as recorded by theorists, historians, and creative writers.
5 units, Spr (Guerard, 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. (DR: X)
2 to 5 units, any quarter (Staff) by arrangement

190-196. 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 Humanities 61, 62, 63 (one course for students majoring in Comparative Literature).

191. History and the Humanities. 5 units, Win (Robinson) TTh 2:15-4:05
193. Philosophy and the Humanities. 5 units, Aut (Strasnick) MW 2:15-4:05
Win (Taurek) MW 2:15-4:05
Spr (Taurek) MW 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 (Lindenberger) MW 2:15-4:05
Spr (Foster) TTh 4:15-6:05
196. Religious Studies and the Humanities. 5 units, Aut (Good) TTh 2:15-4:05

200A, B, C. Honors Essay—A critical essay of about 15,000 words. Limited to Humanities Honors students. (DR:X)

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

MASTER OF ARTS PROGRAM IN HUMANITIES
(The Master of Arts Program is administered by the Committee in Charge of the Graduate Program in Humanities.)
The Master of Arts Program in Humanities will normally require a two-year residency at Stanford, beginning with the autumn quarter the first year and coming to completion at the end of the spring quarter of the second year. Students, however, may apply for admission to the A.M. Program beginning in either winter or spring quarters, in which case the sequence of study will differ.

During the first year the typical candidate for the A.M. degree will take Humanities 301-303 (the first three courses in the series "The Western Traditions"), plus at least one of three required seminars or proseminars in an established discipline (for example, Art History, Classics, Philosophy, etc.). During the second year the student will take Humanities 304-306 (the remaining three courses in "The Western Traditions"), Humanities 353 (the year-long, bi-weekly colloquium), and at least one of the three required seminars or proseminars in the chosen established discipline. The third seminar or proseminar may be taken in either the first or second year. At the end of the second year a written comprehensive examination will be required.

A student will usually complete either 16 or 20 units during the first year, and 22 or 26 units during the second year, for a total of 42 units. Additional elective units may be taken at the option of the student.

When applying for the A.M. Program in Humanities through Graduate Admissions, the candidate should indicate from which established discipline he or she will be choosing the three required seminars or proseminars. This choice should be indicated under the section "Area of Specialization" on the application form for Graduate Admissions. Once a student has been admitted to the A.M. program he or she must submit a proposed plan of study to the Committee in Charge, specifying the courses that will be used to fulfill the requirement of three seminars or proseminars in an established field.

The Committee in Charge of the Graduate Program in Humanities will approve each A.M. program on its own merits, to ensure that the proposed three seminars and proseminars in an established discipline are suited to the A.M. in Humanities. Since mastery of a foreign language appropriate to the department in which specialized work will be pursued is required, language proficiency should be noted on the application form submitted to Graduate Admissions.

**GRADUATE PROGRAM IN HUMANITIES**

Committee in Charge: Lawrence V. Ryan (Director), George H. Brown, Van A. Harvey, Olivia H. McIntyre, Kurt Mueller-Vollmer, David S. Nivison, John Rathman, 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 of its offerings. The normal pattern of the Program involves one Humanities seminar in each of the 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 offerings 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 six historical seminars (Humanities 301-306) in the Western Traditions series. To qualify for candidacy, students should complete at least three of these seminars in the first two years of graduate residence. Special exemption from or permission to audit one or two of the seminars may occasionally be secured by petition to the Committee in Charge.
3. Regular attendance and active participation throughout at least one academic year in the bi-weekly Humanities Colloquium (Humanities 353), 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, though 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, to be certified in the first two years of graduate work.

6. Passing the University Oral Examination according to the schedule prescribed by the major department, 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**

All courses (DR:H) unless noted otherwise

275. Directed Reading. (DR:X)
   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 Periods.
   4 units, Win (A. Raubitschek) TTh 4:15-6:05

303. The Middle Ages.
   4 units, Spr (G. Brown) TTh 4:15-6:05

304. The Renaissance.
   4 units, Aut (Spitz) MW 4:15-6:05

305. The Early Modern Period.
   4 units, Win (Harvey) 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 research and higher education. A three-quarter colloquium of limited enrollment, required of students in the Graduate Program in Humanities. Pre-requisite: Enrollment in or completion of one or more seminars of the series Humanities 301-306.
   1 or 2 units, Aut, Win, Spr (Clebsch) by arrangement

**AMERICAN STUDIES**

Policy Committee: William A. Clebsch, Chairman (Religious Studies); William Chace (English); Albert Cohen (Music); Wendell Cole (Drama); Estelle Freedman (History); Lawrence M. Friedman (Law); Albert H. Hastorf (Psychology); Albert J. Gelpi (English); Robert Horn (Political Science); David M. Kennedy (History); Marion Lewenstein (Communication); Hubert R. Marshall (Political Science); Dwight Miller (Art); Nathan Rosenberg (Economics); W. Richard Scott (Sociology); Bernard Siegel (Anthropology); Jane P. Soyster (Student); John M. Taurek (Philosophy and Humanities); David B. Tyack (Education)

Visiting Scholars: Sacvan Bercovitch (Columbia University), David E. Stannard (Yale University)

**BACHELOR OF ARTS**

Majors will complete 60 units of approved coursework in American Studies for letter grades, including the following distribution: five courses in one of the concentrations (American Thought and Imagination, American Social Organization and Behavior, American Policy and Institutions) and three courses in each of the other two, completing these courses for letter grades. Ordinarily, the five courses in the area of emphasis will include at least two courses from one of these groups: in American Thought and Imagination, English 234A, B, C, D (or equivalent); in American Social Organization and Behavior, History 165A, B, C; in American Policy and Institutions, Political Science 1, and Political Science 10. The program of study of each American Studies major will be subject to approval by the Administrative Committee; on application, appropriate courses not listed here may be approved by this Committee as counting toward the major. Each program of study must include a "statement of purpose" which outlines the student’s particular goals and areas of concern and indicates briefly how the proposed courses comprise a coherent plan towards those ends.

Each major will take, either during the junior or senior year, but only after completing at least one course in each of the concentrations, at least one core seminar.

Before graduation, each student in American Studies must place in his/her academic file copies of two papers (other than take-home or other examinations) completed and graded for approved courses in American Studies.

**AMERICAN STUDIES HONORS PROGRAM**

Majors with an overall letter-grade indicator of 3.2 and with a strong record in American Studies may apply, preferably during the junior year and no later than the second week of the third full quarter before graduation, to seek
honors by writing a senior thesis for ten units of credit. This application is to include the topic and a proposed outline of the senior thesis. The Administrative Committee may approve or disapprove the application, or request resubmission with revisions. The finished essay must be submitted six weeks before the date of graduation.

COURSES
See departmental listings for fuller descriptions and (DR) notations.

AMERICAN THOUGHT AND IMAGINATION

Art 130A. Art in 19th Century America.
4 units, Win (Frankenstein)

Art 130B. Art in 20th Century America.
4 units, Spr (Frankenstein)

Drama 157. American Drama from 1920.
4 units, Aut (Cole)

English 121. American Literature to 1855.
5 units, Aut (Fliegelman)

English 160A. American Jewish Writing.
5 units, Spr (Feldstiner)

English 234B. American Romanticism.
5 units, Aut (A. Gelpi)

English 234D. American Fiction, 1917–1940.
5 units, Win (Moser)

English 234F. History as Literary Art.
5 units, Win (Fliegelman)

English 234G. American Literary Critics.
5 units, Spr (Chace)

English 239. American Short Fiction.
5 units, Spr (Fields)

English 256B. American Poetry, 1900–1945.
5 units, Win (A. Gelpi)

History 174. The American Condition in the Twentieth Century—(Same as English 128.)
Given in 1979–80

Philosophy 105. American Philosophy, Its Sources, Its Influences.
4-5 units, Win (Hacking)

4-5 units, Spr (Levinson)

AMERICAN SOCIAL ORGANIZATION AND BEHAVIOR

American Studies 171. The Development of American Law—(Same as History 171.) The growth and development of American legal institutions with particular attention to crime and punishment, slavery and race relations, the role of law in developing the economy, and the place of lawyers in American Society, from colonial times to the present.
5 units, Aut (Friedman) MWF 9

Anthropology 8. Anthropological Perspectives on American Culture.
5 units, Win (Spindler)

5 units, Aut (Abramovitz)

Economics 117. Modern Economic Growth in Capitalist Countries.
5 units, Win (Abramovitz)

History 152A. The Making of Urban America.
5 units, Spr (Carson)

History 152B. Urban Social History.
5 units, Win (Camarillo)

History 161. Civil War and Reconstruction.
5 units, Spr (Fehrenbacher)

5 units, Aut (Camarillo)

History 165A. The American Revolution and Early National Period from 1750.
5 units, Aut (Macphail)

History 165B. 19th-Century America.
4-5 units, Win (Degler)

History 165C. The United States in the 20th Century—1890 to the Present.
4-5 units, Spr (Kennedy)

History 167. California History.
4 units, Spr (Fehrenbacher)

History 169. American Social History Since 1900.
4-5 units, Win (B. Bernstein)

History 172A. Postwar America Since 1945.
4-5 units, Spr (B. Bernstein)

History 173A, B. History of Women in America.
8-10 units, Aut, Win (Freedman)

5 units, Spr (Macphail)

5 units, Win (Macphail)

History 257A. Undergraduate Colloquium: Afro-American Politics in the 1960s.
5 units, Spr (Carson)
History 260. Undergraduate Colloquium:
American Workers, 1750–1890.
  5 units, Aut (Schatz)

History 262. Undergraduate Colloquium:
Chicano History.
  5 units, Win (Camarillo)

History 263. Undergraduate Colloquium:
Women in America.
  5 units, Spr (Degler)

History 264A. Undergraduate Colloquium:
The American West.
  5 units, Aut (Camarillo)

History 265S. Undergraduate Seminar:
Minorities and Women.
  5 units, Aut (Degler)

History 267. Undergraduate Colloquium: The
"Dangerous Classes"—The Treatment of Deviancy in American History.
  5 units, Win (Freedman)

History 268. Undergraduate Colloquium: The
Shaping of 20th-Century America.
  5 units, Aut (B. Bernstein)

Sociology 2. American Society Through Film
and Literature.
  5 units, Win (Zelditch)

  3-5 units, Spr (Zelditch)

AMERICAN POLICY AND
INSTITUTIONS

American Studies 171. The Development of
American Law—(Same as Political Science
174F.) See description under Social Organization
and Behavior.
  5 units, Aut (Friedman) MWF 9

Communication 131. Media Ethics and Responsibilities.
  4 units, Win (Hulteng)

Communication 142. Broadcast Communication.
  4 units, Aut (Dundes)

Education 105. American Education and Public Policy.
  3 units, Aut (Kirst, Tyack)

History 158. History of Education in the
United States—(Same as Education 201.)
  3 units Spr (Tyack)

Political Science 1. Major Issues of American
Public Policy.
  5 units, Aut (Marshall)
  Win (Marshall)

Political Science 10. American Government.
  5 units, Win (Manley)

Political Science 170. The Supreme Court and
the Constitution.
  5 units, Aut (Horn)

Political Science 171. Seminar: Conservatism
and Constitutionalism.
  5 units, Spr (Horn)

Political Science 172. The Constitution and
Economic Justice.
  5 units, Spr (Horn)

Political Science 173. Civil Liberties in the
United States.
  5 units, Win (Horn)

Political Science 174. Criminal Law and the
Criminal System—(Same as Law 107 and
Sociology 61.)
  5 units, Spr (Kaplan)

Political Science 183. Criminal Justice in
America.
  5 units, Aut (Casper)

Political Science 189. Voting and the American
Electoral System.
  5 units, Spr (Brody)

Political Science 191. Seminar on Civil Liberties and
Civil Rights.
  5 units, Win (Casper)

Political Science 194D. Media and Politics.
  5 units, Win (Brody)

Political Science 195. Seminar: Political and
  5 units, Spr (Manley)

Political Science 196. Seminar: Presidential
Decision-Making.
  5 units, Spr (George)

Political Science 207. Seminar: Governmental
Decision Making and Natural Resources.
  5 units, Win (Marshall)

CORE SEMINARS

American Studies 203. Critics of America—
(Same as English 164.) A study of some writers
part of whose concern was an explicit critical
investigation of the culture of the United States.
These writers would include Tocqueville, Veblen,
Edmund Wilson and Lionel Trilling.
  5 units, Spr (Chace)

American Studies 208. The American Character.
  5 units (Staff) to be arranged

American Studies 210. Administrative Responsibility—
(Same as Political Science 208.)
Conflicting loyalties, accountabilities of ad-
ministrative officials in decision-making pro-
cesses; responsibility to public at large, pressure
groups, chief executive, legislature, profession. Case study method used.

5 units, Aut (Marshall)

American Studies 211. America in Western Civilization—(Same as History 255.) Course covers more than five centuries of history on both sides of the Atlantic focusing on the images of one another that Europeans and Americans have had; the social and economic impact on Europe of the discovery and early exploitation of the New World; and diplomatic effects on Europe of the American Revolution; the effect on and implications for both Europe and America of the 19th and 20th century migration of people; the ideological significance of America and American Democracy, the 20th-century diplomatic and economic relations of Europe to America.

5 units, Win (Kennedy)

HONORS PROJECT


5-15 units, any quarter (Staff)

MEDIEVAL STUDIES

Committee in Charge: Suzanne Lewis, Chairman; George H. Brown, Brigitte Cazelles, Gavin I. Langmuir, Jeanne S. Martin

Affiliated Faculty: John Ahern (French and Italian), Theodore M. Andersson (on leave 1978-79) (German Studies), Robert Ball (Spanish and Portuguese), Rina Benmayor (Spanish and Portuguese), Lawrence V. Berman (Religious Studies), Alan E. Bernstein (History), George H. Brown (English), Brigitte Cazelles (French and Italian), Joseph C. Harris (English), Donald R. Howard (on leave 1978-79) (English), Gavin I. Langmuir (History), Suzanne Lewis (Art), William Mahrt (on leave 1978-79) (Music), Jeanne S. Martin (English), Eleanor Prosser (Drama), William Todd III (Slavic Languages and Literatures), W. Wesley Trimpi (English), Wayne Vucinich (History), Lee H. Yearley (on leave 1978-79) (Religious Studies).

There is no formal undergraduate degree program in Medieval Studies, rather the option exists for interested students to propose individually designed majors in "Medieval Studies." Individually designed majors must be proposed to and approved by the Dean of Undergraduate Studies' Advisory Committee on Individually Designed Majors. Guidelines may be found on page 000. Students interested in planning a course of studies should consult the Chairman of Medieval Studies. Additional information about this option, as well as referral to faculty advisors, is available through the Humanities Special Programs office. For information about proposing individually designed majors, students should go to the Academic Information Center. 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 should 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 these ten courses, a language proficiency equal to two years of college-level study is suggested in Latin or one of the following: French, German, Spanish, or Italian.

COURSES

65. Medieval Culture: An Interdisciplinary Introduction—(Same as English 65, and History 65.) An introduction to the development of medieval culture through study of some salient religious, philosophical, literary, artistic, social, and political sources with emphasis on interrelationships among them. Lectures by faculty
from various departments and sections conducted by the faculty listed. (DR:A) given 1979–80

162. Medieval Narrative: Theory and Practice—(Same as English 230.) A topical approach to narrative, using mainly (but not exclusively) medieval texts and involving a good deal of reading in recent literary theory. A reading knowledge of Middle English is a prerequisite for the course.

5 units, Spr (J. Martin, J. Harris)

RELATED COURSES

Current courses which are suitable for self-designed majors in Medieval Studies are listed below; more detailed descriptions of the courses are to be found under the various departmental headings along with (DR) notations.

ART

103. Byzantine Art.
105B. Medieval Britain.
206A. Colloquium on Chartres.

CLASSICS

103. History of the Roman Empire.
208. Post-Classical Latin.

ENGLISH

171,172. Chaucer.
205. Introduction to Old English.
211. Readings in Middle English.
212A,B. Medieval to Renaissance: Development of Literary Forms.
270A. Beowulf.

FRENCH AND ITALIAN

(French)

130. De l'enthousiasme à la melancholie.

(Italian)

130. The Divine Comedy I: Vita Nova and Inferno (in English).
131. The Divine Comedy II: Purgatorio and Paradiso (in English).
133. Boccaccio’s Decameron.

GERMAN STUDIES

203. History of the German Language.
204. Gothic.
271A. Germanic Poetry and its Poetics.

HISTORY

107A. Medieval Europe, 1050-1200.
107B. 13th-Century Europe.
140. England to 1460.
209. Undergraduate Colloquium: The Formation of Antisemitism to 1500.
214. Undergraduate Colloquium: Hell and History in Early Europe.
221. Problems in Medieval Russian History.

HUMANITIES SPECIAL PROGRAMS


MUSIC

100. Music History: Medieval and Renaissance.

PHILOSOPHY


RELIGIOUS STUDIES

24/124. Christianity.
125. The Medieval Church.
173. Aquinas.

SPANISH AND PORTUGUESE

(Spanish).
151. Spanish Literature I.
208. History of the Spanish Language.

INTERNATIONAL RELATIONS

Committee in Charge: David Kennedy (History) (Chairman), Robert O. Keohane (Political Science), Alexander L. George (Political Science), Harry Harding (Political Science), Gregson Davis (Classics), Herbert Lindenberger (Comparative Literature), Mark Manzell (History), Gerald M. Meier (Graduate School of Business) Michael Sullivan (Art), Wayne Vucinich (History), Robert Ward (Political Science)

This program is an undergraduate major designed to enable students to study international relations in a variety of dimensions and from a variety of disciplinary perspectives. The program aims to educate broad-gauged inter-
Students are encouraged to shape their own program, so that coherent central themes will emerge around which they can organize their reading and thinking about international relations.

There is a presumption that all students majoring in international relations will spend some time overseas.

**Honors Program**

The International Relations Program offers an honors program to those majors who propose an acceptable project to the Committee, and secure two faculty advisors for the project. One advisor must be a member of the Committee. Proposals should be submitted in the form of written statements, 500-1000 words in length, to the Program chairman. The proposal should concisely define the scope of the project, outline the research strategy to be employed and state clearly a timetable for completion of the project. All honors projects must extend over at least two academic quarters, and must receive not less than 8 units of academic credit, up to a maximum of 15 units. It will be the student's responsibility to arrange a conference, before submission of the proposal to the committee, with each of his proposed faculty advisors, and to remain in close and regular contact with one or both advisors over the life of the project. Honors students will also be expected, early in the second quarter of their projects, to make a presentation to a special Honors Colloquy about their progress to date.

All honors projects should be completed no later than the first week of the student's last quarter before graduation. A normal schedule for an honors project would be to commence the definition of the topic and relevant background reading in the third quarter of the junior year (2-5 units); conduct the bulk of the research in the second quarter of their projects, to make a presentation to a special Honors Colloquy about their progress to date.

**COURSES**

It should be noted that course offerings at Stanford often change after catalogue copy is sent to the printer. Students are advised to check each quarter's *Time Schedule* carefully. See departmental listings for (DR) notations.

**REQUIRED COURSE FOR ALL MAJORS**

*How Nations Deal with Each Other*—(Enroll in History 35 or Political Science 35.) 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 dis-
tribution 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 prescription for policy.

4-5 units, Aut (Keohane) MTWTh 11

CLUSTER A: POLITICAL HISTORICAL EMPHASIS

The State and Society in Latin America—(Enroll in Political Science 113C.) Deals with patterns of relations between political authority and various social groups and institutions in Latin America. Several theories for explaining these relationships are also explored.

5 units, Spr (Packenham)

Political Change 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, problems in development planning, and efforts at pan-African cooperation.

5 units, Win (Abernethy) given 1979-80

Socialism in Cuba and Chile—(Enroll in Political Science 119.) An examination of the two socialist experiences in Latin America. The interrelationships between political, economic, and cultural change will be stressed. Special attention given to the historical and international contexts relevant in each case.

5 units, Win (Abernethy)

Eastern Europe Since 1914—(Enroll in History 126.)

4-5 units, Win (Vucinich)

International Communism—(Enroll in History 123B or Political Science 132.) 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 successess, failures, and adaptation.

5 units, Aut (Dallin) given 1979-80

Introduction to International Law—(Enroll in Political Science 130.) A broad overview of theories, development, present state and propensities of international law as a process in various critical arenas of international interaction.

5 units, Win (Triska)

Colloquium: The Practice of Modern Diplomacy—(Enroll in Political Science 130H.) Current organization and procedures of the American Government for determination and conduct of U.S. foreign policy, the profession and practice of diplomacy; the complex relationships between the Department of State and the White House, Congress, and a variety of executive and private agencies involved in the formulation and execution of contemporary American foreign policy. Prerequisite: Political Science/History 35 or equivalent. Primarily for juniors and seniors. Limited to 15 students.

3 units, Aut (Habib)

Case Studies in Contemporary American Diplomacy—(Enroll in Political Science 131H.) A comparative study of selected cases in recent and contemporary U.S. diplomacy in East Asia, the Middle East, or Africa. Prerequisites: Political Science/History 35 or equivalent. Limit of 15 students.

3 units, Win (Habib)


3 units, Spr (Habib)

The Diplomatic Revolution of Our Time—(Enroll in History 135 or Political Science 135.) Problems raised by the collapse of the traditional system of Western diplomacy as a result of two world wars; expansion of the diplomatic community, the breakdown of its homogeneity; new dimensions resulting from technology and domestic political pressures of the 20th century.

5 units, Win (Craig, George)

Soviet Foreign Policy—(Enroll in Political Science 136 or History 122B.) Foreign and domestic determinants of policy, intentions and capabilities; continuity and change since 1917; institutions and personnel; war and peace; perceptions, priorities, and attitudes; alternative futures.

5 units, Aut (Dallin) given in 1979-80

Arms Control and Disarmament—(Enroll in Political Science 138A.) The introductory course, 138A, is a general survey of international security relations, the revolutionary development of modern weapons, the arms competition and efforts at arms control and disarmament in the post World War II period. Political, conceptual and technological problems of national security policies and arms controls are stressed. Time is devoted to the evolution of strategic doctrines and negotiations on strategic arms control in SALT I and SALT II. The course
is taught by an interdisciplinary faculty.

**Seminars**

- **Arms Control**—(Enroll in Political Sciences 138B.) Tutorial and research problems of arms control, disarmament, and international security. 138A is a prerequisite.

- **Japanese Foreign Policy**—(Enroll in Political Science 139A, B.) The postwar evolution of Japan's foreign policy is analyzed in terms of the interplay between domestic and international variables. Analytic concepts, drawn from the western literature on comparative foreign policy, are applied and tested for such areas as the policy-making processes in Japan (a two-quarter sequence for graduates and undergraduates).

- **The World of Superpowers**—(Enroll in Political Science 137.) A comparative and interactional study of the superpowers—U.S., China, USSR, Europe, and Japan—in terms of recent major events and developments. Emphasis is on political change and formulation of theory of political dynamics.

- **Chinese Foreign Policy**—(Enroll in Political Science 139.) 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.

- **The Dynamics of National Expansion**—(Enroll in Political Science 146.) Contemporary Soviet foreign policy-making, instruments of Soviet foreign policy, Soviet interactions 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.

- **Soviet Foreign Policy**—(Enroll in Political Science 146.) Modern Brazil, 1750-1977—(Enroll in History 180B.) With its huge size, multi-racial society, mixed economy and pragmatic foreign policy,
Brazil's drive for great-power status and its neocapitalist model of development distinguish it from its Spanish-speaking neighbors in both Latin America and world contexts.

5 units, Spr (Wirth)

Latin America and the African—(Enroll in History 182.) The contributions of the African to Latin American civilization from the beginnings of Iberian colonization to the present; the institution of slavery, partial assimilation, evolution of race relations and the status of Latin Americans of African descent after abolition.

4-5 units, Win (Bowser)

The Ottoman Empire—(Enroll in History 186.) Its origins and founding; conquests in Europe, Asia and Africa; expansion and decline in the 16th century; international complications of the "Eastern Question"; reforms; the emergence of the modern Turkish state; its legacy in today's southeastern Europe and the Near East.

4-5 units, Aut (Vucinich) MTWTh 11

Seminar: Origins of Fascism and Militarism in Pre-War Japan—(Enroll in Political Science 214A, B.) This seminar examines the social, economic, intellectual and international sources of fascism and militarism, including those of Marx, Moore, and Maruyama as related to the experiences of twentieth-century Japan within a broadly comparative frame of analysis.

5 units, Win, Spr (Okimoto)

Undergraduate Colloquium: Nationalism and Communism in Eastern Europe—(Enroll in History 226B.)

5 units, Win (Vucinich)

Seminar: International Law—(Enroll in Political Science 230.) Survey of recent international law developments. Particular attention will be given to the oceans and to the Law of Sea conferences, as well as to issues such as terrorism, international pollution, and new states and weather control.

5 units, Spr (Trika) Th 2:15-4:05

Seminar on the United States and the Pacific—(Enroll in Political Science 235.) 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.

5 units, Win (Ward) T 2:15-4:05

Seminar: International Relations Theory—(Enroll in Political Science 244.) Examines and compares both traditional and some of the more contemporary approaches to international relations theory from an interdisciplinary viewpoint. Realists, idealists, behaviorists, environmentalists, socio-cultural evolutionists, futurists, and others.

5 units, Win (North) T 4:15-6:05

Colloquium: Global Politics and the Future—(Enroll in Political Science 244.) Readings and discussions about who gets what, when and how in a world of growing population, advancing technology and finite resources.

4-5 units, Win (North)

Seminar: The Four Images in World Politics—(Enroll in Political Science 246.) The individual, the state, the international system and the global system as presented by Hobson, Lenin, Schumpeter, Morgenthau, the "psychologists," the decision-making school, Allison, Halperin, the dependence school, the environmentalists and other major theorists. A critical comparison through reading and discussion.

5 units, Spr (North)

Mau-Mau—The 1950's Anti-Colonial Rebellion in Kenya—(Enroll in History 247S.)

5 units, Aut (Jackson)

Undergraduate Colloquium: Religion and Social Protest in Colonial Africa—(Enroll in History 248A.)

5 units, Win (Irwin)

Undergraduate Colloquium: White Administrators and the Black Elite in Colonial Africa—(Enroll in History 249B.)

5 units, Spr (Irwin)

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, Gabriel Kolko, W. A. Williams, Arthur Schlesinger, Adam Ulam, Robert Tucker, and George Kennan.

5 units, Win (Bernstein) F 2:15-4:05

Cluster B: Humanities Emphasis

Comparative Religion: Varieties of Religious Thought—(Enroll in Religious Studies 1C.) The course focuses on how people in different religious traditions have thought about their own religious experiences and the meaning of their traditions, ideas and practices. We look at their differing approaches to similar questions, such as the meaning of death, the character of human nature, and the role of mystical experience. We will also touch on certain more theoretical questions: is thinking about religious ideas different from thinking about other ideas; what is the relation between religious ideas and the society in which they are expressed; what particular problems arise when religion meets modernity?

3 units, (Yearley) given 1979–80
Traditional East Asian Civilization—(Enroll in History 91, Asian Languages 91, Humanities 91.) An introduction to the development of civilization in China and Japan from the earliest times to the spread of Buddhism. Lectures and discussions will cover political institutions, social and political ideas, religious currents, and artistic and literary trends. Intended for the non-specialist.

5 units, Aut (Duus, Lyell, Matisoff) MWF 10

Traditional East Asian Civilization—(Enroll in History 92, Asian Languages 92, Humanities 92.) A continuation of History 91, covering the period down to 1700. Open only to students who have completed History 91.

5 units, Win (Duus, Lyell, Matisoff) MWF 10

Impact of the West on East Asia—(Enroll in History 93, Asian Languages 93, or Humanities 93.) A continuation of History 92, covering the period from 1700 to modern times.

5 units, Spr (Duus, Lyell) MWF 10

The Black Experience in Fact and Fiction: Parallels/Divergencies, Relation/Opposition to the Western Model—(Enroll in African and Afro-American Studies 101.) This seminar will use both "factual" and fictional texts to explore the complex relation/opposition of black literature and scholarship to the normative Western model. It will be, in a sense, a transdisciplinary approach to the study of comparative literature. Its main intention is to introduce students to an interdisciplinary model which will attempt to define both the perspective and the domain of Afro-American Studies.

5 units, Win (Wynter) TTh 2:15-3:45

Peoples of Latin America—(Enroll in Anthropology 105A, B.) 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 significance of regional variations. Credit offered only for two-quarter continuous enrollment.

5 units, Win, Spr (G. Collier and R. Rosaldo) MWF 10

History of Socialisms and Marxisms—(Enroll in History 105A, B.) Dissimilarities and similarities in development at different times in different parts of the world. Marx's thought, as well as that of his interpreters, on art, aesthetics, law, and politics.

10 units, Aut, Win (Mancall)

Japanese-Western Literary and Cultural Interactions—(Enroll in Asian Languages 110 or Comparative Literature 110.) Discussion of cross-literary and cross-cultural topics, such as haiku in English, Marxism in Japanese prose fiction, and Zen in American literature. Graduate students may register under J257, in which case they will be required to do additional work.

4 units, Aut (Ueda) 1979-80

America in Western Civilization—(Enroll in American Studies 112.) Course covers more than five centuries of history on both sides of the Atlantic, focusing on the images of one another that Europeans and Americans have had; the social and economic impact on Europe of the discovery and early exploitation of the New World; the diplomatic effects on Europe of the American Revolution; the effects on, and implications for, both Europe and America of the 19th and 20th century migration of peoples; the ideological significance of America and American democracy; the 20th century diplomatic and economic relation of Europe to America.

5 units, Win (Kennedy)

Peoples of Southeast Asia—(Enroll in Anthropology 115.) This course will show how the contemporary cultural unity and diversity within the Southeast Asian region may be accounted for in terms of the interaction between indigenous societies and a succession of outside colonizing influences. The region is viewed as a product of long-term historical processes which involve the interaction between indigenous traditions and colonial forces, between the hinterland and the metropolis. Among topics discussed are: prehistory, the process and impact of colonization, the contrast between hill and valley peoples, subsistence modes social organization, religion and aesthetics.

5 units, Aut (M. and R. Rosaldo) MTWh 9

Japanese Buddhism—(Enroll in Religious Studies 16 for 3 units or 116 for 5 units.) Development of Buddhism in Japan from the 6th Century to the present. Lectures and readings will be constructed around the changes in Buddhist institutions and ideas resulting from epochal changes in the country's economy and social order.

3-5 units, Aut (Davis) TWTh 11

Slavic Civilizations—(Enroll in History/Slavic 117.) 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 stressing similarities, differences and continuing tensions.

5 units, Win (Vucinich)
Then we will concentrate upon colonial and revolutionary period. There will be a final section of special attention to the political theories of the philosophers who have made the most important contributions to American political thought, including Locke, and Montesquieu. We will first read those European political thought, with attention to the political theories of the Revolutionary period. There will be a final section on contemporary American democratic theory.

3-5 units, Spr (Clebsch) MWF 9

The Meeting of Eastern and Western Art—(Enroll in 126.E.) The interaction between the art of the Far East, Europe, and America from the 16th Century to the present day.

4 units, (Sullivanc)

Ch'an and Zen Buddhism—(Enroll in Religious Studies 35 for 3 units or 135 for 5 units.) A survey course of the history and development of ideas represented in these two forms of Buddhism in China and Japan respectively. In studying and comparing Ch'an with Zen, emphasis will be given to the cultural transmission of Buddhism from India to China and then from China to Japan. The class will attempt to understand the various methods Buddhists used to "market" their religion and define the "consumer's" needs in both China and Japan. The role of religion as an agent for change will be explored. The last week of class will be devoted to exploring methods used to transmit Zen Buddhism to the United States by Zen centers in California.

3-5 units, (Paul) given 1979-80

Literature of the Holocaust—(Enroll in English 160B, Comparative Literature 160B, or Modern Thought and Literature 160B.) Eastern European Jewish life before Nazism, the destruction of European Jewry. American responses, and questions arising after the Holocaust, seen through fiction and poetry of Singer, Schwarzbart, Wiesel, Kosinski, Celan, Gilboa, Roth, O'Connor, Clatstein, Levine.

5 units, Spr (Felstiner) given alternate years

European Roots of American Democratic Thought—(Enroll in Political Science 165.) This course will explore the connections between European and American democratic theory. We will first read those European political philosophers who have made the most important contributions to American political thought, including Locke, and Montesquieu. Then we will concentrate upon colonial and constitutional American political thought, with special attention to the political theories of the Revolutionary period. There will be a final section on contemporary American democratic theory.

5 units, (N. Keohane) given 1979-80

Colloquium on National and International Identity—(Enroll in Comparative Literature 194A, Modern Thought and Literature 194A, or English 165.) 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.

5 units, (Halliburton) given 1979-80

American Philosophy: Its Sources, Its Influences—(Enroll in Philosophy 105.) An analysis of the interchange of philosophical ideas between America and Europe. The main emphasis is on the Pragmatist tradition of Pierce, James and Dewey; together with their Hegelian antecedents and Positivist heirs. There is a discussion of the arrival of the Vienna Circle and the Frankfurt School in America. Marxist criticism of pragmatism, and the reception of American analytic philosophy in Eastern Europe.

5 units, Win (Hacking)

Ethics, Morality and International Relations—(Enroll in Philosophy 77) An analysis of the role and status of ethical principles in policy decisions concerning international relations. We shall discuss some ethical considerations that might be relevant to the conduct of foreign policy and the manner in which these considerations can be balanced against other ethical and non-ethical considerations. What obligations do nations have to one another, beyond those that people have to other people? And how are these obligations affected by a nation's obligations to its own populace? To what extent should a nation respect the different ideologies and ethical views of another nation in its relations with it? Cases to be analyzed include the conduct of arms policy, population control, and food distribution.

5 units, Aut (Strasnick) TTh 2:15-3:30

Eliot and Neruda—(Enroll in English 298B.) Introduction by way of Yeats, followed by reading of two long poems, Four Quartets and Albras de Macchu Picchu, with brief excursions into W. C. Williams, Robert Lowell, Octavio Paz, Ernesto Cardenal. Students should have some knowledge of modern poetry and of a Romance language.

5 units, Spr (Felstiner) given 1979-80

Stage Comedy from Aristophanes to Shakespeare—(Enroll in Classics 174, Comparative Literature 174, Drama 158 or English 174.) Readings in classical comedy, including Aristophanes, Menander, Plautus and Terence, in Renaissance comedy, including Ariosto,
Shakespeare, and Jonson. Works not written in English will be read in translation.

3 units, Spr (Foley and Riggs)

Humanities and International Relations: The Twentieth Century in Europe—(Enroll in History 244C.) This colloquium will consider through discussions, reports and papers, literary and artistic ideas within Europe from the end of the 19th century through the great age of the Modern Movement, against a background of political change and upheaval. The historical reasons for such developments will be sought and the readings will include a basis in the history of the period. Most of the course will be devoted to considering works characteristic of aspects of the twentieth century and its sensibility. Some background in European history and/or literature is required.

5 units, Aut (Stansky) given 1979–80

Religion and Modernity—(Enroll in Religious Studies 147.) The problem of religion and modernity from the perspective of various humanistic and social scientific disciplines. Prerequisite: consent of instructor.

5 units, Spr (Levinson)

Russia and the West: Western Influences on Russian Culture and Society—(Enroll in History 217.)

5 units, (Atkinson, Dallin) given 1979–80

The Reciprocal Vision—(Enroll in English 264A.) A study of how Americans and Europeans have perceived and portrayed each other in fictional and non-fictional works from the fifteenth century to the end of the eighteenth. By juxtaposing American and European visions in chronological order, their reciprocity and historical evolution will be illuminated.

5 units, (Evans) given 1979–80

Topics in Islamic Civilization—(Enroll in History 287.)

5 units, Aut (Vucinich, Pappas) T 2:15

Travel Literature: Study in Cultural Confrontation—(Enroll in Spanish and Portuguese 296.) The Western traveler as cross-cultural interpreter and mediator in the third world. The ideological appropriation of foreign contexts as related to developments in world history and economy. Fiction, journals, travelogues, essays, documentary and ethnographic writings and film.

3-5 units, Spr (Pratt, Benmayor)

Travel Literature—(Enroll in Spanish and Portuguese 297.) Continuation of 296. May be taken separately from 296.

3-5 units, Spr (Pratt, Benmayor)

CLUSTER C:
POLITICAL-ECONOMIC ISSUES AND POLICY ANALYSIS

Freshman Seminar—Economists as Reformers in the World Economy—An introduction to contemporary problems of international economic reform in historical perspective through the study of three “reforming economists”: Adam Smith, Karl Marx, and John Maynard Keynes. Much of the history of economic thought can be interpreted as embodying the belief that the business of economics is “social betterment” and that diverse systems of public order are to be appraised in themes of their impact upon values of “human dignity.” Within this context, students will consider some of the international public policy implications of market freedom, governmental management, income and wealth distribution, full employment, and eradication of poverty. Written essays will form the basis for seminar discussions.

5 units, Win (Meier)

The World Food Economy—(Enroll in Food Research 103. Economics 106, or 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 (Staff) MWF 10

The Economics of Underdevelopment—(Enroll in Food Research 118 or Economics 118.) The state of underdevelopment and the process of development are at the heart of the international and within-countries conflict between the rich and the poor. This course presents the economic theory and operational analysis of development within an historical and cross-country perspective. The development process is analyzed sequentially in a comparative static framework, in a dynamic framework, and as a process of development disequilibrium. The course deals with mechanisms, determinants, and consequences of capital accumulation, employment-creation, technical change, international trade, imperialism, and dependency. The discussion is organized around specific hypotheses and is buttressed with the empirical evidence pertaining to various aspects of development and underdevelopment. Prerequisites: Economics 51 and 52.

5 units, Aut (Yotopoulos) MW 2:15-4:05
The Marxian and Radical Tradition—(Enroll in Economics 120.) The economic theories of Marx, Lenin and Mao, and the application of the theories to current economic problems. Prerequisite: Economics 1.

5 units, (Gurley)

Development and the International System—(Enroll in Political Science 125F.) An undergraduate research seminar. Focus is on external constraints on development in the Third World. Specific developmental problems such as balance of payments, employment, agrarian reform, will be examined as both domestic and international issues. No formal prerequisites, although previous work in International Relations, Economics, and/or Political Science is highly recommended.

5 units, Spr (Fagen) T 2:15

Underdevelopment and Foreign Policy—(Enroll in Political Science 137W.) Problems which condition the condition of underdevelopment poses for foreign policy and alternative ways of dealing with them. Particular attention is given to the meaning of underdevelopment; the nature of foreign policy elites; the nonaligned movement and its significance; independence and development as goals of foreign policy; foreign aid, neo-colonialism, and dependency relationships; foreign investment and problems of dealing with multinational corporations; and “resource diplomacy,” with emphasis on the experience of OPEC and its implications for development in the Third World.

5 units, Win (Weinstein) MTWTh 11

Colloquium: Latin American Dependency—(Enroll in Political Science 114.) This colloquium explores the main themes and issues in contemporary Latin American dependency theories; examines some empirical studies of dependency; and considers alternative research and political strategies regarding dependency. For both undergraduates and graduates.

5 units, Win (Packenham) W 10-12

International Dependency—(Enroll in Political Science 131.) 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? What occurs when a weak state tries to reduce its dependence on a strong state? These questions will be examined through an historical analysis of European colonialism and through contemporary case studies, including U.S.-Peru, U.S.-Canada, France-Senegal, and the Soviet Union-Czechoslovakia. Desirable prerequisite: History/Political Science 35.

(Abernethy) given 1979-80

International Organizations in World Politics—(Enroll in Political Science 134.) Analysis of the role of international organizations in contemporary world politics. 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, Spr (R. Keohane)

Seminars: Political Economy of U.S.-Latin American Relations—(Enroll in Political Science 143.) An undergraduate research seminar in which participants prepare and present materials on one of a number of problem cases in U.S.-Latin American relations. No formal prerequisites, although previous work in U.S. foreign policy and/or Latin America helpful.

5 units, (Fagen) Spr W 2:15

European Agricultural Policy—(Enroll in Food Research 146 or Economics 142.) An analytical approach to the development of agricultural policy in Europe, with particular reference to the Common Agricultural Policy of the European Community, and its relationship to agricultural and food problems of member states. The importance of European policy will be studied in relation with policy of other advanced countries, with the developing world, and with the Mediterranean area. Agricultural policies will be discussed in the context of general economic, political and institutional development.

3 units, (Josling) given 1979-80

133. Economic Development Problems of Third World Economies with Colonial Heritage—(Same as Economics 127.) (May be taken as 233 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 de-
Development will be analyzed from Neo-classical and Marxian points of view.

3 units, Win (Kofi) MW 3:15-5:05

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). The above topics will be analyzed from Neo-classical and Marxian points of view. Contemporary theories of dependency economics and economic theories of imperialism and their relationships to development and underdevelopment will form an integral part of the course.

3-5 units, Win (Kofi) TTh 3:15-5:05

Ethics of Development in a Global Environment (EDGE): Cross-Discipline Seminar—(Enroll in Engineering 297A, B, C; Political Science 140A, B, C; Education 274A, B, C; Anthropology 133A, B, C; or Social Thought 197A, B, C.) Theory and practice of development in a global setting. Open to graduates and undergraduates; course is designed to be appropriate to both foreign and American students and may be taken for only one quarter or as a three-quarter sequence. Interdisciplinary: faculty from Engineering, Political Science, Economics, Education, Anthropology; encourages convergence of engineering and natural sciences with the social and behavioral sciences in the study of development processes and the ethics implicit in development tested for appropriateness. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures are analyzed in terms of appropriateness to development in both less developed and industrialized societies. Present systems and planning processes will be examined in terms of their present day inequities as well as their consequences for future generations. Autumn: Major world trends—population, food, energy, technology, lifestyles. Development examined in terms of relative satisfaction of human needs. Lectures, discussions, work-groups. Winter: Alternative development strategies—country case studies. Lectures, discussions, work-groups. Spring: The individual and social alternatives and as policy and decision-maker. Work-groups only. 2 units: pass/no credit. 3-5 units: pass/no credit or grade, small discussion groups and workshops, limited enrollment.

A, B, C. 2-5 units, Aut, Win, Spr

(Seigel, Textor, Weiler) M 7:30-9:30 p.m. and by arrangement

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, Spr (Staff)

International Trade and Investment Policy—(Enroll in Economics 166 or Food Research 166.) This course is concerned with the formulation, implementation, effects and possible improvement of selected governmental policies affecting international trade and foreign investment. Topics include governmental responses to competition from imports, policies affecting international trade in energy resources, issues underlying international negotiation of reductions of barriers to trade, influences of domestic agricultural policies on international commodity trade, international implications of environmental control, multinational commodity agreements and cartels, special trade and investment arrangements for developing countries, and domestic and international impacts of multinational corporations. With respect to each topic, initial attention is focused on existing institutions and practices, and policy analysis is then carried out to suggest improvements in current regulations. Prerequisite: Economics 165 or consent of the instructor.

5 units, Spr (Pearson) MW 11:00-12:30

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 economic policy. Approximately one-third of the sessions are devoted to small group policy conferences in which students present and discuss "position papers" on specific policy problems. These problems are studied primarily through sets of specially prepared source materials on trade policy, international monetary policy, and international development policy. Lectures present some international economic principles that can be applied to the problems and place the problems in their wider context. Considerable independent study is encouraged. Prerequisite: Economics 1. Enrollment will be limited to 45 students with priority in economics and international relations majors.

5 units, Win (Meier)
International Political Economy—(Enroll in Political Science 241A,B.) An analysis of how the world economy and the international political system are related to one another. First quarter: theoretical approaches and historical analysis (early development of capitalism, mercantilism, political foundations of liberalism, imperialism, conflicts among advanced industrial states to 1945). Second quarter: contemporary international political economy, emphasizing changes in international regimes, power relations, and industrial structure. A basic working knowledge of economics is necessary. Consent of instructor required.

5 units, Aut, Win (R. Keohane)

Honors Thesis—(Enroll in International Relations 198A,B, or C.)

2-5 units, any quarter (Staff)

A focus program on “The Political Economy of the New Europe” will be offered at Stanford in Britain during summer quarter, 1979. Professor Gerald M. Meier will direct the program.

This focus program will relate new issues in international political economy to “the New Europe.” The program will place the European Community in perspective—in terms of its accomplishments and problems within Europe and its impact on international relations.

Prerequisites for this program are Economics 1 and International Relations 35. Economics 165 or Economics 168 are recommended. A special background course for those who intend to go to Cliveden may be offered in Spring, 1979.

For more information contact the Overseas Studies Office or the International Relations Office.

LANGUAGE LABORATORY

Committee in charge: Clara N. Bush (Linguistics) (Chairman); John Barson (French and Italian), Albert Dien (Asian Languages), Gertrude Mahrolz (German Studies), Richard Schupbach (Slavic Languages and Literature), Maria-Paz Valdes (Spanish and Portuguese)

Director: John Metcalfe

The Language Laboratory with one hundred and fourteen Level III (listen-respond-record) student positions offers varied programs in Amharic, Arabic, Cambodian, Cantonese, Cebuano, Czech, Danish, Dutch, English as a foreign language, Estonian, French, German, Greek, Hausa, Hebrew, Hindi-Urdu, Indonesian, International Morse, Irish, Italian, Japanese, Korean, Mandarin Chinese, Native American, New Guinea Pidgin, Norwegian, Persian, Portuguese, Quechua, Quiche, Rumanian, Russian, Serbo-Croat, Spanish, Swahili, Swedish, Thai, Twi, Vietnamese, Welsh, Yiddish, Yoruba, and Yucatec. Additional recorded language materials in Finnish, Hungarian, Icelandic, Kurdish, Kappele, Latin, Latvian, Lithuanian, Malay, Tagalog, Tamil, and Telugu.

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 language laboratories are covered, from administration and equipment selection to operation of recording and playback equipment. Assumes no prior experience in electronics or instrumentation.

3 units, Spr (Metcalfe) MWF 1:15

CENTER FOR LATIN AMERICAN STUDIES

Committee in Charge: The Committee on Latin American Studies, a subcommittee of the Presidential Committee on International Studies

Chairman of the Committee and Director of the Center: John D. Wirth

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, Medicine, and Education in offering three joint-degree programs.

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, Communication, Economics, History, Political Science, Sociology, Spanish and Portuguese, the School of Education, 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, 1979.

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.)

All requirements for the A.M. degree are normally completed in three academic quarters.

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.

**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 apply to and 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. Candidates must have a teaching credential.

**LAS/Medicine**—An A.M. degree in Latin American Studies is also offered in conjunction with the M.D. degree program at Stanford. Students accepted by the School of Medicine can then apply to the Center for Latin American Studies for admission into the special joint-degree program.

For additional information regarding Latin American Studies joint-degree requirements, inquiry should be made to the Center.

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. 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 students who have maintained a grade average at least mid-way 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

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 is submitted the following autumn quarter for the independent research seminar LAS 153. Students from all departments are eligible to apply.

Advanced Stanford graduate students having an area of concentration may apply to the Committee of Latin American Studies for summer grants for pre-dissertation research.

COURSES

All courses (DR:X)

152. Undergraduate Seminar in Research—Restricted to students accepted for the Latin American Studies Summer Research Program.
   5 units, Spr (Staff) by arrangement

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.
   1-10 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. Restricted to A.M. degree students.
   5 units, Aut, Win, Spr (Wirth) M 2:15-4:05

260. Latin American Bibliography—with emphasis on the contemporary period.
   2 units, Aut (Breidlove) Th 12:00-1:15

LINGUISTICS

Chairman: Clara N. Bush

Professors: Clara N. Bush, Charles A. Ferguson, Joseph H. Greenberg (on leave Autumn, Spring), Elizabeth C. Traugott

Associate Professors: Eve V. Clark, Thomas Wasow (on leave Autumn)

Assistant Professors: Beatriz Lavandera, William R. Leben, Terry Winograd

Visiting Emeritus: Dwight Bolinger (Professor)

Senior Lecturer: Frieda N. Politzer

Lecturer: Elaine Kaufman

Affiliated Faculty:

Professors: Alphonse Juilland, Robert L. Politzer

Associate Professors: Andrew M. Devine, Dorothy A. Huntington, Orrin W. Robinson III

Assistant Professors: James A. Fox (on leave Winter, Spring), Michelle Rosaldo

English for Foreign Students:

Director: Clara N. Bush

Senior Lecturer: Frieda N. Politzer

Lecturer: Beverley McChesney

Special Language Program Coordinator: (Staff)

PROGRAMS OF STUDY

Linguistics offers degrees on both the undergraduate and graduate levels. 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 advisor.

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 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 A.B. include study of a foreign language and 45 units of coursework distributed over principle areas in the study of Human Language.

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. A total of 45 units is required, including Linguistics 10 (or by arrangement, Linguistics 1), and at least two courses of 3 units or more from at least three of the following areas of Human Language.

A. Social Aspects of Language: language, culture and society; bilingualism; language and social stratification; language policy; change in contemporary languages; language adaptivity.

B. Psychological and Biological Aspects of Language: language and mind; language as a component of thought processes; language disorders; physiology of speech perception and production; language acquisition; bilingualism; biological correlates of language.

C. Languages and Literature: structure and history of a particular language or language group; discourse analysis; stylistics, poetics.

D. Formal Aspects of Language: syntactic, semantic, and phonological analysis; philosophy of language; mathematical linguistics; artificial intelligence. Students planning to apply for graduate work in Linguistics are advised to take at least 3 courses in this area. Courses offered by a variety of departments may be taken to satisfy this distribution requirement. A current listing of courses applicable to the various areas is available in the Linguistics Office.

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.

Honors students will take a total of at least 60 units. These will include five courses (of 3 units or more) from any one of the four areas of specialization, plus Linguistics 76, Research in Human Language (4 units), in the Autumn quarter of the senior year, and Linguistics 198, the Honors Seminar (5 units) in the Winter quarter. 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.

GRADUATE DEGREES

The following requirements are in addition to the University residency requirement for the degree sought. Candidates should review departmental Guidelines for A.M. and Ph.D. Degrees for further particulars concerning these requirements.

MASTER OF ARTS

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 departmental Graduate Studies Committee.

2. Courses. Candidates must complete a minimum of 36 units of graduate work in linguistics and allied fields, including the five core graduate courses (Linguistics 200, 215, 220, 230, 240), which total 21 units, and the option of up to 6 units for a research project or A.M. thesis; see 4 below. Courses are to be counted toward the A.M. which are not in general linguistics are to be approved by the advisor. Candidates coming to the program with no previous background in lin-
guistics 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 candidates with the choice of substituting an essay question of general linguistics.

4. Thesis. Terminal A.M. candidates are expected to present a formal A.M. thesis, fulfilling the University requirements specified in the "Degrees" section of the Courses and Degrees.
Under appropriate circumstances a Ph.D. candidate may petition the Graduate Studies Committee for a waiver of the A.M. thesis requirement. (See departmental Guidelines for details.)

MASTER OF ARTS IN TEACHING

The degree of Master of Arts in Teaching is offered jointly by Linguistics and the School of Education. In addition to completing a minimum of 25 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 five graduate core courses (21 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 are to be approved by the linguistics advisor.

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 advisor 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 lan-


guage 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 48 of which are in general linguistics, or, beyond the A.M., 40 units exclusive of dissertation units, at least 21 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 Linguistics 200, 215, 220, 230, and 240. It will normally be taken prior to the end of the first year.
   b) A field of specialization such as anthropoligical linguistics, applied linguistics, computational linguistics, developmental psycholinguistics, grammatical theory, hearing and speech sciences, 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 Linguistics 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 may be fulfilled by Linguistics 396.

6. Colloquia. Two oral presentations exclusive of the oral presentation of thesis proposal (see 7a below). One of these two colloquia may be given in seminar; both should be given during the first three years of study.

   a) Oral presentation of thesis proposal in colloquium.
   b) Approval of dissertation topic and appointment of a dissertation committee by the Chairman.
   c) Successful passing of a University Oral examination on the Dissertation Project and related areas.
   d) Dissertation (up to 15 units).
SPECIAL LANGUAGE PROGRAM
(80A,B,C, 81A,B,C)

Students interested in studying a modern foreign language not regularly taught at Stanford may propose a Special Language course. Over the past two years, the following languages have been taught:

In requesting a special language, 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. Normally grading will be done on a pass/no credit basis.

Special Language courses supersede ad hoc language courses set up under SWOPSI, SCIRE, and Undergraduate Specials.

Address all inquiries to Coordinator, Special Language Program, Linguistics 101B or telephone 497-3279.

RESEARCH

The department maintains a program of basic research in linguistics and related fields. The major projects are language universals, phonological archiving, 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

   4-5 units, Win (Ferguson, Greenberg, Huntington) MWF 10

10. Introduction to Linguistics—(Same as Anthropology 70.) Theoretical foundations of linguistics, with emphasis on application of theory to solution of homework problems from a variety of languages. Topics include: phonetics, phonology, morphology, syntax, semantics, pragmatics, universals, and language change. This course or its equivalent is required for many advanced courses in linguistics. (DR:A)
   5 units, Aut (Fox) MWF 11, plus optional sections.

45. Language, Society, and Culture—(Same as Anthropology 72.) Theories of language and culture (evolutionary, diffusional, functional, structural). Functions of language in the speech community. Role of linguistic data in the analysis of society and culture. Linguistic evidence for social and cultural history. Cultural presuppositions, rules of use, and patterned variability in language. Graduates should enroll for Linguistics 145. Prerequisite: Linguistics 10 or consent of instructor. (DR:A)
   4-5 units, Spr (Frake) MFW 10

50. Language in Use—(Same as Anthropology 73.) 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. Prerequisites: Linguistics 10 or consent of instructor. (DR:A)
   4 units, Spr (Staff) MWF 11, given alternate years

55. Language Change—The time-dimension in language. A survey of the goals and methods of contemporary historical linguistics. Emphasis on types of change and evidence for language
change in progress. The role of social and aquis-
tional factors in explanation of change. Graduate
students should enroll for Linguistics 155 (5
units). Prerequisite: Linguistics 10 or consent of
instructor. (DR:A)

60. Language and Mind—Language and the
mental processes of individuals. Language be-
behavior as an indicator of thought processes and
emotional states, and language as a component
and partial determinant of such processes. Ab-
normal language: aphasia, schizophrenia, al-
tered states of consciousness. Prerequisite: Lin-
guistics 10 or consent of instructor. (DR:A)

65. Language and Meaning—Survey of
theories about linguistic meaning, from word
meanings (componental analysis, markedness,
and semantic fields) to sentence meanings. Di-
rect and indirect meanings. The representation
of meaning and the role of lexicon in a grammar.
Graduate Students enroll in Linguistics 165 (5
units) (DR:H)

4 units, Spr (Clark) MW 1:15-3:05

76. Research in Human Language—
Introduction to research goals and methods in
linguistics and related disciplines. Assigned
readings and presentations by different faculty
members will include discussion of field and
laboratory methods as well as the nature of evi-
dence and argumentation in linguistic analysis
and theory. Each student will be expected to
design a research project on a topic and method
of his or her choice. Open to undergraduate
honors majors, others with consent of instruc-
tor. (DR:S)

4 units, Aut (Clark) by arrangement

80A,B,C. Elementary Special Language
Courses—See "Special Language Program." (DR:X)

Aut, Win, Spr (Staff) by arrangement

81A,B,C. Intermediate Special Language
Courses—See "Special Language Program." (DR:X)

Aut, Win, Spr (Staff) by arrangement

145. Language, Society, and Culture—Con-
tent same as Linguistics 45. (DR:A)

4-5 units, Spr (Frake) MWF 10

146. Introduction to Bilingualism—(Same as
Spanish and Portuguese 205.) The course is
aimed at helping the students to become aware
both of the general characteristics of bilingual
communities and bilingual individuals and of
the variety of specific situations and cases en-
countered in real life. The focus will be on
Spanish-English contact in the United States
but other situations of bilingualism and mul-
tilingualism in the world will be discussed. No
prerequisite.

4-5 units, Spr (Lavandera) WThF 1:15

148. Introduction of Sociolinguistics—(Same
as Anthropology 71.) The study of language in
society. Social dialects, awareness of social and
ethnic differences in speech. Prestige and
stigma associated with different ways of speak-
ing. The aim of this course is to train students in
the systematic observation of speech, there will
be some practice in participant-observation, in-
terviewing, and recording of conversations.
Prerequisite: Linguistics 10 or its equivalent.

5 units, Aut (Lavandera) MWF 9:00

155. Language Change—Content same as
Linguistics 55. (DR:A)

Given alternate years

165. Language and Meaning—Content same
as Linguistics 65.)

4 units, Spr (Clark) MW 1:15-3:05

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, mor-
phology and syntax which present particular
difficulties, presentation of problems, construc-
tion of exercises and lesson planning. With con-
sent of instructor graduate students may enroll
in Linguistics 270. (DR:S)

3 units, Win (F. Politzer) MWF 10

170B. Practicum in TEFL—Workshop for vol-
unteers currently active in area TEFL pro-
grams; discussion of teaching problems and
evaluation of effectiveness of classes. Pre-
requisite: 170A or equivalent. (DR:X)

1 unit, Spr (F. Politzer) by arrangement

170C. Overseas Practicum in TEFL—Avail-
able only by prearrangement, and to students
who have the prerequisite: 170A and 170B or
consent of instructor. (DR:X)

5 units, any quarter, student is registered
in absentia (F. Politzer) by arrangement

175. Linguistic Field Methods—(Same as An-
thropology 171.) Rapid introduction to descrip-
tive phonetics, and to principles of phonetic
transcription and phonological analysis. Appli-
cations to the descriptive analysis of one or more
languages, eliciting data in class from native
speakers. Limited enrollment. Prerequisite: in-
troductory course in linguistics or consent of
instructor. (DR:A)

Given alternate years

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 struc-
ture of English, with some attention to the application of linguistics to literature. (DR:A)
5 units, Aut (Traugott) MW 3:15-5:05

184A,B,C. Modern Standard Arabic (DR:X)
5 units, Aut, Win, Spr (Staff)
by arrangement

185A,B,C. Beginning Hausa (DR:X)
5 units, Aut, Win, Spr, (Staff)
by arrangement

186A,B,C. Intermediate Hausa (DR:X)
5 units, Aut, Win, Spr (Staff)
by arrangement

190A,B,C. Beginning Swahili—Swahili is the major lingua franca of East Africa. Conversation, grammar, reading. (DR:X)
5 units, Aut, Win, Spr (Staff)
by arrangement

191A,B,C. Intermediate Swahili (DR:X)
3-5 units, Aut, Win, Spr (Kaufman, Staff)
by arrangement

193A,B,C. Beginning Yoruba—Yoruba is spoken by 12 million people in Nigeria and the Republic of Benin. Conversation, grammar, reading, composition, discussion of Yoruba culture. (DR:X)
5 units, Aut, Win, Spr (Kaufman)
by arrangement

194A,B,C. Intermediate Yoruba (DR:X)
3-5 units, Aut, Win, Spr (Kaufman, Staff)
by arrangement

196A,B,C. Beginning Hebrew (DR:X)
5 units, Aut, Win, Spr (Staff)
by arrangement

197A,B,C. Intermediate Hebrew (DR:X)
5 units, Aut, Win, Spr (Staff)
by arrangement

198. Honors Seminar—Largely individual work on honors projects. Each student will have a faculty member as project supervisor (usually the student’s advisor). Class meetings chiefly devoted to progress reports and discussion of topics related to the projects. Work on the honors project may continue into the Spring quarter, but the project must be completed no later than six weeks before the date of intended graduation. Prerequisite: Linguistics 76 or consent of instructor. (DR:X)
5 units, Win (Clark) dhR

199. Independent Study (DR:X)
1 or more units, any quarter (Staff)
by arrangement

GRADUATE

THEORY OF GRAMMAR

200. The Goals of Grammar—An historical and theoretical perspective on current linguistic work. Special attention is paid to hypotheses that have remained most influential; also to important areas not covered extensively in other core linguistics courses, such as language change and morphology. (DR:A)
4 units, Aut (Leben) TTh 9:00-10:50

201. Introduction to Formal Grammars—(Same as Philosophy 201.) 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. (DR:T)
4 units, Spr (Wasow) TTh 2:15-4:05

202. Mathematical Linguistics—(Same as Philosophy 202.) Investigation of mathematical results relevant to empirical issues in linguistics. Special attention given to the theories of Peters and Ritchie concerning the generative capacity of transformational grammar and the work of Hamburger and Wexler on learnability of grammars. (DR:T)
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 repeated for credit. (DR:X)
4 units, Win (Staff) MW 9

206. Grammatical Theories—Selected topics in non-transformational grammatical theory. May be repeated for credit. Prerequisite: 200 or consent of instructor. (DR:X)
Given alternate years

208. Typology and Universals of Language—(Same as Anthropology 174.) The relation between typology and universals; universals in phonology, grammar and semantics; universals and linguistic change; the role of universals in overall explanatory theory in linguistics; universals research in contemporary linguistic theory. Prerequisite: Linguistics 10 or consent of instructor. (DR:H)
Given alternate years

Given alternate years

PHONETICS AND PHONOLOGY

215. Foundations of Phonetic and Phonological Analysis—Fundamentals of phonetic analysis (physiological, acoustic, perceptual) together with a survey of human articulatory capabilities. Discussion of some basic assumptions of phonology (segmentation, distinctiveness, pattern) and how various phonological
theories treat them. Includes training in the perception, production and transcription of sounds of representative human languages as well as problems in phonological analysis. (DRA)

5 units, Aut (Bush and Ferguson) MWF 2:15 plus 1 hour by arrangement

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 role of articulatory, acoustic, and auditory parameters. Prerequisite: 215 or consent of instructor. (DRA)

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. (DR:C)

4 units, Spr (Bush) by arrangement

220. Phonology—Basic issues in contemporary phonology, including developments in generative phonology. Description of representative sound systems, sound processes, and sound changes found among the languages of the world. Practice in problem solving. (DRA)

4 units, Win (Leben) MW 1:15-3:05

222. Phonological Theory—Survey of contemporary theoretical issues in phonology, with detailed treatment of topics that have recently led to significant results. Prerequisite: 220. (DRA)

4 units, Spr (Bush) by arrangement

223. Practicum in Phonology and Morphology: Structure of an African Language—Practice in problem solving, using data from an African language. The course is designed to increase proficiency in dealing with linguistic evidence and to contribute to scholarship in lesser known languages.

4 units, Spr (Leben) TTh 11:00-12:50

224. Topics in Phonetics and Phonology—Selected topics in phonetics and phonology. May be repeated for credit. Prerequisite: Linguistics 215 or consent of instructor. (DRA)

4-5 units, (Staff) by arrangement

227. Instrumental Phonetics—Techniques of instrumental research in speech perception and production. Theory and instrumentation for analysis and manipulation of speech signals. Laboratory course. Given any quarter. Prerequisite: consent of instructor. (DR:T)

4 units, (Huntington) by arrangement

228. Language Disorders—Directed reading on selected congenital and acquired pathologies (e.g. deafness, aphasia) which underlie language deficits. Given any quarter. May be repeated for credit. Prerequisite: Linguistics 1 or consent of instructor. (DRA)

1-3 units, (Huntington) by arrangement

288. The Phonology of German—(Same as German Studies 214/314.) Systematic treatment of the German sound system, especially within the framework of generative phonology.

3-5 units, Win (Robinson) by arrangement

SYNTAX AND SEMANTICS

230. Foundations of Syntactic Theory—(Same as Philosophy 230.) Introduction to the transformational theory of syntactic competence. Practical experience in forming and testing linguistic hypotheses, reading and constructing rules, etc. (DRA)

4 units, Win (Wasow) MTWTh 10

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. (DRA)

Given alternate years

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. (DR:X)

Given alternate years

233. Problems in Morphology and Lexical Relations—Investigation in some details of data from several languages with a view to uncovering or resolving problems in current linguistic theory. (DR:X)

Given alternate years.

235. Syntactic and Semantic Analysis—Detailed examination of quantification; reference, and modality in English: review of the basic syntactic and semantic properties of quantifiers and modals; interaction with negation and coordination; behavior in questions; critical analysis of various previously proposed treatments (e.g., Jackendoff, Montague, Hintikka) with emphasis on the underlying assumptions between form and interpretation in natural language. Prerequisite: Linguistics 231. (DR:X)

Given alternate years

240. Semantics—Emphasis on lexical representation, componential analysis, markedness, field meaning at the word vs. sentence levels. (DR:H)

4 units, Spr (Wasow) MWF 10

244. Philosophy of Language—(Same as Philosophy 181.) 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: one course in elementary logic (DR:H)
4 units, Aut (Moravcsik) MTWTh 1:15

LANGUAGE VARIATION AND SOCIOLUMINICSTICS

246. Topics in Bilingualism. (Same as Spanish and Portuguese 208.) Selected topics in bilingualism. 1978–79: the sociolinguistic approach. Prerequisite: one introductory course in bilingualism or one introductory course in sociolinguistics.
4-5 units, Aut (Lavandera) MW 11-12:50

248. Sociolinguistic Analysis. (Same as Anthropology 170.) The place of social and stylistic significance in language structure. The variable component of linguistic structure is investigated in some detail with data from several languages with a view to evaluating alternative models for the description of variation. Prerequisites: Linguistics 146, 200, 220, and 230, or consent of instructor.
4 units, Win (Lavandera) TTh 11-12:50

249. Variation in Spanish. (Same as Spanish and Portuguese 209.) This is a course on the methodology of analysis of language in use. Investigation of data from different geographical and social dialects of Spanish. Comparison of monolingual Spanish situations with bilingual ones involving Spanish. The students will be encouraged to gather their own data as a complement to the data presented by the instructor. Prerequisite: Intermediate level of Spanish and consent of instructor.
5 units, Spr (Lavandera) WF 9-11

250. Topics in Discourse Analysis. Topic for 1978–79: subject and topic, theme and rheme; functional sentence perspective. Prerequisite: Linguistics 230 or equivalent.
4 units, Win (Traugott) MW 11:00-12:50

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. (DR:X)
Given alternate years

253. Introduction to Indo-European Linguistics. (Same as Classics 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. (DR: H)
Given alternate years

255. Topics in Language Change. Topic for 1978–79: the relevance of language acquisition and loss to the theory of language change. Prerequisite: Linguistics 55 or equivalent.
4 units, Spr (Traugott) MW 3:15-5:05

256. Language and Public Policy. Language issues at national and local levels. Characterization of language situations: language diversity, functional allocation of language varieties, language attitudes. Methods and results of sociolinguistically oriented language surveys. Policy alternatives in government and education language planning. Prerequisite: Linguistics 245 or consent of instructor. (DR: A)
Given alternate years

DEVELOPMENTAL PSYCHOLUMINICSTICS

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: Linguistics 10 or 230, or consent of instructor. (DR: A)
4 units, Aut (Clark) TTh 1:15-3:05

261. Child Language II. (Same as Psychology 241.) Variable topics selected from semantics, syntax, or phonology. May be repeated for credit. Topic for 1978–79: word-formation in children’s language—word composition and morphological derivation.
4 units, Win (Clark) T 1:15-4:05

COMPUTATIONAL LINGUISTICS

265. Computational Models for the Syntax of Natural Language. (Same as Computer Science 265.) This course will explore some of the principle algorithms and techniques that have been developed in computational linguistics, notable for morphological and syntactic analysis and synthesis, and the architecture of complete experimental systems such as those developed as a result of recent research on speech understanding. The aim will be not simply to master these methods but also to explore through them the relationship between computational linguistics, theoretical linguistics and computer science. The course will consist largely of lectures by outside people actively engaged in research in computational linguistics. (DR: T)
3-4 units, Aut (Winograd) MWF 9

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.
(DR:T)
4 units, Win (Winograd) TTh 9:30-11:00,
plus 1 hr. dhr

APPLIED LINGUISTICS

270. Linguistics and the Teaching of English as a Foreign/Second Language—(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. (DR:S)
3 units, Aut (Politzer) MW 4:15-5:30

271. Topics in Applied Linguistics—Selected topics in the application of linguistic research findings to practical language problems. Depending on interests of those enrolled, selection will be made from such topics as the language of public documents, interethic communication, literacy, language planning, language in professional contexts.
4 units, Win (Ferguson) MWF 9

METHODS

175. Linguistic Field Methods I—(Same as Anthropology 171.) 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. (DR:A)
Given alternate years

276. Research Methods in Linguistics—Introduces the student to social science research methods within the context of a given area of linguistic research. Completed or ongoing studies will be used in illustration. Students will apply some of the methods discussed to individual research projects. See Linguistics 248—Sociolinguistic Analysis. (DR:A)
Given alternate years

LANGUAGES

173. Spoken Bolivian Quechua—(Same as Anthropology 173.) Introduction to the language of the Quechua Indians of Bolivia, a dialect closely related to the classical Quechua of the Inca Empire.
5 units, Aut (Fox) MWF 2:15,
plus 2 hours lab

283. Structure of Hausa—A sketch of Hausa syntax, morphology, and phonology, with emphasis on points of current theoretical interest. Prerequisite: 215 and 230 or consent of instructor.
4 units, Win (Leben) MW 3:15-5:05

292. The Chinese Language and Current Linguistic Theories—(Same as Asian Languages 292.) Prerequisite: Asian Languages 103 or equivalent. Recommended: a general introductory course in Linguistics. (DR:X)
By arrangement

SEMINARS/WORKSHOPS

All courses (DR:X)

Seminars and workshops are offered on typology and universals of language, phonological archiving, phonological theory, syntax, semantics, sociolinguistics, historical linguistics, developmental psycholinguistics, computational linguistics and philosophy of language. May be repeated for credit. Students are admitted by consent of instructor.

Offered in 1978-79 are:

303. Seminar in Theories of Language—(Same as Philosophy 203.) Discussion of selected problems in the philosophy and psychology of language. (DR:X)
3 units, AWS (Staff) by arrangement

5 units, (Staff) by arrangement

345. Seminar in Sociolinguistics—Topics in sociolinguistics.
Given alternate years

5 units, Spr (Ferguson) TTh 1:15-3:05

361. Seminar on Space and Language—(Same as Psychology 220.) Consideration of parallelisms and possible connections between linguistic and spatial competencies with special attention to "localist" theories, and to the expression of spatial relations and their metaphorical extensions in language.
3 units, Aut (Clark, Shepard)
by arrangement

365. Seminar in Computational Linguistics—(Same as Computer Science 365.) Examination of unsolved problems in computational linguistics.
3 units, Spr (Winograd) by arrangement

COLLOQUIA,
DIRECTED READING

All courses (DR:X)

389. Linguistics Colloquium—(Same as German Studies 219/319.) Topics in German linguistics. Although specific topics are determined by student interest, the general field of study will alternate as follows: synchronic German linguistics in years when GS 212 is taught,
diachronic German and Germanic linguistics in years when GS 203 is taught.
3-5 units, Spr (Robinson)

390A,B,C. Proseminar—Orientation for first-year graduate students and an introduction to different types of linguistic research ongoing at Stanford.
1 unit, Aut (Bush) TTh 3:15
Win (Leben) TTh 3:15
Spr (Staff) TTh 3:15

391A,B,C. Colloquium.
I unit, Aut, Win, Spr (Staff) Th 3:15

1-6 units, any quarter (Staff)
by arrangement

396. Directed Teaching.
1-5 units, any quarter (Staff)
by arrangement

397. Directed Reading.
1-5 units, any quarter (Staff)
by arrangement

398. Directed Research—Research at predis-sertation level.
1-6 units, any quarter (Staff)
by arrangement

399. Dissertation Research.
1-15 units, any quarter (Staff)
by arrangement

OTHER COURSES
See departmental listings for (DR) notations.

ANTHROPOLOGY
278. Advanced Cognitive Anthropology.

CLASSICS

EDUCATION
388. Foreign Language Education and Bilingual Education in the Elementary School.

ENGLISH
102. The History of the English Language.
205. Old English.

FRENCH AND ITALIAN
174. Italian Language.
211. Phonétique et Pronunciation.
221. Introduction to Rumanian.

GERMAN STUDIES
203. History of the German Language.
214. The Phonology of German.

HEARING AND SPEECH SCIENCES
230. Physiology of Speech Production.
231. Speech Perception.
281. Seminar in Animal Communication.
310. Experimental Phonetics.

PHILOSOPHY
163. Modal Logic.

PSYCHOLOGY
146. Language and Thought.
214. Psycholinguistics.

ENGLISH FOR FOREIGN STUDENTS
All courses (DR:X)

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 86 or 96 should normally expect to follow subsequent courses in the sequence during succeeding quarters. Individual instruction in pronunciation is available only on a private tutorial basis.

During the regular 8-week summer session, courses in spoken and written English up to a maximum of 11 units will be offered. In addition, a late-summer 4-week intensive program is offered. 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. This program is open to qualified graduate students who have been admitted to degree programs at other United States institutions as well as those who have been admitted to Stanford for the following autumn quarter.

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)
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.

3 units, Aut, Win, Spr (Staff) 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 (Staff) 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.

1 unit, Aut (Staff) by arrangement

95A, B, C. Special Problems in English—Topics (such as vocabulary, reading comprehension, pronunciation, 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.

4 units, Aut, Win (Staff) by arrangement

97. Written English II—For students with some faculty 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

MATHEMATICS

Emeriti: Harold M. Bacon, Ralph Phillips, George Polya, Menahem Schiffer, Gabor Szegő (Professors)

Chairman: Robert Osserman

Vice Chairman: Gregory Brumfiel


Associate Professors: Gregory Brumfiel, Mary V. Sunseri. Visiting: Jussi Ketonen


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 three sequences of courses in the calculus.

1. Calculus and Analytic Geometry (41, 42, 43) presents one-variable calculus and plane analytic geometry in the first two quarters (41, 42), and multi-variable differential calculus and space geometry in the third quarter (43).

2. Calculus and Analytic Geometry (19, 20, 21, 22, 23) covers the material of (41, 42, 43) in five quarters instead of three.

3. Calculus (41A, 42A, 43A) covers all of the material of (41, 42, 43) with the exception of plane analytic geometry.

Precalculus Mathematics (3) 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 precalculus 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 (113 or 113S). There are no formal prerequisites for this course, but appropriate mathematical maturity is expected.

ADVANCED PLACEMENT FOR FRESHMAN

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 advisor on advanced placement, communicate with the Academy 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. Calculus and Analytic Geometry (Courses 19, 20, 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.

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 (or 113S), 114 (or 114S), 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 courses numbered 100 or above.

Mathematics majors must have at least a C average in all courses used to fulfill the major requirement. Letter grades are required in all courses used to fulfill the major requirement, except for those offered Pass/No Credit only and for cognate courses (see 4, below).

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 (or 113S), 114 (or 114S), 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

The Department of Mathematics offers a program leading to the degree of Bachelor of Science in Mathematics with Honors. Programs leading to this degree are formulated by individual students in consultation with a Department representative. Typically such a program includes, beyond the courses required for the B.S. degree, electives including graduate courses and courses in Independent Work, with one of the latter culminating in a scholarly paper. Further details concerning admission to the program and a statement of the requirements of the program can be obtained from the Academic Secretary of the Department.

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 in the “Other Departments, Institutes, and Programs” section 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 27 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 48 units approved by the Graduate Affairs 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 application of mathematics. In addition, the student must pass the University oral examination. A student must receive a grade B or better in a course to satisfy the Ph.D. requirement.

Training and experience in teaching is part of the Ph.D. program. Each student is required to teach or assist in teaching one course per quarter for three quarters. The quarters and nature of the teaching assignment will be determined by the Department in consultation with the student.

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.

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 (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."

All courses (DR:T) unless otherwise noted.

INTRODUCTORY AND UNDERGRADUATE COURSES

Introductory courses will be offered only if twenty or more students enroll.

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 precalculus mathematics, logarithmic and trigonometric functions in a highly visual treatment to develop basic mathematical intuitions. Both courses (DR:X).

2A. 4 units, Aut (Staff) MTWTh 2:15 and sections
    Win (Staff) MTWTh 3:15 and sections
2B. Win (Staff) MTWTh 2:15 and sections

3. Precalculus Mathematics—Fundamental laws; linear and quadratic equations; inequalities; logarithms; binomial theorem; trigonometric functions, identities, and equations; solution to right and oblique triangles; complex numbers; DeMoivre’s theorem.

   4 units, Aut (Staff) MTWThF 8 and 12

7. Calculus and Probability—Continuation of 6, which was offered in 1977–78. Prerequisite: 6.

   3 units, Aut (Staff) MWF 2:15
19. Calculus and Analytic Geometry—The sequence (19, 20, 21, 22, 23) covers the same subjects as the sequence (41, 42, 43) described below. Prerequisites are the same as for 41.
3 units, Aut (Staff) MWF 8, 9, 10, 11, 1:15, 2:15, and 3:15
Win (Staff) MWF 8, 9, 10, 11, and 2:15

3 units, Win (Staff) MWF 8, 9, 10, 11, 1:15, 2:15, and 3:15
Spr (Staff MWF 8, 9, 10, and 2:15

3 units, Aut (Staff) MWF 8, 9, 10, 11, 1:15, 2:15, and 3:15
Spr (Staff MWF 8, 9, 10, and 2:15

3 units, Aut (Staff) MWF 8 and 2:15
Win (Staff) MWF 2:15

3 units, Win (Staff) MWF 8 and 2:15
Spr (Staff) MWF 2:15

41. Calculus and Analytic Geometry—Courses 41 and 42 together present the calculus of functions of one variable and plane analytic geometry. Principal topics included in 41 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. Prerequisites: algebra and trigonometry.
5 units, Aut (Sunseri) MTWThF 8
(Rudolph) MTWThF 10

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 41, 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.
5 units, Aut (Sunseri) MTWThF 9

42. Calculus and Analytic Geometry—Continuation of 41. Principal topics include: antiderivative, definite integral, fundamental theorem, technique of integration, geometrical and physical applications of the integral, polar coordinates. Prerequisite: 41 or equivalent.
5 units, Aut (Jorgenson) MTWThF 11
Win (Sunseri) MTWThF 8

42A. Calculus—Continuation of 41A.
5 units, Win (Sunseri) MTWThF 9

43. Calculus and Analytic Geometry—Courses 43 and 44 present an introduction to multi-variable calculus and analytic space geometry. Principal topics included in 43 are: determinants, vector algebra in the plane and space, lines and planes in space, parametric equations in the plane and space, surfaces; partial derivatives, total differential, applications; line integrals, exact differentials; brief discussion of double integrals. Prerequisite: 42 or consent of Department.
5 units, Aut (Hawley) MTWThF 1:15
Win (Finn) MTWThF 11
Spr (Sunseri) MTWThF 8

43A. Calculus—Continuation of 42A. Concurrent registration in 44 is permissible.
3 units, Spr (Sunseri) TTh 9

44. Calculus—Continuation of 43. Principal topics included are: double and triple integrals, iterated integrals, applications, surface area; infinite series, convergence tests, power series, Taylor's theorem; complex numbers and functions; introduction to differential equations. Prerequisite: 43 or equivalent.
3 units, Aut (Staff) MWF 9, 10, 11, 1:15 and 2:15
Win (Staff) MWF 10, 12, and 2:15
Spr (Staff) MWF 9 and 11

53. Honors Calculus—The sequence 53, 54, 55 is intended for students who have the equivalent of 41, 42 and wish to continue the study of calculus in a more rigorous and complete fashion. The course begins with a careful study of the concepts and theorems of one-variable calculus and continues at the same level of rigor to the study of multi-variable calculus (topics of 43, 44, 101). Prerequisite: 42 or equivalent, and consent of instructor.
4 units, Aut (Chung) MWF 3:15-4:20

54. Honors Calculus—Continuation of 53. Prerequisite: 53. 113 (or 113S) or equivalent recommended.
4 units, Win (Chung) MWF 3:15-4:20

55. Honors Calculus—Continuation of 54. Prerequisite: 54.
4 units, Spr (Samelson) MWF 11

**COURSES FOR UNDERGRADUATES AND GRADUATE STUDENTS**

All courses (DR:T) if taken for three or more units unless otherwise noted.

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.
101. Advanced Calculus—Topics include: differentiation and integration of integrals depending on a parameter; transformations and the implicit function theorem; change of variables in multiple integrals; vector analysis and the theorems of Gauss, Green and Stokes. Prerequisite: 44 or equivalent. 113 (or 133S) or equivalent recommended.

3 units, Win (Staff) MWF 10 and 2:15
Spr (Staff) MWF 9 and 11

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: 44.

3 units, Aut (Siu) MWF 2:15
Spr (Berg) MWF 9


3 units, Win (Levine) MWF 10

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 (Staff) MWF 10 and 3:15
Win (Meeks) MWF 11
Spr (Staff) MWF 9

113S. Linear Algebra and Its Applications—A treatment of linear algebra and matrices with an emphasis on computational and algorithmic aspects together with a consideration of scientific problems in which linear algebra is applied. Solution of linear equations. Linear spaces and matrices. Orthogonal projection and least squares. Eigenvalues and eigenvectors.

3 units, Aut (Staff) MWF 11, 1:15, and 2:15
Win (Staff) MWF 10, and 1:15
Spr (Kalkow) MWF 11
Sum (Staff)

114S. Linear Algebra and Its Applications—Continuation of 113S. Determinants, eigenvalues and eigenvectors. Positive definite matrices, extremum problems, computations with matrices, elements of linear programming and game theory.

3 units, Win (Staff) MWF 2:15
Spr (Berg) MWF 11

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.

3 units, Aut (Staff) MWF 11 and 1:15
Win (Rudolph) MWF 2:15


3 units, Win (Jorgensen) MWF 11
Spr (Rudolph) MWF 2:15

117. Fundamental Concepts of Analysis—Implicit function theorem. Manifolds, differential forms. Integration on manifolds: Stokes' theorem. Prerequisite: 116 or equivalent. 101 or equivalent recommended.

3 units, Spr (You) MWF 11

120. Modern Algebra—Group theory: normal subgroups, permutation groups, Sylow's theorems, finite abelian groups. Introduction to rings. Prerequisite: 113.

3 units, Win (Kalikow) MWF 1:15
Spr (Milgram) MWF 10

121. Modern Algebra—Continuation of 120. Rings, ideals, polynomials, fields, Galois theory.

3 units, Spr (Kalikow) MWF 1:15


126. Mathematical Models in Population Biology—(Same as Mathematics 226.) A course for advanced undergraduates and beginning graduate students in biology and mathematics. Topics will include the elements of population genetics and ecology, and theory of enzyme kinetics.

3 units, Win (Karlin, Feldman) MWF 9

130. Ordinary Differential Equations—Special equations, exact equations, linear equations; series solutions, numerical solution; Laplace transform; systems of equations. Prerequisite: 44, concurrent registration in 44, or consent of instructor.

3 units, Aut (Staff) MWF 9, 10, and 1:15
Win (Staff) MWF 9, 11, and 2:15
Spr (Staff) MWF 11 and 1:15
Sum (Staff)

3 units, Win (Staff) MWF 10 and 2:15
Spr (Phillips) MWF 11


3 units, Spr (McGregor) MWF 10

134. Honors Analysis—A course designed to give a coherent, mathematically sophisticated presentation of some of the basic areas in classical real analysis. Directed chiefly toward mathematics majors who would normally enroll in an honors sequence—but of use and interest to other majors who are at ease with rigorous proofs and qualitative discussion. A major portion of the course will be devoted to ordinary and partial differential equations. Prerequisite: 55 or 116, or consent of instructor. Corequisites: 113-114, or 113S-114S.

Alternate years, given 1979-80

135. Perturbation Methods in Mathematics and Physics—An introductory account of the analysis intent on securing quantitative results for problems which, though lacking exact solutions, are correlated with others that admit complete resolution. Applications to eigenfunction/eigenvalue problems in irregularly shaped domains, diffusion/wave problems in nonhomogeneous settings and non-linear differential equations. Prerequisite: 131 or equivalent.

Alternate years, given 1979-80

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. Prerequisite: 113.

3 units, Win (Hauley) MWF 10

143. Topics in Geometry—Selected topics. Possible choices include algebraic geometry, differential geometry, and foundations of geometry.

3 units, Spr (Meeks) 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, Wilson; congruence of first and higher degrees; Lagrange's theorem, its applications; residues of power; quadratic residues; introduction to theory of binary quadratic forms.

3 units, Aut (Milgram) MWF 11

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 (Brumfiel) MWF 11

160A,B. Symbolic Logic—Rigorous development of classical symbolic logic. Syntax and semantics of first order predicate calculus, Godel's completeness theorem, the Skolem-Lowenheim theorem, and examples of theories will be covered in 160A. A precise definition of "effective procedure," categoricity and quantifier elimination arguments for completeness and decidability, arithmetization of metamathematics, undecidability of arithmetic, and Godel's incompleteness theorem in 160B. (Enroll in Philosophy 160A,B.)

160A. 4 units, Win (Staff) MWF 11

160B. 4 units, Spr (Staff) MWF 11

161. Introduction to Set Theory—Zermelo-Fraenkel axioms are the basis of the course. 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. This is a computer-based course; there are no lectures. Each student progresses through the course at his own pace. The first meeting is organizational only, held at 2:15 on the first class day of the quarter. (Enroll in Philosophy 161.)

4 units, Aut, Win (Suppes) Spr (Staff)

192A,B. Topics in the History of Mathematics.

192A.— Topics from the 17th to the 19th century. Principally the rapid development of the powerful new concepts and methods in analysis and their direct connection with the physical sciences, in particular mechanics. Illustrations from the work of famous mathematicians from Descartes to Abel.

3 units, Win (Hauley) MWF 1:15

192B. Topics from the 19th to the early 20th century. The further extension and expansion of analysis and its applications. Rigorization
and generality; the rise of algebra and abstract mathematics. Illustrations from the work of famous mathematicians from Fourier to Lebesgue.

3 units, Spr (Feferman) MWF 1:15

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. (DR:X)

3 units, Aut, (Staff) MWF 1:15, and by arrangement

Win (Staff) MWF 1:15,
and by arrangement
Spr (Staff) MWF 1:15,
and 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. The choice of topics is limited to those which are not the content of regular course offerings of the Department. 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 consult the Academic Secretary of the Department.
(Staff) by arrangement

COURSES INTENDED PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:T) if taken for three or more units.


205A. 3 units, Aut (Staff) MWF 10
205B. 3 units, Win (Staff) MWF 10
205C. 3 units, Spr (Staff) MWF 10

206A,B,C. Theory of Functions of 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 (Cohen) MWF 11
206B. 3 units, Win (Cohen) MWF 11
206C. 3 units, Spr (Cohen) 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 (Milgram) MWF 1:15
210B. 3 units, Win (Milgram) MWF 1:15
210C. 3 units, Spr (Milgram) 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, Aut (Finn) MWF 2:15
217B. 3 units, Win (Finn) MWF 2:15

220A,B,C. 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 (Levine) MWF 2:15
220B. 3 units, Win (Levine) MWF 2:15
220C. 3 units, Spr (Levine) MWF 2:15

221A. Calculus of Variations—Euler-Lagrange equations, sufficient conditions; applications to eigenvalue and scattering problems; direct methods, Dirichlet’s principle.
Alternate years, given 1979–80

224. Integral Equations—Singular types and methods for their solution; alternative integral equation reformulation of boundary value problems, dual equations and affiliated variational principles.
Alternate years, given 1979–80

226. Mathematical Models in Population Biology—(Same as Mathematics 126.)
3 units, Win (Karlin, Feldman) MWF 9

230A,B,C. 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.
(Enroll in Statistics 230A,B,C.)

230A. 3 units, Aut (Siegmund) MWF 2:15
230B. 3 units, Win (Siegmund) MWF 2:15
230C. 3 units, Spr (Siegmund) MWF 2:15
232A, B. 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. Prerequisite: 230A.

232A. 3 units, Aut (Chung) MWF 11
232B. 3 units, Win (Chung) MWF 11

233. Stochastic Differential Equations—The Ito and Stratonovich stochastic integrals and their properties will be developed. Methods for solving stochastic differential equations will be discussed. Applications to electrical systems driven by white noise, biological growth processes involving random birth and death rates, and stochastic economic models, will be highlighted. Prerequisite: 230A (or equivalent.)

3 units (Karlin) alternate years, given 1979–80

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

236A, B. Mathematical Population Genetics—A series of classical and new mathematical models dealing with population biology phenomena will be discussed. This will include treatment of multi-gene population models, selection migration interaction, and aspects of quantitative inheritance. Mathematical techniques include mainly finite dimensional non-linear analysis, stability analysis of dynamical systems, tensor and Kronecker product algebras, and some simple probabilistic structures.

Alternate years, given 1979–80


Alternate years, given 1979–80


245A. 3 units, Aut (Siu) MWF 11
245B. 3 units, Win (Siu) MWF 11

252. Advanced Matrix Theory—Perron Frobenius Theorem for positive matrices, eigenstructure of totally positive matrices. Variational formulas in matrix analysis, ordering and monotone preserving properties, a hierarchy of determinantal inequalities, applications to stability analysis of certain nonlinear transformations. Applications in statistics, probability and in the natural, biological and managerial sciences.

Alternate years, given 1979–80

254A, B. Ordinary Differential Equations—Fundamental existence theorems, stability and asymptotic behavior of nonlinear systems, Poincaré-Bendixson theorems, linear systems and Sturm-Liouville eigenvalue problems; selected topics from equations in the complex domain; Fuchsian theory, Hamiltonian systems, existence of periodic solutions and orbital stability.

Alternate years, given 1979–80


256A. 3 units, Aut (Phillips) TTh 11-12:15
256B. 3 units, Win (Phillips) TTh 11-12:15
256C. 3 units, Spr (Gilbarg) TTh 11-12:15

258A, B. Linear Partial Differential Operators—Hörmander’s approach to theory of linear partial differential equations using the methods of functional analysis and distributions. Estimates of one operator by means of another; fundamental existence and uniqueness theorems including Cauchy problem; approximation of solutions by means of exponential so-
lutions; partial extension of results to variable coefficients; nonexistence. Prerequisites: 205A,B,C.
Alternate years, given 1979–80


261A. 3 units, Aut (Jorgensen) MWF 10
261B. 3 units, Win (Jorgensen) MWF 10
261C. 3 units, Spr (Jorgensen) MWF 10

Alternate years, given 1979–80

267A. Harmonic Analysis—Topics chosen from the following: The $L^1$ theory of harmonic analysis—the singular integral theory of Calderón and Zygmund and its extensions, interpolation of operators, multiplier transformations, and smoothness properties of functions; the $L^1$ theory of harmonic analysis—sets of uniqueness for trigonometric series, spectral synthesis, thin sets, the spectral theory of convolution operators, and applications. Prerequisite: knowledge of the elements of Fourier analysis.

267A. 3 units, Aut (Zafran) MWF 2:15

272A,B. Topics in Hydrodynamics—General equations of fluid mechanics will be developed and particular cases discussed from a mathematical point of view. Included will be problems relating to potential flow, compressible flow, viscous flow and/or free boundary problems. Prerequisite: foundations of analysis. Functions of a complex variable, ordinary and partial differential equations desirable but not essential.
Alternate years, given 1979–80

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) MWF 11
277B. 3 units, Spr (Schiffer) MWF 11


281A. 3 units, Aut (Samelson) MWF 9
281B. 3 units, Win (Samelson) MWF 9
281C. 3 units, Spr (Brumfiel) MWF 9


283A. 3 units, Aut (Yau) MWF 1:15
283B. 3 units, Win (Brumfiel) MWF 9

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 (Monk) MWF 2:15
290B. 3 units, Win (Feferman) TTh 1:15-2:30
290C. 3 units, Spr (Ketonen) MWF 2:15

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, Aut (Feferman) TTh 1:15-2:30
291B. 3 units, Win (Ketonen) MWF 2:15

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.

292A. 3 units, Spr (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 1979-80

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 1979-80

350. Directed Reading.
Any quarter, (Staff) by arrangement

351. Seminar Participation—Participation in a student-organized graduate seminar under the general supervision of a faculty member.
Any quarter, (Staff) by arrangement

360. Advanced Reading and Research.
Any quarter, (Staff) by arrangement

361. Seminar Participation—Participation in faculty-led seminar which has no specific course number.

Any quarter (Staff) by arrangement

by arrangement

381. Seminar in Analysis.
by arrangement

383. Seminar in Function Theory.
by arrangement

385. Seminar in Abstract Analysis.
by arrangement

386. Seminar in Geometry and Topology.
by arrangement

387. Seminar in Algebra and Number Theory.
by arrangement

by arrangement

389. Seminar in Mathematical Biology.
by arrangement

391. Seminar in Foundations of Mathematics.
by arrangement

MODERN THOUGHT AND LITERATURE

Committee in Charge: Ian Watt (English), Chairperson; John Foster (English); Ian Hacking (Philosophy); Carolyn Lougee (History); Albert J. Guerard (Modern Thought and Literature); Lucio Ruotolo (English)

Faculty: Charles Drekmeier (Political Science); Jean Franco (Spanish and Portuguese); David Halliburton (English, Comparative Literature, and Modern Thought and Literature); Estelle Freedman (History); Diane Middlebrook (English); Thomas C. Moser (English); Kurt Mueller-Vollmer (German Studies); Paul A. Robinson (History)

Lecturer: Marilyn Yalom

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 English departments or in interdisciplinary programs. 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. Students are expected to acquire an extensive knowledge of English and American literature (normally with more emphasis on one of the two) from 1750 to the present, but no attempt need be made to cover aspects of nonliterary thought or of other arts and literatures for the full modern period. ("Extensive knowledge" is understood to mean a knowledge of major authors and movements as full and as balanced, historically, as that expected of Ph.D. candidates in English).

Three advisory reading lists will help students in planning their academic year's work and their summer reading. One will emphasize English literature, but include American writers; a second will emphasize American literature, but include English writers. The third will be devoted to books, not necessarily literary, considered important to the study of modern thought.

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**

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 advisors. 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 additional 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 adviser) may be counted among the 40 units of interdisciplinary work required.

The requirements for the Ph.D. in Modern Thought and Literature are as follows:

1. An introductory seminar, Modern Thought and Literature 361 (5 units).
2. 45 units of advanced work in modern literature of one language, normally English. Of the 45 units, at least 30 must be regularly scheduled, substantive courses in post-1750 English and American literature. Courses in the teaching of composition (English 396, 397), ad hoc graduate seminars (395), research courses (398), and thesis registration (399) may not be included. 396, 397, and 399 may not be counted among the 90 units of graduate work required for the degree.
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. Qualifying Procedures:
   a) Colloquium or Essay
      By the end of the spring quarter of the first year each student will either organize a colloquium developed from work done in the winter quarter Modern Tradition seminar, or submit a 25–30 page essay based on his term paper for that seminar. The colloquium must be scheduled, or the seminar paper completed and given to the Secretary, at least three weeks before the end of the spring quarter.
   b) Knowledge of Literature Since 1750
      Students may choose between two ways of demonstrating their knowledge of literature since 1750: a special one hour examination at the beginning of the second year, or a collection of brief critical commentaries on authors not covered in courses, to be submitted not later than the eighth week of the sixth quarter in residence. These tests or commentaries will be based on reading lists drawn up by the student in consultation with her or his adviser and approved by the Committee in Charge. The list should be based primarily on one of the advisory reading lists in literature, but may include additional works in modern thought or drawn from the student's special field of interest.
5. Teaching is an essential part of the program. All candidates are required to do four quarters of supervised teaching at half-time. During the first year a candidate is expected to act as a reader for two courses or a section leader for one course, in the second year to teach two quarters of Freshman English, and in the third or fourth years to assist a faculty member as a section leader in a larger course.

As preparation for teaching, students are required to take English 396, a two-unit course introducing students to the obligations and opportunities of graduate study, and 397A, a five unit course on teaching composition.

6. 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.

Students may not take the university oral examination until they have completed the foreign language requirement.

7. Annual review. The program of each student must be approved by the Committee in Charge at the end of each academic year.

8. **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 will normally include a summary of reading in literature as well as in interdisciplinary fields. This statement must be approved by the student’s advisor, by the Chairperson, and by the Committee in Charge.

9. University Oral Examination. This examination, covering the student’s areas of concentration, will normally be taken in the third year of graduate study.

10. 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 “Humanities Special Programs” section.

UNDERGRADUATE PROGRAM

The Committee sponsors several courses open to qualified undergraduates, but does not at present offer a major in Modern Thought and Literature. Undergraduates who wish to develop their own majors in Modern Thought and Literature should consult with the Chairman and may be given permission to undertake an interdisciplinary plan of study under the Humanities Honors Program.

In special cases involving qualified honors undergraduates, the Committee offers a coterminous A.M. Interested students should petition the chairman at least one quarter before they have completed 180 units of work at Stanford.

COURSES

See departmental listings for (DR) notations. Courses are open to qualified students from any department.

119. Modern British Literature—(Same as English 119.)
   5 units, Win (Foster)

120A. Modern Art I—(Same as Art 120A.)
   4 units, (Eitner)

120B. Modern Art II—(Same as Art 120B.)
   4 units, (Eitner)

120C. Modern Art III—(Same as Art 120C.)
   4 units, (Eitner)

120D. Modern Art IV—(Same as Art 120D.)
   4 units, (Eitner)

121A. Modern Art V—(Same as Art 121A.)
   4 units, Spr (Elsen) given 1979–80

121B. Modern Art VI—(Same as Art 121B.)
   4 units, Win (Elsen)

122. American Literature, 1855–1917—(Same as English 122.)
   5 units, Win (Islas)

136. The Age of Reason and Enlightenment—(Same as History 136.)
   5 units, Spr (Lougee)

136A. European Intellectual History in the 19th Century—(Same as History 136A.)
   5 units, Win (Robinson)

136B. European Intellectual History in the 20th Century—(Same as History 136B.)
   5 units, Spr (Robinson)

142. The Female Experience: Victorian Heritage, Part II—(Same as Anthropology 142.) This course presents an examination of the place of gender in social and political theory, from Fourier to Freud.
   5 units, Spr (J. Collier, M. Rosaldo, et al.)

156. Early Modern Political Thought—(Same as Political Science 152.)
   5 units, Aut (Drekmeier) MTWTh 11

160B. Literature of the Holocaust—(Same as English 160B.)
   3 units, Spr (Felstiner)

161. Afro-American Literature—(Same as English 161.)
   5 units, Aut (Taylor)

161C. Black Folklore and Afro-American Literature—(Same as Political Science 162C)
   5 units, Win (Taylor)

162A,B. Seminar: Symbol, Myth and Archetype—(Same as Political Science 162A,B)
   162A. 5 units, Win (Rogat)
   162B. 5 units, Spr (Rogat)

162E. Introduction to Caribbean Poetry: English, French and Spanish—(Same as English 162E.)
   4–5 units, Win (G. Davis)

162F. Comparative Themes in Caribbean Fiction—(Same as African and Afro-American Studies 248.)
   5 units, Aut (S. Wynter)

163A. Feminine/Masculine in Literature—(Same as English 163A.)
   5 units, Win (Middlebrook, Staff)
163P. Nietzsche and Heidegger—The philosophy and social and political relevance of one of the major modern inquiries into the nature of human existence. (Same as Political Science 163P.)

5 units, Win (Lyman)

165. Culture and Society—(Same as English 165 and Comparative Literature 195.)

5 units, Win (W. Stone)

166. Chinese Aesthetic Concepts—(Same as Asian Languages 166.)

4 units, Spr (Liu) given 1979–80

167B. Modern British Comic Writers—(Same as English 167B.)

5 units, Spr (Felstiner)

167C. Introduction to Folklore—(Same as English 167C.)

5 units, Spr (Harris)

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 5 units of credit will be given for Modern Thought and Literature 198 and/or 195 in any one quarter.

Any quarter, by arrangement

205. Sartre: Literature and Politics—(Same as French 107.)

4 units, (Giraud) given 1980–81

206. Contemporary French Literature and Thought—(Same as French 110/209) Modern linguistics; Saussure; Barthes, Levi-Strauss; Robbe-Grillet; Goldmann; Sarroute; Butor; Truffaut, Malle; Sartre; Neo-Marxists; Artaud; Bataille; Beckett; Lacan; Derrida. Lectures in English, readings in English and optional readings in French.

4 units, (Cohn), given 1979–80

207. Sense of Identity in Modern Women Writers—(Same as Comparative Literature 207.) An examination of female writers whose sense of identity is related to their creativity, sexuality, maternity and social class. Simone de Beauvoir, Violette Le Duc, Marguerite Duras, Sylvia Plath, Tillie Olsen and others.

5 units, Win (M. Yalom) TTh 2-4

210A,B,C. Topics in Film Study—(Same as Communication 210A,B,C.) Consult Time Schedule for 1978–79 topics

212. Undergraduate Seminar: Minorities and Women—(Same as History 265S.)

5 units, Aut (Degler)

214. Russian Formalism and Structuralism—(Same as Slavic Languages 230.)

4 units, Spr (Brown) TTh 4:15

220. Film Aesthetics—(Same as Communication 101.) 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 the practitioner, the critic, and the audience.

4 units, Aut (Breitrose)

evening screenings by arrangement

221. History of Film—(Same as Communication 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)

225A. Undergraduate Colloquium: French Revolutionary Thought, 1760–1815.—Same as History 225A.)

5 units, (Lougee) given 1979–80

225B. The English Novel Through the Eighteenth Century—(Same as English 225B.) Study of the most significant novels, with emphasis on the development of the form.

5 units, Aut (W. Stone)

230A. Undergraduate Colloquium: French Revolutionary Thought, 1760–1815.—Same as History 230A.)

5 units, (Lougee) given 1979–80

231A. The English Novel Through the Eighteenth Century—(Same as English 231A.) Study of the most significant novels, with emphasis on the development of the form.

5 units, Aut (Morgan)

231B. The English Novel in the Nineteenth Century—(Same as English 231B.) Study of the most significant novels, with emphasis on the development of the form.

5 units, Aut (W. Stone)

231C. The Twentieth-Century Novel—(Same as English 233.)

5 units, Spr (W. Stone)

234B. American Romanticism—(Same as English 234B.)

5 units, Aut (A. Gelpi)
234D. American Fiction, 1917-40—(Same as English 234D.)
5 units, Win (Moser)

234F. History as Literary Art—(Same as English 234F.)
5 units, Win (Fliegelman)

235. The Impressionist and Experimental Novel—(Same as English 235 and Comparative Literature 235.) Critical analysis of impressionist masters (such as Conrad, Ford, Lowry, Faulkner), of major experimental novelists (Joyce, Woolf, Kafka), and of short works by several living writers.
5 units, Win (Guerard)

237A. Undergraduate Colloquium: Opera, and History—(Same as History 237A.)
5 units, Aut (Robinson)

239. American Short Fiction—(Same as English 239.)
5 units, Spr (Fields)

240. Symbolic Anthropology—(Same as Anthropology 152.) The past and current trends in the analyses 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 analyses and interpretation.

Given alternate years

241-243. Deutsche Geistesgeschichte I, II, III—(Same as German 241-243.) The series is designed to acquaint students with the history of German thought from 1750 to the present and its significance for an understanding of modern culture. Authors to be studied include Herder, Hegel, Schiller, Marx, Nietzsche, Freud, Husserl, Wittgenstein, Marcuse, and Adorno.
3-5 units, Aut, Win, Spr (Wellbery)

244C. Undergraduate Colloquium: Humanities and International Relations in 20th-Century Europe—(Same as History 244C.)
5 units, (Stansky) given 1979–80

245A. Survey of Russian Literature in English Translation I: The Rise of a Secular Literature—(Same as Slavic Languages 143.) Close reading of selected novels and short fiction by Pushkin, Lermontov, Gogol and Dostoevsky. Discussions will focus on problems of literary structure.
4 units, Aut (Todd) MWF 10:00

245B. Survey of Russian Literature in English Translation II: From Realism to Symbolism—(Same as Slavic Languages 146.)
4 units, Win (Anschuetz) MWF 10:00

245C. Survey of Russian Literature in English Translation III: The Modern Period—(Same as Slavic Languages 147.)
4 units, Spr (Brown) MWF 10:00

247. Anthropological Perspectives on American Culture—(Same as Anthropology 8.)
5 units, Win (G. and L. Spindler) TTh 2:15

248. Sex Roles and Society—(Same as Anthropology 9.) The purpose of this course is to develop an appreciation of the diversity of men’s and women’s roles, experiences and self-conceptions in a number of human societies, in order to provide a critical perspective on contemporary views of the “nature” of men and women, and to understand how men and women shape and are shaped by particular forms of social life. Readings will combine ethnographic studies of particular societies with theoretical discussions of sex and gender.
5 units, Aut (J. Collier, M. Rosaldo) MWF 10:00

250. Essentials of Political Theory—(Same as Political Science 254.)
5 units, Aut (Drekmeier) M 4:15

253. Political Thought: The Modern Period—(Same as Political Science 153.) Theories of liberty, equality and social justice in large modern states. The views of socialists, conservatives, liberals, anarchists on the organization of communities, the distribution of power and the role of the individual in the good society. How much flexibility do we have in constructing political communities to realize our values? What are the limits on political creativity? Theorists studied include Mill, Marx, Michaels, Weber, Lenin, Tocqueville, Burke, Fourier and Bakunin.
5 units, Win (Lyman)

253C. Later Eighteenth Century Poetry—(Same as English 253C.)
5 units, Aut (Dekker)

254B. Romantic Poetry as Myth-Making—(Same as English 254B.)
5 units, Spr (Mellor)

254C. Victorian and Early Modern Poetry—(Same as English 254C.)
5 units, Spr (Morgan)

254D. Major Romantic Poets—(Same as English 254D.)
5 units, Aut (Morgan)

255. Modern Drama (1880–1918)—(Same as Drama 255.)
4 units, Spr (Lyons)

255A. 20th Century British Poetry—(Same as English 255A.)
5 units, Aut (von Hallberg)

256. American Drama from 1920—(Same as Drama 257.)
4 units, Aut (Cole)
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<tr>
<td>265</td>
<td>The Concept of Society</td>
<td>5</td>
<td>Win</td>
<td>Drekmeier</td>
</tr>
<tr>
<td>269B</td>
<td>Toward an Understanding of Romanticism</td>
<td>5</td>
<td>Spr</td>
<td>Foster</td>
</tr>
<tr>
<td>271</td>
<td>The Symbolist Poets</td>
<td>4-5</td>
<td>Cohn</td>
<td>given 1979–80</td>
</tr>
<tr>
<td>272</td>
<td>Osip Mandelstam</td>
<td>4</td>
<td>Spr by arrangement</td>
<td></td>
</tr>
<tr>
<td>274</td>
<td>Solzhenitsyn</td>
<td>4</td>
<td>Spr</td>
<td>given 1979–80</td>
</tr>
<tr>
<td>277A/B</td>
<td>Seminar: Modern Architecture</td>
<td>4</td>
<td>Win</td>
<td>Turner</td>
</tr>
<tr>
<td>280</td>
<td>Broadcasting and Film Criticism</td>
<td>4</td>
<td>Spr</td>
<td>Staff</td>
</tr>
<tr>
<td>281A/B</td>
<td>Introduction to Chicano Literature</td>
<td>3-5</td>
<td>Aut</td>
<td>Ybarra-Frausto</td>
</tr>
<tr>
<td>281A</td>
<td>Dickens and Trollope</td>
<td>5</td>
<td>Win</td>
<td>Polhemus</td>
</tr>
<tr>
<td>281D</td>
<td>The Brontes and Elizabeth Gaskell</td>
<td>5</td>
<td>Aut</td>
<td>B. Gelpi</td>
</tr>
<tr>
<td>285B</td>
<td>Twain and James</td>
<td>5</td>
<td>Aut</td>
<td>Moser</td>
</tr>
<tr>
<td>288A</td>
<td>Joyce</td>
<td>5</td>
<td>Win</td>
<td>Chace</td>
</tr>
<tr>
<td>288B</td>
<td>Virginia Woolf</td>
<td>5</td>
<td>Spr</td>
<td>Ruotolo</td>
</tr>
<tr>
<td>288E</td>
<td>Yeats and T. S. Eliot</td>
<td>5</td>
<td>Win</td>
<td>Lindenberger</td>
</tr>
<tr>
<td>288F</td>
<td>Conrad</td>
<td>5</td>
<td>Aut</td>
<td>Watt</td>
</tr>
<tr>
<td>292</td>
<td>Ideology and Mass Culture</td>
<td>3-5</td>
<td>Spr</td>
<td>Franco</td>
</tr>
<tr>
<td>296A</td>
<td>Preconditions of Literature</td>
<td>3</td>
<td>Spr</td>
<td>Cavallari</td>
</tr>
<tr>
<td>297</td>
<td>Semiotics and the Theory of Textuality</td>
<td>5</td>
<td>Ball</td>
<td>given 1979–80</td>
</tr>
<tr>
<td>300</td>
<td>Graduate Seminar: Russian Literature as an Institution</td>
<td>4</td>
<td>Win</td>
<td>Todd</td>
</tr>
<tr>
<td>307</td>
<td>Marxism and Aesthetics</td>
<td>3-5</td>
<td>Win</td>
<td>Cavallari</td>
</tr>
<tr>
<td>315B</td>
<td>Seminar: 18th Century Satire</td>
<td>5</td>
<td>Spr</td>
<td>Hodgart</td>
</tr>
<tr>
<td>315F</td>
<td>Seminar: Enlightenment and its Literary Traditions</td>
<td>5</td>
<td>Aut</td>
<td>Watt</td>
</tr>
<tr>
<td>316C</td>
<td>Seminar: Romantic Irony</td>
<td>5</td>
<td>Spr</td>
<td>Mellor</td>
</tr>
<tr>
<td>329B</td>
<td>Graduate Seminar: Art, Politics and Society</td>
<td>5</td>
<td>Aut</td>
<td>Paret</td>
</tr>
<tr>
<td>335</td>
<td>Graduate Colloquium: Studies in the Enlightenment</td>
<td>5</td>
<td>Spr</td>
<td>Lougee</td>
</tr>
<tr>
<td>337</td>
<td>Graduate Colloquium: European Intellectual History Since the Enlightenment</td>
<td>5</td>
<td>Aut</td>
<td>Robinson</td>
</tr>
<tr>
<td>342</td>
<td>Advanced Studies in Comparative Modes of Thought</td>
<td>5</td>
<td>Aut</td>
<td>Robinson</td>
</tr>
</tbody>
</table>

*Given alternate years*
Religion—(Same as Anthropology 253.) Readings in classical social theory (Weber, Durkheim, Freud) on the nature of religion with special emphasis on their importance for a theory of culture. Theory will be complemented by ethnography and contemporary works which continue and further interpretation of such phenomena as religious sects, worship, rites of passage, magic, shamanism and dreaming. Pre-requisite: consent of the instructor.

5 units, Spr (M. Rosaldo) TTh 9:00-10:50

Graduate Seminar: Problems in Modern British History—(Same as History 444A.)

5 units, (Stansky) given 1979–80

Seminar: Textthermeneutik—(Same as German 349C and Comparative Literature 349C.)

3-5 units, Spr (Muller-Vollmer)

Germanic Poetry and its Poetics—(Same as German 371).

3-5 units, Aut (Weber)

Graduate Seminar: Twentieth Century U.S. History—(Same as History 455A,B.)

10 units, Win, Spr (Kennedy)

Seminar: Neoclassicism and Aesthetics: the Plotinian Construction—(Same as English 360C.)

5 units, Spr (Trimpf)

The Modern Tradition—(Same as English 361 and Comparative Literature 361.) Studies in masters of modern thought (such as Rousseau, Marx, Nietzsche, and Freud) from 1750 to the present.

5 units, Win (Watt)

Seminar: American Historical Romance—(Same as English 365B.)

5 units, Spr (Dekker)

Major Modern Critics—(Same as English 369 and Comparative Literature 369 and Drama 302.)

5 units, Aut (Lindenberger)

Moderne Lyrik—(Same as German 377.)

3-5 units, Aut (Mueller-Vollmer)

La doctrine de l’art pour l’art et la littérature sociale au 19ème siècle—(Same as French 379.)

4 units, (Giraud)

Seminar: Finnegan’s Wake—(Same as English 388C.)

5 units, Spr (Polhemus)

Seminar: The Bloomsbury Group—(Same as English 388E.)

5 units, Win (W. Stone)

Points de vue critiques au 20e siècle—De Valéry à la Nouvelle Critique: Valéry Bachelard; Ch. Mauron; Sartre et Lucien Goldmann; G. Poulet; J. P. Richard; J. Starobinski; Roland Barthes; G. Genette; T. Todorov—(Same as French 389.)

4 units, (Bertrand) given 1979–80

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

Research Courses—The student pursues a special subject of investigation under supervision of some member of the Committee or another faculty member. Thesis work not to be registered under this course.

Any quarter, by arrangement

Thesis.

Any quarter, by arrangement

RELATED COURSES
Students of Modern Thought and Literature are referred to the offerings of the following departments: Anthropology, Art, Asian Languages, Communication, Comparative Literature, Drama, English, French and Italian, German Studies, History, Humanities Special Programs, Linguistics, Philosophy, Political Science, Psychology, Religious Studies, Sociology, Slavic Languages and Literatures, and Spanish and Portuguese. Consent of the instructor is required for most courses offered in these departments.

MUSIC

Emeritus: William L. Crosten, Sandor Salgo, Harold C. Schmidt (Professors); Adolph Balber, Earle Blew (Lecturers)

Chairman: Albert Cohen


Associate Professor: William H. Ramsey

Adjunct Professors: Arthur B. Barnes (Director of Bands), Marie Gibson (Voice), Andor Toth (Director of Orchestras)

Assistant Professor: William P. Mahrt (on leave 1978-79)

Visiting Professor: Thomas Binkley
Lecturers: Robert G. Harvey (Theory), Nathan Schwartz,* Naomi Sparrow (Piano), David Abel,* Anne W.P. Crowden (Violin), Rolf Persinger (Viola), Bonnie Hampton*, Margaret Rowell (Violoncello), Larry Epstein (Contrabass), Jason C. Paras (Viola da Gamba), Frances Blaisdell (Flute), Alexandra W. Hawley (Flute), Raymond H. Duste (Oboe), David B. Breeden (Clarinet), Susan Willoughby (Bassoon), Joyce A. Johnson (Trumpet), Earl Saxton (French Horn), J. Elwood Williams (Trombone), Floyd O. Cooley (Tuba), Danny Montoro (Percussion), Marjorie Chauvel (Harp), Margaret Fabrizio (Harpischord and Early Piano), Herbert Myers (Early Winds)

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 advisor to include certain required work as outlined below plus electives which take into account the individual's particular talent and interest.

To ensure 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 100,101,102,103, and 104 (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 advisors 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
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>
</tr>
<tr>
<td>Individual Instruction and/or Ensemble</td>
<td>1-4</td>
<td>1-4</td>
<td>1-4</td>
</tr>
<tr>
<td>Choice of Foreign Language, Freshman Seminar, or University Distribution requirement</td>
<td>3-5</td>
<td>3-5</td>
<td>3-5</td>
</tr>
</tbody>
</table>

Second Year

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music 101, 102, 103</td>
<td>4</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Individual Instruction and/or Ensemble</td>
<td>1-4</td>
<td>1-4</td>
<td>1-4</td>
</tr>
<tr>
<td>University Distribution Requirement in Science or Social Science</td>
<td>3-5</td>
<td>3-5</td>
<td>3-5</td>
</tr>
<tr>
<td>Elective (or Music 23 in autumn if not taken previously)</td>
<td>3-5</td>
<td>(3)†</td>
<td>(3)†</td>
</tr>
</tbody>
</table>

Third Year

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Music 104</td>
<td>6</td>
<td>--</td>
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</tr>
</tbody>
</table>

TEACHING CREDENTIAL, SINGLE SUBJECT (SECONDARY)—INTERNSHIP PROGRAM IN MUSIC

Students in the Department may prepare themselves for work toward the Single Subject 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 practicum teaching 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, D. Vocal and instrumental classes (4 to 6 units)

* (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).
† Optional

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, and a department entrance test in theory. 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—All Fellows, whatever their sources of financial support, are required to do three quarters of supervised teaching at half-time and one quarter at quarter-time.

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.

MASTER OF ARTS IN TEACHING

The degree of Master of Arts in Teaching is offered jointly by the Music 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 courses are outlined in the School of Education section or may be obtained from the Credential Secretary, School of Education.

**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 purposed 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, in addition to 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 practice will make an extensive study of historical styles of performance, technique, and repertory, leading to four demonstrations of their ability to give performances of music from different historical periods. Each demonstration is to be supported by a written document covering questions of analysis and performance practice.

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 advisor 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 comprehensive 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.
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 comprehensive 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.

COURSES

FOR THE GENERAL STUDENT
All courses (DR:H) unless noted otherwise.

1. Introduction to Music—Musical expression, style, structure explained, illustrated for the listener.
   3 units, Aut (Kuhn)

2A. The Symphony
   3 units, Spr (Kuhn)

2B. The Concerto
   3 units, Spr (Barnes)

2C. Opera
   3 units (Kuhn)

3E. Music in the Baroque Era
   3 units (Horsley)

4A. The Music of J.S. Bach
   3 units, Win (Nanney)

4C. The Music of Beethoven
   3 units (Ratner)

5A. Music in America
   3 units (Cohen) given 1979–80

19. Fundamentals of Music Theory—A course for the non-music major. Topics and skills to be presented will be reading music, ear training, exploration into the elements of sound, time, and timbre in various musical styles, their organization and notation. No prerequisites or previous musical training required.
   3 units, Aut (Kirk)

FOUNDATION COURSES FOR A.B. MAJOR
All courses (DR:H) unless noted otherwise.

20. Introduction to Music Theory—A preparatory course in basic sight reading, ear training, keyboard harmony, and melodic, rhythmic, and harmonic dictation. This is a skills course using the piano and voice as basic tools to develop listening and reading skills. Enrollment is limited to music majors who are unable to pass the proficiency test for entry to 21. (DR:X)
   4 units, Aut, Win (Barnes)

21, 22. Elements of Music—Exploration of the elements of sound and time and their 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. Prerequisite: ability to pass proficiency examination given on the first day of class.
   21. 4 units, Aut (Harvey, Wieneke, Barnes)
       Win (Harvey, Wieneke, Barnes)
   22. 4 units, Win (Harvey, Wieneke, Barnes)
       Spr (Harvey, Wieneke, Barnes)

23. Functional Harmony—Prerequisite: 21, 22, pass the minimum proficiency test in piano, or two quarters prior and concurrent enrollment in Music 12 or consent of the instructor.
   4 units, Aut (Nanney)
   Spr (Harvey)

27. Solfege and Ear Training—Prerequisite: 21, 22, 23. (DR:X)
   3 units, Win (Harvey)

100. Music History: Medieval and Renaissance—Prerequisites: 21, 22.
   4 units, Spr (Horsley)

101. Music History: Baroque—Prerequisites: 21, 22, 100.
   4 units, Aut (Cohen)

102. Music History and Theory: Classic—Prerequisite: 23.
   6 units, Win (Ratner)

103. Music History and Theory: Romantic—Prerequisite: 102.
   6 units, Spr (Ratner)

104. Music History and Theory: Modern—Prerequisite: 103.
   6 units, Aut (Smith)
MUSIC THEORY AND COMPOSITION

All courses (DR:X)

123. Composition—Individual projects in creative work. May be repeated for credit. Prerequisite: consent of instructor.
   3 units, Aut, Win, Spr (Smith)

125. Modal Counterpoint
   3 units, Win (Horsley)

126. Tonal Counterpoint—Prerequisite: 103.
   3 units, Aut (Ratner)

127. Orchestration—Prerequisite: 23.
   3 units, Aut (Barnes)

220. Computer-Generated Music

220A. Fundamentals of Computer-Generated Sound—Introduction to computer sound generation, basic mathematics of signal processing, and computer programming. Prerequisite: experience in musical composition or consent of instructor.
   4 units, Aut (Chowning, Smith)

220B. Compositional Algorithms, Psychoacoustics, and Spatial Processing—Use of high-level programming language as a compositional aid in creating complex musical structures. Studies in the physical correlates to auditory perception, theories of hearing, and review of psychoacoustic literature. Simulation of a reverberant space and the control of the position of sound within the space. Prerequisite: 220A.
   4 units, Win (Chowning, Smith)

220C. Research—Research projects in composition, psychoacoustics, or signal processing. Prerequisite: 220B.
   4 units, Aut, Win, Spr (Chowning, Smith)

223. Seminar in Composition—May be repeated for credit.
   4 units, Aut, Win, Spr (Smith)

224,225. Solfege and Score Reading
   224. 4 units, (Barnes) given 1979–80
   225. 4 units, (Barnes) given 1979–80

   228A. 4 units, (Horsley) given 1979–80
   228B. 4 units, (Horsley) given 1979–80

HISTORY AND LITERATURE OF MUSIC

All courses (DR:X)

Unless otherwise stated, prerequisite for any course in this section is 103.

140. Studies in Medieval and Renaissance Music—Prerequisite: 100.
   140A. The Italian Madrigal
   4 units, (Horsley)

141. Studies in Baroque Music
   141B. The Music of J. S. Bach
   4 units, Win (Houle)

   142A. String Quartets of Beethoven
   4 units, Aut (Ratner)
   142F. The Operas of Mozart
   4 units, Spr (Ratner)

143. Studies in Romantic Music
   143B. The Music of Brahms
   4 units, (Mahrt)
   143D. The Music of Schubert
   4 units, Aut (Schwartz)
   143E. The Nineteenth-Century Symphony
   and Tone Poem
   4 units, Spr (Schwartz)

144. Studies in Modern Music—Prerequisite: 104.
   144A. Twelve-Tone and Serial Music
   4 units, Win (Smith)
   144B. Innovations in Contemporary Music
   4 units, (Smith) given 1979–80
   144C. The Music of Stravinsky
   4 units, Spr (Harvey)

150A. History of Musical Instruments
   4 units, (Houle)

150B. History of Fugue
   4 units, (Horsley)

150C. History of Musical Esthetics
   4 units, Spr (Houle)

151. Studies in Opera
   151A. Survey of Opera—History, reading, listening, and exercises in performance of standard operatic repertory. Prerequisite: Music 22.
   3 units, (Gibson) given 1979–80

153. Organ Literature
   153A. Organ Music (Cabezón to Bach).
   4 units, Spr (Nanney)
   153B. Organ Music (Bach to Ligeti)
   4 units, (Nanney) given 1979–80

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.
251. Choral Repertory (1500–1750)
4 units, (Ramsey) given 1979–80
252. Choral Repertory (1750 to Present)
4 units, (Ramsey) given 1979–80

PERFORMANCE

All courses (DR:X)
18. Introductory Piano—Class for music majors only.
1 unit, Aut, Win, Spr (Sparrow)
65A. Stringed Instruments Class—For Credential candidates.
1 unit, Aut, Win (Kuhn)
65B. Wind Instruments Class—For Credential candidates.
1 unit, Aut, Win, Spr (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, Staff)
65D. Percussion Class—For Credential candidates.
1 unit, Spr (Montoro)
72, 73, 74, 75, 76, 77. Small Group Instruction—A special fee of $40 per quarter is charged for enrollment in any of these groups.
1 unit, Aut, Win, Spr (Staff)
72. Piano Class—For intermediate students.
(Sparrow)
73. Voice Class
(Gibson, Staff)
74A. Stringed Instruments Classes
(Crowden, Hampton)
74C. Classical Guitar Class
(Ferguson)
75A. Wind Instruments Classes
(Hawley and Staff)
75B. Renaissance Wind Instruments Class
(Myers)
76. Brass Instruments Classes
(Staff)
77. Percussion Class
(Montoro)
172, 173, 174, 175, 176, 177, 272, 273, 274, 275, 276, 277. Individual Vocal and Instrumental Instructions—A special fee of $75 per quarter for majors and $150 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
131. Choral Conducting

131A. 3 units, Win (Ramsey)
131B. 3 units, Spr (Ramsey)

4 units, Aut (Houle)

180. Foreign Language Diction for Singers

180A. Italian
1 unit, Aut (Gibson)

180B. German
1 unit, Win (Gibson)

180C. French
1 unit, Spr (Gibson)

188. String Pedagogy—An introduction to teaching string instruments according to the principles and techniques of the Suzuki Talent Education Program. Prerequisite: moderate ability to play the violin or 'cello.
3 units, Win (Kuhn)

230. Advanced Orchestral Conducting
4 units, Spr (Toth)

231. Advanced Choral Conducting
4 units, Aut (Ramsey)

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, Win (Binkley)

269B. Renaissance
4 units, Aut (Houle)

269C. Baroque
4 units, Spr (Houle)

269D. Classic
4 units (Ratner) given 1979-80

1-4 units, Aut (Toth)
Win (Gibson)

ENSEMBLE

All courses (DR:X)

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.

156. Early Music Singers
1 unit, Aut, Win, Spr (Houle)

157. Percussion Ensemble
1 unit, Aut, Win, Spr (Montoro)

158. Contemporary Performance Ensemble
1 unit, Aut, Win, Spr (Harvey) T 4:14-6:05

159. Renaissance Wind Band
1 unit, Aut, Win, Spr (Houle, Myers) M 2:15-5:05

160. University Orchestra
1 unit, Aut, Win, Spr (Toth)
MTh 7:15 p.m.

161. University Bands

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 (Ramsey) M 7:30-9:30 p.m. and 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 (Ramsey) T 4:15-5:30 and Th 7:00-8:30 p.m. and Sunday 10-12

165. Stanford Chorale—Small vocal ensemble specializing in performance music of all periods for the chamber chorus.
1 units, Aut, Win, Spr (Ramsey) MWTh 12

166. Chamber Orchestra—Open to advanced players who have had orchestral experience.
1 unit, Aut, Win, Spr (Toth) TThF 12

167. Glee Club
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

170. Piano Accompanying
2 units (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

All courses (DR:X)

265A,B,C,D. Curriculum and Instruction in Secondary School Music—(Same as Education 265A,B,C.)

265A. 3 units, Sum (Staff) MTWTh 3:15
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

280. Seminar in Music Education
4 units, Aut (Kuhn)

281. Administration and Supervision of Public School Music
4 units, Spr (Kuhn)

GRADUATE RESEARCH AND SPECIAL STUDIES

All courses (DR:X)

200. Music Bibliography—Use of bibliographical materials in graduate study; introduction to methods of research.
4 units, Aut, Sum (Staff)

201. Graduate Review in Musical Analysis
4 units, Aut (Harvey)

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 (Horsley)

301. Seminar in Music History and Analysis
4 units, Aut, Win, Spr (Horsley, Ratner, Smith)

302. Research in Musicology
Aut, Win, Spr (Cohen, Horsley, Ratner)
by arrangement

303. Research in Music Education
Any quarter, (Kuhn) by arrangement

321. Readings in Music Theory
3 units, any quarter (Cohen, Horsley, Ratner)

323. D.M.A. Term Projects in Composition
4 units, Aut, Win, Spr (Smith)

330. D.M.A. Term Projects in Conducting
4 units, Aut, Win, Spr (Ramsey, Toth)

341. Ph.D. Dissertation
Any quarter (Staff) by arrangement

369. D.M.A. Term Projects in Performance

369A. Early Music to 1800
4 units, Aut, Win, Spr (Staff)

369B. Music From 1800 to the Present
4 units, Aut, Win, Spr (Staff)

380. D.M.A. Term Projects in Music Education
4 units, any quarter (Kuhn)

399. D.M.A. Final Project
Any quarter, (Staff) by arrangement

PHILOSOPHY

Emeriti: John D. Goheen, John L. Mothershead, Jr., Philip H. Rhinelander, Jeffery Smith (Professors)

Chairman: John R. Perry

Director of Graduate Study: Ian Hacking

Director of Undergraduate Study: Michael Bratman

Professors: Solomon Feferman, Dagfinn Føllesdal (on leave), Ian Hacking, K. Jaakko Hintikka (Summer), Georg Kreisel (Winter, Spring), Julius Moravcsik, David Nivison (Winter, Spring), John Perry, Patrick Suppes (Autumn, Winter), James Urmson

Associate Professors: Nancy Cartwright (Autumn, Spring), Thomas Wasow (Winter, Spring)

Assistant Professors: Michael Bratman, Leonard Monk (Autumn), Steven Strasnick (Autumn), John Taurek

OFFERINGS AND FACILITIES

Philosophy concerns itself with fundamental problems. Some of these are rather abstract and deal with such issues as the nature of truth, justice, value and knowledge; others are more concrete and their study may help guide our conduct or enhance our understanding of other subjects. In addition, philosophy examines the efforts of past thinkers to understand the world and our experience of it.

Although it may appear to be an assortment of different disciplines, there are features common
to all philosophical enquiry. These include an
emphasis on methods of reasoning and the way
in which our judgements are formed, on
criticizing and organizing our beliefs, and on the
nature and role of fundamental concepts.

Students of almost any discipline can find
something in philosophy which is relevant to
their own speciality. For those interested in the
sciences, philosophy provides a framework
within which the foundations and scope of a
scientific theory can be studied and it may even
suggest directions for future development.

Since philosophical ideas have had an important
influence on human endeavors of all kinds—
arithmetic, political, even economic, students of
the humanities will find their understanding
deepened by some acquaintance with
philosophy. Furthermore, those who plan to
enter one of the professions may find some
background in philosophy helpful when they are
called upon to make decisions about their own
conduct and the welfare of others.

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 under-
graduate majors in philosophy have associations
for discussion of philosophical issues and read-
ing of papers by students, faculty, and visitors.
These associations nominate the Directors of
Graduate and Undergraduate Study and elect
student representatives to Department meet-
ings.

PROGRAMS OF STUDY

BACHELOR OF ARTS

To declare a major, students should consult
with the Director of Undergraduate Studies.
The student will be assigned an advisor, with
whom he or she should work out a coherent plan
for the major. Such a plan will include a
minimum of 52 units in the Department of
Philosophy, and eight units in disciplines re-
lated to the student's philosophical interests.

The philosophy courses must include the fol-
lowing:

1. At least one core course (which may not be
taken pass/no credit) from each of these four areas:
   a) Logic, philosophy of science; 6, 57, 159,
      160A,B, 163, 164, 166.
   b) Ethics, aesthetics, social and political
      philosophy, value theory; 2, 3, 170-174.
   c) Epistemology, metaphysics, philosophy of
      language, 80, 181-186.
   d) History of philosophy; 100-105.

   Normally these are to be lecture courses
   of at least 4 units each. (Not all courses are
   offered every year.)

2. At least six courses in which the student re-
   ceives a grade of B or better. Units of Di-
   rected Reading (Philosophy 197) may not be
counted in the 52 unit requirement. No
   more than 10 units completed with grades of
   Pass may be counted in the 52 unit require-
ment.

3. Transfer units must be approved by the Di-
   rector of Undergraduate Studies at the time
   of declaring a major. In general, transfer
courses cannot be used to satisfy the four area
requirements.

HONORS PROGRAM IN PHILOSOPHY

Students who wish to undertake a more in-
tensive and extensive program of study, in-
cluding seminars and independent work, are
invited to apply for the Honors Program during
the winter quarter of their junior year. Admis-
sion will be selective on the basis of grade point
average, demonstrated ability in philosophy,
and progress towards satisfying the require-
ments of the major.

Students applying for the Honors Program
should submit an intended plan of study for the
remainder of their junior and senior year. This
should include a seminar in the Spring Quarter
of their Junior year, selected from the list of
seminars suitable for Honors students. These
seminars will introduce the student to advanced
work in philosophy and will require five units of
work. For the senior year it should include
either (i) an autumn quarter seminar from the
list and five units of senior tutorial in the winter;
(ii) five units of senior tutorial for each of the
autumn and winter quarters. In the quarter pre-
ceding their senior tutorial, students should
submit an essay proposal to the honors commit-
tee. A tutor is assigned on the basis of this prop-
osal.

In the senior tutorial, students will write an
essay on some philosophical problem. This
essay will be usually about 7500 words for those
taking one quarter of senior tutorial, and about
12,500 for those taking two quarters of senior
tutorial. Of course, length may vary considera-
bly depending on problem and approach. The
essay written in the senior tutorial may use work
in previous seminars and courses as a starting
point.

A completed draft of the senior essay is due to
the advisor at the end of the winter quarter. If
rewriting is necessary, the student may enroll in
two units of senior tutorial for the spring quar-
ter. Two copies of the essay must be turned in to
the honors committee by the end of the fourth
full week of the spring quarter.

The honors committee will review the appli-
cations for honors, establish a list of suitable
seminars for the spring and autumn quarters,
assign tutors and second readers, and make the final determination whether students receive honors.

The Honors Seminars may be counted toward the 52 units required for the major. The Honors Tutorials represent units in addition to the 52 unit requirement.

**COMBINED MAJOR IN CLASSICS AND PHILOSOPHY**

The Departments of Classics and Philosophy offer the following joint major programs:

a) Philosophy and Greek or Latin. 26-30 units of Philosophy; 26-30 units in either Greek or Latin, all at the 100 level or above, and at least two courses acceptable to the Classics Department in ancient history, literature or culture (other than ancient philosophy.)

b) Classics and Philosophy. 26-30 units of Philosophy: at least 4 courses in Greek and 4 in Latin, all at the 100 level or above, and at least two courses acceptable to the Classics Department in ancient history, literature or culture (other than ancient philosophy.)

The Philosophy Department expects that joint majors should have fulfilled three of the four distribution areas specified for philosophy majors in the catalog. Students aspiring to such a joint major should consult early with the appropriate advisors in each department.

**COMBINED MAJOR IN PHILOSOPHY AND RELIGIOUS STUDIES**

The departments of Philosophy and Religious Studies jointly nominate for the A.B. students who have completed a major in the two disciplines according to guidelines available from the undergraduate director of either department.

**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 advisor 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.

**MASTER OF ARTS**

There are two sorts of program leading to the degree of Master of Arts in philosophy. One is a general program providing a grounding in all branches of the subject. The other provides a special training in one branch. A suitably qualified applicant may arrange a specialized program in any subject, analogous to those in the philosophy of science or philosophy of language described below, provided that the department offers sufficiently intensive teaching in the special subject.

**Unit Requirements**

For qualified students the Master of Arts will normally be a one year program, but a longer period may be required of students with inadequate preparation. Likewise, every student must take thirty-six units of philosophy at Stanford, but more may be required in exceptional cases. Students in a special program may be allowed or required to replace up to nine units of philosophy by nine units in the field of specialization. Up to six units of directed reading in philosophy may be allowed. There is no dissertation requirement. A special program may require knowledge of a foreign language.

**Oral Examination**

Students in both the general and special programs are required to take an oral examination in the quarter during which the candidate expects to receive the degree. In the event of failure more courses may be required, and then the examination may be attempted one more time only.

**General Program**

A student must take or have taken the equivalent of two core courses in each of the following five fields. These should be discussed with the director of graduate studies. The student must also take at least three approved advanced courses or seminars in one of (a)-(e) and two advanced courses or seminars in two more of (a)-(e).

a) Logic and formal theories of language
b) Epistemology and the philosophy of science
c) Metaphysics, philosophy of mind and the philosophy of language
d) Ethics, value theory and political philosophy
e) History of Philosophy
Special Program in the Philosophy of Science

Only students with substantial preparation in philosophy or at least one of the sciences will be admitted.

a) Philosophy of science: at least four of 6, 58, 163, 164, 165, 166, 242A, B, C, 265.
b) The Philosophy of Science seminar: 210
c) At least one approved course in the history of science, or in the natural or social sciences.
d) Two courses in logic, numbered 159 or higher.

Special Program in the Philosophy of Language

Only students with substantial preparation in philosophy or linguistics will be admitted.

A student must meet the unit requirements above, and take the following courses:

a) Philosophy of language: 181 and at least one of 183, 203, 206.
b) Syntactic Theory and Generative Grammar: 230 and Linguistics 231.
c) Logic: at least two approved courses numbered 159 or higher.
d) A seminar in metaphysics or epistemology.
e) Philosophy 202, 242C, or an approved course in Automata Theory.

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 of the proficiency requirements that Ph.D. candidates are expected to satisfy. 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 advisor. At least one course must be taken in four of the areas of proficiency. All programs must be approved by the Department Committee on Graduate Study. A faculty member from the Philosophy Department (usually the student’s advisor) 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:

Proficiency Requirements

1. A student must demonstrate proficiencies in each of the following fields:
   a) Logic and formal theories of language
   b) Epistemology and the philosophy of science
   c) Metaphysics, philosophy of mind and the philosophy of language
   d) Ethics, value theory and political philosophy
   e) History of philosophy

2. There is a director of studies for each of these five fields who publishes guidelines at the beginning of each year. Courses and seminars will customarily play a major role in demonstrating proficiency within these guidelines which may be obtained from the departmental office. The director of studies determines when a student has satisfied a proficiency requirement.

3. To continue in the doctoral program, a student shall normally:
   a) satisfy one proficiency requirement at the end of the first year and successfully attend the first year graduate seminar, Philosophy 241.
   b) satisfy at least four proficiency requirements by the end of the second year.
   c) satisfy all five requirements by the end of the winter quarter of the third year.
   d) meet with a committee of the department by the end of the winter quarter of the third year, in order to outline proposed dissertation research and to form a dissertation committee.

4. At the end of the first year, the department reviews the progress of each first year student, to determine whether the student may continue in the program.

Language Requirements—There is no departmental language requirement, but a dissertation committee may demand that a student demonstrate competence in languages needed for research.

Oral Examination—The University oral examination is taken after completion of an acceptable first draft of the dissertation, and is primarily a dissertation defense. 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.

The dissertation must be submitted to the committee in substantially final form at least four weeks before the University deadline in the quarter in which the candidate receives the degree.
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 proficiency requirements. 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), 164 (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 advisor). 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 program 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 advisor.

Proficiency Requirements

1. All first-year students must pass the proficiency requirements in logic and formal theories of language set by the director of studies for this area.
2. All second-year students must pass a special written examination given during Spring Quarter.
   1) logic
   2) philosophy of science
   3) philosophy of language
   Questions from all 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. Students who wish to apply for fellowship support are required to submit a GAPSFAS application.

The Department of Philosophy no longer offers separate teaching assistantships as part of its support program. Each graduate student is considered a member of the Philosophy Fellows Program. All Fellows, whatever their sources of financial support are required to do 6 quarters of teaching assistance at quarter time. 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.

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. Although courses 1, 2, 3 and 4, 5, 6 are designed to constitute coherent sequences, each course is self contained.

1. God, Self, and World—Students are introduced to basic philosophical concepts and methods of analysis by studying three problems which have been of perennial concern to philosophers: the existence of the external world, the existence of God, and the nature of personal identity. (DR:H) 4 units, Aut (Perry) MWF 11
2. Value and Obligation: Introduction to Moral Philosophy—An introduction to some of the major problems of moral philosophy including an examination of the works of classical and contemporary moral philosophers, and an examination of some specific moral problems. The
course will cover topics such as: euthanasia and the right to life; utilitarianism and its alternatives; intrinsic value and the good life; rights and justice; egoism and the ethics of character; the role of reason in ethics. (DR:H)
4 units, Win (Bratman) MWF 11:00

3. Introduction to Political Philosophy—A development and comparison of several philosophical views on the nature of the state. The legitimacy of its authority and the extent of its functions. In addition to some historical texts (Hobbes, Locke, and Bentham), the principal texts will be: Rawls, A Theory of Justice and Nozick, Anarchy, State and Utopia. (DR:A)
4 units, Spr (Taurek) MWF 11:00

4. The Birth of Western Philosophy—This course traces the origin of philosophizing in antiquity, and relates classical problems to current issues of human concern. Readings will include: selections from Greek literature and prose, Greek philosophic writings, and selections from the Christian tradition. Recommended for freshmen. (DR:H)
4 units, Aut (Moravcsik) MWF 9
plus section Tuesday or Thursday

5. Introduction to Philosophy—This is a general introduction which will proceed by examining some central problems in ethics, metaphysics, theory of knowledge and philosophy of religion. The problems will be introduced through the contributions of some of the great philosophers, but it will be emphasized that philosophy is an activity in which the student must participate and of which he cannot usefully be a mere spectator. (DR:H)
4 units, Win (Urmson) MWF 9

6. The Growth of Scientific Knowledge—An introductory course in the philosophy of science, emphasizing questions about the nature of scientific knowledge, theory change and research programs. Work by T.S. Kuhn, I. Lakatos, and P. Feyerabend will provide the focus of study. (DR:B)
4 units, Spr (Hacking) MWF 9

8. Introduction to Philosophy through Problems in Mathematics. (DR:T)
4 units, Spr (Kreisel) TTh 2:15-3:30

9. Philosophy and Subjectivity: The Search for Truth—This course will serve as an introduction to philosophic methods and questions which are outside the orthodox analytical tradition in philosophy. It will focus on the subjectivist challenge to the legitimacy of traditional philosophical analysis. The notions of truth, objectivity, and rationality will be probed, in conjunction with the metaphysical conceptions of reality upon which they rest. The method of historical analysis will be developed, and it will be used to examine the nature of the individual, the status of morality and values, and the problem of scientific change. The readings will be primarily from Nietzsche, but they will be supplemented by readings from philosophers ranging from Descartes and Kant to Thomas Kuhn and Carlos Castaneda and Chuang Tzu. (DR:X)
4 units (Strasnick) given 1979–80

45. Philosophy of Religion—Contemporary and Traditional Issues—(Enroll in Religious Studies 42.)
3 units, Spr (Harvey) MWF 9

46. Philosophical Chinese—Introduction to Classical Chinese and to Chinese philosophical concepts, through study of short philosophical texts; for students who have had no previous work in a Far Eastern language. This course is intended for students who are not yet sure they wish to invest the time needed to learn to read and speak Chinese well, but who would like to learn something of the language of early Chinese philosophy, sufficient to enable them to read translations of Chinese philosophers, and books and articles in English about them, with some critical awareness of underlying language problems when a language radically unlike English is the medium of philosophical thinking. Significant Chinese texts will be examined and explicated as they are encountered, as quotations in articles or as problematic passages in translated works. Philosophers treated will include Confucius, Mencius, and Lao Tzu. This course is self-contained and does not assume that the student will do further work in the subject; a student taking the course may, however, continue study of classical Chinese by enrolling in 47 in the spring quarter and 111A the next year. (Same as Asian Languages 46.) (DR:H)
4 units, Win (Nivison) MWF 11

47. Philosophical Chinese—Continuation of 46. Reading in Mencius and Han Fei Tzu. (Same as Asian Languages 47.) (DR:H)
4 units, Spr (Nivison) MWF 11

56. Critical Thinking—Students learn to interpret difficult material, analyze and criticize arguments, and develop intellectual skills needed for academic work.
4 units, Win (Staff)

57. Introduction to Logic—Axioms and rules of inference for sentential and first-order predicate logic. Elementary applications to a wide variety of domains. Individual choice of topics for a grade beyond pass. This is a computer based course; there are no lectures. Each student progresses through the course at his own pace. The first class meeting is an organizational
meeting only, held at 1:15 on the first class day of the quarter. (DR:T)

3-5 units, Aut, Win (Suppes)  
Spr (Staff)

58. Foundations of Probability—Introduction to elementary axioms of quantitative probability. Consideration of main approaches to the foundations of probability; qualitative and subjective theory, relative frequency theory, and logical theory. Elementary introduction to random variables, relevant basic theorems, and common fallacies of informal reasoning. This is a computer-based course; there are no lectures. Each student progresses through the course at his own pace. The first meeting is organizational only, held at 3:15 on the first class day of the quarter. (DR:T)

3-5 units, Aut, Win (Suppes)  
Spr (Staff)

77. Ethics, Morality, and International Relations—A development and application of the ethical principles governing the interaction of nation-states. The first part of the course will consider how some common issues in international relations may be subjected to ethical analysis. Different theories of ethics will be used to analyze a series of representative foreign policy issues. We will then examine the moral status of nuclear deterrence theory as originally formulated in the work of Schelling and Kahn. Basic principles of game theory and strategy of conflict will be presented and evaluated. The course will end with a consideration of the issue of justice on an international level and its relationship to Hardin's lifeboat ethics model. (DR:A)

5 units, Aut (Strasnick) TTh 2:15-4:05

78. Ethical Problems in Medicine—A discussion of various moral questions that arise naturally when reflecting on the roles and practices of those professionally skilled in the administration of medical or health care in our society. (Same as Human Biology 173.) (DR:A)

4 units, Win (Taurek) MWF 10

79. Philosophy of Law—The course will deal with three general topics: (1) the nature and function of legal systems, (2) the relation of legal norms to other types of norms, including moral norms, (3) judicial decisions and legal reasoning. The general topics will be approached historically and will also be examined with special reference to modern problems and cases in the areas of punishment and responsibility, legal regulation of private conduct and free expression, and civil disobedience. No prerequisites, but some background in philosophy, political science, social science or the history of ideas is recommended. (DR:S)

4 units, Spr (Rhinelander) MWF 10

80. Mind, Matter and Meaning—This is an intensive and rigorous survey of some of the central and perennial topics in philosophy. The course will cover topics such as: skepticism and the possibility of knowledge; perception and "the given"; the distinction between analytic and synthetic truths; meaning, verification, sense and reference; induction, causality and explanation; the relation between mental and physical phenomena; and our knowledge of other minds. In this course we will carefully examine both classical and contemporary philosophical discussions on these topics. This course aims at an understanding of why these issues arise and how they are related. It also aims at providing students with the analytic tools necessary to begin to come to grips with such problems. This course will provide the general background needed for more advanced work in metaphysics, epistemology and philosophy of mind (e.g., Philosophy 180-186). Prerequisite: 1 course in Philosophy or junior standing. (DR:H)

4 units, Aut (Bratman) MWF 11:00

99A, B, C. Undergraduate Colloquium—Group tutorial for undergraduates on topics chosen by student groups. Prerequisite: 2 courses in Philosophy. (DR:X)

3 units, Aut, Win, Spr (Staff)

HISTORY OF PHILOSOPHY

Courses 100-103 constitute a four quarter sequence which covers the most important figures and movements in Western Philosophy. Other courses cover particular periods, movements, and figures in the history of Eastern and Western Philosophy.

Courses 100-102 constitute a coherent sequence which would be an excellent sophomore program for a potential philosophy major.

Students who enroll in courses 100 through 152 should have taken one of the courses 1-6.

100. Greek Philosophy—An examination of the main contributions of Plato and Aristotle to ethics, metaphysics and philosophy of science will be central, but attention will be given to the background (pre-Socratics) and later developments (Stoics and Skeptics). (DR:H)

4 units, Aut (Urmson) MWF 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, Anselm, Abelard, Aquinas, Scotus, and Occam. Prerequisite: one course in philosophy or permission of instructor. (DR:H)

4 units, Win (Staff) MWF 10
102. Modern Philosophy (Seventeenth and Eighteenth Centuries)—Philosophic systems of Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and the philosophy of the Enlightenment. Philosophy of Immanuel Kant. (DR:H)  
4 units, Spr (Hacking) MWF 10

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. Prerequisite: two philosophy courses. Recommended: 102. (DR:H)  
4-5 units, Spr (Mothershead) MTWTh 10 plus Friday Section

104. Contemporary Philosophy—Some principal developments in recent philosophy are studied in the light of new insights by reference to selected central figures. These include Frege, Russell, G. E. Moore, Wittgenstein, Carnap, Husserl, Sartre, and Cassirer. Prerequisite: two philosophy courses. Recommended: 102. (DR:H)  
4 units, (Staff) given 1979-80

105. American Philosophy, Its Sources, Its Influences—An analysis of the interchange of philosophical ideas between America and Europe. The main emphasis is on the Pragmatist tradition of Peirce, James and Dewey; together with their Hegelian antecedents and Positivist heirs. There is a discussion of the arrival of the Vienna Circle and the Frankfurt School in America, Marxist criticism of pragmatism, and the reception of American analytic philosophy in Eastern Europe. (Majors in International Relations should arrange to take this course for 5 units.) (DR:H)  
4-5 units, Win (Hacking) TTh 2:15-4:00

123. The Philosophy of Wang Yang-ming (1472-1529)—(Same as Asian Languages 143.) (DR:H)  
4 units, Spr (Nivison) MWF 1:15

136. Philosophy of Plato. (DR:H)  
4 units, Win (Moravcsik) MWF 2:15

137. Philosophy of Aristotle—Examination of some salient doctrines of Aristotle. (DR:X)  
4 units (Moravcsik) given 1979-80

152. Heidegger and Sartre—A study of works by Heidegger and Sartre in English translation, including Being and Time, Being and Nothingness, and some of Sartre’s novels and plays. (DR:X)  
4 units (Staff) given 1979-80

See also Classics 164, 165, 166.

LOGIC AND PHILOSOPHY OF SCIENCE

159. Introduction to Formal Semantics and Completeness—Formal languages and their interpretations as an attempt to define validity for a narrow class of statements and inferences, the relationship of validity and provability, conflicting treatments of the logic of possibility, and mathematical induction. Oriented towards students having had Philosophy 57 or its equivalent, but without a strong mathematical background. (DR:T)  
4 units, Aut (Monk) MWF 11

160A, B. Symbolic Logic—Rigorous development of classical symbolic logic. Syntax and semantics of first order predicate calculus, Godel’s completeness theorem, the Skolem-Lowenheim theorem, and examples of theories will be covered in 160A. A precise definition of “effective procedure,” categoricity and quantifier elimination arguments for completeness and decidability, arithmetization of mathematics, undecidability of arithmetic, and Godel’s incompleteness theorem in 160B. Both courses (DR:T)  
160A. 4 units, Win (Staff) MWF 11  
160B. 4 units, Spr (Staff) MWF 11

161. Introduction to Set Theory—Zermelo-Fraenkel axioms are the basis of the course. 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. This is a computer-based course; there are no lectures. Each student progresses through the course at his own pace. The first meeting is organizational only, held at 2:15 on the first class day of the quarter. (DR:T)  
4 units, Aut, Win, (Suppes) Spr (Staff)

163. Probability and Induction—Philosophical theories about probability and their application to the problem of induction. (DR:T)  
4 units, Win (Hacking) TTh 11:00-12:15

164. Topics in Philosophy of Science—Detailed analysis of structure and methods of empirical science. Examples range from physics to psychology and sociology. Intended for undergraduate and graduate students and for philosophy majors interested in conceptual problems in the natural and behavioral sciences. (DR:B)  
4 units, Aut (Cartwright) MWF 9

165. Philosophy of the Natural Sciences—Topic for 1978-79: Philosophical problems of time and space: including time’s arrow; Zeno’s paradoxes; the causal theory of time; and rever-
sibility and the heat death of the universe. This year's course will be non-technical, aimed at students with a general interest in the metaphysics of time and space.

4 units, Aut (Cartwright) T 3:15-6:05, given alternate years

166. Philosophy of the Social Sciences
4 units, (Cartwright) given alternate years given 1979-80

167. Elementary Proof Theory—The principal topic of the course is Gödel's incompleteness theorem. It is proved in detail for the system of set theory studied in the computer-assisted course. One shorter proof uses special properties of that system, in particular, its so-called natural models (fully described at the beginning of the course). The other proof is general; it applies not only to systems of set theory, but to all systems which are “adequate” for coding mechanical processes. The consequences of this result for the mechanization of, equivalently, formalization of mathematics are explained. This is a computer-based course; there are no lectures. Each student progresses through the course at his own pace. The first class meeting is an organizational meeting only, held at 4:15 on the first class day of the quarter. (DR:X)

4 units, (Staff) Win, Spr (Kreisel)

169. Introduction to Philosophical Logic—A survey of those aspects of logic which are most important for philosophical applications and for understanding natural language. Topics to be dealt with include the semantical concept of truth, semantics for intensional logics, the logic of questions, the elements of Montague semantics, game-theoretical ideas in logic, theory of definition, and different non-classical interpretations of logic. Prerequisite: Philosophy 57 or preferably Philosophy 159. (DR:X)

4 units, (Hintikka) given 1979-80

ETHICS, AESTHETICS AND SOCIAL AND POLITICAL PHILOSOPHY

170. Ethical Theories—A systematic treatment of basic issues in moral philosophy. Topics covered will include: the role of observation in ethics; moral nihilism, naturalism, intuitionism and non-cognitivism; moral relativism; egoism and altruism; act, rules, and general utilitarianism. Readings will be drawn almost exclusively from the works of twentieth century philosophers. There is a voluntary graduate discussion section (Philosophy 270) in which issues raised in the lectures will be pursued in greater depth. (DR:A)

4 units, Aut (Taurek) TTh 11-12:30

171. Political Argument: Libertarianism and Others—This course will develop and examine different frameworks for political justification. In particular, we will consider the nature of the relationship between moral and political argument. The first part of the course will consider some forms of argument developed by libertarian writers such as Rand, Branden, and Mack in defense of individual rights. Finally we will consider the anarchist challenge to the legitimacy of the state formulated by R. P. Wolff and Nozick's attempt to meet such a challenge in his Anarchy, State and Utopia. (DR:S)

4 units, (Strasnick) given 1979-80

172. Social Choice Theory—An exploration of fundamental issues in distributive and economic justice, using logical axiomatic techniques. The course will begin with Arrow's treatment of the social welfare function and his impossibility theorem. We will then extend his framework and analyze the implications of considering only certain kinds of information in the making of social policy. Solutions to Arrow's paradox will be considered. (Formerly 193.) (DR:S)

4 units, (Strasnick) given 1979-80

173. History of Ethics—A critical study of some of the major historical works in moral philosophy. Philosophers whose works will be studied will include: Plato, Aristotle, Epictetus, Hobbes, Butler, Hume, Kant, Bentham, Mill, and Sidgwick. Prerequisite: one course in philosophy. (DR:X)

4 units, (Bratman) given 1979-80

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 features of individual arts, artistic representation. (DR:X)

4 units, Spr (Urmson) MWF 1:15

EPISTEMOLOGY, METAPHYSICS AND PHILOSOPHY OF LANGUAGE

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: one course in elementary logic. (Same as Linguistics 244.) (DR:X)

4 units, Aut (Moravcsik) MTWTh 1:15

182. Metaphysics—An examination of some problems of ontology and essentialism. Prerequisite: 2 courses in Philosophy. (DR:X)

4 units, Spr (Moravcsik) MWF 2:15
183. Meaning and Experience—A study of the interrelationships between meaning and experience, with particular emphasis on how our judgments concerning meaning may be based on empirical evidence. Philosophers to be discussed will include W. V. Quine and Donald Davidson. The lectures will presuppose some acquaintance with the philosophy of language. (DR:X)
4 units, (Follesdal) given 1979-80

184. Theory of Knowledge—Traditional problems in epistemology, including: the analysis of knowledge; types of justification; skepticism and certainty; perception and memory; induction and explanation; verification and meaning; the objects of knowledge and belief. (DR:X)
4 units, Spr (Perry) TTh 11-12:30

186. Topics in Mind and Action—Various topics in the philosophy of mind and the philosophy of action will be considered. This year the topic will be recent treatments of the mind body problem. Prerequisite: Philosophy 80 or permission of the instructor. (DR:T)
4 units, Win (Perry) MWF 1:15

194. Honors Seminar—These seminars are intended primarily for students in the philosophy honors program, though they are open to others with permission of the instructor. Emphasis is placed on philosophical reasoning and writing, as preparation for the writing of an honors thesis. The topics and authors to be studied will be announced by the instructor.
3 units, Aut (Perry)
Spr (Bratman) M 3:15-5:00

195. Undergraduate Seminar in Philosophy of Religion—The seminar will focus on contemporary philosophical work on the nature of religious belief. (DR:X)
3 units (Staff) given 1979-80

196. Tutorial—Senior year. (DR:X)
5 units, any quarter (Staff) by arrangement

197. Individual Work for Undergraduates. (DR:X)
Any quarter, (Staff) by arrangement

199. Seminar on Topics in Greek Moral Philosophy—Central issues in the ethical theories of Plato and Aristotle, with special reference to their moral psychology. (DR:X)
3 units, Spr (Urmson) M 4:15-6:05

COURSES INTENDED PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:X)

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. (Same as Linguistics 201.)
4 units, Spr (Wasow) TTh 2:15-4:05

202. Mathematical Linguistics—(Same as Linguistics 202.) Investigation of mathematical results relevant to empirical issues in linguistics. Special attention given to the theorems of Peters and Ritchie concerning the generative capacity of transformational grammar and the work of Hamburger and Wexler on learnability of grammars.
Given alternate years

203. Seminar in Theories of Language—(Same as Linguistics 303.) Discussion of selected problems in the philosophy and psychology of language. This course can be repeated for credit.
3 units, Aut, Win, Spr (Staff) W 2:15-4:00

206. Seminar in Theories of Language: Questions, Games, and Dialogues—Discussion of selected problems in the philosophy of language.
3 units, (Hintikka) given 1979-80

3 units, Spr (Cartwright) Th 4:15-6:05

215. Philosophy and Social Theory—(Same as Education 405.) Advanced seminar focusing on philosophy of social science, including examination of bases for social science in the philosophical tradition. Readings include works of Plato, Marx, Weber, and Durkheim, and recent writings on positivism by philosophers of the Frankfurt School. Prerequisite: consent of instructor required.
4 units, Win (Pacheco) T 7-10 p.m. and one hour by arrangement

216B. Aspects of Explanation in Social Science—(Same as Education 304B.) 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, organicism, structuralism, and Gestalt versus atomistic psychology).
4 units, Win (Phillips) MW 1:15-3:05

230. Foundations of Syntactic Theory—(Same as Linguistics 230.) Introduction to the trans-
formational theory of syntactic competence. Practical experience in forming and testing linguistic hypotheses, reading and constructing rules, etc.

4 units, Win (Wasow) TTh 10:00-12:00

234. Seminar on Locke and Berkeley—Special consideration will be given to their views on the philosophy of science, especially the concept of matter.
3 units, Aut (Urmson) M 4:15-6:05

236. Plato’s Philosophy—A study of metaphysical and epistemological themes in the later Platonic dialogues. Prerequisite: Philosophy 100 or 136.
3 units, (Moravcsik) given 1979–80

239. Teaching Methods in Philosophy.
1-3 units, any quarter (Staff) by arrangement

240. Individual Work for Graduates.
Any quarter, (Staff) by arrangement

241. First Year Graduate Student Seminar
3 units, Aut (Hacking) Th 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

3 units, Win (Suppes) M 4:15-6:05

3 units, Spr (Suppes) T 4:15-6:05

245. Seminar in Metaphysics and Epistemology
3 units, Spr (Perry) T 4:15-6:05

246A. Seminar on Mind and Action—Topic for 1978-79: Practical Reasoning—This is the first quarter of a two quarter seminar on this topic. (The second quarter is Philosophy 246B.) Students may take 246A by itself, or both 246A and 246B.
3 units, Win (Bratman) W 4:15-6:05

246B. Seminar on Mind and Action—Topic: Practical Reasoning—This is a continuation of Philosophy 246A (see above).
3 units, Spr (Bratman) W 4:15-6:05

Any quarter, (Staff) by arrangement

255. Seminar in the Philosophy of Physics.
3 units, (Cartwright) given 1979–80

270. Graduate Discussion of Philosophy 170.
2 units, Aut (Taurek) T 2:15-4:05

276. Seminar in Psychoanalytic Theory—(Same as Psychology 276.) This seminar will examine concepts from psychanalytic theory. It will critically explore the theoretical ideas and examine attempts to objectify the concepts empirically form cognitive, behavioral and motivational standpoints.
3 units, (Horowitz, Suppes) given 1979–80

281. Graduate Discussion of Philosophy 181.
2 units, Aut (Moravcsik) Th 2:15-4:05

282. Graduate Discussion of Philosophy 182.
2 units, Spr (Moravcsik) Th 2:15-4:05

286. Graduate Discussion of 186.
2 units, Win (Perry) Th 3:15-5:05

289A. Elementary Intuitionistic Mathematics.
3 units, (Kreisel) given alternate years

289B. Advanced Intuitionistic Mathematics.
3 units, (Kreisel) given alternate years

290A, B, C. Mathematical Logic—(Enroll in Mathematics 290A, B, C.)

291A, B. Topics in Model Theory—(Enroll in Mathematics 291A, B.)

292A. 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.)

391A, B. Seminar in Foundations of Mathematics.

391A. Units by arrangement, Win (Kreisel) T 4:15-6:05

391B. Units by arrangement, Spr (Kreisel) T 4:15-6:05

PHYSICAL SCIENCES

(GENERAL PROGRAM)

Committee in Charge: William A. Little, Chairman (Physics), John Brauman (Chemistry), Marvin Chodorow (Applied Physics), Gerald Lieberman (Statistics, Operations Research), Walter Meyerhof (Physics), Arthur Walker, Jr. (Applied Physics)

PROGRAM OF STUDY

The Physical Sciences Program at Stanford consists of a one-year sequence in the Physical Sciences, plus other introductory courses in the sciences.
The offerings of this program consist of courses offered by cooperating departments. The basic sequence is:
- Chemistry 1
- Physics 19
- Applied Science

Additional courses of interest are:

**PHYSICS**

19. An Introduction to Physics—("Physics for Poets")
15. Special Topics in Physics—(Astronomy Course)
11. The World of Physics: Nuclei and Particles

**CHEMISTRY**

1. The Nature of Chemistry

**APPLIED PHYSICS**

10. Physics and Technology (A)
15. The Nature of the Universe
15. Modern Astronomy (S)
25. Extraterrestrial Intelligent Life

**ASTRONOMY**

The aforementioned courses numbered with 15 to 25 and Astronomy 102 represent courses offered in Astronomy that are elementary courses in the Physical Sciences.

102A,B,C. Astronomy Laboratory and Observational Astronomy

**GEOLOGY**

1. Interpreting the Earth
3. Man's Natural Environment (only offered in summer).

150. The Oceans: An Introduction to the Marine Environment

**PETROLEUM ENGINEERING**

103. Survey of the Energy Industries

For additional courses, see individual departmental listings.

**PHYSICS**

Emeriti: Felix Bloch, Paul H. Kirkpartrick, (Professors)
Chairman: J. Dirk Walecka

Assistant Professors: David L. Clark, T. William Donnelly, Stuart J. Freedman, Robin P. Giffard, Harris T. King, Alan M. Litke, (on leave Fall quarter), Clifford M. Will (on leave Winter and Spring quarters)

Acting Assistant Professors: Edison P.T. Liang, James Lockhart, Stuart Raby

**OFFERINGS AND FACILITIES**

The Russell H. Varian Laboratory of Physics, the adjacent Physics Lecture Hall, and the nearby W. W. Hansen Laboratories of Physics (including the High Energy Physics Laboratory, and the Microwave Laboratory) from 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 Graff accelerator. A superconducting electron linear accelerator is currently under construction and operating at energies over 100 MeV. Separated from this group is the Stanford Linear Accelerator Center (SLAC), a very high-energy physics laboratory which has as its principal tool a two-mile-long, 20-GeV electron accelerator and a 6-GeV electron-positron storage ring. A higher energy storage ring (PEP) is under construction. Also located at SLAC is the Synchrotron Radiation Laboratory.

Professor Mason Yearian is the Director of the High Energy Physics Laboratory; Professors Fairbank, Hofstadter, Schwartz, Schwettman, and Wojcicki are on the staff of the Laboratory. The staffs of the other branches of the W. W. Hansen Laboratories of Physics and the Stanford Linear Accelerator Center are mentioned elsewhere (see Applied Physics Department, 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 offers courses in gravitation. Students who wish to specialize in this field or in astronomy, astrophysics, or space science should also 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 Mössbauer effect and atomic collision physics, intermediate energy physics, 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, 1979 for the following autumn. Graduate students may normally enter the Department 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, 55, 56, 57, 58, 100, 101, 110, 111, 120, 121, 122, 130, 131, 132, 161, 170, 171, 200, 201 and Mathematics 41, 42, 43, 44, 45, 130 and 131. Physics 61, 62, 63 and 101 can replace all of the Physics 50 series requirements. The Department strongly advises the study of Chemistry 31, 33 and 35 and also the study of a modern language. The requirements of Physics 55, 56, 57 and 58 may be waived upon approval of the Physics Undergraduate Study Committee.

Two course sequences can be following. One (Sequence I), based on Physics 61, 62, 63, is deemed preferable for students who have had physics and a year of calculus in high school. In that case, Mathematics 41 and 42 are not required. The other one (Sequence I), based on Physics 51, 53, 55, 57, is mainly for students who have had a lesser background in science and mathematics. Students contemplating a major in physics are urged to consult with the instructor of Physics 61 at the earliest possible date to see which sequence would be the most suitable for them. Students who decide to enter the physics program after the freshman year would normally be advised to take the Physics 61, 62, 63 sequence, 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 advisors 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 advisors, 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.

SEQUENCE I

First Year *

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<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
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<tbody>
<tr>
<td>Physics 51, 53</td>
<td>Mechanics, Electricity</td>
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<td>Physics 54</td>
<td>Electricity Laboratory</td>
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<tr>
<td>Math. 41, 42, 43</td>
<td>Analytic Geometry and Calculus</td>
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Second Year *

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<tbody>
<tr>
<td>Physics 55, 57</td>
<td>Light and Heat, Atomic Physics</td>
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<td>Physics 56, 58</td>
<td>Light and Heat, and Atomic Physics Laboratory</td>
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<td>Physics 110, 111</td>
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<td>Advanced Calculus</td>
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### Third Year*

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<td>Physics 100.</td>
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<tr>
<td>Int. Physics Laboratory ‡</td>
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<td>Physics 120,121,122. Int. Electricity and Magnetism</td>
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<td>Physics 130,131,132. Atomic and Nuclear Structure</td>
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<td>Math. 106. Complex Variable</td>
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### Fourth Year*

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<td>Physics 170,171,172. Thermodynamics, Kinetic Theory and Introduction to Statistical Mechanics, Physics of Solids</td>
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<td>Physics 161, Optics</td>
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<tr>
<td>Physics 200,201. Advanced Physics Laboratory</td>
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<tr>
<td>Physics 210, 211. Introductory Theoretical Physics</td>
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<tr>
<td>Math. 113, 114, or 120. Linear Algebra and Matrix Theory or Modern Algebra</td>
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### SEQUENCE II

#### First Year*

<table>
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<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Physics 61,62,63. Advanced Fresh. Physics</td>
<td>4</td>
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<tr>
<td>Math. 43,44,45. Analytic Geometry, Calculus, Advanced Calculus</td>
<td>5</td>
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<tr>
<td>Math. 130,131. Ordinary and Partial Differential Equations</td>
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#### Second Year*

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<tbody>
<tr>
<td>Physics 110,111. Int. Mechanics</td>
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<td>Physics 100, 101. Int. Physics Laboratory</td>
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<td>Physics 120,121,122. Int. Electricity and Magnetism</td>
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<td>Math. 106. Complex Variables</td>
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<tr>
<td>Math. 132. Partial Differential Equations</td>
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#### Third Year *

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<tbody>
<tr>
<td>Physics 130,131,132. Atomic and Nuclear Structure</td>
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<td>Physics 161, Optics</td>
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<tr>
<td>Physics 170,171,172. Thermodynamics, Kinetic Theory and Introduction to Statistical Mechanics, Physics of Solids</td>
<td>3</td>
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<tr>
<td>Physics 210, 211. Introductory Theoretical Physics</td>
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<td>Math. 113, 114, or 120. Linear Algebra and Matrix Theory or Modern Algebra</td>
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#### Fourth Year*

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<th>Course No.</th>
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<tr>
<td>Physics 200, 201. Advanced Physics Laboratory</td>
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### HONORS PROGRAM IN PHYSICS

The Department of Physics offers a program leading to the degree of Bachelor of Science in Physics with Honors:

a) Students should find a physics project—either theoretical or experimental.

b) The student shall submit his or her proposal to the Honors Subcommittee which will decide on its suitability as an Honors project.

c) Course credit for the project will be assigned by the advisor within the framework of Physics 190.

d) A written report of the work at its completion will be required for Honors.

e) Before the end of the year each Honors candidate shall give a seminar on his or her work. This seminar will be announced publicly and open to the general audience. The expectation is that the student’s advisor and all the other Honors candidates that year shall attend the seminar.

f) The decision as to whether a given independent study project does or does not merit award of Honors shall be made jointly by the Honors Subcommittee and the student’s advisor. This decision shall be based on the quality of the Honors work and of the other work in physics.

g) The work done in the Honors Program should not be used as a substitute for regularly required courses.

### 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 “Degrees” section of this bulletin. Among the Departmental requirements are a “B” average in courses 130, 131, 132, 170, 171, 172, 201, 210, 211, and, if no thesis is submitted, at least 9 additional units of course work above the 200 level (not including 260, 290, 389, or 390).

*Additional elective units must be added to bring the total number of units to 180 as required by the University. Students should consult their advisors 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 take Physics 101.
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, 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 and first year graduate 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 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.

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.

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. Detailed requirements for the degree are outlined in the "School of Education" section.

FELLOWSHIPS AND ASSISTANTSHIPS

The Physics Department makes an effort to support all its graduate students. The support is through fellowships, teaching assistantships, research assistantships, or a combination of some of these. Application for financial aid will be sent to students with the application for admission.

COURSES

There are four series of beginning courses. The Ten Series (11, 14, 15, 19) is recommended for the humanities or social science student who wishes to become familiar 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 (61, 62, 63) is for the well-prepared student who wishes to advance rapidly in physics.

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 63 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).

All undergraduates are offered help with physics problems in the departmental counseling and tutoring center called The Reference Frame. The center is staffed Monday through Friday, 9 a.m. to 5 p.m. and 7 to 9 p.m. except for Fridays when it closes at 3 p.m.

All courses (DR:T) if taken for three of more units.

11. The World of Physics: Nuclei and Particles—This course proposes to familiarize the humanities or social science student with part of modern 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.

3 units, Spr (Meyerhof) T 2:15-4:05; discussion Th 2:15

11S. The World of Physics: Nuclei and Particles—This course is identical to Physics 11, but a special discussion session is available only to freshman and transfer students who enroll in this course under the freshman seminar program.

3 units, Spr (Meyerhof) T 2:15-4:05; discussion Th 3:15

13. Modern Physics Through Science Fiction—A lecture-discussion course for students in Physics 29 interested in exploring topics in modern physics and related fields through readings in science fiction. Topics to be discussed may include time travel, causality and non-causality, parallel universes, extraterrestrial life, interstellar communication, neutron stars, black holes, and general relativity. Prerequisite: current or prior enrollment in Physics 29.

1 unit, Spr (Little) one hour by arrangement


3 units, Aut (Lockhart) MWF 1:15

15. Cosmic Evolution—This course proposes to familiarize the humanities or social science student with part of modern physics. 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 be discussed. No prerequisites but some algebra will be used.

3 units, Win (Liang) TTh 2:15; discussion T 3:15

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 (Fairbank) TTh 2:15; one hour discussion by arrangement

19S. An Introduction to Physics ("Physics for Poets")—This course is identical to Physics 19, but a special discussion session is available only to freshman and transfer students who enroll in this course under the freshman seminar program.

3 units, Aut (Fairbank) TTh 2:15; discussion Th 3:15

21. Mechanics and Heat—An introduction to Newtonian mechanics, fluid mechanics, and the theory of heat. This course is intended primarily for students in the biological and social sciences and for pre-medical students. Prerequisite: a working knowledge of elementary algebra and trigonometry.

4 units, Aut (Schwettman) Lee MWF 10 or 11 and Lab.
Sum (Staff) Lee. MTWTh 10; Lab T or Th 2:15-5:05

21H. Honors Mechanics and Heat—The subject matter of this course is identical to that of Physics 21 but the discussion is more advanced. Prerequisite: Mathematics 19, or consent of instructor.

4 units, Aut (Schwettman) lec. MWF 10 or 11 and Lab.
PHYSICS 459

21W. Mechanics and Heat—This course is identical to Physics 21, but is without laboratory. Most medical schools and biology departments will not accept this course for physics credit.

3 units, Aut (Schwettman) lec. MWF 10 or 11
Sum (Staff)

23. Electricity and Optics—Electric charges and currents, magnetism, induced currents; wave motion, interference, diffraction, geometrical optics. Prerequisite: 21.

4 units, Win (Schawlow) lec. MWF 10 or 11 and lab.
Sum (Staff)

23W. Electricity and Optics—This course is identical to Physics 23, but is without laboratory. Most medical schools and biology departments will not accept this course for physics credit.

3 units, Win (Schawlow) lec. MWF 10 or 11

29. Modern Physics—An elementary introduction to modern physics. Relativity, quantum mechanics, atomic theory, radioactivity, nuclear reactions, nuclear structure, high energy physics, elementary particles, astrophysics, stellar evolution and the big bang. Prerequisite: 23 or permission of instructor.

4 units, Spr (Little) lec. MWF 10 or 11 and lab.

29W. Modern Physics—This course is identical to Physics 29, but is without laboratory. Most medical schools and biology departments will not accept this course for physics credit.

3 units, Spr (Little) lec. MWF 10 or 11

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 20 and continuation in Mathematics 42, or consent of instructor.

4 units, Win (Hofstadter) lec. MWF 9 or 11; and discussions

53. Electricity—Electric charges and currents, electric and magnetic fields, capacitance, inductance, resistance. Maxwell's equations, electromagnetic oscillations and waves. Prerequisites: 51 and Mathematics 42 or 21, or consent of instructor.

4 units, Spr (Wojcicki) lec. MWF 9 or 10; and discussions

54. Electricity Laboratory—Concurrent registration in 53 is required.
1 unit, Spr (Hanna)

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 (Meyerhof) lec. MWF 9 or 10; and discussions

56. Light and Heat Laboratory—Concurrent registration in 55 is required.
1 unit, Aut (Wojcicki)

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 (Hanna) TTh 11:00-12:15

58. Atomic Physics Laboratory—Concurrent or prior registration in 57 is required.
1 unit, Win (Ritson)

61,62,63. Advanced Freshman Physics—An introduction to Newtonian mechanics, special relativity, electricity and magnetism, atomic physics and quantum mechanics from an advanced viewpoint. The format will consist of lectures and small discussions sections. This sequence is designed primarily for students contemplating majoring in physics. Prerequisites: prior or concurrent registration in Math 43 and some high school physics and calculus or consent of instructor.

61. 4 units, Aut (Giffard) TTh 9:00-10:50
62. 4 units, Win (Giffard) TTh 9:00-10:50
63. 4 units, Spr (Giffard) 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.

100,101. 2 units, Aut (Ritson, Yearian) W or Th 1:15-5:05
100,101. 2 units, Spr (Ritson, Clark) W or Th 1:15-5:05

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 (Yearian) MWF 9
111. 3 units, Spr (Yearian) 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 (Bloom) MWF 11
121. 3 units, Win (Schwartz) MWF 11
122. 3 units, Spr (Schwartz) MWF 11

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 (King) TTh 1:15-2:30
131. 3 units, Win (King) TTh 1:15-2:30

132. Nuclear Structure—Interaction of nuclear radiations with matter, basic nuclear properties, nuclear structure, radioactivity, excited states, nuclear reactions, nuclear forces, two-nucleon problem. Prerequisites: 130 and 131.

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. Prerequisites: 122.

170. 3 units, Aut (Hofstadter) MWF 11

170. 3 units, Aut (Will) MWF 9
171. 3 units, Win (Little) MWF 9
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 (Herring) MWF 9

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

192. Senior Seminar: Basic Gravitation—An introduction to experiments in gravitation, with applications to problems in astrophysics. Prerequisites: Physics 120, 121, 122 or equivalent.

3 units, Spr (Fairbank) TTh 3:15-4:30

193. Senior Seminar: X-Ray Astronomy—(Enroll in Astronomy 193.)

3 units, Spr (Walker) alternate years, given 1978–79

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, spectra, Compton effect, decay, X-rays, nuclear magnetic resonance, laser, Mössbauer effect, and superconductivity. In addition, special projects and development of new experiments are encouraged. 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 (Freedman, Schwartz)
Win (Freedman, Litke)
Spr (Litke, Schawlow)

201. 3 units, Aut (Freedman, Schwartz)
Win (Freedman, Litke)
Spr (Litke, Schawlow)


3 units, Aut (Fetter) MWF 10

211. Continuum Mechanics and Mathematical Physics—The physics of classical continuous
media. The course will develop many useful methods of mathematical physics. Physical applications include waves in strings, membranes, and gases, dynamics of nonviscous fluids, radiation and scattering of sound, surface waves on incompressible fluids. The mathematical methods include complex variables, partial differential equations and special functions of mathematical physics, eigenfunctions and Sturm-Liouville theory, variational methods, perturbation theory, Green's functions, Fourier and Laplace transforms, and asymptotic approximations. Prerequisite: 210 and preferably Mathematics 106 and 132.

3 units, Win (Fetter) MWF 10


220. 3 units, Aut (Raby) MWF 9
221. 3 units, Win (Raby) MWF 9

222. Classical Gravitation—Concepts in gravitation, equivalence principle and the red shift, tensor analysis, Einstein's field equations, Schwarzschild solution and observable effects in the solar system, electrodynamics and hydrodynamics in gravitational fields, gravitational radiation, structure of collapsed stars, introduction to cosmology. Prerequisites: Physics 211 and 221.

3 units, Spr (Raby) MWF 9 alternate years, given 1978–79

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 221.

230. 3 units, Aut (Walecka) MWF 11
231. 3 units, Win (Walecka) MWF 11
232. 3 units, Spr (Walecka) MWF 11

234. Spectroscopy and Quantum Electronics—Characteristics and techniques for measurement of spectra from radiofrequency, through microwave, infrared, visible, ultraviolet and shorter wavelengths, with examples from atomic, molecular and solid state spectroscopy. Uses of spectral lines in lasers and other quantum electronic devices. New spectroscopic methods using tunable lasers: high resolution saturation spectroscopy, two- and multi-photon spectroscopy, nonlinear mixing of coherent waves, study of coherent transient phenomena. Prerequisite: 230.

3 units Spr, alternate years given 1979–80

240,241. Nuclear Physics—Nuclear force; properties of nuclei; nuclear models, nuclear structure; alpha beta and gamma decays; nuclear reactions. Prerequisite: 132 and 231, or equivalents.

240. 3 units, Aut (Clark) MWF 10, alternate years, given 1978–79
241. 3 units, Win (Clark) MWF 10, alternate years, given 1978–79

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 alternate years, given 1979–80
251. 3 units, Spr alternate years, given 1979–80
260. Research Activities at Stanford—Review of research activities in the Department of Physics at a level suitable for entering graduate students. Registration required by all entering students. 0-3 units, Win (Fairbank) TTh 12:15

270. Statistical Mechanics—Ensemble theory, thermodynamic functions, classical ideal gas, imperfect gas, chemical reactions, quantum statistics, solids, magnetism, phase transitions. Prerequisite: 171. Concurrent or prior enrollment in 232 and Mathematics 106 is required. 3 units, Spr (Staff) TTh 11:00-12:30

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

299. 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. 0 to 3 units, Aut, Win (Schwettman) Spr (Little) by arrangement

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. 3 units, Aut, Win (Schwettman) Spr (Little) by arrangement

340. Theory of Many-Particle Systems—Application to quantum field theory to the many-body problem, including methods of Green's functions and canonical transformations. Theory of ground state and low-lying excited states of interacting Bose and Fermi systems. Study of finite temperature properties using temperature-dependent Green's functions. Prerequisite: 232. 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. 3 units, Win (Staff) alternate years, given 1979-80

342. 3 units, Spr (Staff) alternate years, given 1979-80

350. Elementary Particle Theory—Muon decay, semileptonic K and hyperon decays, and nonleptonic decays of strange particles. Current algebra and PCAC, neutrino reactions. The problem of higher order corrections. Charm. Intermediate boson hypotheses. Introduction to the unified gauge theories. Prerequisite: 332. 3 units, Aut (Perl) by arrangement alternate years, given 1978-79

351. Elementary Particle Theory—K-meson decays and CP non-conservation—phenomenology and experimental status. Deep inelastic scattering of leptons—scaling and the parton model. Quarks and weak currents, quark counting sum rules. Introduction to unified gauge theories; finiteness and unitarity, the Higgs phenomenon, recipes for model building, phenomenology of various models. Charm and the absence of neutral strangeness-changing currents, naturalness. Effects of heavy quarks in e+e- annihilation and neutrino physics. CP violation in gauge theories. Integer-charged quark model of Pati and Salam. More parton phenomenology—lepton pair production, large transverse momentum events, jets. Path integral derivation of Feynman rules, Fadeev-Popov ghosts. 3 units, Win (Brodsky) by arrangement alternate years, given 1978-79

352. Symmetries and Lagrangians—Theories of strong interactions with emphasis on hadron spectroscopy and symmetries. The quark model and transitions between hadronic states. The new particles, their spectroscopy and transitions. 3 units, Spr (Staff) by arrangement alternate years, given 1978-79

368, 369. Gravitation—Fundamental experiments and principles. Differential Geometry and Tensor analysis. General structure of the gravitational interaction. Einstein's and other theories. Observational tests. Gravitational radiation. Various astrophysical applications, such as relativistic stellar structure and black holes. Prerequisites: 220, 221. 3 units, Aut alternate years, given 1979-80

368. 3 units, Win alternate years, given 1979-80

369. 3 units, Win alternate years, given 1979-80

370, 371. Structure of Condensed Matter—Topics from solid state and low temperature

370. 3 units, Win, (Donnelly) TTh 1:15-3:05, alternate years, given 1978–79
371. 3 units, Spr (Donnelly) TTh 1:15-3:05, alternate years, given 1978–79

385 Long Range Order in Solids—(Enroll in Applied Physics 385)
3 units, Spr (Geballe, White) W 12:00-2:00 plus 1 hour by arrangement alternate years, given 1978–79

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 supervision of a faculty member outside the Department, Physics Graduate Study Committee approval is required.
Any quarter, (Staff) by arrangement

POLITICAL SCIENCE

Emeriti: Gabriel A. Almond, Thomas S. Barclay, Philip W. Buck, Anthony E. Sokol, Kurt Steiner, Graham H. Stuart, Robert A. Walker, James T. Watkins IV (Professors)

Chairman: John F. Manley


Associate Professors: David B. Abernethy (on leave 1978–79), Jonathan D. Casper, Nannerl O. Keohane (on leave 1978–79), Robert A. Packenham (on leave winter quarter), Yosel Bogat, Paul M. Sniderman, Hans N. Weiler

Assistant Professors: Harry Harding, Daniel I. Okimoto

Acting Assistant Professor: John E. Chubb

Lecturers: Philip C. Habib, Robert M. Rosenzweig, Franklin B. Weinstein

Visiting Professors: Samuel E. Finer (spring quarter), Klaus von Beyme (winter and spring quarters)

Visiting Associate Professors: George Peter Lyman (winter and spring quarters), Alberto Martinelli (autumn quarter)

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. A minimum of 25 units of work offered by this Department or members of the Department teaching at overseas campuses.
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.
c) The completion of 15 additional units which relate in a direct way to one or more of the student’s interests in political science. These courses, which may be in political science (including a departmental honors thesis) or in other departments, must be approved by the student’s advisor.

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 60 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 the 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 as follows:
1. 30 units in political science, all of which must be taken for standard letter grades. The 30 units in political science should include:
   a) Three advanced courses or seminars (numbered 100 or above). These must include courses in at least two of the six fields in political science.
   b) At least one seminar which may be counted toward fulfillment of a) above. Of these 30 units, at least 15 must be completed in courses offered by this Department or by members of this Department teaching at overseas campuses.

2. 20 units from the course offerings of the departments of Anthropology, Communication, Economics, History, Psychology, and Sociology, selected in consultation with the student's advisor.

**HONORS THESIS PROGRAM IN POLITICAL SCIENCE**

The honors thesis program offers qualified students an opportunity to conduct independent research, and to write a thesis of superior quality summarizing the results of their research. The program provides for close contact between students and their advisors, so that students can receive intensive guidance and assistance throughout their research and writing. The aim is to help students go through the process of research, analysis, drafting, rethinking, and redrafting which is essential to excellence in writing.

Because the honors thesis program involves close student-faculty contact, the basic requirement for admission to the program is that students secure the agreement of a regular faculty member to be their thesis advisor. Students should be aware that no faculty member can effectively supervise more than a few honors theses each year. Application to the program should therefore be made as early as possible, and certainly well before the beginning of the quarter in which the student wishes to enter the program. Application forms can be obtained from the Department Office, should be countersigned by both the student and his or her thesis advisor, and then approved by the Director of Undergraduate Studies, who supervises the program. Normally, the thesis advisor will be a faculty member with whom the student has already worked. Normally, too, students enroll in the program in their senior year, and have at least a 3.3 average in political science courses when they apply.

The honors thesis program is based on the assumption that good writing takes time. Students are therefore strongly discouraged from attempting to complete an honors thesis in less than two quarters. While details will always be worked out on an individual basis between students and their thesis advisors, the following patterns are typical: (a) If a student already has substantial background on the thesis topic, then the honors thesis program can be completed in two or three quarters (for a total of 10-15 units). (b) If a student has done little or no previous work on the topic, but the thesis advisor believes that the proposed project is viable, then the honors thesis program should be spread over three quarters (for a total of 15 units).

Successful completion of the honors thesis program, and graduation with honors in political science, requires (a) completion of all requirements for the major and (b) successful completion of a thesis of honors quality.

**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 15. Only in the most exceptional circumstances will students applying after that date be admitted. Graduate students begin their programs of study in the Department only in the Autumn Quarter.

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.

**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 to the Ph.D. program. 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 during the autumn of 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 of 200 level and above. Not more than 25 units of the 45-unit requirement may be taken in a single field. The student shall take as least one course or seminar in three fields and at least two graduate 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. At the beginning of the Winter Quarter, each candidate for the A.M. degree will outline a course of study for the entire program with an advisor.

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 coterminal 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**

a. 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 six divisions of the Department. Any two courses in the "General" category (courses numbered 200 to 205 or 301 to 305) may be used to fulfill the third field requirement. Students may also use two courses with a common topic to meet the third field requirement, provided the areas of the courses offered are not already covered by examination. If this last option is chosen, the student will have the responsibility of obtaining his or her advisor's approval for the two-course sequence, and this petition will also require the approval of the Director of Graduate Studies.

b. 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 alternative 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 advisor and program committee. In consultation with his or her advisor 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 examination 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. Students may also use two courses in the "General" category (courses numbered 200 to 205 or 301 to 305) may be used to fulfill the third field requirement. Students may also use two courses with a common topic to meet the third field requirement, provided the areas of the courses offered are not already covered by examination. If this last option is chosen, the student will have the responsibility of obtaining his or her advisor's approval for the two-course sequence, and this petition will also require the approval of the Director of Graduate Studies.

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 advisor 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 plan for meeting language and/or skill field requirements, plans for scheduling of comprehensive examinations, and, where possible, dissertation ideas or plans. This statement will be discussed with, and must be
approved by, the student's advisor not later than May 15. It will then be reviewed by the Director of Graduate Studies 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 advisor 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 successive examination periods. These examinations are normally given in the third week of the autumn and winter quarters, and late in the spring quarter.

f. A formal dissertation proposal will be submitted by the student to his/her thesis committee for approval during the student's third year.

g. 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.

As part of the Ph.D. program, the candidate will normally serve as a teaching assistant for several quarters.

**MINOR**

**Minor in Political Science**—Candidates in other departments, offering a minor in political science, select two fields in political science in consultation with the Director of Graduate Studies and submit to her or him, or to a member of the faculty designated as a minor advisor, a program of study for approval. Students are required to complete at least 20 units in Political Science courses, all of which must be at least 100-level and above. Two of these courses, must be in separate fields of political science and must be 200-level and above. All grades must be of B- or better. By special permission, no more than 5 units of directed reading may count toward the minor. Candidates will be examined in their fields in the general oral examination.

**WEST REFERENCE ROOM**

The Department maintains, for its faculty, guests, graduate students and advanced undergraduates, a small reference room that holds political science journals, handbooks, books useful in preparing for Ph.D. examinations, and other materials. Access to West Reference Room is restricted to eligible key holders.

**PRIZES**

The attention of undergraduate students is called to three annual prizes—the 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, and the Lindsay Peters, Jr., Memorial Prize for the 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 faculty available during the summer quarter.

**COURSE OFFERINGS**

The Department uses the following course numbering system:

- 1-99 Introductory Courses
- 100-199 Advanced Courses and Undergraduate Seminars (may be open to graduates)
- 200-299 Undergraduate-Graduate Seminars
- 300-400 Graduate Seminars

Course information is accurate when Courses and Degrees goes to press, however, students should be aware that there are sometimes changes and should check the Time Schedule each quarter for up-to-date information.

All courses (DR:S) if taken for three or more units unless noted otherwise.

**INTRODUCTORY COURSES AND SEMINARS FOR ENTERING STUDENTS**

1. Major Issues of American Public Policy—Alternative public policies in selected areas, including control of monopoly, poverty, foreign policy. Political process; influence of cultural, economic, political factors and the location of political power on determination of public policy.
   - 5 units, Aut (Marshall)
   - 5 units, Win (Marshall)

10. American Government—Congress, the President, political parties; the process of policy formation in the federal government; the Constitution, the Supreme Court and judicial review.
   - 5 units, Win (Manley)

15. Introduction to Political Development—Analysis of the formation and development of political systems, from the primitive state to the post-industrial society.
   - 5 units, Win (Harding)
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.
4-5 units, Spr (Finer)

35. How Nations Deal With Each Other—(Same as History 35.) 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.
4-5 units, Aut (R. Keohane)

SEMINARS FOR ENTERING STUDENTS

FS71. Freshman Seminar: Introduction to Political Behavior—This seminar will review some interdisciplinary approaches to the study of individual and group behavior in political life. There will be a series of exercises in the quantitative analysis of political and politically relevant data, but no prior statistical knowledge is required.
5 units, Win (Eulau)

ADVANCED COURSES AND UNDERGRADUATE SEMINARS

Advanced undergraduate courses are open to undergraduates who have the necessary prerequisites and to graduates where advisable. Undergraduate seminars have limited enrollments, and admission generally requires the consent of the instructor. They are intended for juniors and seniors, but may admit graduates where advisable. Sign-up sheets for undergraduate seminars are posted in the Department office at registration time. Undergraduates interested in taking seminars should also consider the undergraduate-graduate seminars, numbered 200-299, listed in the next section.

GENERAL

101. Political Analysis—(Same as Business 338 and Sociology 148.) An introduction to some ideas used in the analysis of political processes. Structural models: Demography of politics, social structure and stratification, social and political institutions. Rational actor models: Rational choice, political trading, bargaining, and the formation of coalitions. Force models: Power, the distribution of resources, and the mobilization and organization of social forces. Information models: Political promises and signals, mass communication, expertise, and the development of belief. Behavioral models: Political roles and socialization, political styles, imitation, diffusion, learning, and other forms of adaptation. Symbolic models: Ideology, psychopolitics, political drama, and the symbolic meanings of politics. The emphasis throughout the course is on specifying a few simple ideas about political processes and exploring their implications, not on providing a detailed explication of any specific set of political institutions or events.
4 units, Spr (March)

104. Politics and Society—(Same as Sociology 141.) An analysis of the relationship of sociological structures to political behavior. This course will deal with topics such as social stratification, mass movements and the political roles of academic intellectuals.
5 units, Win (Lipset)

105. Introduction to Models in Social Science—(Same as Education 110 and Sociology 171.) Models of choice, exchange, adaptation, diffusion, and structure are used to predict and interpret human behavior. Emphasis is placed on the invention and application of models more than the testing of them.
4 units, Aut (March) given 1979–80

PUBLIC ADMINISTRATION

The courses and seminars listed below are open to all undergraduates in the University, regardless of major. There are no prerequisites. There are no formal course sequences in public administration.

It should be noted that public administration courses numbered 206-210 are undergraduate-graduate seminars and are open equally to undergraduates and graduates. There are, however, prerequisites for some of these courses. Students interested in enrolling in them should check the course descriptions.

107. Organizational Decision Making—(Same as Education 120 and Sociology 163.) Decision making in complex organizations, such as universities, schools, hospitals, business firms, and public bureaucracies. Information, power, resources, organizational structure, and the environment. Alternative models of choice and their implications.
4 units, Win (March) given 1979–80

108. Leadership in Organizations—(Same as Education 333 and Sociology 162.) The problems of leadership in complex organizations, such as universities, schools, hospitals, business
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Firms, armies, and public bureaucracies. Special attention to the role of major executives.
4 units, Win (March)

109. Directed Reading in Public Administration—Advanced individual study in public administration.
Any quarter, (Staff) by arrangement

Comparative Politics

Students interested in comparative politics are encouraged to consider taking Political Science 15, "Introduction to Political Development," or Political Science 20, "Introduction to Comparative Government and Politics," before beginning more advanced work.

Undergraduate courses and seminars in comparative politics generally fall into two groups: those dealing with a particular country or region, and those dealing with major political problems or processes. Students concentrating in comparative politics are encouraged to take courses from both groups, and are also urged to do course work in more than one country or region.

111F. 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.
5 units, Spr (Finer)

111V. The Political System of the German Federal Republic—Introductory course dealing with: the formation of the two German states, the political culture in Germany, parties, elections, interest groups, elite recruitment and the institutions of the system (parliament, government and administration, the constitutional court and federalism).
5 units, Win (von Beyme)

112. Contemporary Asian Politics—Major problems of the area; evolutionary and revolutionary processes of change; and attempts to build viable political structures.
4-5 units, Aut (Ike) given 1979–80

112V. Comparative Politics: The Political Systems of Western Europe—Introduction to the Western European Systems not by a country-by-country approach but rather analyzing in a systematic way the differences in nation building and political culture, the systems of interest articulation and aggregation and the parliamentary systems. The second half of this course should deal with the output of the system in the most important policy areas such as economic policy, educational policy, social policy.
5 units, Spr (von Beyme)

113A. The Politics of Development in Latin America—Survey of major political systems of Latin America. Lectures and readings deal with Brazil, Mexico, and Argentina, the most populous countries in the region, and more briefly with Cuba, the only Socialist country in it. Optional student papers may deal with any country in Latin America.
5 units, Spr (Packenham)

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.
4-5 units, Win (Ike)

115. Government and Politics of China—An overview of Chinese politics from 1800 to the present, with particular emphasis on the origins of revolution in modern China, the politics of modernization since 1949, and the succession to Mao Tse-tung.
5 units, Spr (Harding)

118L. Political Leadership—An examination of political leadership from conceptual, historical, and comparative perspective. Lectures in 118L will analyze leadership in peasant societies, empires, revolutionary movements, modernizing politics and modern industrial states.
5 units, Spr (Lewis)

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. Special attention given to the historical and international contexts relevant in each case.
5 units, Win (Fagen)

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 (Dallin) given 1979–80

120. Seminar: Rebellion and Revolution—A comparative study of the causes, organizational development, leadership strategies, sociological variables, and theories of rebellions and revolutions during the last century.
5 units, Spr (Lewis)
122. Seminar: Modernization and Democracy in Asia—Political change in Japan, the Philippines, and India.  
5 units, Spr (Ike)

125F. Seminar: Development and the International System—Focus on external constraints on development in the Third World. Specific problems such as balance of payments, employment, agrarian reform, will be examined as both domestic and international issues. No formal prerequisites, although previous work in International Relations, Economics, and/or Political Science is highly recommended.  
5 units, Spr (Fagen)

126. Seminar in Comparative Politics: Eastern Europe—Systematic examination of the eight East European political systems in terms of their historical development, their policy-making processes, and their system maintenance and adaptation.  
5 units, Aut (Triska)

126C. Colloquium: Problems in Soviet History and Politics—(Same as History 326.) Readings and reports on selected topics, including models of the Soviet system; Leninism and Stalinism; leadership, elites, interest groups; legitimacy, dissent, and participation; the role of ideology; alternative futures. Prerequisites: History 123A, Political Science 119A or equivalent.  
5 units, Win (Triska)

129. Directed Reading in Comparative Politics—Advanced individual study in comparative politics.  
Any quarter, (Staff) by arrangement

INTERNATIONAL RELATIONS

Students interested in international relations are encouraged to take Political Science 35, “How Nations Deal With Each Other.” While not a formal prerequisite for many of the courses listed below, Political Science 35 is an introduction to international relations and thus provides a desirable background for more advanced work.

The courses in international relations offered by the Political Science Department can generally be divided into two groups: those dealing with global political, military, and economic problems; and those dealing with the foreign relations of specific nations or geographic regions. Students concentrating in international relations are encouraged to select their courses from both these groups.

Students with interests in international relations are encouraged to refer to the “International Relations” section of this catalog, which lists international relations courses in other departments.

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.  
5 units, Win (Triska)

130H. Colloquium: The Practice of Modern American Diplomacy—Current organization and procedures of the American Government for determination and conduct of U.S. foreign policy, the profession and practice of diplomacy; the complex relationships between the Department of State and the White House, Congress, and a variety of executive and private agencies involved in the formulation and execution of contemporary American foreign policy. Prerequisite: Political Science/History 35, or equivalent. Primarily for juniors and seniors. Limit of 15 students.  
3 units, Aut (Habib)

131H. Seminar: Case Studies in Contemporary American Diplomacy—A comparative study of selected cases in recent and contemporary U.S. diplomacy in East Asia, the Middle East, or Africa. Prerequisite: Political Science/History 35 or equivalent. Limit of 15 students.  
3 units, Win (Habib)

132. International Communism—(Same as History 123R.) 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.  
5 units, Aut (Dallin) given 1979–80

3 units, Spr (Habib)

3 units, Spr (Habib)

134. International Organizations in World Politics—Analysis of the role of international organizations in contemporary world politics. Attention will be concentrated less on traditional peacekeeping activities or 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.  
5 units, Spr (R. Keohane)

134M. Multinational Corporations—The aim of the course is to provide an analytical
framework for the analysis of the major institutional forms taken by the present international division of labor and of the relationships between multinational corporations and nation states both in industrialized and developing countries. Major interpretations of the rise and present role of MNC's will be critically reviewed with reference to empirical evidence.

5 units, Aut (Martinelli)

135. Diplomatic Revolution of Our time—
(Same as History 135.) Problems raised by the collapse of the traditional system of Western diplomacy as a result of two world wars; expansion of the diplomatic community and breakdown of its internal homogeneity; new dimensions resulting from technology and domestic political pressures of the 20th century. Pre-requisite: PS/History 35.

5 units, Win (George, Craig)

136. Soviet Foreign Policy—
(Same as History 122B.) Foreign and domestic determinants of policy; intentions and capabilities; continuity and change since 1917; institutions and personnel; war and peace; perceptions, priorities, and attitudes; alternative futures.

5 units, Aut (Dallin) given 1979–80

137. The World of Superpowers—A comparative and interactional study of the superpowers—U.S., China, U.S.S.R., Europe and Japan—in terms of recent major events and development. Emphasis is on political change and formulation of theory of political dynamics.

4-5 units, Spr (Ike, North, Triska)

137W. Underdevelopment and Foreign Policy—Problems which the condition of underdevelopment poses for foreign policy and alternative ways of dealing with them. Particular attention to the meaning of underdevelopment; the nature of foreign policy elites and the domestic political determinants of foreign policy; the nonaligned movement and its significance; independence and development as goals of foreign policy; foreign aid, neocolonialism, and dependency relationships; foreign investment and problems of dealing with multi-national corporations; and “resource diplomacy,” with emphasis on the experience of OPEC and its implications for development in the Third World. Illustrations are drawn mainly from Southeast Asia.

5 units, Win (Weinstein)

138A,B. Arms Control and Disarmament—
(Same as History 138A, 235S.) The introductory course, 138A, is a general survey of international security relations, the revolutionary development of modern weapons, the arms competition and efforts at arms control and disarmament in the post World War II period. Political, conceptual and technological problems of national security policies and arms controls are stressed. Time is devoted to the evolution of strategic doctrines and negotiations on strategic arms control in SALT I and SALT II. The course is taught by an interdisciplinary faculty. 138A is a prerequisite to 138B. 138B is a tutorial and research course.

138A. Arms Control
5 units, Win (Lewis, Barton)

138B. Seminar: Arms Control
5 units, Aut (Lewis)

138W. Seminar: Strategic Doctrines and Security in East Asia—Examines the nature of conflict in East Asia and analyzes critically the Asian application of a wide range of strategic concepts. Emphasis on American doctrines, with some discussion of strategic thinking in Japan, China, the USSR, and those Asian nations which have been the scene of armed conflict since World War II. Many cases are surveyed, but special attention is given to the Indochina conflict, the Korean problem, and the US-Japan alliance relationship. The final segment of the course focuses on current policy options for the United States in its security relations with East Asia.

5 units, Aut (Weinstein)

139. Chinese Foreign Policy—Analysis of China's goals and conduct in world affairs, with emphasis on the historical roots of Chinese foreign policy, China's dilemmas as a revolutionary power, and the domestic context of China's foreign policy.

5 units, Aut (Weinstein)

139A,B. Japanese Foreign Policy—The post-war evolution of Japan's foreign policy is analyzed in terms of the interplay between domestic and international variables. Analytic concepts, drawn from the Western literature on comparative foreign policy, are applied and tested for such areas as the policy-making processes in Japan. For graduates and undergraduates.

5 units, Aut (Okimoto)
5 units, Win (Okimoto)

140A,B,C. Ethics of Development in a Global Environment (EDGE): Cross-Discipline Seminar—(Same as Anthropology 133A,B,C; Education 274A,B,C; Engineering 297A,B,C; Graduate Special 297A,B,C; Social Thought 197A,B,C.) Theory and practice of development in a global setting. Open to graduate and undergraduates, course is designed to be appropriate to both foreign and American students and may be taken for only one quarter or as a three-quarter sequence. Interdisciplinary: faculty from Engineering, Political Science,
Economics, Education, Anthropology; encourages convergence of engineering and natural sciences with the social and behavioral sciences in the study of development processes and the ethics implicit in development choices. By making underlying values explicit development options can be tested for appropriateness. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures are analyzed in terms of appropriateness to development in both less developed and industrialized societies. Present systems and planning processes will be examined in terms of their present day inequities as well as their consequences for future generations. Autumn: Major world trends—population, food, energy, technology, life-styles. Development examined in terms of relative satisfaction of human needs. Lectures, discussions, work-groups. Winter: Alternative development strategies—country case studies. Lectures, discussions, work-groups. Spring: The individual and social change; the engineer, political scientist, educator, etc., as designer of alternatives and as policy and decision-maker. Work-groups only. 2 units: pass/no credit. 3-5 units: pass/no credit or grade, small discussion groups and workshops, limited enrollment.

144M. Seminar: International and Domestic Factors in the Process of Economic Development—The seminar aims at comparing the different paths to economic development followed by a few selected countries in different stages of development of the international economy and at showing the constraints posed by the international division of labor at any given time. The works of Hobson, Hilferding, Schumpeter, Gerschenkron, Bendix, Barrington Moore, Polanyi, Wallerstein and Anderson will be discussed. And national trade policies of a few selected countries will be examined in order to show how international constraints can to some extent be modified.

3 units, Aut (Martinelli)


5 units, Spr (George)

146. Seminar: 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.

5 units, Win (Triska)

147. Seminar: China in the International System—Readings and research on China's relations with the U.S., and U.S.S.R., Japan, the Third World and various other countries.

5 units, Win (North)

149. Directed Reading in International Relations—Advanced individual study in international relations.

Any quarter, (Staff) by arrangement

POLITICAL THEORY

Undergraduate courses in political theory are arranged in several groups and sequences. While the courses can often be taken separately, an understanding of how they are related to one another may help students interested in political theory to construct their course of study.

Lecture sequence in the history of political ideas: 152 and 153. 150 and 151 to be given next year; a seminar on classical theory will, however, be offered in the spring (166). (The series on social philosophy and social science, 158A and 158B, will not be offered this year.) Seminar groups and sequences:

a) Political concepts: 156, 166, 254
b) Knowledge and theory construction: 162A, B, 163P, 254, 263P.
c) Social science and politics: 156, 263P, 265.

152. Political Thought: Machiavelli to Rousseau—(Same as Modern Thought and Literature 156.) The development of political theory from the Renaissance to the French Revolution. The major focus of the course is on the relation between individuals and the political community; the sources of and limits on the rightful authority of states over individuals, the reasons
people undertake or refrain from political action, the division between rulers and ruled, the comparative satisfactions of public and private lives. The different methods used in studying politics will also be examined; theorists studied include Machiavelli, Montaigne, Hobbes, Locke, Montesquieu and Rousseau. (DR:A)

5 units, Aut (Drekmeier)

153P. Political Thought: the Modern Period—(Same as Modern Thought and Literature 253.) Theories of liberty, equality and social justice in large modern states. The views of socialists, conservatives, liberals, anarchists on the organization of communities, the distribution of power and the role of the individual in the good society. How much flexibility do we have in constructing political communities to realize our values? What are the limits of political creativity? Theorists studied include Mill, Marx, Michels, Weber, Lenin, Toqueville, Burke, Fourier and Bakunin. (DR:A)

5 units, Win (Lyman)

156. Authority, Hegemony, and Legitimacy—This course considers the value ascribed to authority in the life of the individual, society, and the state. In addition to a discussion of different political belief systems, we shall also examine the major contributions of research and theory in psychology (particularly Freud and Piaget), sociology and anthropology, and politics. No prerequisites. (DR:A)

5 units, Spr (Drekmeier)

163P. Nietzsche and Heidegger—The philosophy and social and political relevance of one of the major modern inquiries into the nature of human existence. No prerequisites. (DR:A)

5 units, Win (Lyman)

162A,B. Seminar: Symbol, Myth and Archetype—Examples will be taken from Twentieth Century political and social theory, philosophy and the arts. 162A may be taken alone but is a prerequisite for 162B. (DR:A)

162A. 5 units, Win (Rogat)

162B. 5 units, Spr (Rogat)

166. Seminar: Classical Political Theory—This seminar will assess the moral and political writings of Plato and Aristotle and the conceptions of knowledge and political life out of which these philosophical systems developed. No prerequisites. (DR:A)

5 units, Spr (Drekmeier)

169. Directed Reading in Political Theory—Advanced individual study in political theory. (DR:X)

Any quarter, (Staff) by arrangement

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)


5 units, Spr (Horn)


5 units, Spr (Horn)

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)

174. The Criminal Law and the Criminal System—(Same as Law 107 and Sociology 61.) 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)

174F. The Development of American Law—(Same as History 171 and American Studies 171.) The growth and development of the American legal institution with particular attention to crime and punishment; slavery and race relations; the role of law in developing the economy; and the place of lawyers in American society, from Colonial times to the present.

5 units, Aut (Friedman)
179. Directed Reading in Public Law—Advanced individual study in public law.
   Any quarter, by arrangement with Public Law faculty

AMERICAN POLITICS

180C. Introduction to Public Policy—As an introduction to a very broad field, this course deals with a variety of topics: the topics of policy formation, policy implementation, policy analysis and policy evaluation. Substantive problems and current issues—e.g., energy, environment, welfare, and food—will be relied on to convey the conceptual and theoretical material.
   5 units, Win (Chubb)

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)

188. Disaffection and Protest—This course will look at the wave of alienation and protest that has washed over the country in the last decade. It will pay special attention to the causes and consequences of attitudes toward authority.
   5 units, Aut (Sniderman)

189. Voting and the American Electoral System—The focus of this course is the citizen and its object is to make comprehensible the voting behavior of the citizen. The course seeks to explain what lies behind electoral participation, i.e., the turnout decision, and candidate choice, i.e., the voting decision. Such topics as the effect of the legal context on behavior, the social background of the voter, partisanship, issue concerns, media effects, campaign and candidate effects will be addressed. Voting behavior in primary and general elections will be considered; both presidential and Congressional elections will be discussed.
   5 units, Spr (Brody)

190A,B. Seminar: Political Behavior and Democratic Theory—This course will attempt to weave together empirical research and normative theory in an effort to address two questions: What habits of mind are congenial to a democratic politics? What forms of conduct are appropriate to a democratic society?
   5 units, Win (Sniderman)
   5 units, Spr (Sniderman)

190K. Women in American Politics—This seminar will focus on the problem of women’s participation in American political life. We will look at women as individual voters and office holders, and as activists in the contemporary feminist movement. We will also direct our attention to the family and the workplace to see how they affect women’s activity in public life.
   5 units, Spr (Benedict)

191. Seminar: Civil Liberties and Civil Rights—A discussion of selected topics in civil liberties and civil rights, including equality, freedom of expression, and criminal procedures.
   5 units, Win (Casper)

194D. Media and Politics—This seminar for the undergraduate student will examine the links between mass media and government, on the one hand, and between media and the individual citizen, on the other. Via an examination of the relevant literature, questions of the role of the “organization” of the media in the formation of “news”, “biases” and the “effects” of media on individual “agenda,” attitudes and behaviors will be explored.
   5 units, Win (Brody)

195. Seminar: Political and Economic Power in the United States—The purpose of this seminar is to explore various theories about the distribution of political and economic power in contemporary America. Among the topics covered are pluralism, elitism, modern capitalism, the welfare and warfare state, and the role of national political institutions in affecting the distribution of economic values. Special attention will be placed on the works of Dahl, Mills, Miliband, Shonfield and Galbraith. Prerequisite: Political Science 10 or equivalent, and junior standing.
   5 units, Spr (Manley)

196. Seminar: Presidental Decision-Making—Role of personality factors in incumbent’s conception of the Presidency, his organization and management of the policy-making system, use of advisors, performance as a decision-maker. Enrollment limited to 20 juniors and seniors. Prerequisite: Political Science 10 or equivalent.
   5 units, Spr (George)

198. Directed Reading in American Politics—Advanced individual study in politics. Prerequisite: 10 or equivalent. (DR:X)
   Any quarter, (Staff) by arrangement

UNDERGRADUATE HONORS

199. Senior Honors Thesis—(DR:X)
   Any quarter, (Staff) by arrangement
GRADUATE—UNDERGRADUATE

SEMINARS

Conducted as seminars or colloquia, and open to both advanced undergraduates and graduates. In most cases non-majors as well as majors are welcome, but enrollments are limited. Sign-up sheets for all 200-level courses are posted in the Departmental Office at registration times. These sheets should be checked for indications of class size and other specific enrollment information.

GENERAL

203. Introduction to Political Data Analysis—This course is designed to introduce the student to the problems and procedures associated with quantitative analysis of political data. It is not a course in philosophy of science nor in statistics but it will deal with ideas from both. The course focuses on data analysis as distinguished from data making or acquisition; it should be applicable whether the data are system-generated (e.g., aggregate data) or come from instrumentation (e.g., surveys of content analyses). The emphasis will be practical and specific assignments will be made with a sample data set requiring the student to use SPSS (Statistical Package for the Social Sciences) and the computer. We will meet twice a week; one session will be lecture and discussion, the other will be a lab session.

5 units, Aut (Brody)

203C. Dynamic Models of Politics—The course objective is to provide students with the tools needed to develop formal dynamic models of political phenomena and to execute empirical analyses where data is available. The major topics will be difference equation models, formal systems analysis, time series estimation, and interrupted time series quasi-experiments. Applications will be largely in political behavior and public policy. Permission of the instructor required.

5 units, Spr (Chubb)

204A. Seminar: Empirical Political Theory—The seminar will deal with a variety of level-of-analysis problems in political science and the social sciences generally, their inherent dilemmas or solutions; theories of methodological individualism and collectivism; the nature of the empirical and theoretical units of analysis on different levels of organizational complexity—individual person, small group, association, national state and international system; problems of comparison among units on different levels; aggregation and disaggregation; and conceptualization of unit properties. For graduate students and advanced undergraduates. Although this is envisaged as a two-quarter seminar, each part may be taken alone.

204A. 5 units, Win (Eulau)

204B. 5 units, Spr (Eulau)

205. Seminar: Topics in Political Sociology—(Same as Sociology 245.) An analysis of differing approaches based on reading the works of major figures such as Lasswell, Mannheim, Marx, Michels and Weber.

5 units, Aut (Lipset)

PUBLIC ADMINISTRATION

207. Seminar: Governmental Decision-Making 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 I.

5 units, Win (Marshall)

208. Seminar: 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, Aut (Marshall)

209. Directed Reading in Public Administration.

Any quarter, (Staff) by arrangement

COMPARATIVE POLITICS

211. Theories and Method in Comparative Politics—Concepts, models, theoretical frameworks, and typologies in comparative politics; theoretical approaches to political development.

5 units, Win (Sartori) given 1979–80

211V. Seminar: West European Party Systems in Transition—The seminar starts with recent typologies and concepts (as for instance party identification) and leads to the analysis of new trends in the party systems of Western European countries, such as: the rise of "Eurocommunism," the revival of nationalist parties of the "forgotten nations," (Scotland, Wales, Flemings, Bretagne, Alsatia, Catalonia and the Basques). The failure of interest aggregation in times of crisis: trade unions as a substitute for parties? Citizens' protest groups as a break up of the party system.

5 units, Win (von Beyme)

212V. Seminar: Interest Groups in West European Systems—The seminar deals with
recent trends in cooperation and conflict of interest groups, especially trade unions. It analyzes the systems of labor relations and the institutionalization of conflicts in the light of theories of "new corporatism." Success and failure of institutions such as "incomes boards," "concerted action," "Harpsund democracy" and the different types of interest group participation in the fields of incomes policy, social policy, co-determination in West European systems will be subject of the seminar.

214A, B. Seminar: Origins of Fascism and Militarism in Prewar Japan—This seminar examines the social, economic, intellectual, and international sources of fascism and military dictatorship in prewar Japan. Theoretical and empirical studies of fascism and militarism, including those of Marx, Moore, and Maruyama, are related to the experiences of twentieth-century Japan within a broadly comparative frame of analysis. For graduates and undergraduates.

214A. 5 units, Win (Okimoto)
214B. 5 units, Spr (Okimoto)

215. Seminar: State and Economic Enterprise in Post-Industrial Japan—An analysis of the organization, role, and interaction of the major economic institutions in Japan: government bureaucracies, public corporations, political parties, business and financial firms, trading companies, multinational corporations, labor unions, and managerial practices. Emphasis on the complex interplay between state and private enterprise in the determination of domestic and international economic behavior.

216R. Theories of Political Modernization and Development—Alternative modes of defining and explaining political modernization and development. Liberal, radical, and conservative theories are considered.

221. Education and Political Development—(Same as Education 306B.) Introduction to analysis of relations between educational and political systems from a comparative perspective. Special emphases include: political socialization, international elements in educational development, politics of educational innovation and evaluation. Course consists of lecture, discussion sections and individual projects.


224. Seminar: Latin American Dependency—This seminar explores the main themes and issues in contemporary Latin American dependency theories; examines some empirical studies of dependency; and considers alternative research and political strategies regarding dependency.

225. Colloquium in Chinese Politics—A critical survey of the principal literature on leadership, organization, key policy issues, and political development of the People's Republic of China. Prerequisite: 115 or the equivalent.

229. Directed Reading in Comparative Politics.

INTERNATIONAL RELATIONS

230. Seminar: International Law—Survey of recent international law developments. Particular attention will be given to the oceans and the law of the sea conferences, as well as to issues such as terrorism, international pollution, new states, and weather control.

235. Seminar: 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.

235L. Seminar: China's International Behavior—This seminar examines the linkages between China's domestic politics and foreign policy. It will focus on changes in PRC views of "national sovereignty" and "self-reliance" as China becomes a more active and important participant in international affairs. Specific topics will include China's role in international conferences on food, population, and the law of the sea, as well as strategic doctrine and bilateral relations in regard to the transfer of technologies and "cultural diplomacy." The objective will be to determine whether and how strongly foreign policies shape, or are shaped by, domestic politics and national developmental objectives.

241A, B. International Political Economy—An analysis of how the world economy, and the international political system, are related to one
another. First quarter: theoretical approaches and historical analysis (early development of capitalism, mercantilism, political foundations of liberalism, imperialism, conflicts among advanced industrial states to 1945). Second quarter: contemporary international political economy, emphasizing changes in international regimes, power relations, and industrial structure. A basic working knowledge of economics is necessary.

5 units, Aut (R. Keohane)  
5 units, Win (R. Keohane)

242. Seminar: The Dynamics of National Expansion—Readings and research in the processes of colonialism and other forms of national expansion and dependency.

5 units, Aut (R. Keohane)  
5 units, Win (R. Keohane)

243. Seminar: 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, sociocultural evolutionists, futurists, and others.

5 units, Aut (North)

244. Colloquium: Global Politics and the Future—Readings and discussions about who gets what, when and how in a world of growing population, advancing technology and finite resources.

4 to 5 units, Win (North)

246. Seminar: The Four Images in World Politics—The individual, the state, the international system and the global system as presented by Hobson, Lenin, Schumpeter, Morgenthau, the "psychologists," the decision-making school, Allison, Halperin, the dependencia school, the environmentalists and other major theorists. A critical comparison through reading and discussion.

5 units, Spr (North)

249. Directed Reading in International Relations.  
Any quarter, (Staff) by arrangement

POLITICAL THEORY

254. Essentials of Political Theory—(Same as Modern Thought and Literature 250.) Power and authority, justice, values and valuation, problems of methodology.

5 units, Aut (Sniderman)

263P. Politics and Consciousness—On the relation of thought and action, contemporary political ideologies, theories of reification and false consciousness, and modes of political and ideological analysis that have been designed in recent years to assist the analysis of human autonomy and decision.

5 units, Spr (Lyman)

265. The Concept of Society—The most influential theories of social conflict and cohesion will be considered in this seminar. Class and institutional analysis, rationalization processes, ideology and concepts of legality and legitimation are among the concepts, structures, and approaches discussed. Open to advanced undergraduate students.

5 units, Win (Drekmeier)

269. Directed Reading in Political Theory.  
Any quarter, (Staff) by arrangement

PUBLIC LAW


5 units, Aut (Horn)

279. Directed Reading in Public Law.  
Any quarter, (Staff) by arrangement

AMERICAN POLITICS

283. Seminar: Interest Groups—This seminar will take a critical excursion into the theoretical and empirical American and Western European literature on interest groups. Topics to be covered include: guild socialism and functional representation, group theory and pluralism, group formation and maintenance, "public interest" groups, the politics of access and lobbying, and neocorporatism and co-optive politics.

5 units, Spr (Chubb)

285A,B. Seminar: Public Opinion and Political Behavior—An intensive review and analysis of the major research topics in the systematic study of political belief and behavior. The course will cover such areas of inquiry as political participation, attitude change, public opinion, ideology, personality and politics, political socialization, and alienation.

5 units, Aut (Sniderman)  
5 units, Win (Sniderman)

288A,B. Seminar: 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. Stu-
dents should plan to take both 288A and 288B.

288A. 5 units, Aut (Casper)
288B. 5 units, Win (Casper)

298. Directed Reading in American Politics.
   Any quarter, (Staff) by arrangement

GRADUATE SEMINARS

Seminars numbered 300 and above are limited to graduate students. Instructors should be consulted before enrolling.

300. Thesis.
   Any quarter, (Staff) by arrangement

301. Seminar: Case Studies and Theory Development—The seminar will examine the use of single and comparative case studies as a research strategy for the development of theory. In addition to reading and discussing general descriptions of this research strategy that appear in the literature, the seminar will examine a number of studies that have employed some variant of this approach in an effort to identify the requirements for making successful use of this research strategy. Students will have an opportunity to develop research designs in substantive problems of interest to themselves, employing “controlled comparison” and the method of “structured, focussed comparison.”
   5 units, Aut (George)

306A,B. Seminar: Advanced Organization Theory—Topics in organization theory for advanced students. Prerequisite: permission of instructor.
   5 units, Win (March)
   5 units, Spr (March)

313. Seminar-Workshop on Development and the International System—Working in small groups, participants will address a number of key issues raised by external constraints and influences on development in the Third World. Among the issues addressed are the political implications of balance of payments problems, employment, human resource development, and agrarian reform.
   5 units, Spr (Fagen)

321. Seminar: Approaches to Study of Political Leadership—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)

323. Research Seminar: Comparative Study of the Politics of Education—(Same as Education 408.) Seminar oriented towards theoretical and methodological problems involved in studying various aspects of the politics of education: political socialization, interest group politics in education, politics of resource allocation, etc. Prior course work in appropriate fields of political science; facility in handling empirical data required.
   4-5 units, Spr (H. Weiler)

   5 units, Aut (Ike) given 1979–80
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 65 units in psychology and supporting fields are required; of these, a minimum of 45 units must be completed in psychology itself. A maximum of 20 units in non-introductory courses in supporting fields (i.e., mathematics, computer sciences, physical sciences, biological sciences, and social sciences) may also be counted toward the 65 unit requirement.

Beyond these overall requirements, the 45 units in psychology must include Psychology 1, Psychology 60, and at least two courses from each of two groups listed below: Group A consists of broad content courses in the areas of cognition, perception, physiological psychology, and psycholinguistics. Group B consists of courses in the areas of social, developmental, abnormal and personality.

Group A: 102, 103, 106, 107, 108, 109, 110, 146, 147, 163, 164, 166

Group B: 111, 113, 114, 115, 121, 132, 134, 135, 136

These two lists of courses, it should be noted, may change from year to year, and 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 45 units. All independent study courses are graded on a no-option pass/no credit basis.

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. Such students may receive transfer units for courses completed in psychology at any accredited university or college provided that the courses were taught by a regular faculty member. There is no limit to the number of units that may be transferred, but all students must satisfy Group A and Group B requirements through courses completed at Stanford.

**Beyond the minimal requirements.** Many students will wish to complete a "strong" program rather than merely fulfill the minimal requirements listed above. This may be especially true for students who anticipate graduate study in psychology or in closely related fields. Listed below are some recommendations that should help students to strengthen their programs.

1) Research experience, particularly in the junior or senior year, is highly desirable for anyone considering graduate work in psychology. For those interested in clinical psychology, counselling psychology, etc., "paraprofessional" experience (e.g., Psychology 184 or some similar program) is highly recommended.

2) Courses in statistics (beyond Psychology 60), mathematics, and computer sciences are becoming increasingly important and helpful for graduate work.

3) Courses beyond the introductory level in fields related to psychology (e.g., sociology, anthropology, biology, physiology, etc.) will further strengthen students' programs.

4) Students should seriously consider the advanced seminars offered by the Psychology Department, particularly in areas closely related to the student's career plans (e.g., prospective clinicians might enroll in advanced seminars in psychopathology, personality, or behavior modification). Academic advisors can be particularly helpful in guiding such choices.

5) Finally, for those students interested in graduate work in psychology, the senior honors program is strongly recommended. A description of this program follows below.

**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 academic performance and 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 arrange-
ments 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.

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).

**Masters of Arts**

The Department of Psychology offers a Master of Arts program to students who are already enrolled in another doctoral or professional program at Stanford. This is a two-year program requiring at least 27 units in psychology beyond the equivalent of an undergraduate major, as well as sufficient additional units to make up a program totaling 45 or more units. In partial fulfillment of this unit requirement, Psychology 151 must be selected 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, 213, and 254. The balance of the 45 units may be satisfied by a master's thesis if both the student and advisor feel that is appropriate.

**Doctor of Philosophy**

In addition to fulfilling the residence requirement for the degree, the following requirements are stipulated.

1. **First-year course requirements.** During the first year of graduate study, the student is required to take 207 (Contemporary Viewpoints in Psychology), 151 (Statistical Methodology), and 152 (Analysis of Data). In addition, the student must take at least one core course selected from Group H and one core course selected from Group S (listed below).

**GROUP H**

208. Physiological Psychology: Brain and Behavior
209. Perception
210. Memory and Learning: An Information Processing Approach
214. Psycholinguistics
215. Mathematical Psychology

**GROUP S**

211. Advanced Developmental Psychology
212. Social Psychology
213. Personality
254. Personality Change

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. The student will normally take no more than 9 units of course work each quarter. 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.

2. **Second-year course requirements.** During the second year of graduate study (or as additional courses during the first year) the student must show competence in three additional areas selected from the core group. Of the five core courses selected during the first and second years of graduate study, at least two are to be selected from Group H and at least two from Group S. The student may meet these requirements either by taking the courses listed above, or by special examination. Further course work prior to admission to doctoral candidacy should be arranged under the guidance of the student’s advisor.

3. **Third-year major area paper.** During the first week of the Fall quarter of the fourth year, the student will turn in a Conceptual Analysis of the Dissertation Area (CADA). This paper will provide a general framework for the research topic of the dissertation, address the central issues within the specialty area, and review the pertinent literature(s). Typically, the analysis would have the kind of scope found in the opening chapters of the more traditional dissertations, although the exact format and scope of the paper would be a joint decision made by the student and the advisor.

At this same time, the student would select two faculty members to read the paper and give feedback and commentary on it. These should be two faculty members most likely to serve on the later orals committee of the dissertation.

A portion of the paper, revised as appropriate, could then become the first section of the actual dissertation proposal. Thus the student will receive additional feedback on CADA at the oral examination itself.

If the student should radically change the area of the dissertation research after CADA has been written, the procedure will not have to be repeated for the second dissertation topic. It is still expected, of course, that the student will be knowledgeable about the literature and problems of any research topics being pursued for the dissertation; it is only the formal CADA procedure which need not be repeated.
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. A student choosing to design his own program of 12 units outside the psychology department will be expected to do so in consultation with his advisor.

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 advisor; (2) a second member from within the Department; and (3) a third member chosen from Psychology or another department.

6. Orals. The candidate shall pass the University Oral Examination which will be based on the dissertation proposal, not on the defense of the dissertation itself. The reason for the policy is to permit the orals to serve the function of guiding and improving the proposed research. This function can be best served if the orals are scheduled early in the year in which the dissertation research will be conducted. It is therefore expected that the orals will be taken by the end of the Autumn quarter of the fourth year.

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. These two courses may be cross-listed courses. 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 advisor, 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 the courses or seminars. This is the firsthand knowledge of, and practical experience with, the methods of psychological investigation and study. These methods to 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 many research interests.

Each student will achieve competence in somewhat unique ways and at a somewhat unique rate. Each student and advisor share in planning a program which will lead to the objectives discussed. The student is expected to spend one-half of his/her time on research and will normally take no more than 9 units of course work per quarter.

FELLOWSHIPS, SCHOLARSHIPS, AND ASSISTANTSHIPS

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, Ford Foundation, and the United States Public Health Service among others. Applications may be made by college seniors planning to work for a higher degree. Students should apply early in the fall of their senior year. For information concerning application forms and procedures, consult representatives from the financial awards office of your home institution.

TEACHING REQUIREMENT

The Department views experience in supervised teaching as an integral part of its graduate program. Regardless of the source of financial support, all students are expected to participate in four quarters of teaching. Students will be
discouraged from T.A.ing during their first year. The student typically progresses from closely supervised teaching to more and more independent work. Typically, this might involve giving a section in statistics or a lab course in the student's special area initially, then serving as a teaching assistant in introductory psychology, next co-teaching a small advanced course, and finally giving a supervised but essentially independent seminar.

**STUDENT EVALUATIONS**

**First-year evaluation.** It is the policy of the Department to evaluate the progress of each graduate student at the end of the first year of graduate study. As a part of the evaluation procedure, each student is required to file with the Department a report of his first year research activities.

Students should discuss this report and the evaluation procedures with their advisor as early as possible in their first year. The report is due on June 1st.

If the student fulfills the academic promise which he displayed upon entrance, he/she is invited to continue to the doctorate.

The first-year evaluation is made primarily on the basis of three factors:
1. The quality of research carried out in the first year.
2. Performance in courses (especially required courses).
3. Recommendations of the advisor (including a commitment on the part of that advisor to continue in that role.)

**Second-year evaluation.** A similar evaluation is conducted at the end of the second year of graduate training. The same criteria are involved in the second year as the first year; however, the student is not required to file a paper with the department. Students who do not make satisfactory progress during the second year may be dropped from the program.

**PSYCHOLOGY COLLOQUIUM**

The Psychology Colloquium meets on most Wednesday afternoons at 3:45. Topics of current interest are presented by speakers from Stanford and 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, 1979.

**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. (DR:S)

   4 units, Aut (R. Katzer) MWF 10
   Win (Maas) MWF 10
   Spr (Zimbardo) MW 10:00-11:30

1A. **General Psychology Discussion Section**—Optional supplement to Psychology 1. Small discussion groups led by graduate teaching assistants. Prerequisite: concurrent enrollment in 1. (DR:X)

   1 unit, Aut, Win (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. (DR:T)

   5 units, Aut (Carlsmith) MTWThF 9
   Win (Efron) MTWThF 9
   Spr (Thomas) MTWThF 9

102. **Perception**—A survey of the traditional topics in perception. This course deals with the psychological and psychophysiological relationships involved in the perception of brightness, color, form, movement, and briefly with other aspects of perception. Prerequisites: 1 and 60 or equivalent. (DR:S)

   3 units, Spr (Sakitt) MW 1:15-2:30

102A. **Perception Laboratory**—Optional supplement to 102. Laboratory demonstrations and experiments on varied topics of visual perception. Prerequisite: concurrent enrollment in 102. (DR:X)

   2 units, Spr (Sakitt) 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. (DR:X)

   1-6 units, any quarter (Staff) by arrangement

106. **Introduction to Cognitive Psychology**—A survey and analysis of the major topics in cogni-
tive psychology, including perception, memory and thought, with an emphasis on contemporary research and theory. Prerequisites: Psychology 1 and 60. (DR:S)
4 units, Aut (Smith) TTh 11:00-12:15

107. Physiological Psychology: Basic Mechanisms—A survey of neural interactions underlying behavior. Prerequisite: 1 or equivalent. (DR:T)
4 units, Aut (Wine) MWF 10:00

108. Neuropsychology—An orientation in those facts of brain anatomy and physiology relevant to the analysis of behavioral processes. Prerequisites: 1 or equivalent, and elementary biology. (DR:T)
4 units, Win (Pribram) MWF 10:00

109. Physiological Psychology: Brain Structures and Perceptual Processes—An analysis of the structure of our sensations and memories as they are determined by physiological encoding mechanisms. We will examine neuronal machines which produce our perception of color, brightness, movement, and shape as well as our memory of those events. Prerequisite: 1 or equivalent. (DR:T)
4 units, Spr (Ganz) MWF 9

110. Perception, Imagery, and Thought—An in-depth examination of experiments in which subjects who are manipulating or comparing objects perform in a similar way whether those objects are physically present or are only remembered or imagined; and a consideration of the relation of such work to mental imagery, spatial problem solving, and creative thinking. Prerequisites: 102, 106 or equivalents.
3 units, Win (Shepard) MW 2:15-3:30

111. Developmental Psychology—Psychological development from birth to adulthood, with primary emphasis on the infancy, early childhood, and middle childhood years. A broad introduction to the nature of change during childhood and to theories of development. Prerequisite: 1 or equivalent. (DR:S)
3-5 units, Aut (Flavell) MWF 11

113. Adolescent Development—This course focuses on the cognitive and personality development that takes place during adolescence. Prerequisite: 111 or equivalent.
4 units, Win (Feldman) TTh 1:15-2:45

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.
3-4 units, Spr (Lepper) TTh 10-12

117. Observation of Children—Enrollment limited to 16. Prerequisites: 111 or equivalent, and consent of instructor. (DR:X)
3-5 units, Aut (Staff) T 2:15-4:05

118A, B, C. Practicum in Preschool Education—Supervised experience with young children at Bing Nursery School. Four units involves participation in two ½-day sessions, 5 units involves participation in three ½-day sessions. Prerequisite 117. Students may enroll for up to 15 credits of 118. (DR:X)

118A. Teaching Strategies—Seminar discussions focus on the ecology of the classroom—Influence of physical arrangement of the classroom on learning—teacher roles, effect of different teaching strategies, teacher communication styles, and assessing teacher behaviors. (DR:X)
4-5 units, Aut (Staff) T 2:15-4:05
and by arrangement

118B. Curriculum Development—Seminar discussions focus on the identification, development, and assessment of curricula materials. (DR:X)
4-5 units, Win (Staff) T 2:15-4:05
and by arrangement

118C. Preschool Programs—Seminar discussions focus on examination of different preschool programs with regard to: role of the teacher, curriculum program structure, role that the child is expected to play. (DR:X)
4-5 units, Spr (Staff) T 2:15-4:05
and by arrangement

120. Cognitive Development—A survey of major topics and issues concerned with cognitive development, developmental changes in memory, conceptual organization, logical reasoning, and communication skills will be discussed. (DR:S)
3 units, Win (Markham) TTh 3:15-4:45

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. (DR:S)
3-4 units, Spr (Zanna) TTh 10:00-11:30

126A. Psychology of Black Experience—An overview of contemporary topics in the area of black psychology, including self-concept, achievement and motivation, black family and others. Prerequisite: 1 or consent of instructor. (DR:S)
3-4 units, Aut (Brown) TTh 2:15-3:30

126B Seminar in the Psychology of Black Experience—(Graduate students enroll in 226.) This seminar is primarily for students interested
in Afro-American related research. Prerequisite: Psychology 126A or graduate standing in psychology, Education, or related areas. (DR:S)
3 units, Win (Brown) by arrangement

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. (DR:S)
3-4 units, Spr (Staff) MW 11:00-12:30

130A. Sex Roles Discussion Section—Optional supplement to Psychology 130. Small discussion groups, led by graduate students, devoted to exploring the personal, social and political issues raised by class lectures and readings. Particular emphasis will be placed on the implications of sex roles in students' own lives. Offered exclusively for Pass/No Credit. (DR:X)
1 unit, Spr (Staff) by arrangement

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 (DR:S)
4 units, Spr (H. Mischel) TTh 1:15-2:30

135. Basic Issues in Clinical Psychology and Personality—A critical analysis of the most enduring and controversial issues in the areas of personality and clinical psychology. Topics include: the units for conceptualizing persons; the nature and role of dispositions; the meaning of normality, abnormality, and deviance; the development and maintenance of personality problems; self-regulatory processes and ego development; clinical inference and evidence; the rationale underlying alternative treatment strategies; the assessment and therapeutic modification of selected personality problems. Prerequisite: Psychology 1 or equivalent (DR:S)
3-4 units, Win (W. Mischel) TTh 1:15-2:30

136. Abnormal Psychology—Genetic, psychodynamic, behavioral, and social psychological aspect 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. (DR:S)
4 units, Aut (Rosenhan) TTh 2:15-3:30

136A. Abnormal Psychology Discussion Section—Optional supplement to Psychology 136. Small discussion groups led by graduate teaching assistants. Prerequisite: concurrent enrollment in 136. (DR:X)
1 unit, Aut (Rosenhan) by arrangement

137. Personality and Psychopathology—This course will examine the nature and origin of selected human problems from a cognitive and psychoanalytic perspective. Prerequisite: Psychology 136. (DR:S)
3 units, Aut (Horowitz) Th 3:15-6:00 given 1979–80

139. Behavior Modification: Introduction—(Same as Education 136.) Rationale, concepts and issues in application in educational settings. Implementations of behavioral change program. (DR:S)
3 units, Win (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. (DR:X)
3 units, Aut (Hastorf) TTh 9:30-10:50

141A. History of Psychology Discussion Section—Optional supplement to Psychology 141. (DR:X)
2 units, Aut (Hastorf) by arrangement

143. Experimental Psychology of Reading—(Same as Education 154.) Survey of literature on the reading process, and acquisition of reading. Review of experiments on reading and reading instruction.
3 units, Aut (Calfee) MWF 8:00

144. Counseling and Therapy: An Introduction—(Same as Education 130.) Some major approaches to counseling and psychotherapy. Primary emphasis on social learning strategies as to key concepts and clinical techniques. Study number of case studies on variety of personal, social, academic problems. Psychology 1 recommended as prerequisite. (DR:S)
3 units, Spr (Thoresen) M 3:15-5:05 and by arrangement
Sum (Thoresen) MW 8:00-10:00

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. (DR:S)
4 units, Aut (Gage) TTh 3:15-5:05
Sum (Gage) MW 4:15-6:05
146. Language and Thought—Surveys current topics of interest in language and thought, including language acquisitions by children, language comprehension and production, phonological perception, biological bases of language and meaning, linguistic relativity, bilingualism, and aphasia. These topics will be related to other cognitive processes such as perception and reasoning. Prerequisite: 1 or equivalent. (DR:S)

4 units, Win (B. Tversky) TTh 11:00-12:30

147. Animal Behavior: Neurobiological Aspects—Ethological viewpoints of behavior will be presented, with an emphasis on understanding the physiological substrates. Prerequisites: Psychology 107, 108, or 109, or Biology 22, or Human Biology 2A. (DR:T)

4 units, Win (Wine) MWF 10, alternate years, given 1979-80

149. Seminar: Cellular Neurophysiological Approaches to Behavior—(Graduate students enroll in 227.) A detailed consideration of selected examples of current research that have solved or are close to solving persistent problems. We will also try to identify problems and preparations which might profitably be explored. Sample topics: the Mauthner cell system; the function of muscle spindles; efferent control of sensory input.

3 units, Spr (Wine) by arrangement

151. Statistical Methodology—Prerequisite: 60 or equivalent. (DR:T)

3-4 units, Win (Thomas) MWF 9:00

152. Analysis of Data—Prerequisite: 151 or consent of instructor. (DR:T)

3-4 units, Spr (Carsmith) MTWF 9

155. Human Abilities—(Same as Education 255.) The nature, development, and measurement of intellectual abilities. Prerequisites: Psychology I and Education 250 or Psychology 60. (DR:S)

3 units, Spr (Snow) MWF 10

157. Sleep and Dreams—A multi-media lecture presentation of current knowledge in the area of sleep, dreams, and sleep disorders. Goal is to provide essentials of basic information about sleep that everyone should know. Course includes narcolepsy, the nature and function of sleep, physiology of REM sleep versus NREM sleep, circadian rhythms, the insomnias, the hypersomnias, sleep-walking, sleep-talking, night terrors, sleeping pills, sleep in mental illness, dream content and psychophysiological correlation. Current research is integral part of course. No prerequisite. (DR:S)

3 units, Win (Dement) TTh 11

157A. Sleep and Dream Discussion Sections—Optional supplement to Sleep and Dreams. Prerequisite: concurrent enrollment in 157.

161. The Human Connection: Overcoming Shyness, Alienation and Asocial States of Existence—This course will explore the importance of close encounters of the people-kind for species' survival and the health of its members. Our focus begins with those forces in us and imposed upon us that prevent, dilute or destroy human bonding. Some topics that will concern us are: shyness, envy, the cult of ego, narcissism, alienation, prejudice, competition, industrial capitalism, dehumanization, and the efficient management of behavior. Some attention will also be directed toward the negative impact of institutional life on our social-emotional development and expression. "The Stanford Experience" can serve as a case study for how we might attempt to right what has gone wrong in our lives. In the end, time permitting, we shall try to accentuate the positive with pragmatic plans to reprogram our programmers so that we may discover the joys of the human connection. Prerequisite: Psychology 1.

3 units, Win (Zimbardo) TTh 2:15-3:30

163. Mathematical Psychology—(See 215.) (DR:S)

164. Mathematical Representation of Structures in Psychological Data—(See 218.) (DR:S)

165. Graduate Seminar: Picture Memory—(See 219.)

166. Mathematical Theories of Perception and Psychophysics—(See 222.)

3-5 units, Win (Sakitt) MW 1:15-2:45, given 1979-80

180. Undergraduate Seminar: Selected Topics in Psychology—(Refer to quarterly time schedules for seminar listings.) (DR:S)

182. Senior Honors Seminar—Limited to students in the Senior Honors Program. Can be repeated for credit. (DR:X)

4 units, Aut, Win, Spr (Staff) by arrangement

184A. Individual Participation and Study in Paraprofessional Programs.—A variety of programs within the broadly defined area of Community Mental Health utilize Stanford undergraduates as volunteer "paraprofessionals." Each program provides training and has supervision and each offers academic credit for participants. The Zonta Children's Center in San Jose allows students to learn behavior modification techniques in working with schizophrenic, autistic, or otherwise "disturbed" children. Children's Health Council similarly offers op-
opportunities to work with young children handicapped with emotional, educational, or behavioral problems. A number of opportunities for working with adolescents are provided by Social Advocates for Youth. Volunteers may be matched with youngsters who are experiencing in special educational, or academic problems. Alternatively, SAY coordinates participation in special education and counseling programs at Los Altos and Await High Schools. Currently, three programs involve working with adults. Volunteers at the Menlo Park Veterans Administration Hospital work with middle-aged inpatients and outpatients, both in classroom settings and in “community outreach” programs designed to improve the patients’ social skills and confidence. Outreach for Women allows volunteers to provide women clients with vocational or personal counseling at critical transitions points in their lives. Finally, The Gerontology Action Program places volunteers in a variety of programs addressing the needs and problems of older people. Each of these programs demands a heavy commitment in terms of time and energy (8 to 12 hours per week), but each offers an unusual opportunity for mature, responsible and dedicated students. They are particularly recommended for those who are considering careers in counseling, clinical, community, or educational psychology. Prerequisite: students must be prepared to take this course for two consecutive quarters. (DR:X)

3-5 units, Aut (L. Carlsmith) by arrangement

184B. Individual Participation and Study in Paraprofessional Programs—(Same as 184A.) (DR:X)

3-5 units, Win (L. Carlsmith) by arrangement

184C. Individual Participation and Study in Paraprofessional Programs—(Same as 184A and 184B.) (DR:X)

3-5 units, Spr (L. Carlsmith) by arrangement

185. Conceptions of Mental Illness and Health—This seminar explores several competing concepts of mental illness and mental health, of deviance and normalcy, of therapy and personal growth. Contributions to the literature and conflicting viewpoints from humanistic, existential psychoanalytic, and behaviorist psychologists will be studied and discussed. Sociological, social-psychological and cross-cultural perspectives will also be examined. Relatively heavy reading demands, and relatively light emphasis on experimental research will be distinguishing features of this course. Enrollment will be limited; prior consultation with the instructor is recommended.

3 units, Spr (Ross) TTh 1:15-2:30

given 1979–80

186. Personality and Its Social Context—This course will be organized around the dynamic relationship between the individual and his/her social environment. Contemporary approaches to personality will be applied to such topics as identification and personality development, self control, alienation and aggression.

3-4 units, Win (Brown) TTh 1:15-2:30

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. (DR:X)

1-3 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, Spr (Levine) MWF 8 alternate years, given 1979–80

190A. Early Experience—This course focuses on the experimental literature related to the effects of pre- and postnatal environmental factors on development and adult function. The material covers both animal and human research and deals with behavioral and physiological function. Prerequisite: consent of the instructor.

3-5 units, Win (Levine) T 4:15-6:00

190C. Special Topics in Sleep Research—This intensive undergraduate seminar is designed to allow student 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, physiological psychology or biology is recommended. Prerequisite: Psychology 157 and permission of instructor. (DR:S)

3 units, Spr (Mitler) by arrangement

191. Undergraduate Seminar: Behavior Change—This seminar will examine social learning approaches to personal and social change. Prerequisite: consent of instructor. (DR:S)

3 units, Win (Bandura) MW 10:00-11:30

192. Undergraduate Seminar: Aggression—This seminar will examine the determinants of individual and collective aggression. Primarily
intended for majors in psychology. Prerequisites: 1 and consent of instructor. (DR:S)
3 units, Spr (Bandura) M 2:15-4:05

194A. Parent-Child Interaction—Prerequisite: consent of instructor.
3 units, Spr (Maccoby)
by arrangement, given 1979-80

194B. Memory Development—A survey of major topics and issues concerning the development of aspects of memory and related cognitive processes, with an emphasis on contemporary research and theory. Primarily intended for majors in psychology. Prerequisite: consent of instructor. (DR:X)
3 units, Spr (Flavell) Th 7:00-9:00

194C. Undergraduate Seminar: The Child's Acquisition of Concepts—A critical examination of theory and research in conceptual development. Topics to be discussed include: What is the nature of children's concepts? How do they differ from adult concepts? How are they acquired? Prerequisite: consent of instructor.
3 units, Spr (Markman) by arrangement

195. Undergraduate Seminar: Case History Approach to Theories of Personality—Some of the major personality theories will be applied to the analysis of several case histories. Students will be exposed to original writings by major theorists and to clinical case materials that illustrate concretely the basic issues which the theories address. By consent of instructor. (DR:S)
3 units, Win (H. Mischel) T 1:15-3:05

196. Moral Development—Prerequisite: consent of the instructor.
3 units, Aut (Lepper) MW 1:15-3:05

COURSES PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:X)

Undergraduate students may be admitted only by consent of instructor.

207. Contemporary Viewpoints in Psychology—A survey of major issues in contemporary psychology with their historical backgrounds. Required of and limited to first-year graduate students in psychology.
3 units, Aut (Wine, Zimbardo)
TTh 11:00-1:00

208A. Physiological Psychology—A survey of research in physiological psychology and the neurosciences, with an emphasis on basic issues. Prerequisite: graduate standing in Psychology or consent of instructor.
3 units, Win (Wine) M 2:15-5:00
alternate years, given 1978-79

208B. Physiological Psychology: Brain and Cognitive Processes—Prerequisite: graduate standing in Psychology or consent of instructor.
3 units, Win (Pribram) alternate years, given 1979-80

209. Perception—Advanced treatment of visual perception. Prerequisite: graduate standing in Psychology or consent of instructor.
3 units, Aut (Ganz) TTh 9:00-10:30

210. Human Memory—Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Spr (Smith) TTh 11:00-12:30

211. Developmental Psychology—Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Win (Maccoby, Flavell, Markman)
MW 10-12

212. Social Psychology—Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Win (Carlsmith, Lepper)
TTh 1:15-3:05

213. Personality—Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Aut (W. Mischel) T 2:15-5:00

213A. (See 134.)

214. Psycholinguistics—Prerequisite: graduate standing in psychology or consent of instructor.
3 units, Spr (Patterson) TTh 3:15-4:30

215. Mathematical Psychology—(Undergraduates enroll in 163.) 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 of consent of instructor.
3 units, Aut (Thomas, Tuersky)
MW 10:00-12:00

216. Abnormal Psychology—This course will examine selected literature in abnormal psychology approached from a cognitive and motivational perspective. It attempts to integrate psychoanalytic and behavioral views of the nature, origin, and treatment of abnormal behavior. Prerequisite: graduate standing in psychology of consent of the instructor.
3 units, Win (Horowitz) Th 3:15-6:00
given 1979-80

217. Graduate Seminar: Social Learning of Complex Behavior Patterns—This is an advanced seminar intended primarily for students who are familiar with social learning theory. The seminar will focus on the social learning analysis of several behavior domains, including language learning, moral development, and others. Pre-
requisite: graduate standing in psychology or consent of instructor.

2-3 units, Win (Brown) by arrangement

218. Mathematical Representation of Structures in Psychological Data—(Undergraduates enroll in 164.) Theory and methods of multidimensional scaling, hierarchical clustering, and related methods for discovering and representing structures underlying matrices of similarity and multivariate data. Prerequisite: graduate standing in psychology or consent of instructor.

3 units, Spr (Shepard) MW 2:15-4:05

219. Graduate Seminar: Picture Memory—(Undergraduates enroll in 165.) Discussion of research and theories about memory for pictures and pictorial representations with perspective provided from comparison to memory for verbal material and from development of picture memory.

2-3 units, Spr (B. Tversky) by arrangement

220. Seminar on Space and Language—(Same as Linguistics 361.) Consideration of parallelisms and possible connections between linguistic and spatial competencies with special attention to "localist" theories, and to the expression of spatial relations and their metaphorical extensions in language.

3 units, Aut (Shepard, E. Clark) by arrangement

222. Mathematical Theories of Perception and Psychophysics—(Undergraduates enroll in 166.) Mathematical theories of perception and psychophysics including signal detection theory. Fourier analysis and its applications in perception, information theory and other topics. Prerequisite: Psychology 1 and some calculus.

4 units, Win (Sakitt) MW 1:15-2:45, given 1979-80

223. Graduate Seminar on Memory—Prerequisite: graduate standing in psychology or consent of the instructor.

3 units, Win (Smith) by arrangement

224. Models of Thought Processes—(Same as Computer Science 224.) Introductory survey of concepts and problems in artificial intelligence research; heuristic processes in problem solving; heuristic programming; information processing models as explanations of human cognitive and affective behavior. Prerequisite: Computer Science 105 or 106 or equivalent.

2 units, Spr (Staff) TTh 1:15-2:30


227. Seminar: Cellular Neurophysiological Approaches to Behavior—(See 149.)

228. Seminar in Animal Communication—(Same as Hearing and Speech Sciences 281.) A general survey of the communicative aspects of social behavior of animals, including man. Emphasis will be placed on diversity of signal systems and the contrasts between these systems and human linguistic behavior. Prerequisite: consent of instructor.

3-4 units, Win (Dewson) by arrangement


4 units, Aut (Dewson) by arrangement

230. Seminar in Neural Substrates of Human Communication—(Same as Hearing and Speech Sciences 390.) Prerequisite: consent of instructor.

3-4 units, Spr (Dewson) by arrangement

231. The Auditory Process—(Same as Hearing and Speech Sciences 292.) 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. Prerequisite: consent of instructor.

3 units, Aut (Schubert) by arrangement

232. Selected Topics in Psychoacoustics—(Same as Hearing and Speech Sciences 392.) A detailed study of the normal auditory 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.

3-4 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 units, Spr (Schubert) by arrangement

235. Issues in Moral Development—Prerequisite: graduate standing in psychology or consent of instructor.

3 units, Aut (Lepper) by arrangement

239. Advanced Cognitive Development—A critical examination of current theory and research in cognitive development. Topics will include: Piagetian and other theoretical approaches; problems and issues concerning cognitive-developmental assessment, mecha-
nisms or processes of growth, structures, stages and sequences; developmental aspects of such processes as attention, learning memory, social cognition, and communication. Prerequisite: 211.

2-3 units, Win (Flavell) M 7:00-9:30

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 ad past literature. Prerequisites: Linguistics 10 or 230, or consent of instructor.

4 units, Aut (E. Clark) TTh 1:15-3:05


4 units, Win (E. Clark) T 1:15-4:05

243. Issues in Early Childhood Education—(Same as Education 244.) Provides opportunities for graduate students to critically review and discuss issues relating to child development and educational settings and programs for programs for young children. Topics vary from year to year. Focus deals with the application of present knowledge base to early childhood education. Prerequisite: consent of instructor.

3 units, Win (Staff) TTh 10:00-12:00

and by arrangement

244. Seminar in Social Development and Family Interaction—Prerequisite: graduate standing or consent of instructor.

2-3 units, Spr (Maccoby) by arrangement

245. Socialization and Social Institutions—(Same as Education 311.) Students in this course will examine the role of the family and the school as socializing institutions. Particular attention will be given to the influence of family structure and environment upon educational achievement and to social class and cultural variation in family interaction.

3 units, Win (Hess) T 9, Th 9:00-11:00

246. Graduate Seminar: Selected Topics in Cognitive Development—Prerequisite: Graduate standing or consent of instructor.

2-3 units, Spr (Flavell) by arrangement

247. Intensive Experimental Research—(Same as Education 233.) Introduction to single (or few subjects) time series designs in education, psychology and clinical medicine settings. Examine research design and analysis methods along with philosophy of science issues. Intended primarily for students interested in doing observational and experimental studies in applied settings.

4 units, Win (Thoresen) T 2:15-4:05

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: Education 250 or Psychology 60 or equivalent.

3-4 units, Aut (Cronbach) MW 2:15-4:05

249. Problems in Measurement—(Same as Education 353.) 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: 152 and 248 or Education 250B and 252, or Psychology 152 and 248, or equivalent

3 to 4 units, Spr (Cronbach) MW 2:15-4:05

250. Individual Counseling Psychology Methods—(Same as Education 234.) Techniques for helping individual clients learn successful procedures for coping with problems such as shyness, depression, anxiety, obesity and aggression.

3 units, Aut (Krumboltz) T 2:15-4:05

and by arrangement

252. Multivariate Analysis—Multiple regression, analysis of covariance, multivariate analysis of variance. Prerequisite: 152 or equivalent.

2-3 units, Win (Carlsniith) TTh 9

given 1979-80


4 units, Aut (Thoresen) M 3:15-5:05

and by arrangement

254. Principles of Personality Change—Prerequisite: graduate standing in psychology.

3 units, Aut (Bandura) M 2:15-4:05

254A. Principles of Personality Change—(See 191.)

257. Individually Supervised Practicum—Can be repeated for credit. Prerequisites: graduate standing in psychology and consent of instructor.

3-5 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.

3-5 units, Aut, Win, Spr (Staff) by arrangement
264. Advanced Topics in Human Learning—
Prerequisite: consent of the instructor.
3 units, Spr (Bower) by arrangement

269. Graduate Seminar: Personality—
Prerequisite: consent of the instructor.
3 units, Spr (W. Mischel) by arrangement

275. Graduate Research—Research of inter-
mEDIATE nature whether or not to be used to-
ward Master's thesis, to be undertaken with
members of Departmental faculty. Prerequi-
site: consent of instructor.
(Staff) by arrangement

276. Graduate Seminar in Psychoanalytic
Theory—This seminar will critically explore
selected psychoanalytic ideas and examine at-
ttempts to objectify the concepts empirically.
3 units, Spr (Horowitz, Suppes)
by arrangement given 1979–80

279. Graduate Seminar in Social Cognition—
Prerequisite: consent of instructor.
3 units, Win (Zajonc) by arrangement

Prerequisite: consent of instructor.
(Staff) by arrangement

282. Graduate Seminar: Similarity—The
seminar will review new theoretical and empiri-
cal developments regarding the perception and
representation of similarities. The geometric
approach to similarity will be contrasted with
alternative approaches based on feature
matching and clustering.
2-3 units, Win (A. Tversky) T 3:15-5:05

305. Research Seminar in Cognitive and
Mathematical Psychology—Can be repeated for
credit. Prerequisite: consent of instructor.
1 unit, Aut, Win, Spr (Staff) F 3:15-4:30

308. Research Seminar in Brain and Be-
havior—Can be repeated for credit. Prerequisi-
tive: consent of instructor.
1-3 units, Aut, Win, Spr (Pribram,
Ganz, Wine) F 1:15-3:05

315. Pro-seminar in Social and Personality
Psychology—Limited to graduate students in
social and personality psychology. Prerequisite:
consent of instructor.
2-3 units, Spr (Hastorf, Zimbardo,
Carlsmith, Lepper, Ross) by arrangement

352. Psychology and Law—(Same as Law 337.)
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 insan-
ity; 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; in-
troduction materials on the social psychology of
institutions; the implications of dissonance
theory for torts, and bankruptcy. Prerequisite:
consent of instructor.
3 units, Aut (Rosehan) by arrangement

353. Psychopathology and Mental Health
Law—(Same as Law 338.) Prerequisite: consent
of instructor.
4 units, Aut (Law 338) by arrangement

RELIGIOUS STUDIES
Chairman: William A. Clebsch

Professors: William A. Clebsch (Religious
Studies and Humanities), Edwin M. Good,
Van A. Harvey, David S. Nivison (Asian Lan-
guages and Philosophy and, by courtesy, Re-
ligious Studies), Lewis W. Spitz (History and,
by courtesy, Religious Studies). Visiting:
Wilhelm Pauck

Associate Professors: Lawrence V. Berman, Lee
H. Yearley (on leave 1978-79)

Assistant Professors: Winston B. Davis, Henry
S. Levinson (on leave Autumn, Winter
1978-79), Diana Y. Paul (on leave Autumn,
Acting: James J. Heaney

Lecturers: Robert G. Hamerton-Kelly, Paul H.
Mosher

As one of the humanities, the study of religion
aims to understand and interpret the history,
literature, thought, social structures, and types
of personality in various religious traditions and
cultures. The Department offers courses at sev-
eral levels, indicated by course numbers and
units:

1-9 World Religions (usually 3 units)
11-89 Introductory (usually 3 units)
101-189 Intermediate (5 units)
201-299 Graduate Courses (4 units)
300-399 Graduate Seminars, Research, and
Teaching (variable units)

BACHELOR OF ARTS

The following Departmental requirements
are in addition to the University's basic re-
quirements for the Bachelor's degree: 60 units
of course work (no more than 10 units of which
can be taken pass/no credit), including at least
two courses on World Religions, three courses
on Traditions, two courses on Problems, and
two courses on Thinkers.

The Bachelor's degree with honors in Reli-
gious Studies may be earned by students who
are endorsed by their advisers and by the Un-
dergraduate Director and who meet additional
requirements.
JOINT MAJOR IN RELIGIOUS STUDIES AND PHILOSOPHY

The Departments of Religious Studies and Philosophy jointly nominate for the A.B. students who have completed a major in the two disciplines according to guidelines available from the Undergraduate Director of either Department.

MASTER OF ARTS IN RELIGIOUS STUDIES

University regulations pertaining to the Master of Arts are listed in the section "Degrees" in this bulletin. The following requirements are in addition to the University's basic requirements for the A.M.

Each student must complete at least 48 units of graduate work at Stanford beyond the Bachelor of Arts degree, including the four required graduate seminars. Because this series of seminars (16 units) is offered only over the course of two years, residence is normally halftime study for two years, but may be full-time study during the autumn and winter quarters of two consecutive years.

The other 32 units must comprise a plan of courses subject to approval by the Graduate Director. No thesis is required, and if a thesis is written it may earn no more than 9 units.

Each student must demonstrate by the second quarter of graduate study reading competence in one foreign language. Introductory language courses do not count towards the 48-unit requirement, but advanced courses in which primary works in foreign language are read may count.

As many as 12 units of the 48 may be taken as a coherent program in advanced and graduate courses in other Departments of the University.

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's 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. Each student must complete 90 units of graduate work in addition to the dissertation, of which the last 60 units must be taken at Stanford.

Fields of Study: Students may propose for approval any substantial field of study in which there is a coherence of strengths in the faculty in Religious Studies and other faculty in the University. Examples: East Asian Religions, Western Religions, Modern Religious Thought, and American Religions.

Courses: Each student takes courses subject to approval of a faculty member designated as the adviser. The four required seminars must be completed satisfactorily before the Candidacy Essay is written.

Candidacy Essay: This Essay is written in the sixth quarter of graduate study. The Essay must demonstrate the student’s ability to apply to the field of concentration the scholarly approaches of the four required graduate seminars. After the Essay has been judged satisfactory, the student is eligible to be recommended for Candidacy 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 student has advanced to Candidacy for the Ph.D. 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 a reading knowledge of two foreign languages, including French or German, before beginning the second full year of graduate work at Stanford. Before writing Candidacy Essays, students must demonstrate reading knowledge of other ancient or modern languages if relevant to the field of concentration. Knowledge of additional languages may be required for certain areas of dissertation research.

Supporting programs: A coherent and substantial supporting program consisting of no fewer than 20 and no more than 27 units shall be taken in advanced and graduate courses in other Departments of the University.

Dissertation: During the University oral examination, the student must engage in a colloquium on the proposed dissertation topic and demonstrate 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. in Religious Studies and Humanities. For a description of that program see that section on “Humanities Special Programs” in this bulletin.

COURSES

All courses (DR:H) unless noted otherwise.

WORLD RELIGIONS

Comparative approaches to religions in their social, personal, and intellectual dimensions. Designed as series but may be taken individually.

1A. Comparative Religious Communities. 3 units, Spr (Davis) MWF 10

1B. Comparative Religious Personalities. 3 units, Aut (Clebsch) MWF 10

1C. Comparative Religious Thought. 3 units, (Yearley) given 1979-80

1D. Comparative Religious Literatures. 5 units, Win (Good) MWF 10

1E. Comparative Religious Rituals. 3 units, (Levinson) given 1979-80

INTRODUCTORY TRADITIONS

13. Hinduism—Major Hindu doctrines, myths, and symbolic expressions from Vedic times to the present; the Krsna cults and Yogic experience. 3 units, Spr (Paul) TWTh 11

14. Buddhism—The philosophical, religious, and cultural legacies of major strains of Buddhism in East Asia; Tendai and Shingon; Pure Land, Shin, and Nichiren; Ch'an and Zen. 3 units, Aut (Berling) MWF 1:15

15. Religion in Japan—The religious life of the Japanese: the syncretism of Shinto and Buddhist sects; Confucian schools; the religious outlook of both the folk and the elite traditions. 3 units, Aut (Davis) TTh 11

16. Japanese Buddhism—Development of Buddhism in Japan from the sixth century to the present. 3 units, Spr (Davis) MWF 1:15

18. Ch'àn and Zen Buddhism—History and development of Chàn and Zen Buddhism in China and Japan; interpretation of selected scripture and Koan. 3 units, (Paul) given 1979-80

19. The Taoist Tradition—The evolution of Taoist thought in relation to social and cultural changes and in interaction with Confucianism and Buddhism; Lao Tzu and Chuang Tzu; neo-Taoism; later understandings of the Tao Te Ching. 3 units, Aut (Berling) MWF 9

20. Confucianism—The sage ideal from Confucius to the present day; the evolution of Confucian religious ideals in relation to social and cultural changes and in interaction with developments in Taoism and Buddhism. 3 units, Win (Berling) MWF 9

22. Greek Religion—Origin and development of Greek religious phenomena from Mycenae to Byzantium. (Same as Classics 117.) 3 units, Win (Jameson)

23. Judaism—Talmudic and post-Talmudic Jewish thought; Midrash, Mishnah, and Talmud; codification of the law; religious philosophy; Kabballah and Hasidism. 3 units, Win (Berman) MWF 11

24. Christianity—Historic types of Christian religiousness from the early martyrs to the current activists. 3 units, Spr (Clebsch) MWF 9

27. Islam—The Koran; traditional literature; basic concepts of law; sects; theology and philosophy; mysticism. 3 units, Spr (Berman) MWF 1:15

PROBLEMS

31. Prophecy in Judaism and Islam—Moses and Muhammad in the view of thinkers like Alfarabi, Avicenna, Maimonides, and Spinoza. 3 units, Aut (Berman) TTH 4:15-6:05

32. Jesus in the Gospels—Varying interpretations of Jesus and his teaching. 3 units, (Hamerton-Kelly) given 1979-80

34. Images of the Feminine in East Asian Culture—The mysterious female; the ideal of the feminine in relation to the realities of life in religion, literature, and legend. 3 units, Win (Berling) MWF 1:15

36. Secularization—The alleged decline of religion in modern society with emphasis on the influence of English Puritanism. 3 units, Win (Davis) MWF 1:15

38. Psychological Theories of Religion—Freud, Jung, Maslow, and Becker. 3 units, Aut (Harvey) MWF 9

42. Philosophy of Religion—Contemporary and traditional issues. 3 units, Spr (Harvey) MWF 9

49. Approaches to the Study of Religion—Various ways in which scholars have interpreted the phenomenon of religion. 3 units, (Staff) given 1979-80
THINKERS

66. Theology of Paul—The religious thought of Paul within its cultural and historical context.  
3 units, Win (Hamerton-Kelly) TWTh 11

76. Modern European Religious Thought—The crisis of religious belief as seen in such thinkers as Barth, Teilhard de Chardin, Freud, and Bonhoeffer.  
3 units, Win (Heaney) MWF 9

77. Religious Existentialists—Existentialist dimensions in the thought of Kierkegaard, Heidegger, Buber, Bultmann, Rahner, and Tillych.  
3 units, Aut (Heaney) MWF 1:15

INTERMEDIATE TRADITIONS

113. Hinduism—(See 13 for description.)  
5 units, Spr (Paul) TWTh 11

114. Buddhism—(See 14 for description.)  
5 units, Aut (Berling) MWF 1:15 plus section dhr

115. Religion in Japan—(See 15 for description.)  
5 units, Aut (Davis) TWTh 11

116. Japanese Buddhism—(See 16 for description.)  
5 units, Spr (Davis) MWF 1:15

118. Ch'an and Zen Buddhism—(See 18 for description.)  
5 units, (Paul) given 1979–80

119. The Taoist Tradition—(See 19 for description.)  
5 units, Aut (Berling) MWF 9 plus section dhr

120. Confucianism—(See 20 for description.)  
5 units, Win (Berling) MWF 9 plus section dhr

121. Ancient Israel—Religious traditions of ancient Israel, approached through its literary tradition; Israel in the religious context of the ancient Near East.  
5 units, Spr (Good) MTWTh 11

123. Judaism—(See 23 for description.)  
5 units, Win (Berman) MWF 11

124. Christianity—(See 24 for description.)  
5 units, Spr (Clebsch) MWF 9

125. The Medieval Church—The organization, function, and teachings of the Roman Catholic Church in Western Europe from 300 to 1500.  
5 units, Win (Mosher) TTh 4:15-6:05

126. The Christian Humanists, Lutheran, Calvinist, Catholic, and Radical Reformations—(Same as History 110.)  
5 units, Spr (Spitz)

127. Islam—(See 27 for description.)  
5 units, Spr (Berman) MWF 1:15

PROBLEMS

131. Prophecy in Judaism and Islam—(See 31 for description.)  
5 units, Aut (Berman) TTh 4:15-6:05

133. Jewish Religious Thought—Structure, function, and status of the commandments in historical perspective.  
5 units, Spr (Berman) MW 4:15-6:05

134. Images of the Feminine in East Asian Culture—(See 34 for description.)  
5 units, Win (Berling) MWF 1:15 plus section dhr

5 units, Spr (Berling) MW 2:15-4:05

136. Secularization—(See 36 for description.)  
5 units, Win (Davis) MWF 1:15

144. Nineteenth Century European Religious Thought—Interpretations of religious conceptions of deity and human nature in such thinkers as Hegel, Newman, Kierkegaard. Prerequisite: consent of the instructor.  
5 units, Win (Harvey) MW 4:15-6:05

147. Religion and Modernity—The problem of religion and modernity from the perspectives of various humanistic and social scientific disciplines. Prerequisite: consent of the instructor.  
5 units, Spr (Levinson) MW 2:15-4:05

148. Anthropological Studies of Religion—Interpretations of myths, symbols, and rituals, in sacrifice, magic, and witchcraft. (Same as Anthropology 153.)  
5 units, Win (Rosaldo) MWF 9

THINKERS

151. Chinese Buddhist Thought—Two texts in translation: one by Fa-tsong, the Hua-yen master, and one by Seng Chao, the San-lun (Madhyamika) master. Prerequisite: consent of the instructor.  
5 units, Spr (Paul) TTh 4:15-6:05

152. Chuang-Tzu—The thought in its historical setting. Prerequisite: consent of the instructor.  
5 units, (Yearley) given 1979–80
153. Chinese Religious Thought—Psychological approaches to classical Chinese thought. Prerequisite: consent of the instructor. 5 units, (Yearley) given 1979–80

164. Muhammad and the Koran. 5 units, (Berman) given 1979–80

165. Islamic Thought. 5 units, (Berman) given 1979–80

172. Maimonides. 5 units, (Berman) given 1979–80

173. Aquinas—The thought in its historical setting. 5 units, Aut (Heaney) TTh 2:15–4:05

174. Major Western Religious Thinkers—Prerequisite: consent of the instructor. 5 units, (Staff) given 1979–80

175. Modern Catholic Thought—Responses to developmental notions of history, to individualism, to democratic institutions, and to Marxism by Newman, Loisy, de Lubac, Küng, Rahner, and Lonergan. 5 units, Win (Heaney) TTh 2:15–4:05

177. Religious Existentialists—(See 77 for description.) 5 units, Aut (Heaney) MWF 1:15 plus section dhr

178. American Religious Thought. 5 units, Spr (Levinson) TTh 2:15–4:05

179. Karl Marx and Max Weber—Radical and liberal analyses of society, economy, and religion focusing on the concepts of value, rationality, fate, and human nature. 5 units, Aut (Davis) TTh 2:15–4:05

DIRECTED READING

198. Honors Essay—Prerequisite: consent of the instructor, and of the Department. (DR:X) Aut, Win, Spr (Staff) by arrangement

199. Individual Work—Prerequisite: consent of the instructor and of the Department. (DR:X) Aut, Win, Spr (Staff) by arrangement

GRADUATE COURSES

Prerequisite: consent of the instructor.

224. Christianity. 4 units, Spr (Clebsch) MWF 9

231. Prophecy in Judaism and Islam—(See 31 for description.) 4 units, Aut (Berman) TTh 4:15–6:05

233. Jewish Religious Thought. 4 units, Spr (Berman) MW 4:15–6:05

235. Topics in Eastern Religions. 4 units, Spr (Berling) MW 2:15–4:05

236. Secularization. 4 units, Win (Davis) MWF 1:15

242. Philosophy of Religion. 4 units, Spr (Harvey) MWF 9

244. Nineteenth Century European Religious Thought. 4 units, Win (Harvey) MW 4:15–6:05

247. Religion and Modernity. 4 units, Spr (Levinson) MW 2:15–4:05

251. Chinese Buddhist Thought. 4 units, Spr (Paul) TTh 4:15–6:05

252. Chuang-Tzu. 4 units, (Yearley) given 1979–80

253. Chinese Religious Thought. 4 units, (Yearley) given 1979–80

269A,B. Topics in the Renaissance and Reformation—(Same as History 410A,B.) 4 units, Win, Spr (Spitz)

272. Maimonides. 4 units, (Berman) given 1979–80

273. Aquinas. 4 units, Aut (Heaney) MWF 4:15–6:05

274. Major Western Religious Thinkers. 4 units, (Staff) given 1979–80

275. Modern Catholic Thought. 4 units, Win (Heaney) TTh 2:15–4:05

278. American Religious Thought. 4 units, Spr (Levinson) TTh 2:15–4:05

279. Karl Marx and Max Weber. 4 units, Aut (Davis) TTh 2:15–4:05

299. Individual Work—Prerequisite: consent of the instructor and of the Department. Aut, Win, Spr (Staff) by arrangement

GRADUATE SEMINARS

301. Interpretations of Religious Texts—Required of all graduate students in Religious Studies; may be repeated for credit. Topic for 1978–79: Problems in Hermeneutics. Prerequisite: consent of the instructor. 4 units, Aut (Harvey) MW 2:15–4:05

303. Histories of Religious Movements—Required of all graduate students in Religious Studies; may be repeated for credit. Prerequisite: consent of the instructor. 4 units, (Staff) given 1979–80

305. Analyses of Religious Thought—Required of all graduate students in Religious Studies; may be repeated for credit. Topic for 1978–79: Gods and Their Attributes. Prerequisite: consent of the instructor. 4 units, Win (Berman) MW 2:15–4:05
307. Comparisons of Religious Traditions—Required of all graduate students in Religious Studies; may be repeated for credit. Prerequisite: consent of the instructor. 4 units, (Staff) given 1979–80

GRADUATE RESEARCH AND TEACHING

319. East Asian Religions. (Berling, Davis, Nivison, Paul) by arrangement

329. Near Eastern Religions. (Berman, Good, Hamerton-Kelly) by arrangement

339. Medieval Western Religions. (Berman, Clebsch, Mosher, Pauck, Spitz) by arrangement

349. Modern European Religions. (Harvey, Heaney, Levinson) by arrangement

359. American Religions. (Clebsch, Harvey, Heaney, Levinson) by arrangement

369. Social and Psychological Aspects of Religion—Prerequisite: consent of the instructor and of the Department. (Staff) by arrangement

379. Religious Thought—Prerequisite: consent of the instructor and of the Department. (Staff) by arrangement

389. Theory of Religion—Prerequisite: consent of the instructor and of the Department. (Staff) by arrangement

390. Teaching in Religious Studies—Supervised internship. 4 to 6 units, Aut, Win, Spr (Staff) by arrangement

392. Candidacy Essay—Prerequisite: consent of the instructor and of the Graduate Director. 10 units, Spr (Staff) by arrangement

395. Thesis. (Staff) by arrangement

CENTER FOR RUSSIAN AND EAST EUROPEAN STUDIES

Committee in Charge: The Committee on Russian and East European Studies, a subcommittee of the Committee on International Studies.

Chairman: Wayne S. Vucinich (History)

PROGRAM OF STUDY

The Center for Russian and East European Studies administers a Coterminal 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 Coterminal 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 university 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, 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, 312 History Building, Stanford, California 94305.

The Center also administers an 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.

**COURSES**

**Slavic 117: Slavic Civilization to 1918**—(Same as History 117.)
- 4-5 units, (Vucinich, Staff)
- offered alternate years

**Slavic 184: Introduction to Slavic Bibliography**—(DR:X)
- 2 units, Aut (Zalewski)

**SLAVIC LANGUAGES AND LITERATURES**

**Emeriti:** Edward J. Brown, Jack A. Posin (Professors); Sarra Kliachko, Elisabeth Stenbock-Fermor (Assistant Professors)

**Chairman:** William Mills Todd III

**Professor:** Joseph A. Van Campen

**Associate Professors:** Lawrence L. Stahlberger, Richard Schupbach, William Mills Todd III

**Assistant Professors:** Carol Anschuetz, Gregory Freidin

**Lecturer:** Wojciech Zalewski (Curator, Russian and East European Collection, Stanford Libraries)

**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. The degree is intended for candidates with a teaching credential who wish to further strengthen their academic preparation. 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 “Humanities Special Programs” section 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 advisor, to include in any case courses numbered 111, 112, 113, 145, 146, 147, 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, 162, either 163 or 187, or 188, and 192, 193. Students should take at least 12 additional units to be selected from among the following: 167, 168, 169, 187,
188, 191, 195, 196, 198, 220. 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, 162, either 163 or 187 or 188, and 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 second Slavic language.
2. Requirements in Russian literature: Slavic 145, 146, 147, 187, 188, 200 (the last to be taken during 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 advisor.
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, 162, either 163 or 187 or 188, and 167-169.
2. At least two additional courses within the department to be chosen from among the following: 191, 195, 196, 197, 198, 211, 212, 213.
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, 187, 188.
5. Recommended courses in other departments: Communications 100, 102, 107; Computer Science 105, 106, 109A, or 111; History 120; Linguistics 010, 200, 206, 215, 230, 240, 253; Mathematics 3; Philosophy 57, 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 ensure 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 A.M. 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 advisor, 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 advisor.

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 may either submit an A.M. thesis or take a final examination. In the latter case, regardless of the area of specialization, the student will be required to demonstrate on a written examination (1) command of the phonology, morphology, syntax, and lexicology of contemporary Standard Russian sufficient to allow him or her to teach beginning and intermediate courses at the college level; (2) an ability to read contemporary Standard Russian sufficient to permit him or her 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 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 or 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 choice of patterns given in the next column may be offered:

either

1. A sequence of three courses in one West European literature, to be selected in consultation with the advisor, or
2. Three basic courses in Comparative Literature to be selected in consultation with the graduate advisor and the Comparative Literature Department, or
3. A course sequence in Russian History.

If the student elects to present a minor in French, German, or Spanish he or she should take six graduate courses in that department. Students considering minors in other areas, such as Asian Languages, English, Comparative Literature, or History, should consult with the advisor, the chairman of the Slavic department, and the chairman of their minor 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 or she 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 a 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) In the case of students wishing to specialize in literature, written an acceptable A.M. thesis, to be completed before the end of the 4th quarter, or, in the case of students wishing to specialize in Slavic linguistics, passed a written examination based on course materials and a reading list. 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 A.M. written examinations. If successful, the student will then be awarded the A.M. 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; (Students specializing in literature will be excused from this portion of the examination if they have completed Slavic 211, 212 and 213 with grades of "B-" or better.)
   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. (Students specializing in Slavic linguistics will be excused from this examination if they have completed, with a grade of "B-" or better, Slavic 221, 222 and either Slavic 187 or Slavic 188. They should also have taken Slavic 145, 146, and 147 or show equivalent training.)
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 advisor. 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 advisor. 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 residence requirements, see page 15. 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 Department 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 advisor 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 be required to do four quarters of teaching in partial fulfillment of the requirements of the Ph.D. degree.

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 first year of study. The reading examination in the second language must be passed by the end of the second year of study. Both language examinations 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.

145. Survey of Russian Literature in English Translation I: The Rise of a Secular Literature—(Same as Modern Thought and Literature 245A.) Close reading of selected novels and short fiction by Pushkin, Lermontov, Gogol, Tolstoy and Dostoevsky. Discussions will focus on problems of literary structure with reference to developments in Russian society and in European literatures. Open to all students, including freshmen. (DR:H)
4 units, Aut (Todd) MWF 10

146. Survey of Russian Literature in English Translation II: From Realism to Symbolism—(Same as Modern Thought and Literature 245B.) Close reading of selected novels and short fiction by Turgenev, Dostoevsky, Tolstoy, Chekhov, Saltykov-Shchedrin, and Bely. This course is a continuation of Slavic 145 but may be taken independently of it. Open to all students, including freshmen. (DR:H)
4 units, Win (Anschuetz) MWF 10

147. Survey of Russian Literature in English Translation III: The Modern Period—(Same as Modern Thought and Literature 245C.) Analysis of the major prose works of the twentieth century, with emphasis on structure and style, as well as on the place of literary works in the historical setting. Works of Pilnyak, Zamyatin, Babel, Zoshchenko, Sholokhov, Pasternak, Solzhenitsyn, will be read. This course is a continuation of Slavic 145 but may be taken independently of it. Open to all students, including freshmen. (DR:H)
4 units, Spr (Brown) MWF 10

149. Introduction to the Culture and Literature of the Slavic Peoples—No foreign language required.
4 units, (Stahlberger) given 1979–80

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. Macha, the Czech, and Aleksandr Pushkin, the Russian.
4 units, (Stahlberger) given 1979–80

151. Dostoevsky's Possessed and the Pretender in Russian Literature—(In English translation.) Pushkin's Boris Godunov and The Cappi's Daughter, Dostoevsky's Double and The Possessed will be read together with Schiller's Demetrius. Open to all students. (DR:H)
4 units, Aut (Anschuetz) MWF 11

152. Gogol—Reading of major works in English translation with reference to related development in European literatures. Open to all students.
4 units, (Todd) given 1979–80

153. Leo Tolstoy—(Same as Modern Thought and 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. (DR:H)
4 units, Spr (Stahlberger) MWF 11

154. The Russian Drama—(Same as Modern Thought and Literature 254.) A survey of the major Russian plays in English translation from Fonvizin to Mayakovsky, 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, (Stahlberger) given 1979–80

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. (DR:X)
5 units, Aut (Schupbach, Staff) MTWThF 9, 12, and 1:15

2. First-Year Russian—Continuation of 1.
(DR:X)
5 units, Win (Schupbach, Staff) MTWThF 9, 12, and 1:15

3. First-Year Russian—Continuation of 2.
(DR:X)
5 units, Spr (Schupbach, Staff) MTWThF 9, 12, and 1:15

5 units, Aut (Van Campen, Staff) MTWThF 11 and 1:15

52. Second-Year Russian—Continuation of 51 with focus on vocabulary building, syntax and
the reading of selected texts from twentieth-century authors. (DR:H) 5 units, Win (Van Campen, Staff) MTWTThF 11 and 1:15

53. Second-year Russian—Continuation of 52. Reading centers on selected texts from nineteenth-century authors. (DR:H) 5 units, Spr (Van Campen, Staff) MTWTThF 11 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. (DR:H with 114-116 only) 3 units, Aut, Win, Spr (Schupbach) MWF 1:15

114-116. Third-Year Russian Conversation and Composition—Coordinated with and to be taken in conjunction with 111-113. 2 units, Aut, Win, Spr (Freidin) TTh 1:15

117A,B. Slavic Civilization—(Same as History 117A,B.) (DR:A) 10 units, (Staff) offered alternate years

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. All Courses (DR:X)

Third-Year Level

162. Third-Year Russian (for Translators)—Translation of graded contemporary texts of a general nature, illustrative of problems encountered in Soviet journalistic prose. Drills on vocabulary and syntax of the translated material. Normally open only to students who have completed Sl. 111. 3 units, Win (Van Campen) MWF 12

163. Third-Year Russian (for Translators)—Continuation of 162. Reading and translation of technical materials in the physical sciences and mathematics, as well as other areas. 3 units, Spr (Schupbach) by arrangement

Fourth-Year Level

192. Introduction to Independent Translation—Translation of texts in the student’s area of interest. Open only to students in the Translators Program. Prerequisite: 162 and either 163 or 187 or 188, or equivalent. 1-5 units, Aut, Win (Schupbach) Spr (Van Campen) by arrangement

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. A grade of B—or better is required in order to qualify for a translator’s certificate. 3-5 units, Aut, Win, Spr (Van Campen, Schupbach) by arrangement

ADVANCED AND GRADUATE COURSES

167-169. Fourth-Year Russian Seminars I-III—Designed for students who would like to perfect their verbal and written skills while concentrating on major problems in Russian cultural history, as reflected in that country’s literature. Following an introduction to critical reading, the students are expected to approach selected texts systematically both as literature and as “documents” in the social and intellectual history of Russia. Open to all majors; the seminars are conducted in Russian (oral reports and short compositions are required). (DR:H)

167. Fourth-Year Russian Seminars I—Varieties of Russian literary expression. Introduction to critical reading. Concentration on short texts representative of different genres. Prerequisite: 12 units of Third-Year Russian or equivalent. (DR:H) 3-4 units, Aut (Freidin) MTTh 12

168. Fourth-Year Russian Seminars II—The idea of the artist in Russian literature. Selected texts characteristic of the evolution of the idea as both an aesthetic and a social phenomenon from the beginning of the 19th century to the present. Prerequisite: 167 or equivalent. (DR:H) 4 units, Win (Freidin) MTTh 12

169. Fourth-Year Russian Seminars III—Prerequisite: 167 and 168 or equivalent. Nabokov’s Gift. Intensive study of the Russian text will show how Nabokov works out his own idea of the artist by parodying the ideas of his nineteenth century predecessors. (DR:H) 4 units, Spr (Anschuetz) MTTh 12

172. Pushkin. 4 units, (Stahlberger) given 1979–80

184. Introduction to Slavic Bibliography—Analysis of basic Slavic research tools and bibliographic research media with emphasis on Russian and Soviet materials. The approach will be historical and evaluative. The aim of the
course is to acquaint students with reference sources, bibliographic search techniques, library use, and materials available in Stanford University Libraries. Students will examine, evaluate and employ reference material. Knowledge of Russian and/or another Slavic language helpful. Open to graduate and undergraduate students. No final examination.

3 units, Aut (Zalewski) Th 2:15-4:05

187. Russian Poetry of the Nineteenth Century—A study of the major representatives of Sentimentalism, Romanticism, Realism, Pushkin, Lermontov, Tjutchev and others. Lectures and discussions in English. Readings in Russian. Graduate students may earn 4 units. (DR:H)

3 units, Aut (Stahlberger) MWF 11

188. Russian Poetry of the Twentieth Century—A study of the major representatives of Symbolism, Acmeism and Futurism. Blok, Mandelstam, Mayakovsky, Esenin and others. Lectures and discussions in English. Readings in Russian. Graduate students may earn 4 units. (DR:H)

3 units, Win (Stahlberger) MWF 11

189. Russian Literature of the Middle Ages—Introduction to Medieval Russian literature, art, and thought. Open to all students. An extra credit and weekly meeting will be arranged for students who wish to read the texts in the original. (DR:X)

4 units, (Todd) given 1979-80

190. Russian Literature of the Eighteenth Century—Emphasis on poetry; theory of genres, the satire, the ode, the mock-epic. (DR:X)

4 units, (Stahlberger) given 1979-80

191. Derivational Morphology. 3 units, (Schubbach) given 1979-80

195. The Russian Verb—Study of problems of use of aspect; analysis of verb semantics dealing with the category as a whole and in particular with verb government and prefixation. Prerequisite: Slavic 53 or equivalent. 3 units, (Schubbach) given 1979-80

196. Grammatical Categories of Russian—Major grammatical categories of Russian: case, gender, number in the noun and aspect, tense, voice, mood as well as prefixation and transitivity in the verb are analyzed in some detail. Comparisons are drawn between the Russian and English systems. 3 units, Win (Schubbach) TTh 2:15-4:05

197. Russian Lexicology and Phraseology. 3 units, (Staff) given 1979-80

198. Russian Syntax—Study of sentence structure and word order in contemporary Russian with emphasis on differences from English. Prerequisite: Slavic 53 or consent of instructor. 3 units, (Van Campen) given 1979-80

199. Individual Work—Open to Russian majors or students working on special projects. May be repeated for credit. Consent of instructor required. (DR:X)

1-5 units, any quarter (Staff)

200. Proseminar in Russian Literature—The terms and concepts of literary study: the various approaches of literary criticism; rhetoric, poetics, and reception. Students in this course should also register for Slavic 184, Slavic Bibliography. Required of all entering graduate students and all honors majors in Russian literature. 4 units, Aut (Todd) M 2-4

211. Introduction to Old Church Slavic. 3 units, (Van Campen) given 1979-80

212. Reading of Old Church Slavic and Old Russian Texts. Prerequisite: 211. 3 units, (Van Campen) given 1979-80

213. History of the Russian Literary Language—A survey of the major structural and semantic changes from the tenth to the nineteenth centuries. Prerequisites: 211 and 212. 3 units, (Schubbach) given 1979-80

220. Literary Translation—The translation into English of Russian literary texts as an exercise in critical analysis. Readings in the theory of translation, and criticism of existing translations. Each student produces as his principal course work a publishable translation of a literary text. (DR:X)

4 units, (Brown) given 1979-80

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. (DR:X)

4 units, (Todd) given 1979-80

222. Stylistic Studies in Modern Russian Literature—To be taken in conjunction with 146. (DR:X)

4 units, (Brown) by arrangement


4 units, (Todd) given 1979-80
225. Problems of Romanticism in Russia—
(Same as Modern Thought and Literature 227.)
The Caucasus serves as a background for the
Byronic and Anti-Byronic hero in the poetry and
prose of Pushkin, Lermontov, Marlinsky, and
Tolstoy.
4 units, Aut (Anschuetz) W 2-4

226. Problems of Symbolism in Russia—(Same
as Comparative Literature 226.) Nineteenth-
century theories of language as a means of access
to myth find application in the poetry and prose of
Merezhkovsky, Ivanov, Blok and especially
Bely.
4 units, Win (Anschuetz) W 2-4

230. Russian Formalism and Structural-
asim—(Same as Comparative Literature 230A,
Modern Thought and Literature 214, and Eng-
lishe 262A.) The Russian Formalists' contribution
to literary criticism and theory; the relationship
of Russian Formalism to critical movements in
the West; the Prague School, and the Russian
Structuralists. No knowledge of Russian is re-
quired, but a knowledge of Russian, French,
German, or Czech is highly desirable. (DR:X)
4 units, Spr (Brown) TTh 4:15

271. Solzhenitsyn—(Same as Modern Thought
and Literature 274, and Comparative Literature
271.) Study of the major work of Solzhenitsyn in
the novel, short story, drama, and essay forms,
as well as in the genre most characteristic of him:
"literary investigation" of historical back-
ground, its place in the literary tradition, and its
significance for contemporary literature in the
west are the principal concerns of the course.
No knowledge of Russian is required, but con-
centrators in Slavic will be expected to do a
major portion of the reading in Russian. (DR:X)
4 units, (Brown) given 1979-80

272. Osip Mandelstam—(Same as Modern
Thought and Literature 272.) Examination of
the poetry, prose and critical writings of this
most brilliant and still highly intriguing poet of
the post-symbolist generation. Approaches to
his work will vary from structural to historical
and comparative. Primary reading will be done
in Russian.
4 units, Spr (Freidin) by arrangement

277. Gogol—Also open to undergraduates with
advanced training in Russian. (DR:X)
4 units, (Todd) given 1979-80

279. Dostoevsky—A study of Dostoevsky's
shorter works in the context of European
thought and literature. (DR:X)
4 units, (Todd) given 1979-80

299. Individual Work—Exclusively for
graduate students in Slavic working on theses or
engaged in special work. Prerequisite: written
consent of instructor.
1-12 units, any quarter (Brown, Schupbach,
Stahlberger, Van Campen, Todd,
Anschuetz, Freidin) by arrangement

300. Graduate Seminar. (DR:X)
4 units, Aut (Stahlberger) by arrangement

300. Graduate Seminar: Russian Literature as
an Institution—(Same as Modern Thought
and Literature 300, and Comparative Literature
300.) A study of literary production, dissemina-
tion, and reception in selected periods of Rus-
sian literature, from the Middle Ages to the
present. Readings in social theory, literary criti-
cism, and imaginative literature. Open to stu-
dents without Russian only by permission of
instructor.
4 units, Win (Todd) M 2-4

300. Graduate Seminar: Theory of
Narrative—(Same as English 330, Comparative
Literature 300A, and Modern Thought & Liter-
ature 300.)
4 units, (Todd) given 1979-80
For additional offerings in literature, see
Comparative Literature.
Students interested in languages not listed for
a specific language department should contact
the Special Language Program, Department of
Linguistics.

SOCIAL THOUGHT
AND INSTITUTIONS
Chairman: Charles Drekmeier
Committee: Barton Bernstein, St. Clair Drake,
Margot Drekmeier, John Felstiner,
Raymond Giraud, R. Hamerton-Kelly, Hal-
sted Holman, Henry Levin, Robert North,
H. Pierre Noyes, Martin Perl, Charles Stein,
Wilfred Stone, Walter Weisskopf

STATEMENT OF PURPOSE
As an interdisciplinary honors program, So-
cial 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 contribu-
tions the social sciences are able to make to one
another and to a specific problem, an awareness
of differences and agreements in their theoreti-
cal assumptions, and facilitation of communica-
tion among these disciplines. It seeks to com-
bine rigorous training with the breadth of
knowledge interdisciplinary study provides.
The objective is a balanced and comprehen-
sive 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

A year-long seminar, organized around the study of a particular idea or problem (Social Sciences 101-103) is offered. Students wishing honors work will enroll in Social Science 101, and will be expected to complete an honors thesis. 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 advisor. In most cases the committee will arrange for the appointment of a second advisor 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.)

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. It is possible for a student who enrolls in the Honors Seminar to propose an individually designed major in Social Thought and Institutions. The individually designed major program is administered by the Dean of Undergraduate Studies' Advisory Committee on Individually Designed Majors. See the "Individually Designed Majors" section for guidelines for the proposal of such a major. Members of the Committee on Social Thought and Institutions are available to provide academic advising for students interested in proposing an individually designed major.

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. Drekmeier may be consulted about admission to the Honors Program (his office is in the Department of Political Science).

SPECIAL COURSES OF INSTRUCTION

All courses (DR:X)

101-103. Honors Seminar.
4 units, Aut, Win, Spr (Drekmeier, Staff) by arrangement

193. Senior Thesis and Directed Reading.
1 to 5 units, any quarter (Staff) by arrangement

197A,B,C. Ethics of Development in a Global Environment (EDGE): Cross Discipline Seminar—(Same as Education 274A,B,C; Political Science 140A,B,C; Anthropology 133A,B,C; Engineering 297A,B,C; Graduate Special 297A,B,C.)
2-5 units, Aut, Win, Spr (Cooper, McWhorter and Staff)

SOCIOLOGY

Emeriti: Richard T. LaPiere (Professor)
Chairman: Joseph Berger
Associate Professor: Michael T. Hannan
Assistant Professors: Patricia R. Barchas (on leave), Diana P. Dutton (by courtesy), JoAnne Martin (by courtesy), William G. Ouchi (by courtesy), Barbara Rosenblum, Joan Talbert (by courtesy), Nancy Tuma
Consulting Assistant Professor: Gerald Talley

OFFERINGS AND FACILITIES

The Department offers courses and programs of study designed to: (1) contribute to the liberal arts training and knowledge of all undergraduates; (2) provide systematic programs of study and research opportunities for undergraduates interested in applied research or policy analysis; (3) initiate the training of undergraduates who expect to pursue a research or teaching career involving advanced training in the social sciences; and (4) prepare researchers and scholars seeking advanced degrees.

Because sociology is concerned with the full spectrum of social behavior—of individuals, small groups, large organizations, communities, institutions, and societies—it provides a strong intellectual background for students considering careers in the professions and in business. A special set of courses—Series on Problems in Contemporary Society—is designed for students interested in applying sociological concepts and research techniques to the solution of social problems.

Students may pursue degrees in Sociology at the Bachelor's, Master's, or Doctoral level.
The Department is housed in Mariposa and Rogers Houses. Courses numbered 0-199 are open to all students without prerequisites unless specifically indicated. Courses numbered 200 or above are primarily for graduate students.

Description of Areas of Concentration

Three major areas of concentration are: (a) Social Psychology and Interpersonal Behavior, which focuses upon the social organization of individual identity, beliefs, and behavior; and upon social structures and processes in interpersonal interaction; (b) Formal Organization, which focuses upon the functioning of large-scale formally structured associations oriented to the pursuit of specialized goals, e.g., schools, hospitals, corporations and political bureaucracies; and (c) Comparative Sociology, which focuses upon regularities and change in societies and institutions.

Many of the courses offered by the Department can be categorized as primarily oriented to one of these three areas. And within each area, a few courses are more general and provide a basis for more advanced work. These courses are termed Foundation Courses. For the academic year 1978-79, courses are classified as follows:

(a) Social Psychology and Interpersonal Behavior
Foundation Courses: 100, 101.
Other courses: 102, 103, 105, 107, 109, 110, 161, 242A, 242B.
(b) Formal Organizations
Foundation Courses: 160, 161, 163.
Other courses: 147, 162, 164, 166
(c) Comparative Sociology
Foundation Courses: 131, 140, 141, 142, 143, 150.

Programs of Study
Undergraduate Study
Bachelor of Arts

Majors are expected to demonstrate both some breadth of exposure to the discipline as well as give evidence of some depth of experience in a single area of study. Specifically:

1. All majors are to take at least one of the Foundation Courses in two of the three areas of concentration. (Note that a prerequisite for some of the Foundation Courses in Sociology 1, Introduction to Sociology, or its equivalent.)

2. All majors are to take a minimum of 20 additional units in one of these areas. Specific courses to be taken will vary depending on the interests and the career objectives of the student and are to be selected in consultation with an undergraduate advisor. Students are strongly encouraged to fulfill part of this requirement in directed research, tutorials, or individual study in the area of concentration. Suggested courses which can be used to fulfill the requirement are listed above for each area. However, with the approval of the advisor other courses—including courses outside the department—can be used to meet this requirement.

The faculty believes that it is important for all majors to have at least some exposure to research methods. How we know is as important as what we know. Therefore:

3. All majors are required to take Sociology 180 A and B, Introduction to Sociological Research, or its equivalent. Other methods courses are offered within and outside the Department, but the required course is specifically designed to provide both an introduction to scientific methods and an exposure to the variety of research techniques employed by sociologists.

It is recommended that undergraduate students who are planning to pursue graduate work in sociology or a related field take additional course work in research methods and in related areas such as statistics and computer science. Directed research or a research apprenticeship is a highly valuable experience for the undergraduate major.

4. All majors are required to take Sociology 195, a one-unit course designed to provide orientation to the department and to sociology as a field of study. This course meets during the first half of the Autumn quarter.

5. All majors are required to take a minimum of 60 units of course work in their major. Since sociology is closely linked to several other substantive disciplines, and also uses diverse methods of investigation, related courses in other departments, if approved in advance by the departmental advisor, may fulfill up to 20 units for the degree.

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 (SOCILOGY)**

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 60 units of course work with 40 units from Sociology including an introductory course in Sociology and a course in methodology (Sociology 180 A and B, for example). The remaining 20 units are chosen from related departments (Communication, Economics, Political Science, Psychology, Anthropology, and Linguistics).

**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.

**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 to 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 100 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. For such Masters the usual admission requirements are waived, but course requirements are determined in consultation with the Departmental advisor for doctoral candidates of other Departments and Schools. 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 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 as a teaching assistant under the supervision of a faculty member—the Teaching and Research Apprenticeships should total at least five quarters; (d) develop a thorough grounding in sociological theory and research methods. To accomplish this, five graduate courses are required: Sociology 181, 270, 271, 281, 282 or 283. 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. Detailed requirements are outlined in the School of Education section of this bulletin.

**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 advisors 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 to 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**

All courses (DR:S)

1. **Introduction to Sociology**—An introduction to the study of social forms and processes and their impact on individual behavior. Emphases vary from quarter to quarter as described below:
   - 5 units, MWF 11; one section by arrangement

   **1A. Introduction to Sociology**—This course is designed to explore for each student how he or she developed in a changing social environment. The emphasis is on the interaction between individuals and the groups they belong to. Therefore, topics covered will include: internalizing society's norms, developing images of yourself in relation to others, and problems to fit between the individual and the organizations and institutions of the society. Abstract theories will be presented and discussed as they help us to understand ourselves and our social world.
   - 5 units, Aut (Dornbusch) MWF 11; one section by arrangement

   **1B. Introduction to Sociology**—An examination of how humans connect themselves and thereby structure their experience. We will examine a range of phenomena including (1) small intimate relations, (2) family groups, (3) organizational and institutional settings, (4) deviance, and (5) the myth of personality. In each case we will be looking for the rules and processes which determine the nature of our personal experience in these settings.
   - 5 units, Win (Talley) MWF 11; one section by arrangement

   **1C. Introduction to Sociology**—Cross-national and historical analysis of social structures and processes; the impact of group memberships, group values and norms, and group pressures on people's behavior and attitudes. Specific topics include: the social control systems of power and prestige; stratification; deviance and conformity; race and ethnic relations; sex roles; formal organizations; and family and social change.
   - 5 units, Spr (Goode) MWF 11; one section by arrangement

2. **American Society Through Film and Literature**—Various aspects of American social structure are studied as observed in novel and film. The course studies one novel or film a week (sometimes both). Lectures provide any necessary sociological background.
   - 5 units, Spr (Zelditch) TTh 1:15; section by arrangement

4. **Individual and Society**—Modern society and the expansion of cultural individualism, individual freedom and alienation. The development of individual character in families, peer groups, schools, places of work, and the state. Readings in Marx, Weber, Freud, Dukheim, and contemporary studies.
   - 5 units, Win (Meyer) MWF 1:15
5. Status, Friendship, and Social Pressure: An Experiential Approach—Examines basic social processes that structure the individual’s experience in interpersonal situations. Processes studied include (1) group pressure on individual choices, (2) social control of deviants, (3) operation of status distinctions (such as sex and race), (4) formation of friendships and, (5) formation of intimate relationships (such as love relationships). Through structured exercises and simulation gaming the student first has the opportunity to experience these processes in section meetings. After these laboratory experiences, lectures provide the student the chance to examine these processes in terms of the theoretical ideas, empirical research, and clinical strategy. Enrollment limited.

3-5 units, Aut (Berger, Talley) MWF 9, one 2-hour section M or W 2:15-4:05

SERIES ON PROBLEMS IN CONTEMPORARY SOCIETY

10. Childhood and Modern Society—A study of the ways the lives of children are organized in modern society, how this situation is changing, and how it influences the child’s experience of later life. Special focus is on how institutional arrangements (organizations, legal structures, normative systems) structure the status of “child.” Of particular interest for students anticipating careers in education, problems of juveniles, social work, or other helping professions.

3-5 units, Aut (Meyer) MWF 10

11. Adolescence and Modern Society—An examination of the role of adolescents in contemporary society, their social organization, norms, values and behavior, and location in our cultural stratification system.

3-5 units, given 1979–80

12. Marriage and Its Alternatives—Examines marriage as it is and as it could be. Considers marriage as one arena for emotional intimacy and questions whether it is the most workable option available. The course will consider (1) the interpersonal processes which shape and often distort personal intimacy, (2) the institutional interconnections which structure the marital relationship, and (3) the role of marriage in the major ideologies of our culture. Special attention will be paid to constructing viable alternative structures and to the imagined “difficulties” that keep us from taking other options. (DR:S)

3-5 units, Spr (Talley) TTh 2-4

13. Sociology of Masculinity and Femininity—Examines the social determinants of gender-based behavior. Considers various theories of the origin of sex-role differentiation and socialization patterns, the impact of changing family structure and occupational roles upon men and women, the process of labeling non-traditional sex-role behaviors as “deviant,” the historical context of the women’s movement and its impact upon men’s groups, and some alternatives to our traditional conceptions of masculinity and femininity. (DR:X)

5 units, given 1979–80

20. Poverty and Public Policy in America—Why does large-scale poverty persist in America and what are the effects of poverty on the individual? Through lectures, class discussions, and individual projects students will explore the facts, myths, and theories around this important social issue.

3-5 units, Aut (Tuma) MWF 2:15

21. Deviance and the Ideology of Social Control—This course focuses on deviance of all sorts: sexual deviance, drug abuse, mental illness, crime in the streets and crime in the suites (corporate and governmental abuses). The social foundations of the detections, labeling and processing of dangerous persons and dangerous classes will be explored. We will look at various institutions and agencies not only as organizations but as politically motivated agencies mandated to keep the public order by keeping people—especially non-white and non-bourgeois people—in line. We will also think about how labeled persons are perceived as social contaminants and are separated from the rest of society both physically and symbolically, through such means as public denunciation and soul damming ceremonies. The consequences for those individuals and for society will be examined.

3-5 units, Aut (Rosenblum) MWF 1:15

22. Alcohol, Drinking and Alcoholism—Deals with the use of alcohol in the United States and its effects on interaction in large and small groups.

3-5 units, (Barchas) given 1979–80

23. Sociology of Mental Illness—Considers the study of frequency distribution of psychiatric categories along social dimensions such as age, sex, ethnicity, and social class; contrasts genetic and psychoanalytic theories of mental illness with explanations which focus on social-structural sources of stress; examines the social processes of those labeled as mentally ill; and considers mental health/illness as a service industry, as an institution of social control, and as a twentieth-century religion. (DR:S)

5 units, given 1979–80

30. The World of Organizations—Organizations are the mechanisms by which work
gets done in modern societies. Various organizational forms are discussed and their impact on individuals and society evaluated. Organizations studied include schools, hospitals, prisons, public bureaus, and corporations. (DR:S)

3-5 units, Win (Scott) MWF 9, one section by arrangement

40. Race and Ethnic Relations—Examination of the relations among ethnic and racial groups in industrial societies. (DR:S)

3-5 units, alternate years, given 1979–80

61. 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 application of theory to contemporary problems. Topics will include the police, the trial, sentencing, corrections and "non-victim" crimes. (DR:S)

5 units, Spr (Kaplan) TTh 10-11:30

70. The Structure of Intimate Groups—This course examines the ways in which basic social processes organize the behavior of individuals in intimate social settings: marital relationships, living-together units, and long-term lover relationships. Among the problems that will be studied are: How are status distinctions (such as sex) used to structure the individual's behavior in intimate groups; How do affect processes (processes of love and hate) operate in such groups; How do the members of such groups exercise social control and act to define each others everyday world; and, How are social objects (persons) constructed and maintained in such relationships. In addition to theoretical and empirical research that bears on these problems, extensive use will be made of relevant clinical literature and materials. Prerequisites: Sociology 5, or with special permission of the instructor.

3-5 units, (Berger) given 1979–80

SMALL GROUPS AND SOCIAL PSYCHOLOGY

All courses (DR:S)

100. Interpersonal Behavior—This course is concerned with power, exchange, coalition formation, status, conformity, and deviance. Important traditions of research have developed from basic theories of these processes. Emphasis will be on (1) understanding the basic theories, and on (2) drawing out their implications for change in a broad range of situations, such as families, work groups, and friendship groups.

5 units, Aut (Staff) MWF 9

101. Introduction to Social Psychology—The main objective of this course is to promote understanding of the individual's relationship to social groups, from the intimate two-person group to the society at large. Both theoretical and experiential perspectives will be employed to illuminate these relationships. The course will include simulation and observation exercises. Among the topics covered will be social pressure and conformity, racism, and sexism, self-evaluation, equity and justice, and the social self.

5 units, Win (B. Cohen) MWF 10

102. Physiological Sociology—An examination of evidence and theory fragments which bear on the question of how physiologic processes both reflect and have impact upon the social system in which the individual is embedded.

5 units, (Barchas) given 1979–80

103. Personality and Social Structure—(Same as Education 208.) An interdisciplinary approach to the interrelations of personality and social structure: how the personal qualities of individuals influence social systems and institutions, and how the social order of a group or society shapes the personality of the individual. Among the issues examined: suicide; juvenile delinquency and mental illness; recruitment to and performance in occupational roles; the character of groups and nations; political behavior and political extremism; child socialization. Recommended prerequisite: background in personality theory or sociology. Enrollment limited to 65.

3-5 units, Spr (Inkeles) TTh 9-11

105. Family Interaction—The course primarily deals with small group interaction in the context of the family, with focus upon aspects of power, affiliation, and conformity relationships, along with exchange and balance processes. Communication, commitment, and socialization are considered. Some attention is given to the family as an institution.

3-5 units (Staff)

107. Status, Expectations, and Behavior—Deals with a wide range of problems, concerning the effect of status characteristics such as race and sex on the individual's interpersonal behavior: How are status distinctions maintained; How and under what conditions do status distinctions determine an individual's expectations and behavior; How can the effects of status distinctions be changed and perhaps eliminated. The theoretical and empirical research on Status Characteristics Theory will be closely examined for an understanding of the dynamics that link status, expectations, and behavior in interpersonal situations. Prerequisites—
109. Small Group Behavior in the Work Environment—(Same as Business 373.) This course will emphasize those aspects of group behavior that are most relevant to managers in task-oriented group settings. Topics will include: roles; conflict-resolution and problem-solving; interpersonal interaction and attraction; member reaction to leadership styles; phases of group development; risk-taking and decision-making. Teaching methods will emphasize lectures, readings, exercises and case discussions. Although some assignments will be given to small study groups, this course is not in any way a T-group.

3-5 units, Win (Kirk) MTWTh 10

110. Evaluation and Social Control—Evaluation is the basic process by which persons control themselves and control others. We will try to understand evaluation processes within the individual, in small groups, in organizations, and in the institutions of a society. We will not only study how evaluations control behavior but also how and why groups struggle to keep themselves from being evaluated. There will be some attention to issues of moral choice and individual freedom in relation to societal pressure.

3-5 units, Win (Zelditch) MWF 1:15

COMPARATIVE SOCIAL ORGANIZATIONS AND INSTITUTIONS

All courses (DR:S)

131. Social Structure and Social Change: A Population Ecology Perspective—The study of human social organization using the principles of population and community ecology. In contrast to the most typical understanding of behavior through internal causes, we will explore the external influence of an environment on a variety of social structures including nation-states, communities, organizations, collective movements. Other topics of interest will include ethnic relations and social change in the world system. The course is of particular value for students anticipating careers in human biology, business, and urban design.

5 units, Aut (Hannan) MWF 1:15

132. Population Problems—(Same as Food Research 135 and Economics 131.) (May be taken as Sociology 232 and Food Research 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, recourses, and modernization in developing countries. Population policies; family planning programs and population control.

5 units, Spr (Berger) T 2:15-5:05

135. Power Elites in American Society—Analysis of the conflicting views on the reality and importance of power elites in American society. (DR:S)

3-5 units, Win (Zelditch) MWF 1:15

140. Class, Status, and Power—Analysis of stratification in simple and complex groups and societies. General theories of stratification are analyzed and evaluated. Topics covered within this analysis will include bars to opportunity, problems of justice and equality, revolution, ethnic/sex/class discrimination, social mobility and political action in socialist and nonsocialist countries.

5 units, Win (Goode) MWF 10

141. Politics and Society—(Same as Political Science 104.) An analysis of the relationship of sociological structures to political behavior. This course will deal with topics such as social stratification, mass movements and the political roles of academic intellectuals.

5 units, Win (Lipset) MWF 10

142. The Family—A cross-cultural analysis of family organization and processes in different societies, and over time, with some special attention to the urban family of Western Society. Divorce, illegitimacy, courtship, changing sex roles, and the relations between family patterns and social class will be discussed.

5 units, Spr (Goode) MWF 1:15

143. Education and Society—The effects of schools and schooling on individuals, on the stratification system, and on society. The distinction between education as socializing individuals and as legitimizing social institutions. Social factors affecting the expansion of schooling, individual educational attainment and the organization of schooling.

5 units, Spr (Meyer) MWF 9

144. The Social Structure of Science—The objective of this course is to analyze science as a social institution, to look at the way science and scientific research are organized, and the impact of this organization on the development of scientific knowledge.

5 units, Spr (B.Cohen) MWF 10

147. Status Attainment: Education and Work—(Same as Education 172.) Examines classical theories of social stratification as repre-
senting alternative conceptions of the roles of work and education in determining individual success. Reviews research on educational, occupational, and income-attainment processes in the U.S. tradition and considers additional research paradigms focused on class-formation. Issues addressed include: the role of educational institutions in challenging and reinforcing social inequities (including macro-level focus on differential class access and attainment and micro-level focus on the implications of testing practices and stratification in the schools), factors influencing individual mobility (considering ascribed statuses, achieved statuses, labor-market and work-organization factors), and the links between standards of success, cultural values, and educational/workplace policy.

4 units, Spr (Talbert) TTh 4:15-6:05

148. Political Analysis—(Same as Political Science 101 and Business 338.) An introduction to some ideas used in the analysis of political processes. Structural models: Demography of politics, social structure and stratification, social and political institutions. Rational actor models: Rational choice, political trading, bargaining, and the formation of coalitions. Force models: Power, the distribution of resources, and the mobilization and organization of social forces. Information models: Political promises and signals, mass communication, expertise, and the development of belief. Behavioral models: Political roles and socialization, political styles, imitation, diffusion, learning, and other forms of adaptation. Symbolic models: Ideology, psychopolitics, political drama, and the symbolic meanings of politics. The emphasis throughout the course is on specifying a few simple ideas about political processes and exploring their implications not on providing a detailed explication of any specific set of political institutions or events.

4 units, Spr (Talbert) TTh 4:15-6:05

150. Urban Sociology—The city can be usefully viewed as a special social psychological setting having important effects on its participants; as an economic-geographical unit performing important sustenance functions; and as a complex social organization which structures activities within a locality. All of these approaches will be discussed and evaluated. Topics will include community power and decision-making, segregation and differentiation, and mechanisms of integration and control. Emphasis will be placed on the role of the city in a larger society-wide system of social and economic relations.

3-5 units, Spr (Scott) MWF 10

ORGANIZATIONS

All courses (DR:S) unless otherwise noted.


5 units, Aut (Scott) MWF 9

161. Social Psychology of Organizations—(Same as Business 471.) This seminar focuses on recent social psychological research relevant to behavior in organizations. Topics will include: decision-making under conditions of uncertainty and organizational ambiguity; pay inequality and perceptions of injustice; cognitive aspects of stereotyping, attitude-behavior inconsistency; blaming the victim and the "just world" paradigm; attribution and the naive psychologist; organizational myths as cognitive scripts; and learned helplessness in the work environment. Prerequisites: Sociology 160 or social psychology course work; and consent of instructor.

4 units, Win (Martin)

162. Leadership in Organizations—(Same as Education 333 and Political Science 108.) 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, Win (March) TTh 8-10

163. Organizational Decision Making—(Same as Education 120 and Political Science 107.) Decision making in complex organizations, such as universities, schools, hospitals, business firms, and public bureaucracies. Information, power, resources, organizational structure, and the environment. Alternative models of choice and their implications.

4 units, Win (March) alternate years, given 1979–80

164. Seminar on Organizations—Advanced topics in organizations theory and research.

5 units, (Scott) given 1979–80

166. Social Issues in Health Care—Provides an overview of major policy issues and problems in health care which have important social dimensions. Sociological perspectives and research findings, but discussions stress critical evaluation of alternative viewpoints and evidence. Areas covered include social factors influencing illness and use of health services, problems in patient-provider relationships and proposed remedies, education and professionalization of
physicians and other providers, incentive structures in various health institutions, and assumptions underlying alternative reform strategies. (Lectures held jointly with FCPM 250.) (DR:S)  
3 units, Win (Staff) TTh 2:15-4:05

167. Research Workshop on Social Issues in Health—(Same as FCPM 255.) Gives students experience in the application of quantitative methods in health services research. Individually or in groups, students will define suitable research problems, review relevant literature, conduct statistical analyses of a common large-scale data set, and synthesize findings in major research papers. Possible topic areas include health status differentials, factors affecting patient utilization and satisfaction, quality of care in different health care systems, organizational performance, and others. Considerable independent work required. Prerequisite: consent of instructor. (DR:X)  
3-5 units, Aut, Win, Spr (Dutton) by arrangement; 703 Welch Rd., Suite G-1

THEORY

170. Introduction to Sociological Theory—The aim of this course is to provide the student with the opportunity to read some of the great classic texts in sociology in a thorough, slow and careful manner. We will study Marx, Durkheim, Weber and Simmel in depth. We will examine the social circumstances in which these men became the founding fathers of sociology and how they formulated the questions that shaped the development of sociology.  
5 units, Spr (Rosenblum) MWF 11

171. Introduction to Models in Social Science—(Same as Education 110 and Political Science 105.) 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. (DR:S)  
4 units, Aut (March)  
alternate years, given 1979-80

METHODS

180A. 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. Required of all sociology majors. (DR:S)  
3 units, Aut (Cohen) MWF 11;  
for associated laboratory, see Sociology 180B

180B. Introduction to Sociological Research: Laboratory—Laboratory exercises consider problems of collecting observations, constructing theory, testing hypotheses and generalizing research results. Required of all sociology majors. Students must enroll concurrently in 180A.  
4 units, Aut (Cohen) by arrangement

181. Quantitative Methods in Social Research—Surveys basic statistical methods that social scientists use to analyze data. Focus on issues involved in selecting the most appropriate method of analysis for a particular problem, what is likely to go wrong if the method fits the data poorly, what steps are involved in analyzing data, and how to explain the results of analysis to others. Analysis of some set of social scientific data (your own or one of several supplied) required. Prerequisite: Statistics 60, its equivalent or consent of instructor. Basic knowledge of SPSS is helpful. (DR:T)  
4-6 units, Spr (Tuma) MW 12-2

182. Field Work Methods—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. (DR:S)  
5 units, Win (Rosenblum) MW 2:15-4:05

183. How to Do Your Own Research: Training for Undergraduate Independent Research—Designed to assist undergraduates in doing independent research in the social sciences. Includes defining a research problem, stating hypotheses, examining the relevant theoretical and empirical literature, designing the research, collecting data and analyzing the results. Students may work on projects for other courses or select a project specifically for this course. Arlo and SCIRE will provide assistance in gaining access to research projects in the community. Students will be encouraged to assist each other, under the direction of the instructor. Course requirement is a research report. (DR:X)  
5 units, Win (Rosenblum) MW 2:15-4:05

INDIVIDUALIZED LEARNING EXPERIENCES, PRIMARILY FOR UNDERGRADUATE MAJORS

All courses (DR:X)

190. Undergraduate Directed Research—Provides an opportunity for a student to work on
a project of his or her own choice under the close supervision of a faculty member who has agreed to do the supervision. Prior arrangement required.

1-6 units, (Staff) by arrangement

191. Sociology Tutorial—Each quarter a number of faculty members will be available to meet with two students each in weekly tutorial sessions on jointly-agreed-upon readings. Students will present short papers each week, discuss them, and receive critical feedback. Prior arrangement required. Sociology majors given preference.

2 units, (Staff) by arrangement

192. Undergraduate Research Apprenticeship—Provides an opportunity for a student to work in an apprentice-like relationship to a specific faculty member or members in an ongoing research project. Prior arrangement required.

1-10 units, (Staff) by arrangement

193. Senior Thesis—Provides the opportunity to work intensively on an honors thesis project under faculty supervision (see description of Honors Program). It is assumed that this project will be arranged early in the year of graduation, if not before.

3-10 units, (Staff) by arrangement

195. 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.

1 unit, Aut (Rosenblum)
(six weeks course) T 12

COURSES PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:X) unless noted otherwise.

200A,B,C. Graduate Proseminar—Limited to first-year graduate students in Sociology.

2 units, Aut (Staff) 12
Win (Staff) 12
Spr (Staff) 12

201. Practicum on Teaching—An introduction to the art of teaching. Emphasis will be placed on the acquisition of specific teaching skills including preparation and delivery of lectures, leading discussion sessions, course preparation, and grading.

3 units, Aut (Staff) by arrangement

220. Social Structure of World Society—(Same as Education 398.) This seminar pursues a sociological analysis of society on a world-wide basis, that is, all the people inhabiting the earth and the institutions through which their lives are organized, are treated as participants in one global social system. Competing models of the emerging world order will be reviewed and compared. Among the topics to be covered will be the worldwide population dynamics, the nature of the world economy, communication of persons on a global scale, socio-economic stratification of the world population and education, science and technology as global systems. The seminar will utilize a mixed lecture-discussion format, and each student will be expected to write several brief research papers. Enrollment limited.

4-5 units, Spr (Inkeles) W 3-5
and by arrangement

222. Population Perspectives in the Third World—(Same as Food Research 285.) Population problems and policies as shaped by economic, socio-cultural, and political forces in the major countries and regions: case studies from Latin America, Islam, Tropical Africa, India, and China. Prerequisite: 132 or consent of instructor. (DR:S)

5 units, Spr (Kirk) MW 1:15-3:05
and by arrangement

231. Seminar on Human Ecology—Consideration of population and community ecology models to the study of human social organization.

5 units, Win (Hannan) Th 2:15-5:05

241. Sociology of Education—(Same as Education 310/210.) For doctoral and masters students. Provides acquaintance with selected sociological concepts, theories, and the application to applied problems in sociology of education. Emphasis on learning suitable conceptualization and methodology of applied research. Strong cross-cultural emphasis. (DR:S)

4-6 units, Aut (E. Cohen) MW 9-11

242A. The Law Status Student: Race and Social Class—(Same as Education 321A. Sociological treatment of contemporary problems in education. Covers relevant sociological theory and research literature form stratification, socialization and race relations. Relationship of research to policy formation stressed. Prerequisite: Education 310 or equivalent. (DR:S)

4 units, Win (E. Cohen) MW 2:15-4:00, given alternate years

245. Seminar: Topics in Political Sociology—(Same as Political Science 205.) An analysis of differing approaches based on reading the works of major figures such as Lasswell, Mannheim, Marx, Michels and Weber.

5 units, Aut (Lipset) Th 1:15-3:05

248. Seminar on Revolutionary Processes—A comparison of the causes, processes, and out-
comes of revolution; analyses of failed revolutions and of different forms of revolt and rebellion, in different nations and historical epochs.

5 units, Aut (Goode) M 2:15-5:05

260A, B, C. Trainee Seminar on Organizations and Mental Health—An ongoing seminar devoted to examining the impact of organizations on mental health of their participants; and the organization of mental health services. Required of trainees but open to other interested students.

2 units, Aut, Win, Spr (Scott and Staff) T 3:15-5:05

265A, B. Seminar on Advanced Organization Theory—(Same as Political Science 306A, B.) Topics in organization theory for advanced students. Prerequisite: Permission of instructor.

5 units, Win, Spr (March) by arrangement

266. Problems in Organization Theory—(Same as Graduate School of Business 318.)

4 units, Spr (Ouchi) MF 8-9:50

270. Theory Construction—Prerequisite: consent of instructor.

5 units, alternate years, given 1979-80

271. 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, Aut (Zelditch) T 2:15-5:05

272. Seminar in Critical Theory—Each student will become an expert on one major figure in the Frankfurt school of social thought. The student will be required to read the writings thoroughly and to present major ideas (and the theorist’s intellectual development) to the class.

5 units, Aut (Rosenblum) W 2:15-5:05

280A. Introduction to Sociological Research—(Same as 180A but restricted to Ph.D. candidates in Sociology.) For associated Laboratory see 280B.

3 units, Aut (Cohen) MWF 11

280B. Introduction to Sociological Research—(Laboratory, Same as 180B but restricted to Ph.D. candidates in Sociology.) Students must enroll concurrently in 280A.

4 units, Aut (Cohen) by arrangement

281. Design and Analysis of Sociological Research—A consideration of the principles of experimental and nonexperimental design and analysis from a casual inference perspective. Prerequisite: 181.

5 units, Win (Hannan) MWF 1:15

282. Casual Models in the Social Sciences—Sociological applications or structural equations methods with special emphasis on models with unobservable variables and dynamic analysis. Prerequisite: 281

5 units, Spr (Hannan) M 2:15-5:05, alternate years

283. Problems of Cumulative Research Strategies—This course will consider limitations on the usefulness of single empirical studies, the necessity for cumulative research programs and some of the key issues in the development of a research strategy.

5 units, (B. Cohen) alternate years, given 1979-80

284. Demographic Methods—(Same as Food Research 286.) Methodology of population analysis stressing demographic research methods and modeling which are widely applicable techniques in sociology, economics, anthropology, and other social sciences.

3-5 units, given 1979-80

286. Research Practicum: Social Sciences in Education—(Same as Education 327.) Seminar designed to assist students in developing their dissertation proposals. Intended for doctoral students who have identified a dissertation problem area and are prepared to begin work on a proposal draft. Issues relevant to stages of research design are addressed: conceptualizing a research problem and developing hypotheses, choosing a research strategy, identifying and selecting cases, measuring variables and producing data, and strategies for analyzing the data. Course structure facilitates the decision-making process and the writing of the proposal and provides feedback to individuals at each stage of the proposal's development.

4 units, Win (Talbert) Th 1:15-4:05

GRADUATE INDIVIDUAL STUDY

All courses (DR:X)

290. Graduate Individual Study.

(Staff) by arrangement

291. Special Colloquia.

(Staff) by arrangement

292. Graduate Research

(Staff) by arrangement

293. Teaching Apprenticeship.

(Staff) by arrangement

294. Research Apprenticeship.

(Staff) by arrangement


(Staff) by arrangement

296A, B, C. Traineeship Research Seminar

Aut, Win Spr (Cohen) by arrangement
SPANISH AND PORTUGUESE

Emeriti: Aurelio M. Espinosa, Jr., Ronald Hilton, Juan B. Rael, Isabel Magaña Schevill (Professors); Grace Knopp (Assistant Professor)

Chairperson: Jean Franco

Professors: Fernando Alegria, Jean Franco, Bernard Gicovate, Sylvia Wynter

Associate Professor: Joaquim-Francisco Coelho

Assistant Professors: Roberto Ball (on leave Autumn, Winter 1978-79), Rina Benmayor, Héctor Mario Cavallari, Mary Pratt. Acting: Tomás Ybarra-Frausto

Lecturers: María-Paz Valdés (Director of Undergraduate Language Program), Karen Van Dool, Douglas Morgenstern

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.

PROGRAMS OF STUDY

BACHELOR OF ARTS

The Department of Spanish and Portuguese has newly revised its program of study for the A.B. Recognizing that students have different interests and reasons for pursuing a major in this Department, we have designed the following major paths. Each has different objectives and requirements. Students will wish to consider in conjunction with a faculty advisor, which major corresponds most closely to their own personal and professional objectives.

I. LITERATURE

This path is recommended for those students who enjoy reading literature and wish to acquire a knowledge of the variety of poetry, prose, and drama in the Hispanic world. Courses are intended to provide historical perspective and develop critical skills in approaching literature. Candidates are expected to complete a minimum of 45 units from courses in the Department numbered 100 or higher.

Requirements: Spanish 140 (Introduction to Methods of Literary Analysis); 180 (Undergraduate Winter Colloquium); 201 and 202 (Advanced Grammar and Composition); Two courses in Peninsular Literature; Two courses in Latin American Literature; Two courses in literature prior to 1750.

Recommended: Courses in Chicano Literature, Linguistics, and Literary Theory. As a supplement to this major path we urge students to take courses in the Social Sciences in order to acquire an understanding of the social context in which the literature is produced and which it reflects.

II. LITERATURE AND SOCIETY

The aim of this path is to permit more flexibility to students by allowing them to plan a broader major than is possible in the other areas of concentration. The student can combine the study of Spanish, Portuguese, or Latin American Literature with such fields as Political Science, History, Anthropology, and Economics. Students must complete a minimum of 35 units in the Department from courses numbered 100 or higher, and 25 units in related fields with advisor approval.

Requirements: Spanish 140 (Introduction to Methods of Literary Analysis); 180 (Undergraduate Winter Colloquium); Two courses in Peninsular Literature; Two courses in Latin American Literature.

III. CHICANO STUDIES

This program is for students who wish a concentration in Chicano studies based on courses in Departments of Literature, Linguistics, and History, including optional courses in Chicano culture. Students must design their program in conjunction with Prof. Ybarra-Frausto. Students will also be expected to acquire an adequate knowledge of the roots of Chicano literature. Candidates must complete 35 units in Chicano Studies and 25 units in Latin American or Peninsular Literature from courses numbered 100 or higher in the Department.

Requirements: Spanish 140 (Introduction to Methods of Literary Analysis); 180 (Undergraduate Winter Colloquium); Two courses in Chicano Literature; Two courses in Peninsular Literature; Two courses in Latin American Literature.

IV. LANGUAGE

This path is intended for students whose primary interest is in the structure and use of the Spanish language. Students must complete a minimum of 45 units from courses in the Department numbered 100 or higher.

Requirements: Spanish 201, 202, 203 (Advanced grammar, composition, and translation); Spanish 140 (Introduction to Methods of Literary Analysis); Spanish 180 (Undergraduate Winter Colloquium); one course in introductory linguistics (in Linguistics Department); three courses in Spanish linguistics.

Recommended: Two literature courses in one
area; at least a reading knowledge of Portuguese.

The Department offers a series of core courses designed to fulfill the requirements for all the major paths. All majors are required to take Spanish 140 and 180. Courses numbered 151-152 (Peninsular Literature) and 161-162 (Latin American Literature) are introductory survey courses. These satisfy the minimum literature requirements for all the paths. We recommend that majors enroll directly in 151-152 or 161-162. It is also expected that they will go on to take courses at the 200 level. The core courses will be offered each year in the following sequence:

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<tr>
<th>Autumn</th>
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<td>140</td>
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Courses numbered 130, 131, 132 (130B, 131B, 132B) are designed for students who do not wish to make literature their major area of concentration but wish to continue studying Spanish beyond the Second year level.

We also recommend that majors take Portuguese for Students of Spanish so as to acquire a basic reading knowledge of Portuguese. This is not a substitute for First or Second year Portuguese but is intended to build skills for conducting research in the language.

**EXTENDED MAJORS**

Candidates for the A.B. in English and Spanish Literature should register with the Department of English.

Extended majors in Spanish and Portuguese may be arranged through the advisor with other Departments by taking a minimum of 40 units in Spanish and Portuguese, plus 15 or 20 units in a related field.

For students in the Honors Program in Humanities, up to six units of that program may be applied toward completion of the Spanish major.

**STANFORD SPANISH PROGRAM IN SALAMANCA**

Students with two years of college Spanish or the equivalent 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 University courses and courses given and organized by the Director in Residence. Application forms may be obtained from the Department.

Courses taught at Salamanca. Spanish Civilization; Spanish Literature from 1870 to the Present; History of Spain. Students also enroll in courses given in the Facultad de Filosofía y Letras at La Universidad de Salamanca.

Students may take up to 20 units at Salamanca to apply toward their majors.

**INTENSIVE SUMMER PROGRAM**

Stanford University offers intensive language 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 Courses and Degrees and the Credentials Secretary, School of Education.

**COURSES FOR BILINGUAL STUDENTS**

The Department offers a series of courses especially for bilingual students who need to concentrate on special problems of language or who have particular cultural interests. For specific courses consult the course offerings section. The suffix B indicates the bilingual course.

**UNDERGRADUATE HONORS**

Majors in the Department who wish to be considered for honors at graduation may take an oral examination in the second to the last quarter of their senior year, on a 15-book reading list developed by the student in conjunction with a faculty advisor. The exam will be given by the student’s adviser and two other faculty members.

**MASTERS 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: Spanish 201, 202, (Advanced Grammar and Composition; can be waived in special cases); Introduction to Literary Theory or an equivalent course; four courses in the Department numbered 200 or above which form a coherent program (to be worked out with advisor); reading knowledge of one foreign language (this language may be Portuguese).

In addition, students may take further units of graduate courses in Spanish or Portuguese and/or approved courses in related fields such as Linguistics, Comparative Literature, Philosophy, History of Art, Education. Students planning a career in language teaching may also take part in the Department’s teacher training program.
CO-TERMINAL A.B. AND A.M.

The requirements for the Coterminal A.M. are the same as those outlined above for the A.M. No course can count for both the A.B. and A.M. degrees.

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 that may be of interest to graduate students in Spanish may be found in the section "Comparative Literature" and "Modern Thought and Literature" of this bulletin.

Students who choose a minor in Comparative Literature should consult with Professor Herbert Lindenberger, Chairman, Committee on Comparative Literature. Students who choose to minor in Modern Thought and Literature should consult with Professor Ian Watt, Chairman, Committee on Modern Thought and Literature.

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) completion of the requirements for the A.M. degree; (3) a reading knowledge of one foreign language other than Spanish and Portuguese; (4) the preliminary, qualifying and University Oral examinations, as described below; (5) the writing of a dissertation.

In consultation with the advisor, students will select one major field of study from the following: (1) Spanish Literature to 1700, (2) Spanish Literature from 1600, (3) Spanish American Literature, (4) Latin American Studies, (5) Lusobrazilian Studies.

In addition, candidates will select two secondary areas of study outside the major field from 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 advisor.

Ph.D. students who will be working as teaching assistants in their second and third years will participate in a teacher apprenticeship program in the spring quarter of the first year.

After the first year of study, each student is evaluated by the faculty to determine whether continuation to the Ph.D. is recommended and whether there are particular areas where improvement is needed. For this evaluation, students submit a sample term paper and take a test in textual analysis.

After the preliminary examination, students concentrate on the major field of study. After completion of course work requirements at the end of the third year of study they will take the qualifying examination, which is based on a comprehensive list of readings in the candidate's major field.

Ph.D. candidates must fulfill the requirements for the A.M. before proceeding to the qualifying examination.

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 advisor); (2) plans for the dissertation based on a prospectus approved by the advisor.

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 advisor. The advisor 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 advisor 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.

COURSES

OVERVIEW OF COURSES

A. General Courses (given in English)
B. First and Second Year Spanish (1-99)
C. Intermediate Courses (100-199)
  Culture 130-132, 130B-132B
  Literature (140-199)
D. Courses for Advanced Undergraduates and Graduates (200-299)
   Advanced Language and Linguistics (200-209)
   Peninsular Literature (210-245)
   Genre Survey Courses (210-213)
   Medieval and Golden Age Literatures (214-235)
   Modern and Contemporary Literatures (236-245)
   Latin American Literature (246-279)
   Genres and Literary Movements (246-259)
   National Literatures (260-275)
   Individual Authors (276-279)
   Chicano Literature (280-289)
   Special Topics (290-298)
   Individual Reading (299)

E. Graduate Seminars (300-399)
   Literary Theory and Methodology (300-313)
   Peninsular Literature (314-345)
   Latin American Literature (346-379)
   Chicano Literature (380-389)
   Special Topics (390-398)
   Individual Reading (399)

F. Portuguese Program (1-399)
   Language (1-199)
   Portuguese Literature (210-245)
   Brazilian Literature (246-279)
   Graduate Seminars (300-399)

INFORMATION

"Students interested in languages not listed for a specific language department should contact the Special Language Program, Department of Linguistics."

GENERAL COURSES

The courses in this section are given in English and do not require a knowledge of Spanish or Portuguese, although in some instances a reading knowledge may be recommended. Majors taking these courses as a part of their requirements must do assigned work in the language. These courses are open to all students. When registering, students are advised to add the identifying letter A to the course number.

120A. Don Quixote in Translation. 3-5 units, (Ball)
121A. Spanish Drama in Translation. 3-5 units, (Gicovate)
123A. Spanish-American Literature in Translation: Contemporary Mexican Writers—(Same as English 62A.) 20th-century Mexican literature in translation. (DR:T)
126A. Brazilian Literature in Translation—Analysis, discussion of representative works. 3-5 units, any quarter (Staff) by arrangement

FIRST AND SECOND YEAR SPANISH

Unless otherwise specified, all courses are offered Autumn, Winter and Spring. Students registering for the first time in a first or second year course must take a placement test if they have studied Spanish before entering Stanford.

FIRST YEAR COURSES

1. First Stage Spanish—An introductory course with emphasis on speaking and oral comprehension. (DR:X)
   5 units, MTWThF, plus additional work in the Language Laboratory

2. Second Stage Spanish—As above, with additional development of reading and writing skills. Prerequisite: Spanish 1 or equivalent. (DR:X)
   5 units, MTWThF, plus additional work in the Language Laboratory

3. Third Stage Spanish—As above, with additional cultural and/or literary readings. Prerequisite: Spanish 2 or equivalent. (DR:H)
   5 units, MTWThF, plus additional work in the Language Laboratory

4. Elementary Conversation—Conversation practice offered as a supplement to Spanish 2 or Spanish 3. May also be taken when student intends to continue in first year series but current course load does not permit it. Prerequisite: Spanish 1 or equivalent. (DR:X)
   1-2 units, (Staff)

SECOND YEAR COURSES

4-5 units, MTWTh. 4 hours weekly plus an optional 5th hour on Friday. Continuation and development of speaking, oral comprehension, reading, and writing. For courses 4B, 5B, and 6B see special section for bilingual students.

4. First Stage—Intensive review of grammatical concepts; composition and conversation based on primarily cultural readings. Prerequisite: Spanish 3 or equivalent. (DR:H)
   4-5 units, (Staff) MTWTh

5. Second Stage—As above, with composition and conversation based on primarily literary readings. Prerequisite: Spanish 4 or equivalent. (DR:H)
   4-5 units, (Staff) MTWTh

6. Third Stage—Application of grammatical concepts to composition, conversation, and oral presentation, based on materials selected by the
instructor and students. Prerequisite: Spanish 5 or equivalent. (DR:H)
4-5 units, (Staff) MTWTh

50. Intermediate Conversation—Recommended as a complement to Second Year courses. Prerequisite: Spanish 3 or equivalent. (DR:H)
3 units, (Staff) MWF

SPECIAL COURSES

10. Reading Spanish—Intensive course designed for those seeking to fulfill the University requirement of a reading knowledge of Spanish (DR:X)
4 units, Spr (Staff) MWF

15. Intensive First Year Spanish—Equivalent of 1, 2, and 3 combined. Enrollment limited to 15. (DR:X)
15 units, Sum (Staff) MTWThF 8:00-9:30 and 10:30-12:00

99. Individual Reading—Cannot be taken as a substitute for any of the regularly scheduled language courses. (DR:X)
1-5 units, (Staff) by arrangement

INTERMEDIATE COURSES

100. Advanced Conversation—Prerequisite: Spanish 6 or equivalent. (DR:H)
3 units, (Staff) MWF

CULTURAL READINGS

Courses will emphasize composition and structured discussion based on the readings. Especially designed for students who do not anticipate a literature major but want to continue beyond the Second year. Prerequisite for each: Spanish 6 or equivalent. For courses 130B, 131B, 132B see special section for bilingual students.

130. Journalism and Composition (DR:H)
3-5 units, Aut (Cavallari)

131. Spanish Cultural Readings and Composition. (DR:H)
3-5 units, Win (Staff)

132. Latin American Cultural Readings and Composition. (DR:H)
3-5 units, Spr (Alegria)

COURSES FOR BILINGUAL STUDENTS

4B. Intensive Second Year Spanish—Designed for students of Hispanic background who are at or above the oral comprehension level of Spanish 3 but would benefit from emphasis on grammar and composition. Readings and topics for conversation practice are chosen with special regard to interests of the bilingual student. Prerequisite: determined by interview with instructor. (DR:H)
5 units, Aut (Staff) MTWThF

5B. Intensive Second Year Spanish—Continuation of 4B. Prerequisite: 4B or interview with instructor. (DR:H)
5 units, Win (Staff) MTWThF

6B. Intensive Second Year Spanish—Continuation of 5B. Prerequisite: 5B or interview with instructor. (DR:H)
5 units, Spr (Staff) MTWThF

100B. Advanced Conversation for Bilingual Students—Offered in anticipation of an adequate enrollment. (DR:X)
3 units, by arrangement with Professor Ybarra-Frausto

The following courses are designed to meet the specific linguistic and cultural needs of the bilingual student above the second year level. Readings and topics for conversation and composition begin with a focus on the Mexican-Chicano heritage, and expand to include sociocultural and historical material from Latin America and Spain. The aim of this sequence is to develop a critical perspective on issues affecting a bilingual-bicultural reality. Prerequisite: Permission of instructor. For special courses in Chicano literature and history see courses numbered 280-289.

130B. Mexican and Chicano Cultural Readings—Includes selected grammatical problems and emphasis on oral expression. (DR:H)
3-5 units, Aut (Ybarra-Frausto)

131B. Latin American Cultural Readings—Includes selected grammatical problems and introduction to literary texts. (DR:H)
3-5 units, Win (Ybarra-Frausto)

132B. Hispanic Cultural Readings—Selected grammatical problems and emphasis on composition. (DR:H)
3-5 units, Spr (Ybarra-Frausto)

162B. Creative Writing for Bilingual Students—(Same as English 162B.) A basic function and narrative writing course in which students will be encouraged to draw from their bicultural, bilingual experience. Knowledge of Spanish and familiarity with barrio dialects essential. (Not open to graduate students or freshmen.)
5 units, Win (Islas)

LITERATURE

Courses will emphasize a broad perspective on Hispanic literature and provide an introduction to literary studies. Prerequisite: Spanish 6 or equivalent.
140. Introduction to Methods of Literary Analysis—Designed for students with little or no background in literary analysis. Introduces basic terminology of literary criticism and examines a variety of critical approaches to literature. Specific literary texts will be discussed in detail in light of readings in literary theory and criticism. Emphasis will vary with individual instructors, but the general purpose of this course is to teach students to read, write, and think about literature. Given annually. Prerequisite: Spanish 6 or equivalent. (DR:H) 3-5 units, Aut (Pratt)

151,152. Spanish Literature—These courses make up the basic introduction to Spanish Peninsular literature. They deal with major works from several periods and genres, and are designed to prepare the student for more specialized 200 level course. Though designed as a sequence, they need not be taken in sequence. Exact composition of courses will vary from year to year. Given annually. Prerequisite: Spanish 6 or equivalent.

151. Spanish Literature I—Major works of the Middle Ages and the Renaissance. (DR:H) 3-5 units, Aut (Benmayor)

152. Spanish Literature II—Major works of prose (novel, short story, essay) in Spain from 1800 to the present. (DR:H) 3-5 units, Spr (Ball)

161,162. Spanish American Literature—These courses make up the basic introductions to Spanish American literature. They deal with major works from several periods and genres, and are designed to prepare the student for more specialized 200 level course. Though designed as a sequence, they need not be taken in sequence. Exact composition of courses will vary from year to year. Given annually. Prerequisite: Spanish 6 or equivalent.

161. Spanish American Literature I—Major works of the Middle Ages and the Renaissance. (DR:H) 3-5 units, Win (Cavallari)

162. Spanish American Literature II—Major works of prose (novel, short story, essay) in Latin America from 1800 to the present. (DR:H) 3-5 units, Spr (Staff)

180. Undergraduate Winter Colloquium—This course is chiefly designed to provide a forum where Spanish majors of all paths can come together to do collective reading and research on a selected topic in Hispanic culture. Topics will vary widely from year to year, but will usually involve areas of interest which students would be unlikely to encounter in regular course work. Students are also encouraged to suggest topics for this colloquium. Open to non-majors by consent of instructor. Prerequisite: Spanish 6 or equivalent. (DR:H)

201. Advanced Grammar—Problems of grammar at an advanced level. (DR:H) 3 units, Aut (Staff)

202. Advanced Composition—Workshop on syntax and style. (DR:H) 3 units, Win (Staff)

203. Problems in Translation—A workshop for advanced language students. (DR:H) 3 units, Spr (Gicovate)

204. Spanish Pronunciation and Phonetics—(DR:X) 3 units, (Gicovate)

205. Introduction to Bilingualism—(Same as Linguistics 146.) The course is aimed at helping the students to become aware both of the general characteristics of bilingual communities and bilingual individuals and of the variety of specific situations and cases encountered in real life. The focus will be on Spanish-English contact in the United States but other situations of bilingualism and multilingualism in the world will be discussed. No prerequisite. 4-5 units, Spr (Lavandera) WThF 1:15

206. Introduction to Spanish Versification. 3 units, Spr (Gicovate)

207. Spanish Phonology and Syntax—Study of specific problems in the analysis of Spanish from a variety of linguistic points of view, including traditional grammar, structural grammar, and generative-transformational grammar. 3 units, (Pratt)

208. History of the Spanish Language—Study of the historical development of Spanish from Vulgar Latin. Combined with close readings of Old Spanish poetic and prose texts. (DR:X) 3 to 5 units, Aut (Benmayor)

209. Variation in Spanish—(Same as Linguistics 249.) This is a course on the methodology of
analysis of language in use. Investigation of data from different geographical and social dialects of Spanish, comparison of mono-lingual Spanish situations with bilingual ones involving Spanish. Students will be encouraged to gather their own data as a complement to data presented by the instructor. Prerequisite: Intermediate level of Spanish and consent of instructor.

5 units, Spr (Lavandera)

209A. Topics in Bilingualism—(Same as Linguistics 246.) Selected topics in bilingualism. 1978-79: the sociolinguistic approach. Prerequisite: one introductory course in bilingualism or one introductory course in sociolinguistics. 4-5 units, Aut (Lavandera) MW 11-12:50

PENINSULAR LITERATURE

210. Prose Narrative in Spain—Texts from the Medieval, Golden Age and Modern periods. 3-5 units, (Benmayor)

212. Poetry in Spain from the beginnings through 1970. 3-5 units, Spr (Ball)

216. The Lyric: Popular and Learned Voices—Hispano-Arabic, Galician-Portuguese, and Castilian lyric traditions from the jarchas to Jorge Manrique. Intended as a sequence to The Epic and the Ballad. Graduates enroll in 316. (DR:H) 3-5 units, (Benmayor)

217. History, Fantasy, and Morality—Narratives in the Middle Ages: the morality story, hero and adventure tales, and historical chronicles and biographies. Graduate students enroll in 317. 3-5 units, (Benmayor)

218. Literature as Propaganda in the Spanish Middle Ages—A survey of major works of poetry and prose from 1100 to 1500, focusing on the connections between formal artistic expression and the function of this literature in promoting the perspectives of conflicting social groups and classes. Emphasis on the epic, historical ballads, chronicles, religious fictions, novels of chivalry and various forms of didactic poetry and prose. (Open to majors in Medieval Studies.) 3-5 units, (Benmayor)

222. Golden Age Drama from Gil Vincente to Calderón. (DR:H) 3-5 units, Win (Gicovate) given 1979-80

223. The Literature of Delinquency—The Spanish Ficareresque novel and its sequel in Europe and Latin America. El Lazarillo, Guzmán de Alfarache, El Buscón, Moll Flanders, Tom Jones, Periquillo Sarniento, Fué Pérez, and contemporary adaptations of the picaresque mode. (DR:H) 3-5 units, (Benmayor)

225. Introduction to the Lyric Poetry Camões—See Portuguese 225. (DR:X) 3-5 units, (Coelho)

240. Main Currents of the Literature of Portugal—For description see Portuguese 240. Enroll in Portuguese 240. 3-5 units, (Coelho)

LATIN AMERICAN LITERATURE

248. Contemporary Caribbean Fiction—This course will be based on a comparative analysis of the major themes of the contemporary novel in the Spanish-speaking, French-speaking and English-speaking Caribbean. The course will be taught in English; Spanish and French novels will be read in translation. 3-5 units, Aut (Wynter)

249. The Latin American Essay—Study of a genre which in Latin America is related in a special way with the development of philosophical, political and social ideas. Essayists to be studied include Rodó, Martí, Vasconcelos, Henríquez Ureña, Mariátegui, Alfonso Reyes, Martínez Estrada, Picón-Salas and Octavio Paz. The second half of the course will emphasize topical subjects as treated in contemporary essays. (DR:H) 3-5 units, Win (Ybarra-Frausto)

250. Latin American Theater: Theory and Practice—Study of the development of Latin American theater from pre-Colombian times to the present. Emphasis on recent trends in socially committed theater. Reading and interpretation of dramatic texts. (DR:H) 3-5 units, Win (Ybarra-Frausto) given 1979-80

251. Taller de Teatro: Theater Workshop—Investigation of current theater esthetics in the
dramatic production of Latin America and of Spanish-speaking groups within the United States. Special focus on both popular theater and vanguard experiments. A group class in which the participants will experience the many aspects of mounting a production. (DR:H)

3-5 units, (Ybarra-Frausto)

252. Latin American Literature in a Social Context. the Mexican Revolution and the Narrative.—The course will deal not only with the Mexican novel of the revolution (Azuela, Guzmán, Rulfo, Yañez) but also with texts in English (John Reed, B. Traverso, Graham Green) as well as with oral narrative and autobiography. (DR:H)

3-5 units, (Ybarra-Frausto)

260. The Mexican Short Story.

3-5 units, Aut (Alegria)

263. Chilean Literature in Exile.

3-5 units, Win (Alegria)

264. Post-Revolutionary Cuban Literature—Cuba's socialist process and the corresponding developments in social and individual consciousness will be the central topic of investigation. Analysis of the nation's main poetic, narrative and essayistic production since 1960.

3-5 units, (Cavallari)

266. Contemporary Argentine Literature—Analysis of works by Sábato, Puig, Walsh, Marechal, Viñas, Urondo and others will center around specific developments in literary form and changes in world outlook reflecting the complex problems generated by (a) the increasing penetration of foreign capital, military dictatorships and the collapse of liberal democratic ideals; and (b) the depersonalization of social relations and the disintegration of traditional institutions. (DR:H)

3-5 units, (Cavallari)


3-5 units, Aut (Coelho)

268. Brazilian Literature II—(Enroll in Portuguese 268.) See Portuguese 268 for description.

3-5 units, Win (Coelho)

CHICANO STUDIES

280. Introduction to Chicano Literature—(Same as Modern Thought and Literature 281.)

280. Introduction to Chicano Literature—Study of selected works by major Chicano writers including poetry, fiction, and drama with emphasis on twentieth-century literature. General introduction to questions of genre and textual interpretation, emphasis on the socio-historical and cultural context of Chicano literature. Topics such as bilingual expression, popular vs. "high" culture, the relationship between literature and society, and the historical trajectory behind 20th-century literary expression will be discussed through study of the texts. (DR:H)

3-5 units, Aut (Ybarra-Frausto)


4-5 units, Aut (Camarillo)

282. La poesía chicana.

3-5 units, Spr (Ybarra) given 1979–80

283. Literature of Spanish-Speaking Groups in the United States—Introduction to selected works from contemporary Chicano, Nuyorican, and Cuban American literature. Points of contact and divergence in literary production within a social-cultural context.

3-5 units, (Ybarra-Frausto)

285. Creative Writing for Chicanos—(Same as English 162B.) Knowledge of Spanish required. (DR:X)

5 units, Win (Islas)

288. Undergraduate Seminar: Topics in Chicano History—(Same as History 262S.)

Aut (Camarillo)

SPECIAL TOPICS

290. The Hispanic Elegy.

3-5 units, Win (Coelho) given 1979–80

291. The Poem Itself—(Same as 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. (DR:X)

3-5 units, Win (Coelho)

292. Ideology and Mass Culture—(Same as Modern Thought and Literature 292.) Theories and new approaches to mass culture including semiotics, neo-freudianism and ideological criticism. (DR:X)

3-5 units, Spr (Franco) given 1979–80

293. Colonialism and Literature—A study of the literary and cultural legacy of colonialism, based on a combination of European literary works about the colonies or ex-colonies, and works by writers from the colonies or ex-colonies themselves. Readings deal mainly with
Latin America, North Africa and the Caribbean, with background readings on colonialism. (DR:H)
3-5 units, (Pratt)

294. Hispanic Poetry of the Twentieth Century I.
3-5 units, Aut (Gicovate) given 1978–79

295. Hispanic Poetry of the Twentieth Century II.
3-5 units, Win (Gicovate)

296. Travel Literature: Study in Cultural Confrontation—The Western traveler as cross-cultural interpreter and mediator in the third world. The ideological appropriation of foreign contexts as related to developments in world history and economy. Fiction, journals, travelogues, essays, documentary and ethnographic writings and film.
3-5 units, Win (Pratt, Benmayor)

297. Travel Literature—Continuation of 296, but may be taken separately.
3-5 units, Spr (Pratt, Benmayor) given 1978–79

298. Creative Writing in Spanish: A Workshop. (DR:X)
3-5 units, Spr (Alegria)

299. Individual Reading—May be repeated for credit. Open only to majors. (DR:X)
1-12 units, any quarter (Staff) by arrangement

GRADUATE SEMINARS (300-399)
Open to undergraduates by permission of instructor. All courses (DR:X)

304. Proseminar in Problems and Methods of Research in Hispanic Literature I.
3-5 units, Aut (Gicovate) given 1979–80

305. Proseminar in Problems and Methods of Research in Hispanic Literature II.
3-5 units, Win (Gicovate) given 1979–80

306. Introduction to Literary Criticism and Theory—A graduate seminar dealing with contemporary critical theory and methods of literary analysis, with special emphasis on the theory of the narrative. Reading knowledge of Spanish and/or French required.
3-5 units, Aut (Cavallari)

307. Semiotics and the Theory of Textuality—(Same as Comparative Literature 307 and Modern Thought and Literature 307.) Readings in contemporary theory, including Barthes, Kristéva, Derrida, Creimas, Said, Sarduy, and de Man (DR:T)
5 units, Spr (Ball) given 1979–80

308. Marxism and Aesthetics—(Same as Comparative Literature 308 and Modern Thought and Literature 308.) An introduction to some of the most essential problems (genetic, structural, teleological) in the study of art, as posed and developed by dialectical and historical materialist thought, concentration primarily on literature. Topics of inquiry and discussion will include: art, objective truth, and the problems of realism: art in contemporary bourgeois society and the impoverishment of form.
3-5 units, Win (Cavallari) given 1979–80

309. Critique of Structuralism and Post-structuralism—Selected readings in contemporary French critical theory of literature and of writing. The course will explore the possibilities and limitations of certain lines of structuralist and post-structuralist thought, seeking to elucidate their epistemological and ideological foundations.
3-5 units, Win (Cavallari)

310. Linguistics and Literature—(Same as Comparative Literature 310.) Focuses on linguistic problems of relevance to literary analysis, such as the description of narrative discourse, metaphor, and fictional discourse; the pragmatics of literature; the sociolinguistic status of literature.
5 units, Spr (Pratt)

316. The Lyric: Popular and Learned Voices—See Spanish 216 for description.
3-5 units, (Benmayor)

3-5 units, (Benmayor)

318. The Libro de Buen Amor and Medieval Love Poetry—(Same as Comparative Literature 318.) Allegory, autobiography, and parody in the troubadours, the dolce stil nuovo, and the Libro de Buen Amor.
3-5 units, (Ball)

324. Don Quijote and the Theory of the Novel—(Same as Comparative Literature 324 and Spanish 224.) A close reading of Don Quijote in the light of recent theories of narrative structure.
3-5 units, Spr (Ball)

326. Seminar on Baroque Poetics—(Same as Comparative Literature 326.) The "Metaphysical" style of Quevedo and Donne. Reading knowledge of Spanish required.
3-5 units, Aut (Ball) given 1979–80

327. Seminar—Topic to be announced.
3-5 units, Spr (Gicovate)

3-5 units, (Coelho)
350. Twentieth Century Latin American Narrative I: The Limits of Realism—An examination of novels which depend on the realist canon and at the same time suggest its limitations. The discussion will concentrate on novels by Augusto Roa Bastos, José Revueltas, Vargas Llosa and José María Arguedas.
  3-5 units, Aut (Franco)

351. Twentieth Century Latin American Narrative II: Against Narration—The critique of “narration” implied in a number of contemporary Latin American texts. The course will concentrate on shorter fiction, including stories by Borges, Cortázar, Guimarães Rosa, and Carlos Fuentes.
  3-5 units, Win (Franco)

352. Twentieth Century Latin American Narrative III.
  3-5 units, Spr (Alegria)

353. Poetics of Modernism—Readings in poetic theory and Spanish American poetry from 1880 to 1920, especially José Martí, Rubén Darío, López Valarde, Herrera y Reissig, Pezoa Veliz. The course will include discussion of general theoretical problems.
  3-5 units, Aut (Franco) given 1980–81

  3-5 units, Win (Franco) given 1980–81

355. Contemporary Spanish American Poetry—A seminar investigating the main lines in the development of poetic production after the publication of Neruda’s Canto general and Parra’s Poemas y antipoemas. Works by Cardenal, Trejo, García Robles, Lihn, Cisneros, Adoum and others will be examined, seeking to establish both the internal characteristics of individual creation and the essential contours of the continental production as a whole.
  3-5 units, (Cavallari)

356. Latin American Writing of the Colonial Period.
  3-5 units, Aut (Franco) given 1979–80

357. Latin American Writing in the Nineteenth Century I.
  3-5 units, Win (Alegria) given 1979–80

358. Latin American Writing in the Nineteenth Century II.
  3-5 units, Spr (Cavallari) given 1979–80

370. The Luso-Brazilian Short Story—For description see Portuguese 370. Enroll in Portuguese 370.
  3-5 units, (Coelho)

376. Seminar on Contemporary Latin American Literature: García Márquez.
  3-5 units, Aut (Alegria)

  3-5 units, Win (Alegria)

  3-5 units, (Coelho)

  3-5 units, (Alegria)

380. Interdisciplinary Research Seminar in Chicano Studies—(Enroll in English 380.) Sponsored by Chicano Fellows Program and English Department. Open to graduate students from various disciplines throughout the university. Designed to afford an intellectually coherent framework for participants to discuss their areas and problems of research in subjects that relate to Chicanos, Mexican Americans, and Americans of Mexican descent. Permission of instructor required.
  5 units, (Islas)

392. Research Seminar on Dante—(Same as Comparative Literature 392 and Italian 392.) Topics of theoretical and methodological interest from the Vita Nuova, Convivio, and Commedia.
  3-5 units, Win (Ball) given 1979–80

PORTUGUESE COURSES

FIRST AND SECOND YEAR PORTUGUESE

All courses (DR:X)

1. First Stage Portuguese—An introductory course with emphasis on speaking and oral comprehension.
   5 units, Aut (Staff) MTWThF, plus additional work in the Language Laboratory

2. Second Stage Portuguese—As above, with additional development of reading and writing skill. Prerequisite: Portuguese 1 or equivalent.
   5 units, Win (Staff) MTWThF, plus additional work in the Language Laboratory.
3. Third Stage Portuguese—As above, with additional cultural and/or literary readings. Pre-requisite: Portuguese 2 or equivalent.
5 units, Spr (Staff) MTWThF, plus additional work in the Language Laboratory

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

109. Portuguese for Students of Spanish—Accelerated course for beginners with advanced knowledge of Spanish. Designed to give reading competence in Portuguese for research and courses in Luso-Brazilian studies. Includes some practice in speaking and comprehension.
3 units, Spr (Staff)

110. Intermediate Portuguese—Emphasis on reading, discussion, and composition. Grammar review included. Prerequisite: Portuguese 3 or equivalent.
3 units, Aut (Coelho)

120. Advanced Portuguese—Continuation of 110. Prerequisite: 110 or equivalent.
3 units, Win (Pratt)

199. Individual Reading—Enrollment only by permission. Prerequisite: 120 or equivalent.
1-5 units, any quarter (Staff) by arrangement

ADVANCED UNDERGRADUATE AND GRADUATE (200-299)

All courses (DR:X)

225. Introduction to the Lyrican Poetry of Camões—Study of the most significant lyrical poems of Camões, with emphasis on the sonnets.
3-5 units, (Coelho)

240. Portuguese Literature—Main currents of the literature of Portugal. Major authors and socio-aesthetic ideas from the twelfth century to the present.
3-5 units, (Coelho)

267. Brazilian Literature I—Survey of literary trends and authors of Brazilian literature.
3-5 units, Aut (Coelho)

268. Brazilian Literature II—Survey of literary trends and authors of Brazilian literature.
3-5 units, Win (Coelho)

290. The Hispanic Elegy—(Same as Spanish 290.)
3-5 units, Win (Coelho) given 1979-80

291. The Poem Itself—(Same as Spanish 291 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.
3-5 units, Win (Coelho)

299. Individual Work—May be repeated for credit.
1-12 units, any quarter (Staff) by arrangement

GRADUATE SEMINARS (300-399)

All courses (DR:X)

341. Seminar on Fernando Pessoa—A study of the poetry of Fernando Pessoa, as well as the poems of his "heterónimos" Alberto Caeiro, Ricardo Reis, and Alvaro de Campos.
3-5 units, (Coelho)

370. 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.
3-5 units, (Coelho)

378. 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.
3-5 units, (Coelho)

399. Individual Work—Exclusively for graduate students in Portuguese working on theses or engaged in special work.
1-12 units, any quarter (Coelho) by arrangement

STATISTICS
Emeritus: Quinn McNemar (Professor)
Chairman: Bradley Efron
Professor of Biostatistics: Byron W. Brown
Professor of Educational Statistics: Rosedith Sitgreaves (by courtesy)
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 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), Stanford Linear Accelerator (Persi Diaconis). The research activities of the Department reflect an interest in both applied and theoretical statistics and probability. In the applied area, for example, the Department is one of two centers to study statistics and environmental factors in health. The courses themselves generally tend to be theoretical. However, there are three practicum workshops, in biology-medicine, behavioral sciences, and environmental factors in health, in which graduate students may become involved in the analysis of actual problems in the field.

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.

For the doctoral program, 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 awards approximately 10 to 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.

Computer facilities are available at the Center for Information Processing, which maintains an IBM 370-168 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 PDP 11/34A computer, a Hewlett-Packard 9810A computer, a Wang 2200, and a number of smaller calculators.

The Department has always been a center for visitors from other countries and universities. As a consequence, there is usually a wide range of seminars offered by both the visitors and our own faculty.

The Department of Statistics is located in its own building. Space for Ph.D. graduate students is provided adjacent to faculty offices.

PROGRAMS OF STUDY

BACHELOR OF SCIENCE IN
MATHEMATICAL SCIENCES

The Statistics Department participates with the Departments of Mathematics, Computer Science, and Operations Research in a program leading to the degree of Bachelor of Science in Mathematical Sciences. For further information on this program, 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 101 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). These will normally be taken from the group of courses 180, 201, 202, 203, 204, 205, 206, 207, 210. 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 (usually to 40-45 units, depending on the program). 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 advisor.
3. Three additional courses from offerings in the Statistics Department. These are normally taken from the group of courses 201, 202, 203, 204, 205, 206, 207, 208, 210, 228.
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 mathematical models in behavioral sciences can take 140, 204, 208, 210, 228, 250, 251, 257 within the Department, as well as authorized courses from other departments.

Students interested in Operations Research will normally be interested in the application of quantitative techniques to business and industrial technology. They may take 136, 207, 228, 240, 250, 251, 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, 160, 206, 207 and 240 within the Department.

Students interested in sociology, political science, or communications may take 140, 150, 160, 161, 162, 203, 204, 205, 206, 208, 228, 237.

**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, in mathematical statistics, and in 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. In general, it is advisable for students to obtain as strong a mathematical background as is feasible.

2. Probability and Statistics. Statistics 230A, B, C, 233A, B, C, and 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, Nonparametric Inference, Time Series, Robust Estimation, Geometric Probability, Stochastic Processes, Pattern Recognition, Statistical Complexity. Other advanced topics may be offered with the consent of the advisor. Normally students should consider completing three to four of the basic advanced topic courses.

3. Examinations. Two written examinations in probability and statistics—an elementary examination based on Statistics 116, 217, 218,
(or 317, 318), 219, 220, and an advanced examination based on Statistics 230A, B, C, 233A, 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 prognoses 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, computer programming. 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 the 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, tutoring, or teaching problem or laboratory sessions, 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. Applicants are urged to take the Graduate Record Examination between July and November in order to afford time for receipt of the scores before January 15. 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

All courses (DR:T) unless noted otherwise.

Introductory courses for general students with an interest in the problems of descriptive statistics and statistical inference are: Statistics 10, 40, 50, 60, 61, 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, 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 — Designed for students who wish to gain familiarity with statistical ideas; a course on statistical literacy. Emphasis on descriptive measures such as mean, median, percentiles, mode, variance, correlation, and methods for presenting data. Interpretation of data which occur in daily life, e.g., in newspapers, magazines, etc., is stressed. This is a terminal course and is not acceptable as a prerequisite for later courses.

4 units, Win (Singpurwalla) MWF 9

20. Scientific Method and Data Analysis— (Enroll in Humán Biology 20.) Introduction to the elements of quantitative thinking in biology and the behavioral sciences. Emphasis is on the foundations of scientific reasoning and statistical methodology including the use of computers for data analysis and the critical reading of quantitative data in scientific papers. Topics covered include probability models, statistical inference, design of sample models, linear models and analysis of variance, contingency tables, regression and correlation, multivariate procedures. Concurrent laboratory of data analysis, use of calculators and computers. Prerequisite: Elementary high school algebra.

3 units, Win (Cavalli-Sforza, Olkin) MWF 1:15-3:00

40. Introduction to Probability and Its Applications— Precalculus course for non-
mathematical students. Special attention to elementary applications of probability and statistics. Random variables, distributions, expectation. (Graduate students enroll in 140.)

3 units, Aut (Johns) MWF 11

60. Introduction to Statistical Methods I—A nonmathematical study of statistical methods. Emphasis on statistical techniques. Organization of data, averages, variability, and association. Statistical inference, tests of hypotheses, estimation, and confidence intervals. Computer statistical packages will be used. (Graduate students enroll in 160.)

5 units, Aut (Miller) MTWThF 1:15
Spr (Anderson) MTWThF 1:15
Sum (Staff) MTWThF 1:15

61. Introduction to Statistical Methods II—Treats chi-square tests, analysis of variance, regression, correlation, nonparametrics, sample surveys, elementary design of experiments. Prerequisite: Statistics 60 or consent of instructor. (Graduate students enroll in 161.)

5 units, Win (Efron) MTWF 1:15

70. Biostatistics—(Enroll in Family, Community and Preventive Medicine 202.) Statistical reasoning and basic methods. Applications to biology and medicine. Prerequisite: High school algebra.

3 units, Aut (Brown) MTTh 4:15

80. Introduction to Statistical Computing—Introduction to the use of the computer for statistical analysis. MINITAB will be used interactively on LOTS. Emphasis on analyzing data using the computer. Topics include: descriptive statistics, hypothesis testing, correlation, regression, and ANOVA. Prerequisite: Statistics 60 or consent of instructor. No previous computer experience required. (Graduate students enroll in 180.)

2 units, Spr (Stutzle) MWF 9

110. Statistical Methods in Engineering and the Physical Sciences—A first course for engineers and physical scientists. Basic probability theory and statistics: Point and interval estimation, tests of hypothesis, nonparametric methods, curve fitting by least squares, analysis of variance, elementary experimental design. Prerequisite: One year of calculus.

4 units, Aut (Singpurwalla) TTh 10
plus MW 4:15
Spr (Faith) TTh 10
plus MW 4:15
Sum (Staff) MTWThF 9

116. Theory of Probability—Probability spaces as models for phenomena with statistical regularity. Discrete spaces (e.g., binomial, hypergeometric, Poisson). Continuous spaces (e.g., normal, exponential) and densities. Random variables, expectation, independence, conditional probability. Introduction to the Laws of Large Numbers and Central Limit Theorem. Prerequisite: Mathematics 44 or equivalent.

4 units, Aut (Staff) MTWF 10
Win (Johns) MTWF 10
Spr (Mittal) MTWF 10
Sum (Staff) MTWThF 2:15

116E. Theory of Probability—A course similar to 116 designed especially for engineering students. Prerequisite: Mathematics 44.

3 units, Aut (Stein) MWF 11

119/120. Statistical Inference—A first course in the theory of mathematical statistics. Modern statistical procedures derived from a mathematical framework; 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, nonparametric methods, sequential analysis, least squares methods in regression, correlation, elementary analysis of variance, design of experiments. Prerequisite: Statistics 116. (Graduate students enroll in 219, 220.)

119. 4 units, Win (Lai) MWF 11
120. 4 units, Spr (Johns) MWF 11
119,120. 8 units, Sum (Staff) MTWThF 8:00-9:50

140. Introduction to Probability and Its Applications—For graduate students. Lectures same as 40.

3 units, Aut (Johns) MWF 11

152. Introduction to Operations Research I—(Enroll in Operations Research 152.) Theory and computation of optimal selection of decisions under certainty. Linear programming (simplex method and duality theorem), network flows, dynamic programming, convex programming (convex sets and functions, Lagrange multipliers, Kuhn-Tucker conditions, algorithms), integer programming. Applications drawn from problems in pricing resources, production planning, inventory control, transportation, pollution control, personnel assignment, construction management, capacity expansion, and financial management. Prerequisite: Mathematics 43 or consent of instructor.

4 units, Aut (Hillier) MWF 11:00-12:05

programming, simulation, certainty equivalents and quadratic costs. Prerequisite: Statistics 116.
4 units, Win (Hillier) MWF 11:00-12:05

160. Introduction to Statistical Methods I—For
graduate students. Lectures same as 60.
5 units, Aut (Miller) MTWThF 1:15
Spr (Anderson) MTWThF 1:15
Sum (Staff) MTWThF 1:15

161. Introduction to Statistical Methods II—
For graduate students. Lectures same as 61.
5 units, Win (Efron) MTWF 1:15

180. Introduction to Statistical Computing—
For graduate students. Lectures same as 80.
2 units, Spr (Stutzle) MWF 9

199. Independent Study—For undergraduates.
(Staff) by arrangement

B. COURSES PRIMARILY FOR
STUDENTS IN OTHER
DEPARTMENTS AND FOR
MASTER’S CANDIDATES

All courses (DR:T)

Courses in this category have been designed
for particular use in applications, either by pro-
fessional statisticians or by researchers in other
fields. The core courses for the Master’s degree
program are 116, 217, 218, 219, 220, plus addi-
tional courses. These will normally be from the
following group.

200. Statistics for Scientists, Mathematicians,
and Engineers—Discusses methods of wide use
in data analysis; linear models, correlation and
regression, analysis of variance, t and F tests.
Emphasis on broad understanding statistical
methodology rather than details of specific
applied areas (though some real applications
used for illustrative purposes). Prerequisites: A
good understanding of matrix algebra at the
level of Mathematics 113, and of elementary
probability theory at the level of Statistics 116.
3 units, given alternate years.

201. Introduction to Data Analysis—Statistical
techniques for the exploratory and “rough
confirmatory” stages of data analysis: Transforma-
tions, robust multiple regression, graphical
methods for high dimensional data. All topics
illustrated on actual case material. Prerequisite:
Statistics 60 or equivalent.
3 units, (Faith) MWF 9

202. 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.
(Formerly Statistics 136.)
3 units, Spr (Cover) MWF 9

203. Introduction to Analysis of Variance and
Design—The most widely used statistical
technique. The proper design for and interpre-
tation of observational data. Topics include re-
gression, one- and two-way factorial experi-
ments, orthogonal contrasts, model II. Pre-
requisites: a basic course in Statistics (Statistics
61, 110, or 120). (DR:X)
3 units, Win (Faith) MWF 2:15

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, nonresponse models; par-
ticular emphasis on applications. Prerequisite:
A basic course in statistics (Statistics 61, 110, or
120).
3 units, Aut (Staff) MWF 1:15

205. Introduction to Nonparametric Statistics—Nonparametric analogs of the one-
and two-sample t tests and analysis of variance: the
sign test, median test, Wilcoxon’s tests, and the
Kruskal-Wallis and Friedman tests, tests of in-
dependence. Nonparametric confidence inter-
val estimates. Prerequisites: A basic course in
statistics (Statistics 61, 110, 120, or 200). (Con-
current registration in 120 is permitted.)
3 units, Aut (Staff) MWF 1:15

206. Applied Multivariate Analysis—Intro-
duction to statistical analysis of several quantita-
tive measurements on each observational unit.
Emphasis on concepts, methods, computation,
interpretation. Examples drawn from substan-
tial fields such as economics, education, geol-
ogy, psychology. Topics include multiple re-
gression, multivariate analysis of variance, prin-
cipal components, factor analysis, canonical cor-
relations. Prerequisites: A basic course in statistics
(Statistics 61, 110, 120, or 200). (Concurrent
registration in 120 is permitted.)
3 units, Aut (Staff) MWF 11

207. Introduction to Time Series Analysis—
Time series models used extensively in eco-
nomics, engineering, physics, geology, etc.
Trend fitting, autoregressive schemes, moving
average models, periodograms, second order
stationary processes, spectral analysis. Pre-
requisites: Statistics 116 and a basic course in
statistics (Statistics 61, 110, 120, or 200). (Con-
current registration in 120 is permitted.)
3 units, Spr (Singpurwalla) MWF 2:15

208. Mathematical Models in Behavioral
Sciences: Psychometrics—Examination of math-
ematical models and applications in psychometrics. Illustrative topics are factor analysis, mental testing, clustering and classification, multidimensional contingency tables. Prerequisite: Statistics 120.

3 units, given alternate years

210. Selecting and Ordering Populations—
Normally statistical techniques have been developed to determine whether a number of treatments, say, differ with respect to some parameter. Ranking and selecting procedures are statistical techniques for comparing these populations where the goal may be to select the single best population, or perhaps to rank all the populations. These techniques will be illustrated by using actual data from a variety of fields. The course will concentrate on the ideas underlying the material and not on derivations; the course requires knowledge of a first course in statistics.

3 units, Spr (Olkin) MWF 8:30-10:00


217. 3 units, Aut (Mittal) MWF 2:15
218. 3 units, Win (Mittal) MWF 2:15
Spr (Steele) MWF 3:15

217,218. 6 units, Sum (Staff) MTWThF 10:00-11:50

219,220. Statistical Inference—For graduate students. Lectures same as 119, 120.

219. 3 units, Win (Lai) MWF 11
220. 3 units, Spr (Johns) MWF 11

219,220. 6 units, Sum (Staff) MTWThT 8:00-9:50

227. Statistical Computing—(Same as Computer Science 235.) Numerical analysis aspects of least squares, nonlinear and robust regression, random number generation and Monte Carlo, eigenvalue computations in multivariate analysis, numerical integration and computational complexity. Emphasis on computational aspects which are relevant in practical statistical problems. Prerequisites: Statistics at the level of 219-220, matrix algebra, knowledge of a programming language.

3 units, given alternate years

228. Statistical Computer Packages—Comparison, evaluation, and use of statistical computer packages. Emphasis on an organized approach to data analysis. Statistical methods discussed include univariate and multivariate techniques. Prerequisites: Statistics 120 or a 200 level statistics course.

3 units, Win (Faith) MWF 10

251. Stochastic Models in Operations Research—(Enroll in Operations Research 251.) Introduction to stochastic modeling. Orientation is applied and directed to students who anticipate doing project work in government or industry which involves stochastic modeling. Emphasis on stress formulation, solution, and analysis of stochastic models in operations research. Topics include queuing theory, inventory theory, Markov decision processes, dynamic programming, reliability theory. Prerequisite: Statistics 217.

3 units, Spr (Hillier) TTh 4:15-5:30

257. Simulation—(Enroll in Operations Research 257.) Generation of uniform and nonuniform random numbers, discrete event simulations, simulation languages, design of simulations, statistical analysis of the output of simulations, applications to modeling stochastic systems in computer science, engineering, and operations research. Prerequisites: A working knowledge of FORTRAN, BASIC or ALGOL; Statistics 217 or the equivalent. (DR:X)

3 units, Spr (Iglehart) TTh 2:40-3:55

299. Literature of Statistics—Intensive study of literature of any special topic, usually culminating in the preparation and presentation of reports upon topics studied.

(Staff) by arrangement

C. COURSES PRIMARILY DESIGNED FOR DOCTORAL STUDENTS

All courses (DR:T) unless noted otherwise.

The 230A,B,C, 233 A,B,C, and 236 A,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 (Siegmund) MWF 2:15
230B. 3 units, Win (Siegmund) MWF 2:15
230C. 3 units, Spr (Siegmund) MWF 2:15

233A,B,C. Applied Statistics—Analysis of variance, multiple regression, components of var-
variance, experimental design, failure of assumptions, randomization, exploratory data analysis, nonparametric methods, robust point and interval estimation, contingency tables, analysis of quantitative data, censored data, and actual case histories. Prerequisite: Statistics 220 and Mathematics 113, or consent of instructor.

233A. 3 units, Aut (Switzer) MWF 3:15
233B. 3 units, Win (Switzer) MWF 3:15
233C. 3 units, Spr (Duan) MWF 3:15

236A,B,C. Theoretical Statistics—Decision theory; minimax and Bayes solutions, the concepts of admissibility and invariance. Bounds for the variance of estimators, maximum likelihood estimation, exponential families, tests of hypotheses, confidence intervals. Neyman-Pearson theory, large sample theory, sequential analysis, multiple decision problems. Prerequisite: Statistics 220.

236A. 3 units, Aut (Steele) MWF 11
236B. 3 units, Win (Steele) MWF 11
236C. 3 units, Spr (Stein) 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, given alternate years


3 units, Win (Hart) TTh 4:15-5:30

260A,B,C. Workshop in Biostatistics—Applications of statistical techniques to current problems in medical science. Intended primarily for doctoral students in statistics. Enrollment for more than two units of credit will involve extra reading or consulting and requires permission of the instructor. (DR:X)

260A. 1 to 5 units, Aut (Brown, Efron, Miller) Th 1:15-3:05
260B. 1 to 5 units, Win (Brown, Efron, Miller) Th 1:15-3:05
260C. 1 to 5 units, Spr (Brown, Efron, Miller) Th 1:15-3:05

262A,B,C. Workshop in Environmental Statistics—A seminar dealing with statistical aspects of pollution and related health effects.

262A. 1 to 3 units, Aut (Switzer) W 4:15-5:30
262B. 1 to 3 units, Win (Switzer) W 4:15-5:30
262C. 1 to 3 units, Spr (Switzer) W 4:15-5:30

314. Matrix Analysis and Inequalities—Topics in matrix theory and inequalities have applications in computer science, operations research, and statistics. Subjects covered will be chosen from 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 113 and approval of instructor.

3 units, given alternate years


317. 3 units, given alternate years
318. 3 units, given alternate years

324A,B,C. Multivariate Analysis—General theory of multivariate distributions; multivariate normal distribution and related distributions such as the Wishart distribution and Hotelling's $T^2$. 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.

324A. 3 units, given alternate years
324B. 3 units, given alternate years
324C. 3 units, given alternate years

326A,B. Sequential Analysis—The Wald sequential probability ratio test, operation characteristics and applications. General theory of optimal stopping with applications to sequential statistical decision problems.

326A. 3 units, Win (Siegmund) MWF 3:15
326B. 3 units, Spr (Lai) MWF 3:15

328A,B. Nonparametric Statistical Inference—Statistical inference without strong model assumptions; hypothesis testing and
estimation using permutations and ranks; non-parametric model-fitting, tolerance limits, discriminant analysis, and analysis of variance.

328A. 3 units, Aut (Johns) MWF 2:15
328B. 3 units, Win (Friedman) MWF 2:15

330. Stochastic Processes—Selected topics in stochastic processes from among martingales, branching processes, extreme value theory, regenerative phenomena, stationary processes. Prerequisite: Statistics 230A,B,C.

332. Asymptotic Methods in Statistics—Concepts of efficiency, the asymptotic efficiency of maximum likelihood estimators, best asymptotically normal (BAN) estimators, asymptotic behavior of likelihood ratio tests, optimal designs, empirical Bayes methods.

333. Robust Estimation—Procedures which continue to be effective when the usual parametric assumptions are violated. The estimation of location for symmetric distributions: M L, and R estimators, asymtotics, the influence curve. Robustness in hypothesis testing. Survey of recent literature. Prerequisites: Statistics 236A,B,C.

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.


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. Application of ideas in astronomy, atomic physics, biology, crystallography, physical chemistry, traffic flow and others.


399. Research—Research work as distinguished from independent study of nonresearch character listed in 199 and 299. (Staff) by arrangement

WESTERN CULTURE PROGRAM

Faculty: Lewis W. Spitz (History), Coordinator, William Chace (English), Edwin M. Good (Religious Studies), Fred A. Hargadon, Charles R. Lyons (Drama), John Nichols (Classics), Antony E. Raubitschek (Classics), Lucio P. Ruotolo (English), Edwin W. Spofford (Classics), Susan Thomas (English)

The Western Culture general education courses provide a basic introduction to the history and thought of western man. Designed primarily for beginning students, the courses
courses develop the historical structure, introduce some of the great classics in our religious, literary, philosophical and scientific tradition, and provide an essential core of knowledge as a base for further study of the arts, humanities and sciences. The classes will be small discussion groups meeting three hours a week with an occasional lecture or film on Thursday afternoon.

COURSES

0. Western Culture: From the Beginnings to the End of the Ancient World—Following history like a river through time, the course will explore the great writings of the Babylonians, Jews, Greeks, Romans and Christians from Genesis and the Gilgamesh Epic to St. Augustine's *City of God.*

5 units, Aut (Staff)

2. Western Culture: From the Middle Ages to the Enlightenment—While directing some attention to socio-economic developments and political events, the emphasis will be upon great religious, philosophical, cultural and scientific writings of the Medieval, Renaissance, Reformation and Enlightenment periods of European history.

5 units, Win (Staff)

3. Western Culture: From the Enlightenment to the Present—Through the study of major political treatises, literary works, historical documents and scientific writings, the course will focus upon major trends in western culture from the eighteenth through the twentieth century.

5 units, Spr (Staff)
SCHOOL OF LAW

Dean: Charles J. Meyers

Professors: Marc A. Franklin, Lawrence M. Friedman, John Kaplan, Victor H. Li, John H. Merryman, Robert L. Rabin, David Rosenhan, Michael Wald

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 6, 1978, and spring term will end on June 6, 1979.

COURSES

GRADUATE

All courses (DR:X)

The following courses are open to qualified graduate students of other departments of the University upon permission of the instructor:

231. History of American Law—This course will deal with selected topics in the development of American Legal institutions with special emphasis on the 19th century. The course will treat such subjects as legal aspects of slavery and race relations; legal control of the economy and its relationship to the development of a distinctively American social order; crime, violence, lawlessness and criminal justice in the American past; and changing concepts and functions of the legal profession. Friedman, A History of American Law (1973).

3 term units, Spr (Friedman)

235. Art and the Law—An examination of the range of problems that arise at the intersection of law and the visual arts (painting, sculpture, and graphic art) including: the protection of works of art in time of war, occupation and civil strife; the international traffic in stolen and smuggled cultural treasures; censorship, criticism, selection, and artistic freedom; copyright, moral right, and the proceeds right; art forgery, fakes, and consumer protection in the visual arts; legal relations between artists, dealers, museums, collectors, and auction houses; tax and estate problems of artists and collectors; legal services for artists; artnapping and insurance; legal problems of art museums, etc. Merryman and Elsen, Law, Ethics and Visual Arts (1978).

3 term units, Spr (Merryman, Elsen)

242. Children and the Law: A Policy Analysis—(Same as Psychology 351.) This course will be a seminar, limited to 20 graduate and law students. Admission is by consent of the instructor. The course will focus on how information from psychology and other behavioral sciences can be utilized in the development of legal policies affecting children. Areas focused on will include child custody decisions, "children's rights," definitions of child abuse and neglect, informed consent and experimentation with children, laws regarding family structure. An attempt will be made to apply existing knowledge about child development to the resolution of policy issues in each of these areas and to design research projects that will provide new data relevant to policymakers.

2 term units, (Macoby, Wald) given 1979–80

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. A portion of this course will focus on the criminal process and the control of anti-social behavior. The second part of the course will deal with the effort to implement a positive social program: the Marriage Law and its effect on the status of women. 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)

311. Law and Social Science—(Same as Sociology 60.) 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 defini-
tions 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, Aut (Friedman)

323. Legal Systems of Western Europe and Latin America—An introduction to the civil law tradition and a description of the modern legal systems in Europe and Latin America that have grown out of it. This course also provides a systematic foundation for subsequent study of international business transactions, Soviet and East European law, private international law, and the law of major international organizations, and is essential background for the externships in Florence, Hamburg, and Mexico. Merryman and Clark, Comparative Law: West European and Latin American Legal Systems (1978).

3 term units, Spr (Merryman)

337. Seminar in Psychology and Law—(Same as Psychology 352.) The implications of psychological research and theory for law and legal processes 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; introductory materials on the social psychology of institutions; the implications of dissonance theory for torts and bankruptcy.

2 term units, Aut (Rosenhan)

338. Psychopathology and Mental Health Law—(Same as Psychology 353.) The course reviews the literature on severe psychopathology focusing especially on diagnosis, nature and effects of treatment, predictions of dangerousness to self and others, and assessment of grave disability and competence. The effects of diagnostic stereotyping, current modes of treatment, and our technical ability to predict social behavior are assessed for their legal implications. Law and practice in commitment and conservatorship are considered, as well as issues, and case law in right to treatment, patients' rights, informed consent, assessment of malpractice and psychosurgery. Brooks, Law, Psychiatry and the Mental Health System (1974).

3 term units, Aut (Rosenhan)

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 may not be counted toward professional degrees in law.

105. American Law, Development of—(Same as American Studies 171, History 171, and Political Science 174F.) The growth and development of American Legal institutions with particular attention to crime and punishment, slavery and race relations, the role of law in developing the economy, and the place of lawyers in American society, from colonial times to the present.

5 units, Aut (Friedman) MWF 10

107. The Criminal Law and the Criminal System—(Same as Political Science 174 and Sociology 61.) Exploration of the purposes and processes of the criminal law, with emphasis on the actual operation of the system, and the applications 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.) (DR:S)

5 units, Spr (Kaplan)

149. Communication Law—(Same as Communications 149.) This course introduces nonlaw students to the issues surrounding government regulation of the mass media. These issues emerge in virtually every aspect of the operation of the print and broadcast media—getting permission to begin broadcasting; what media may do to get a story; legal controls on what media may publish—or must publish; constraints on dissemination of the final product. Major attention will be given to decisions of the Supreme Court involving First Amendment issues and to the functioning of the judicial and administrative processes. (DR:X)

5 units, Win (Franklin) MWF 11:10-12:15

150. Regulation, Welfare and Public Policy—(Same as Values, Technology and Society 150.) 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 practical and theoretical limitations of 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 product safety and environmental protection. In addition, the role of the courts in controlling administrative discretion will be explored. (DR:S)

4 units, Spr (Rabin)
SCHOOL OF MEDICINE

Dean: Clayton Rich

The School of Medicine was established as a department of the University in 1908, when the Cooper Medical College in San Francisco was acquired by Stanford University. 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 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 current goals of the School of Medicine can be stated as follows:

To continue an exceptionally strong participation in the intellectual life of the University as a whole, including joint interdisciplinary research and teaching involving the interfaces between the physical and social sciences and medicine.

To maintain an intensive, individualistic program of medical education which emphasizes scientific knowledge and professional excellence at the medical student, graduate, and postgraduate levels.

To preserve present strong commitments to fundamental biomedical research and the education of medical scientists; to develop greater commitments to research related to the scientific base and professional practice of medicine.

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 provided 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, or include 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.

Provided an applicant to medical school has completed the basic courses in physics, chemistry and biology, the choice of an undergraduate major may reflect other interests, including the arts and humanities. Course work in mathematics and the behavioral sciences is highly recommended because of its importance in understanding medicine. Extracurricular activities and breadth of interests and experiences play an important role in the selection of students from among those applicants having superior academic records. The general requirements for admission are in the Medical School Bulletin. For application materials write: Chairman, Committee on Admission, Stanford University, School of Medicine, Stanford, California 94305.

ALLIED MEDICAL SCIENCES

DIVISION OF PHYSICAL THERAPY

Emeriti: Lucille Daniels (Professor), Sarah Semans (Associate Professor)

Director: Helen Blood

Adjunct Professors: Helen Blood, Barbara E. Kent

Assistant Professor: John Medeiros

Senior Lecturer: Katherine F. Shepard

Lecturers: Valerie Coon, Rochelle Parker, Gay L. Raymond, Katharine B. Robertson, Terry L. Sanford, Linda VanHoesen

Clinical Associate Professor: Catharine Graham


Panel of Consultants: John E. Bell, Clinical Associate Professor, David S. Burton, Assistant Professor, Ronald L. Kaye, Clinical Associate Professor, Leona M. McGann, Assistant Professor
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: the courses required for state licensure, one of the three advanced study areas—Administration and Community Health, Curriculum Development and Instruction, Approaches to Neuro-muscular Dysfunction, and research requirements.

Classes are held at the Stanford Medical Center, which houses physical therapy lecture, laboratory, seminar and research rooms. Students have a two- and three-week period of directed clinical experience during the first year, a ten to twelve week internship during summer quarter, and a four week advanced internship during the spring of the second year at Stanford Medical Center and/or affiliating health care facilities in California. This clinical sequence provides the opportunity for students to move toward the full utilization of their knowledge and skill in evaluating, planning, and implementing physical therapy programs.

The curriculum is accredited by the American Physical Therapy Association and the Council on Medical Education of the American Medical 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. The application must be completed by January 15 including letters of recommendation and transcripts. The last possible Graduate Record Examination that can be taken to meet this deadline is the prior December. Upon request of the Division, a personal interview, and completion of supplemental admission tests and forms may be required. Applicants will be considered without regard to race, color, creed, religion, sex, age or national origin.

Students are admitted autumn quarter each year. Dates for registration and general information will be found in the Information Bulletin of the University.

TRAIINEESHIPS, 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 human anatomy, human physiology, chemistry, physics, psychology (2), sociology, and statistics. Mathematics, biology, 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 required courses offered by the Division, 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 departments may attend courses in the Division with the consent of the instructor. Any one of the following courses may not be offered if an insufficient number of students enroll.

COURSES

All courses (DR:X)

220. Human Motion and Therapeutic Procedures—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 specialty areas, with emphasis on problems of patient care.

4-6 units, Aut (Kent, Staff)

MW 8:00-11:50; F 8:00-9:50

221. Human Motion and Therapeutic Procedures II—Continuation of Human Motion and Therapeutic Procedures I. Prerequisite: 220.

4-6 units, Win (Kent, Staff)

MW 8:00-11:50; F 8:00-9:50

222. Human Motion and Therapeutic Procedures III—Continuation of Human Motion and Therapeutic Procedures II. Prerequisites: 220, 221.

4-5 units, Spr (Staff) MW 8:00-10:50
225. Neurophysiological Basis of Human Motion I—Basic neuroanatomical and neurophysiological principles of normal and pathological motor control, pre- and post-natal development of motor activity and related assessment skills; current treatment principles for the infant and adult neurological patient; evaluation, treatment, and program planning for patients with neuromuscular disabilities.
4-5 units, Aut (Parker, Staff)
TThF 10:00-11:50

226. Neurophysiological Basis of Human Motion II—Continuation of Neurophysiological Basis of Human Motion I. Prerequisite: 225.
4-5 units, Win (Parker, Staff)
TTh 8:00-11:50; F 10:00-11:50

227. Neurophysiological Basis of Human Motion III—Continuation of Neurophysiological Basis of Human Motion II. Prerequisite: 225, 226.
4-5 units, Spr (Parker, Staff)
TTh 8:00-11:50; F 10:00-11:50

229. Physical Agents and Basic Skills—Analysis of the principles underlying the use of electrotherapy, massage, and hydrotherapy; practice of essential techniques.
2 units, Aut (Robertson, Staff)
MW 1:15-3:05

230. Physical Agents—Introduction to kinesiologic electromyographic techniques; functional activities.
2 units, Win (Robertson, Staff)
MW 1:15-3:05

231. Kinetic Electromyography—Analysis of human motion using electromyography techniques.
3 units, Aut (Robertson) by arrangement

232. Clinical Electromyography—Clinical application of electromyographic procedures and techniques.
3 units, Win, Spr (Robertson) by arrangement

240. Clinical Medicine—Lectures, demonstrations and discussions presented by pathologists, physiologists, and medical and surgical specialists with emphasis on abnormalities, caused by disease or trauma, which produce or contribute to disorders of movement.
3 units, Spr (Physicians) TTh 1:15-3:05

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.
2-3 units, (Kent, Staff) by arrangement

245. Directed Clinical Experience in Physical Therapy II—Continuation of Directed Clinical Experience in Physical Therapy I. Prerequisite: 221, 226, 244.
3 units, (Staff) by arrangement

247. Internship in Physical Therapy—Students are assigned to treatment facilities for full-time clinical experience. Prerequisites: 222, 227, 244, 245, 250.
3-5 units, (Kent, Staff) by arrangement

248. Advanced Internship in Physical Therapy—A practicum related to the Advanced Study Area planned by the student, advisor and preceptor from an approved clinical facility. Prerequisites: 244, 245, 247 and 2 quarters of advanced study.
3 units, (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.
5 units, Spr (Shepard) MW 1:15-3:05; F 1:15-2:05

251. Early Childhood Screening—Lecture hours on organization of public health clinics, screening processes and cultural considerations in child development followed by field experience in three public health clinics.
2 units, (Raymond) by arrangement

257. Organizational Behavior and Physical Therapy—Interpersonal and inter-professional relationships, leadership styles, groups dynamics and related areas and the application to physical therapy.
3 units, Aut (Shepard) by arrangement

258. Special Topics—Current issues and problems related to developing physical therapy knowledge, techniques and practice.
2-5 units, Win (Staff) TTh 3:15-5:05

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 (Sanford) MW 10:00-11:50

ADVANCED STUDY AREAS
Courses 244, 245, 247 and their prerequisites must be satisfactorily completed before enrollment in the Advanced Study component of the program. Courses listed between 260 and 285 are related to the Advanced Study Areas. Students must select and complete courses in one of the following areas:
Administration and Community Health—260, 261, and 262
Approaches to Neuromuscular Dysfunction—265, 266 and 267
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.
   4 units, Aut (Blood, Sanford)
   by arrangement

261. Administration and Community Health II—Continuation of Administration and Community Health I. Prerequisite: 260.
   4 units, Win (Blood, Sanford)
   by arrangement

262. Administration and Community Health III—Continuation of Administration and Community Health I and II.
   2 units, Spr (Blood) by arrangement

265. Advanced Approaches to Neuromuscular Dysfunction I—Normal processes of growth, development, and aging related to neurological dysfunction; includes the physiological and functional ramifications of pathology, patient evaluation, and analysis of treatment approaches.
   4 units, Aut (Raymond) by arrangement

266. Advanced Approaches to Neuromuscular Dysfunction II—Continuation of 265.
   4 units, Win (Raymond) by arrangement

267. Advanced Approaches to Neuromuscular Dysfunction III—Continuation of 265 and 266.
   2 units, Spr (Raymond) by arrangement

270. Advanced Approaches to Musculoskeletal Dysfunction I—Advanced kinesiology and biomechanics; in depth study of selected evaluation and treatment procedures for patients with musculoskeletal dysfunction.
   4 units, Aut (Staff) by arrangement

   4 units, Win (Staff) by arrangement

272. Advanced Approaches to Musculoskeletal Dysfunction III—Continuation of 270 and 271.
   2 units, Spr (Staff) 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.
   4 units, Aut (Shepard) by arrangement

   4 units, Win (Shepard) by arrangement

   2 units, Spr (Shepard) by arrangement

278. Directed Teaching—Practicum in teaching physical therapy in professional, academic, and clinical education programs and/or physical therapists assistant curricula.
   1-4 units, Win, Spr (Shepard, Staff)
   by arrangement

   1-5 units, any quarter (Staff)
   by arrangement

RESEARCH COURSES

Research requirements of the Division must be satisfied by completing 291.

290. Seminar in Research—Basic principles of research with emphasis on material applied to physical therapy.
   1-3 units, any quarter (Staff)
   by arrangement

291. Research.
   1-10 units, (1977-78) any quarter
   (Staff) by arrangement
   1-8 units, (1978-79) any quarter
   (Staff) by arrangement

BIOCHEMISTRY

Chairman: I. Robert Lehman
Associate Professor: Ronald W. Davis
Assistant Professors: Douglas Brutlag, James Rothman
Consulting Professor: Abraham White
Senior Lecturer: Carl Rhodes

OFFERINGS AND FACILITIES

The Department of Biochemistry, located in the Stanford Medical Center on the University campus, is part of the Graduate Division of the University and a department of the Medical School. An introductory course series in general biochemistry (Biochemistry 200-201) is taught by the entire staff as well as a number of guest lecturers. The sequence consists of both basic lectures, intended to provide all students with a rigorous background in biochemistry, and special lectures enabling students with varied interests to explore new topics in depth. Medical students as well as graduate and under-
graduate students may enroll in this series. Advanced courses in more specialized areas are offered as well. These include courses in the chemistry and biology of nucleic acids, mechanism and regulation of protein biosynthesis, mechanistic aspects of enzyme action, biochemistry of membranes, physical chemistry of proteins and nucleic acids, the biochemistry of bacterial and animal viruses, the molecular basis of morphogenesis, and the structure and function of prokaryotic and eukaryotic chromosomes. Opportunities also exist for directed reading and research in biochemistry and molecular biology, utilizing a small but excellent departmental library as well as the most advanced computer facilities and other specialized types of equipment. Facilities are available for light and electron microscopy, chromatography and electrophoresis, enzyme purification and analysis, analytical preparative centrifugation, amino acid and radioisotope analysis; and for research with bacteria, bacteriophage, animal cell culture and animal viruses, as well as with yeast and *Drosophila*.

**ADVANCED DEGREES**

The Department of Biochemistry offers a Ph.D. degree program beginning only in the fall of each year. The program of study is designed to prepare men and women for careers in research and teaching; its main emphasis is training in research, in which each student works closely with members of the staff. In addition to the requirement for a Ph.D. dissertation based upon original research, students are required to enroll in at least six advanced courses in biochemistry or related areas. Selection of these courses is tailored to fit the background and interests of the student. A second departmental requirement involves the submission of three research proposals, which are presented by the student to a faculty committee. Students in the Ph.D. program are expected to participate actively in the departmental noon seminar program and are also given the opportunity to attend and to present papers at regional and national conferences and meetings in biochemistry and molecular biology. Participation in departmental teaching efforts is also required. General University regulations concerning the Ph.D. degree are summarized in the section “Degrees” in this bulletin.

Men and women interested in pursuing a career in biochemical research and teaching are invited to apply directly to the Department of Biochemistry for admission to the Ph.D. program. Those applying should have a bachelor's degree and have completed work in differential and integral calculus, and have had at least a year of basic physics, inorganic chemistry, qualitative and quantitative analysis, organic chemistry, physical chemistry and biological sciences. In special cases, deficiencies can be made up after admission to the department. Before submitting a formal application to the Department of Biochemistry, students must complete a Preliminary Information Form, returning it not later than December 1. Students subsequently invited to apply must see to it that all materials pertinent to the formal application are received by the department before January 15. All applicants will be notified by April 15. Stanford University requires Graduate Record Examination scores (verbal and quantitative) from all students admitted to the Graduate Division. Students are encouraged to submit scores from the advanced test in biology or chemistry.

Students are urged to compete for non-Stanford fellowships or scholarships. Those who do not obtain stipends from such sources will receive from departmental funds an annual basic stipend of $3900. Supplements to the stipend may also be granted, depending on the availability of other funds. In addition, Stanford tuition costs will be paid by the department.

Postdoctoral research training is available to graduates holding a Ph.D. or M.D. degree. Qualified graduates may write to individual faculty members for further information.

At present the chief research interests of the department are in proteins and nucleic acids; their enzymatic synthesis, chemical structure, physical chemistry, and biochemical functions; in the biochemistry of bacterial and animal virus infection, in the structure and function of chromosomes; and in the biochemistry and control of developmental processes.

**COURSES**

All courses (DR:X)

(200,201. General Biochemistry—A two-quarter sequence in basic biochemistry and molecular biology. The first quarter lectures deal with the structure and function of proteins, enzyme kinetics and mechanisms, biochemical energetics, pathways of intermediary metabolism and their control, membrane structure and function, and biochemical regulation. Alternative lectures dealing with special topics will also be presented during the fall quarter. The second quarter course work is concerned with presenting students with a basic background in molecular biology as well as with the most recent information about rapid developing frontiers in polynucleotide synthesis and its control, chromosome structure and function, transcription and translation, hormone action, and
virus biochemistry. A series of special alternative "minicourses" is offered during the last three weeks of winter quarter. Open to medical, graduate, and undergraduate students. Prerequisites: cell biology and organic chemistry.

200. 5 units, Aut (Kaiser, Kornberg, Lehman, Rhodes, Rothman, Stark)
MTWThF 1:15

201. 5 units, Win (Berg, Brutlag, Hogness, Rhodes) MTWThF 1:15

202. The Teaching of Biochemistry—To be taken by all graduate students acting as teaching assistants in Biochemistry 200-201. Emphasizes practical experience in teaching on a one-to-one or small group basis, as well as in problem set design and analysis. Familiarization with current lecture and text material is expected, as well as assistance in evaluating the final examinations. Prerequisites: enrollment in the graduate program in the Department of Biochemistry, and Biochemistry 200-201 or its equivalent.

3 units, Aut, Win (Rhodes) by arrangement

208. Mechanisms of Enzyme Action—A brief account of recent developments in our understanding of enzyme catalysis and mechanism, with emphasis on advances in X-ray crystallography, transient kinetics, and studies on chemical catalysis. Prerequisites: Biochemistry 200-201, physical chemistry.

3 units, Win (Stark) by arrangement

213. The Arrangement and Expression of Genes in Eukaryotic Chromosomes—Emphasis will be placed on Drosophila as a model system, with frequent comparison to other eukaryotes. While gene mapping will be discussed primarily at the molecular level afforded by recombinant DNA molecules, consideration will also be given to classic cytogenetic methods. Topics that will be discussed include: gene transposition, multigene families, hierarchal systems for the regulation of gene expression, and gene systems that control developmental pathways. Prerequisites: Biochemistry 200-201 or its equivalent.

3 units, Aut, Win (Stark) by arrangement

215. Mechanisms of Gene Expression—The course will examine several models for regulation of eukaryote gene expression. Animal viruses, (RNA and DNA transforming and non-transforming) will be featured, although other suitable systems will be included as appropriate. The course will be taught principally by Paul Berg, but guest lecturers will also be featured. Class will meet twice weekly for one hour each, usually for lecture but occasionally for discussions. There will be extensive reading assignments and an examination at the end of the quarter for those wanting course credit.

3 units, Spr (Berg) by appointment

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, biochemical genetics, animal tumor viruses, and nucleic acid enzymology.

1-3 units, Aut, Win, Spr (Staff) by arrangement

222. Research Techniques in Biochemistry—Lectures, demonstrations and laboratory practice dealing with fundamental techniques in modern biochemistry and molecular biology. Includes growth of bacterial cells, viruses, and fractionation and analysis of macromolecules using ultracentrifugation, electrophoresis, and electron microscopy. Enrollment limited at present to students in the graduate program in the Department of Biochemistry.

3 units, Aut, Win (Staff) by arrangement

270. Seminar.
by arrangement

299. Research.
by arrangement

CANCER BIOLOGY PROGRAM

Committee on Cancer Biology: Robert F. Kallman, Ph.D., Professor of Radiology (Radiobiology), Chairman and Director of the Program; Errol C. Friedberg, M.D., Associate Professor of Pathology; Philip C. Hanawalt, Ph.D., Professor of Biological Sciences; Wray H. Huestis, Ph.D., Assistant Professor of Chemistry; Henry S. Kaplan, M.D. Professor of Radiology; Eric M. Shooter, Ph.D., Professor of Neurobiology

The Cancer Biology Program is designed to provide a framework for students with an interest in the understanding and control of neoplastic growth to build a curriculum in varied biomedical areas relevant to that subject. Students in this Program are based in departments appropriate to their speciality and are subject to the core requirements specified below. The degree offered is the Ph.D. in Cancer Biology.

PROGRAM OF STUDY

A limited number of well qualified applicants will be admitted to the Program each year. It is preferable that applicants will have completed
an undergraduate major in the biological sciences; applicants with undergraduate majors in physics, chemistry, or mathematics may be admitted under the condition that they will complete background training in biology during the first two years of study. Each incoming student will be assigned an Advising Committee which, with progress through the program, will be succeeded by Dissertation Committees; these committees will assist each student to develop an appropriate course program to suit his or her needs.

The requirements for the Ph.D. degree are as follows:

1. Training in biology equivalent to that of an undergraduate biology major at Stanford.

2. Completion of the following courses (or their equivalents, except for the Cancer Biology course):
   - Biochemistry 200, 201;
   - Pathology 230A;

3. Completion of a sufficient number of elective courses so that the student will have accumulated a total of at least 50 units. Of the elective courses, it is recommended that at least four be drawn from a preferred listing of especially relevant courses (furnished by the Director).

4. Attendance at the Seminar in Cancer Biology. First year Cancer Biology students are urged to attend this seminar, and students in their second and later years are required to attend and participate in the seminar.

5. Successful passing of a comprehensive qualifying examination in Cancer Biology is required for admission to Ph.D. candidacy. This examination is normally taken early in the second year of study after completion of at least three of the required four courses specified above. The examination will cover material relevant to Cancer Biology and to the special interests of the individual student.

6. 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 advisor, and at least one member from the Committee on Cancer Biology. The candidate may be called upon to defend the dissertation proposal in an oral examination. A Dissertation Reading Committee will then be organized by the student and will normally evolve from the Dissertation Proposal Review Committee.

7. The presentation of a Ph.D. thesis as the result of independent investigation and constituting a contribution to knowledge in the area of cancer biology.

8. The successful passing of the University oral examination which is to be taken only after the student has substantially completed his research. The examination will be preceded by a public seminar in which the research will be presented by the candidate.

**Courses**

All courses (DR: X)

241, 242, 243. Molecular and Cellular Aspects of Cancer Biology—This newly designed course will be given over three academic quarters and will cover primarily three major subject areas: cancer cell biology, carcinogenesis, and fundamental principles of therapy. Each of these should occupy approximately one academic quarter. This course is not intended to replace other specialized courses offered under departmental headings, but will give a comprehensive view of the major, relevant scientific bases and advances in areas directly relating to the understanding and control of neoplastic growth. The course will be organized and coordinated by R.F. Kallman, and its faculty will be drawn almost exclusively from the list of Stanford faculty participating in the Cancer Biology Program.

242. 2 units, Win (Staff) dhur
243. 2 units, Spr

271. Seminar in Cancer Biology—A weekly seminar on research in Cancer Biology, with presentations by students, postdoctoral fellows, faculty, and guest speakers. To meet weekly throughout the year.

1 unit, Aut (Staff) dhur

**GENETICS**

Chairman: Joshua Lederberg


Adjunct Professors: Elliott C. Levinthal, G. Loew

Assistant Professor: Douglas C. Wallace

**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 inter-
departmental program leading to a Ph.D. in Neuro- and Biobehavioral 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 background in biology, biochemistry and also chemistry, physics and mathematics or computation. The Department administers a Ph.D. program of unusual flexibility which makes special provision to support training in biology for students whose main background 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 pathology of intellectual development. These facilities offer unusual opportunities for research and study in the fields of molecular biology, heredity, neurobiology, and developmental medicine. The program of the Laboratories together with courses in the various neurological sciences divisions of the Medical School and in the Biology Department cover the requirements of the Ph.D. degree in Neuro- and Biobehavioral 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 biphysical analysis with sophisticated computer support. Besides laboratory instrumentation, the department supports 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 Biotechnology Resources Branch, designed to serve the local research groups as well as a national community of investigators in the field of artificial intelligence as applied to biomedical research. It offers unusual opportunities for training in advanced applications of computers in areas like the emulation of scientific reasoning and the design of experiments 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 immunology, biochemical neurogenesis, biochemical genetics of mental disease, the interactions of cultural and biological evolution, the investigation of extraterrestrial life, application of new physical methods and of quantum theory to biochemical analysis, cell detection and sorting procedures, genetic demography, 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 advisor (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**

All courses (DR:X)

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, Aut (Cavalli-Sforza) MTWTh 2:15

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) MW 9; F 11

212. **Somatic Cell Genetics**—Selected topics on the use of higher animal and plant cells in culture to examine eukaryotic genetic phenomena. Areas discussed are cell culture, cell fusion, chromosome analysis, selective systems, mutagenesis, gene mapping, gene transfer, regulation, and development. Open to medical students, graduate students, and advanced undergraduates. Prerequisites: Undergraduates only, Biology 20 and 21.

2 units, Spr (Wallace) Th 4:15-5:05
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, Spr (Herzenberg, McDevitt)
MW 4:15-5:30


3 units, Aut (Ganesan) MWF 10
given 1979–80

260. Supervised Study—Prerequisite: consent of instructor.
Any quarter, (Staff) by arrangement

270. Genetics Seminar.
Any quarter, (Staff) by arrangement

299. Individual Research.
Any quarter, (Staff) by arrangement

HEALTH SERVICES RESEARCH

MASTER OF SCIENCE PROGRAM IN THE
DEPARTMENT OF FAMILY, COMMUNITY AND PREVENTIVE MEDICINE

Director: John P. Bunker, M.D.
Professors: John P. Bunker, M.D., Richard W. Scott, Ph.D. By Courtesy: Alain C. Enthoven, Ph.D., Victor R. Fuchs, Ph.D.
Associate Professor: David M. Eddy, M.D., Ph.D. (By Courtesy)
Assistant Professors: Diana B. Dutton, Ph.D., Harold S. Luft, Ph.D.
Lecturer: Roland Merchant, M.S.H.A.
Clinical Associate Professor: Peter J. Levin, Sc.D.

The Division offers courses for medical and other graduate students in masters and doctoral programs as well as for advanced under-graduates; programs of study and research training leading to a Masters of Science degree in Health Services Research; and doctoral and postdoctoral research opportunities and training.

The Master of Science degree in Health Services Research is an interdisciplinary program training students in research and analytic skills for careers in the growing health industry as innovative health 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 45 units of course work. This course work is to be split approximately equally between research workshops and formal courses relevant to the health sector. Each student’s program is planned to meet individual interests in health services in addition to fulfilling HSR core requirements.

A limited number of candidates for the M.S. in Health Services Research 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.

The Division of Health Services Research is University-wide in participation and addresses questions of the organization, distribution, utilization, and quality of medical services. Current and planned research includes the development of methodologies for evaluating the outcomes of care, assessment of the costs and benefits of medical technology, studies of physician decision-making and of the role of patient behavior, studies of the structural and economic determinants of patient and physician behavior, organizational and economic incentives in medical care delivery, and analyses of clinical and public policies.

For additional information, address inquiries to the Program Administrator, Division of Health Services Research, Dept. of Family, Community and Preventive Medicine, School of Medicine, Stanford University, Stanford, California 94305.

COURSES

All courses (DR:X)

The following are selected courses offered through the Division of Health Services Research which are open to all graduate students at Stanford. Information on additional courses can be obtained by contacting the Program Administrator.
220. Social Controversy and Policy Analysis in Medicine—(Same as Human Biology 181.) Case studies of social problems. Analytical techniques from the biological and social sciences will be used in developing strategies for solution of specific problems and their implementation. Cases will be drawn from areas of current controversy and concern—e.g., screening for breast cancer by mammography; home delivery versus hospital delivery; and reparations for injuries to patients and experimental subjects.

4 units, Spr (Bunker, Staff)

225. Clinical Overview of Health Care Services—The objectives of the course are to expose non-medical students to clinical decision-making 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.

Not offered 1978–79

230. The Economics of Health—There are many aspects of the health sector that do not meet the traditional assumptions of economic theory such as consumer sovereignty, certainty, competition, perfect information, and profit maximization. Extensions of microeconomic theory provide useful tools to deal with the important problems in the health sector. This course will emphasize the development and appropriate use of these extensions of theory. Specific applications include the measurement of output; the demand for care; uncertainty, insurance, and incentives; the supply of physicians services; production of hospital services; investment and project evaluation; health sector planning; and an alternative view of the system.

4 units, not offered 1978–79

235. Research Workshop in Health Economics—This workshop will critically evaluate and practice the application of economic analysis to select in the health sector. The first part of the course will focus on work that has been done in specific areas such as demand models, the supply of physicians' services, and health care production functions. The choice of topics will be jointly determined by the students and instructor.

The second part of the course will be primarily devoted to the presentation, analysis, and critique of student research papers. These research papers will involve the application of analytical tools of varying degrees of sophistication to answer questions in health services research. Examples of such questions include: What fraction of health expenditures occur in the last year of life? What accounts for the variation of HMO performance? How soon is a hospital bed filled—Roemer's Law? What is the competitive impact of HMOs? Prerequisites: FCPM 230 or Econ 156/256: Quantitative Methods.

4 units, not offered 1978–79

250. Social Issues in Health Care—Provides an overview of major social issues and policy problems in health care and their practical application of present and future roles of physicians. Sociological perspectives and research findings are contrasted with other approaches; discussions stress critical evaluation of alternative viewpoints and evidence. Areas covered include social factors influencing illness and use of health services, problems in patient-provider relationships and proposed remedies, education and professionalization of physicians and other providers, incentive structures in various health institutions, and assumptions underlying alternative reform strategies. (Lectures held jointly with Sociology 166.)

5 units, Win (Staff) to be arranged

251. Controversies in Current Medical Practice—This seminar-format course will devote two or three sessions to each of a few controversial areas of medical practice, reviewing existing literature and examining relevant scientific evidence. Analytic tools of epidemiology and biostatistics will be applied.

1 unit, Aut, Win, Spr (Bunker staff)

255. Research Workshop on Social Issues in Health—(Same as Sociology 167.) Gives students experience in the application of quantitative methods in health services research. Individually or in groups, students will define suitable research problems, review relevant literature, conduct statistical analyses of a common large-scale data set, and synthesize findings in major research papers. Possible topic areas include health status differentials, factors affecting patient utilization and satisfaction, quality of care in different health care systems, organizational performance, and others. Considerable independent work required. Prerequisite: consent of instructor.

3-5 units, Aut, Win, Spr, Sum (Dutton) by arrangement

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 nongovernmental), consumerism, and community influence.

2 units, Win (Mecklenburg, Levin)

F 3:00-5:00
281. Clinical Decision-Making and the Analysis of Clinical Policies—This course will explore a theory of how physicians do and should make clinical decisions. The complexity and number of problems a clinician faces every day is overwhelming, yet somehow they have managed to tame this complexity and make very difficult and very important decisions very quickly. In this course we will examine how this is done. The principles of quantitative decision theory will be introduced and then used to construct models of physician decision-making. The applicability of these models will be tested through the study of actual clinical problems and through the analysis of the reasoning displayed in the published literature. We will study evidence that important errors are made in the analysis of clinical problems and that recommendations about how patients should be managed may be incorrect. Finally, we will search for ways to improve the quality of clinical decisions and clinical policies. Limited to medical students; non-medical students admitted only by special permission. 

4 units, Win (Eddy) to be given 1979–80

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

Cooperating in the offerings of the Program are: Clara N. Bush, Professor of Linguistics, and Katherine R. Beadle, Clinical Assistant Professor, Department of Surgery

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 advisor, 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

All courses (DR:X)

200. Individual Study—Study under direction in fields or subjects of special interest. Prerequisite: consent of instructor.

1-3 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. Prerequisite: course in phonetics or consent of instructor.

4 units, Win (Huntington) by arrangement
231. Speech Perception—Perceptual and physiological correlates of the acoustic constituents of speech. Prerequisite: course in phonetics, course 230 or consent of instructor.
3 units, Spr (Huntington) by arrangement

2-3 units, any quarter (Schubert) by arrangement

268. Assessment of Animal Auditory Behavior—(Same as Psychology 229.) Review and critique of laboratory studies of auditory-governed behaviors in, primarily, cats and monkeys. Emphasis on comparisons of experimental techniques and results across species, including man.
4 units, Aut (Dewson) by arrangement

281. Seminar in Animal Communication—(Same as 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. Enrollment limited to 16.
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 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.
3-4 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

390. Seminar in Neural Substrates of Human Communication—(Same as Psychology 230.) Enrollment limited to 16.
4 units, Spr (Dewson) by arrangement

392. 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.
3-4 units, Win (Schubert) by arrangement

393. Peripheral Auditory Mechanisms—(Same as Psychology 233.) 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.
3 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 units, any quarter (Dewson) by arrangement

400. Doctoral Research.
1-15 units, any quarter (Staff) by arrangement

MEDICAL MICROBIOLOGY
Emeriti: Sidney Raffel (Professor), Monroe D. Eaton (Adjunct Professor)

Acting Chairman: Bruce A. D. Stocker
Professors: Hugh O. McDevitt, Carlton E. Schwerdt, Bruce A. D. Stocker
Associate Professors: Robert J. Roantree, Leon T. Rosenberg. Clinical: Orland A. Soave
Adjunct Professors: Esther M. Lederberg, John P. Steward
Assistant Professor: Abdul Matin

PROGRAMS OF STUDY
BACHELOR OF SCIENCE
Requirements include: Biological Sciences, 15 quarter units; Chemistry, 20 quarter units (Chemistry 31, 33, 35, 36, 131, 135 or equivalent); Physics, 12 quarter units. Specific course requirements are the following: Medical Microbiology 101 or 202, 102 or 200, 203, 204, and 206; Biochemistry 200 and 201.

Students in this program can arrange to take units in research (see 199—Special Problems).

HONORS PROGRAM IN MEDICAL MICROBIOLOGY
An undergraduate honors program is available to qualified Medical Microbiology majors. The purpose of the program is to expose the
student to research in some area of the subject and to encourage an independent and original approach in pursuing this research. A student interested in enrolling in this program should have completed at least two of the required courses in the major, and should have the consent of a faculty member of the Department. Successful completion of the program and the requirements for the B.S. in Medical Microbiology entitles the student to graduate "with Departmental Honors." This designation appears on the student’s transcript and in the Commencement Program. An Honors Certificate is awarded (see MM198 under "Courses").

ADVANCED DEGREES

MASTER OF SCIENCE

Available places are normally reserved for candidates for the Ph.D. degree. Although there is no regular Master of Science program, this degree is, under special circumstances, occasionally awarded. Students for Master’s degree will be expected to have completed the preliminary requirements listed above for the B.S. degree. 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 written and oral examinations covering the fundamentals of general and medical microbiology, bacterial genetics, immunology, and virology at the end of the first year of work, and to complete a thesis.

DOCTOR OF PHILOSOPHY

Application, Admission, and Financial Aid—Prospective graduate students should apply formally through the Graduate Admissions Office, which will submit completed applications to the Department. Deadline for receipt of applications with all supporting materials is January 15.

An applicant must file a report of scores on the aptitude tests and the advanced test (normally in biology, but where appropriate in some other subject, e.g., chemistry) of the Graduate Record Examination. It is strongly recommended that the GRE be taken in October so that scores will be available when applications are evaluated.

It should be noted that in recent years, owing to large numbers of well-qualified applicants, only a small proportion of applicants have been accepted. The Department is able to provide support for a limited number of new predoctoral candidates through traineeships (restricted to citizens of the United States, or those with permanent residence visas) and teaching and research assistantships, without citizenship requirements. There are also provisions for loan funds, and where financial need is documented, for scholarship aid and tuition subsidy. It is current policy not to offer financial support from University-derived funds beyond the third 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.

Preparation for graduate study—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.

Foreign language requirement can be satisfied by two college years of an acceptable language or examination during the first year of graduate work.

The student is expected to achieve a B or better grade average in those departmental courses listed as required for the Bachelor of Science degree as well as Biochemistry 200 and 201, which are required courses. Formal departmental courses are to be graded by letter, not pass/no credit. Grading of research and reading courses is optional for the faculty member concerned. In addition, courses in statistics (Family, Community and Preventive Medicine 202, Psychology 60 or Statistics 160), principles of computer science (e.g., Computer Science 105 or 106), and molecular biology (e.g., Biological Sciences 210, 250) should be taken. These general recommendations should be discussed with faculty advisors. Other recommendations contingent upon individual previous experiences and interests include: parasitology (Family, Community and Preventive Medicine 204); histology (Structural Biology 205); genetics (e.g., Biological Sciences 252, Genetics 201, 249); biochemistry (e.g., Biochemistry 208, 215); physical chemistry (e.g., Chemistry 171, 173); calculus (Mathematics 10, 11, 21, 22, 23); virology (Biological Sciences 213); pathology (Pathology 230A,B,C); electron microscopy (Pathology 207, 281). The choice among these (or other) formal courses should be discussed with an advisor.

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 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

All courses (DR:X) unless noted otherwise.

### 101. General Microbiology

A lecture and laboratory course providing an introduction to the biology of bacteria, bacteriophages, and animal viruses. Coverage will include bacterial anatomy, genetics, and physiology, as well as antibiotic action, immunology, and host-parasite relationships. Prerequisites: Biological Sciences 1 and Chemistry 31, 33, and 35. (DR:T)

5 units, Aut (Roantree) MWF 1:15; lab MWF 2:15-4:05

### 102. Principles of Immunology

The basic principles of host responses to foreign incursion will be covered. The emphasis will be on responses to microbes. Medical Microbiology 101 may, but need not, be taken concurrently. (DR:T)

3 units, Aut (Rosenberg) TTh 2:15

### 198. Honors Program

Research in some area of Medical Microbiology. Satisfactory completion of 10 units of Medical Microbiology 198 is required for graduation "with Departmental Honors." Units taken in another numbered research course in Medical Microbiology may be counted towards this minimum, with the approval of the research supervisor. An essay based on the research performed for the Honors Program must be presented to, and accepted by, both the research supervisor and a "reader to be appointed by the Department. (Staff) by appointment

### 199. Special Problems

Individual study or research in microbiology by arrangement with a faculty member. Possible fields of study include: general bacteriology, bacterial physiology and ecology, bacterial genetics, microbial pathogenicity, immunology, virology, and viral oncology. (Appropriate backgrounds for these various areas are required, to be discussed with the faculty member concerned.)

1-15 units, any quarter (Staff) by arrangement

### 200. Immunology

(Same as Pathology 220.) 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, Spr (Rosenberg, Weissman) MWF 9

### 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. Prerequisites for undergraduates: Biological Sciences 1 and Chemistry 31, 33, and 35.

4 units, Spr (Staff) MWF 2:15-4:05

### 203. Bacterial Physiology and Ecology

A lecture course dealing with in-depth coverage of selected topics in microbial physiology and ecology; growth kinetics and yields; structure and function; respiration and anaerobic respiration; transport; chemolithotrophy and photosynthesis; Bdellovibrio; wastewater microbiology and cycles of elements). Prerequisites: Biological Sciences 1 and 21 and Chemistry 31, 33, and 35.

3 units, Win (Matin) MWF 10

### 204. Bacterial Genetics

A course of lectures (optional minilab) on inheritance in bacteria. Prerequisite: 101 (or equivalent): and consent of instructor for minilab.

3-4 units, Win (Stocke) MWF 9, Lab. by arrangement

### 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, Aut (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 1:15

### 260. Literature Reviews

Review of literature on special topics to be assigned by instructor.

1-3 units, any quarter (Staff) by arrangement

### 261. Current Topics in Immunology

A review of the current literature in one of a few selected areas of interest. Prerequisite: consent of the instructor. (Min. 5, Max. 8 students.)

3 units, any quarter (Staff) 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 physiology and ecology, bacterial genetics, microbial pathogenicity, immunology, and virology.

15 units maximum, any quarter (Staff) by arrangement

NEURO- AND BIOBEHAVIORAL SCIENCES PROGRAM

Committee: Eric M. Shooter, Professor of Neurobiology, Chairman; K.L. Chow, Professor of Neurology; Peter A. Getting, Asst. Professor of Biological Sciences; Seymour Levine, Professor of Psychiatry and Psychology; John G. Nicholls, Professor of Neurobiology; David A. Prince, Professor of Neurology; Jeffrey J. Wine, Associate Professor of Psychology; Student Members: Sallyane Coyle and Robert Nichols

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, Anesthesiology, Neurobiology, Neurology, Pathology, Pharmacology, Physiology, Psychology, Psychiatry, and Structural Biology.

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 three 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. Psychology.

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. Remission of fees and a personal stipend are available to those students accepted. Qualified applicants should, where possible, apply for predoctoral fellowships in open competition, especially those from the National Science Foundation. Application should be made through the Graduate Admissions Office which will submit completed applications to the Department. Deadline for receipt of applications with all supporting material is January 31st.

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. All students are required to complete the basic courses in neurobiology (Neurobiology 200 or its equivalent). The remaining courses are then chosen to reflect the students interests in one or more of the biochemical, neurophysiological, neuroanatomical or biobehavioral aspects of the subject. 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 the program may be adjusted to fit in with their special circumstances.

NEUROBIOLOGY

Chairman: Eric M. Shooter
Professors: Denis A. Baylor, Jack McMahan, John G. Nicholls, Eric M. Shooter
Assistant Professors: Carla J. Shatz, Bruce G. Wallace

PROGRAMS OF STUDY

The Department offers a one quarter course on the structure and function of the nervous system open to medical students, qualified graduate students and advanced undergraduates. Advanced courses given by the Department are open to students who have completed the basic course.

ADVANCED DEGREES

Graduate students in the Department obtain the degree of Doctor of Philosophy through the
interdepartmental Neuro- and Biobehavioral Sciences Ph.D. Program. Remission of fees and a personal stipend are available to those students accepted. Inquiries should be directed to the Chairman. Medical students engaged in research in the Department are also encouraged to enroll in the Ph.D. Program. The requirements of the Ph.D. program will be fitted to the individual interests and time schedules of the student. Postdoctoral training is available to graduates holding Ph.D. or M.D. degrees and further information should be sought directly from the faculty member concerned.

Research interests of the department include mechanisms of visual transduction and information transmission in vertebrate retina, integrative mechanisms and regeneration in the central and peripheral nervous system, the biochemistry of neuronal growth and differentiation and of neurotransmitters.

COURSES

All courses (DR:X)

200. The Nervous System—An introduction to structure and function of the nervous system, including neurophysiology, neurochemistry and neuroanatomy. Topics range from the properties of neurons to the mechanisms and organization underlying higher functions. The course is designed to present a coherent framework as a preparation for neurology, neuropathology and clinical medicine in general, as well as for more advanced work in neurobiology. In addition to the lectures and neuroanatomy laboratories, there will be frequent, informal seminars with students in small groups, and demonstrations. Although presented as an integrated course, the neuromcytology and neurobiology components can be taken separately for 4 and 5 units, respectively.

9 units, Aut (Staff) M 2:15-4:05;
W 8-10, 2:15-3:05;
Th 1:15-2:05; F 8-10;
Lab. W 3:15-5:05

210. Function and Development of the Nervous System—An advanced seminar and reading course dealing in detail with topics that include: (a) fine structure, biophysics and chemistry of neurons and synapses; (b) integrative mechanisms in the central nervous system, (c) growth of neurons and the development of connections. Emphasis will be placed on the study of original papers and on student presentations. Prerequisite: Principles of Neurobiology 200 or equivalent.

3 units, Spr (Baylor, Nicholls)

260. Supervised Study—Prerequisite: consent of instructor.

Any quarter, (Staff) by arrangement

270. Neurobiology Seminar—Prerequisite: consent of instructor.

Any quarter, (Staff) by arrangement

299. Individual Research—Prerequisite: consent of instructor.

Any quarter, (Staff) by arrangement

PATHOLOGY

Emeriti: Bruno Gerstl, David Glick, Lelland J. Rather (Professors)

Chairman: David Korn

Professors: Klaus G. Bensch, Ronald F. Dorfman, Richard L. Kempson, David Korn, Lucien J. Rubinstein

Professor of Clinical Neuropathology: Lysia Forno

Professor of Clinical Pathology: Jon Kosek

Associate Professors: Charles Carrington, David A. Clayton, Luis F. Fajardo, Errol C. Friedberg, Mary M. Herman, Howard H. Sussman, Irving L. Weissman

Adjunct Professor: Lawrence Eng

Assistant Professors: Margaret E. Billingham, Jerome S. Burke, Stephen S. Chen, Edgar Engleman, Michael Hendrickson, Roger A. Warnke

Attending Physician and Clinical Associate Professor: Carl Grumet

Physician Specialist and Clinical Assistant Professor: Jean Howard

Physician Specialist and Clinical Instructor: Peter B. Windhorst

Senior Research Associate: Teresa S-F Wang

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 Biophysics Program 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, viral leukemogenesis, differentiation in human and experimental tumors of the nervous system, a variety of clinico-pathological studies with particular emphasis on disease 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

All courses (DR:X)

202. Surgical Pathology—Covers the major areas of surgical pathology and emphasizes clinico-pathological correlation.
  Aut, Win (Dorfman, Kempson, Staff)

205. Clinic-Pathological Correlations—Correlation of clinical histories with surgical and autopsy material, including microscopy.
  Win (Kosek, Fajardo, Forno, Egbert)

206. Neuropathology—Systematic lectures and laboratory sessions on gross and microscopic lesions in diseases of the central and peripheral nervous system.
  Spr (Rubinstein, Forno, Herman)

  Aut, Win, Spr (Haydon) by arrangement

208. Interpretation of Electron Micrographs.
  Spr (Haydon) by arrangement

220. Immunology—(Same as Medical Microbiology 200.) 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 (Rosenberg, Weissman)
  MWF 8

230A,B,C. General and Special Pathology—A 3 quarter course providing an introduction to general principles of pathology followed by lecture and laboratories considering the pathology of human disease based upon disordered structure and function of individual organ systems.
  Spr, Aut, Win (Carrington, Friedberg, Kempson, Staff)

281. Practical Introduction to Electron Microscopic Techniques.
  Aut, Win, Spr (Haydon) by arrangement

290. Research in Experimental Neuropathology.
  Aut, Win, Spr (Eng, Forno, Herman, Rubinstein) by arrangement

291. Medical Scientist Training Program Seminar—Arranged by participants in the Medical Training Program. Oncogenic Viruses. Prerequisite: Consent of instructor.
  Aut (Weissman, Kaplan) Th 8-10 p.m.

292. DNA Repair and Mutagenesis—(Same as Biology 205, Radiology 205.) Interactions of mutagens and carcinogens with DNA. Response of living systems to damaged genetic material, including molecular mechanisms for DNA repair. Enzymology of DNA modification and repair. Inducible repair responses and "error-prone" mechanisms. Human hereditary deficiencies in DNA repair. Relationships of DNA repair and mutagenesis to carcinogenesis. Prerequisite: Biology 21 and/or current consent of instructor.
  3 units, Spr (Hanaus, Friedberg, K. Smith)
  TTh 1:15 alternate years, given 1979

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—Carrington, 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 (Kempson, Dorfman, Staff) full-time for six or twelve weeks.

CONFERENCES
Autopsy Demonstration. Any quarter, (Carrington) TF 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 4:15
Surgical Pathology Conference. Any quarter, (Dorfman, Kempson) WF 8

PHARMACOLOGY
Emeritus: Robert H. Dreisbach (Professor)
Chairman: Tag E. Mansour
Professors: Avram Goldstein, Dora B. Goldstein, Oleg Jardetzky, Sumner M. Kalman, Tag E. Mansour. By courtesy: Stanley Cohen, Leo Hollister
Consulting Professors: Ralph I. Dorfman, Arthur Furst, Richard K. Richards
Consulting Associate Professor: Brian M. Cox.
Assistant Professors: Helen B. Blau, Gordon Ringold, Howard Schulman, James P. Whitlock. By courtesy: Terrence Blaschke

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, graduate 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 in 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.

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. The major fields of research interest in the Department are molecular pharmacology, biochemical pharmacology, cellular regulatory mechanisms in carbohydrate metabolism that may be amenable to pharmacologic manipulations, chemotaxis, biotransformation of xenobiotics, molecular biology of differentiation and development particularly as it relates to chemical teratogenesis, molecular mechanism of steroid hormone action, biochemical basis for control of synaptic functions, drug metabolism and toxicology, and biochemical mechanisms associated with drug addiction and tolerance.

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 the Time Schedule for additional advanced courses.

BASIC COURSES
All courses (DR:X)
Pharmacology 201. 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. Students may elect a program within this context that best meets their individual needs. Many medical students, however, will choose to take the entire sequence in their second year.

201. Pharmacology—A lecture 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.
4 units, Aut (Staff) MTWF 1:15

202. Pharmacology—Continuation of 201. Major drug groups to be considered include the drugs affecting the nervous system and the hormones. Emphasis is on pharmacological principles in relation to the use of drugs in man, centrally acting drugs discussed include convulsants, anticonvulsants, anesthetics, sedatives,
analgesics, tranquilizers, and other psychoactive drugs. Problems of drug abuse are also considered.

4 units, Win (Staff) MTThF 1:15

203. Pharmacology—Continuation of 202. The major drug groups to be considered include the chemotherapeutic agents, antibiotics, antiparasitic drugs, and the anti-cancer agents. Also to be considered are topics such as mutagenesis, carcinogenesis, and teratogenesis.

2 units, Spr (Staff) WF 1:15

ADVANCED COURSES

All courses (DR:X)

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.

204. Alcohol and Alcoholism—Lectures and discussions on the pharmacologic actions of alcohol and on various aspects of alcoholism.

1 unit, Fall (D. B. Goldstein) T 4:15-5:45

205. The Bio-Transformation of Xenobiotics—An examination of both the biochemical mechanisms in and the biological consequences of the metabolism of foreign compounds by mammalian cells. Among the topics discussed will be: the pathways involved in xenobiotic metabolism, the regulation of microsomal enzyme activity, genetic variability in metabolism, metabolic activation and toxicity, and chemical carcinogenesis.

2 units, Win (Whitlock) T 4:15-6:05

206. Toxic Effects of Environmental Pollutants—This course will include discussions of heavy metals, chlorinated hydrocarbons and other organic pesticides, components of smog, asbestos, contaminants of food and water, and the casual use of medicinal products. Drugs will be discussed in terms of their misuse or overuse and the attendant hazards.

1 unit, Spr (Kalman)

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)

not given 1978-1979

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 1978-1979

217. Clinical Pharmacology: Principles of Therapeutics—(Same as Medicine 217.) A series of clinically oriented presentations on principles of drug use in humans. The course will consider various pharmacological, physiological and disease factors involved in the choice of appropriate drug therapy and its method of administration. Clinical evaluation of drug efficacy, therapeutic pitfalls, manifestations of drug toxicity and drug interactions will be included.

2 units, Spr (Staff of Pharmacology Department and Division of Clinical Pharmacology) M 1:15-3:05

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 1978-1979


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, Ronald Grant, Maurice E. Krahl (Professors)

Acting Chairman: Eugene D. Robin

Professors: George A. Feigen, Frederick A. Fuhrman, Eugene D. Robin

Associate Professors: Julian M. Davidson

Consulting Associate Professor: Noel 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 students with the consent of the instructor. 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 and physical chemistry), physics, calculus, 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, 214, and 216. 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 Behavioral Physiology, Respiratory Physiology, Neuroendocrinology and Immunophysiology. By arrangement with affiliated extradepartmental instructors, research training is also available in cardiovascular, endocrine, renal, and gastrointestinal physiology.

Qualifying examination—At the end of the second year in residence as a graduate student, each Ph.D. candidate will be given a written comprehensive examination. This examination may be taken only after the respective courses have been completed to the required standard. Students will undertake individual research studies as early as possible after consultation with their preceptor.

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

All courses (DR.X)


6 units, Aut (Perlroth, Staff) MWF 9-11

201. Clinical Physiology (Physiology and Medicine)—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 (Robin, Maffly, Jamison, Weiner) MWF 8-10; TTh 10-12


7 units, Win (Davidson, Feldman, Luetscher, Gray) MWF 9-11; T 8-9


3 units, Win (Thompson) W 4:15-6:05 and F 4:15-5:05, alternate years, given 1978-79

207. Immunophysiology Laboratory—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 8 students. Prerequisite: consent of instructor.

4 units, Aut (Feigen) Lab. Th 9:00-4:05

210. Neuroendocrinology—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) W 1:15-3:05 given 1979–80

211. Special Studies in Cardiovascular Physiology—The material covered will be limited to the cardiovascular system, but within those limitations it will be very complete. The anatomy, histology, function, and fluid dynamics of the cardiovascular system will be studied. Selected topics in pathology will also be studied to bring out the basis and effects on function of the alterations produced. In addition to lectures there will be anatomic, histologic and pathologic demonstrations.

3 units, Win (Thompson) TTh 4:15-5:30

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—A quantitative, experimental approach to problems in thermodynamics, kinetics, transport, and bioelectric phenomena. Restricted to Ph.D. candidates in Physiology, or consent of instructor. Alternates with 216.

2 units, Win (Feigen) Th 9:00-4:05

(alternates with 217, given 1979–80)

215. Tutorial in Clinical Physiology—Guided study, with readings and discussions in both introductory and advanced physiological topics, to supplement 200, 201, 202.

1-2 units, any quarter (Robin, Staff)

by arrangement

216. Laboratory in Circulatory Physiology—Set laboratory exercises and discussions to illustrate the basic functions of the mammalian heart and circulatory system. Designed for graduate students in physiology but open to qualified persons in the basic medical sciences. Prerequisites: Clinical Physiology 200 and consent of instructor. Limited to 6 students. (Alternates with 214. Given in 1978–77).

4 units, Spr (Feigen, Grant) 9:00-5:05, by arrangement

217. Advanced Immunophysiology Laboratory—Identification, pharmacological behavior, and bioassay of such mediators as Histamine, Bradykinin, SRS-A, 5-HT, and Acetylcholine released from tissues and cells undergoing specific immunological anaphylaxis or envenomation. Open to qualified applicants who require a theoretical background and practical experience in the design and performance of experiments dealing with immediate hypersensitivity. Prerequisite: Consent of instructor.

3 units, Win (Feigen) (alternates with 214, given 1978–79)

220. Reproductive Physiology—A lecture course dealing with various aspects of male and female reproduction.

2-3 units, Spr (Davidson, Heinrichs) T 1:15-3:15

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. Marinostat Laboratory, HMS.

6 units, Sum (Fuhrman) see Hopkins Marine Station Bulletin for days and hours (June 16-July 19, MWF 9-5) Minimum 8 students, alternate years, given summer 1979

283H. Bioactive Marine Natural Products—The biological effects of naturally occurring substances from marine animals and plants. Lectures will present a comprehensive survey of known substances from marine organisms that have antibiotic, growth inhibiting, neurohumoral, cardiovascular or toxic effects. The chemical nature of the substances will be described, but the principal emphasis will be on the physiological and pharmacological effects of these substances. In addition to the general survey, the following topics will be discussed in depth: general methods for isolation and bioassay of biologically active substances from marine organisms, "red tides" and paralytic shellfish poisoning; the nature of fish poisoning in man; the use of marine toxins as specific inhibitors in neurobiology.

2 units, Sum (Fuhrman) TTh 2-4
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, 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

RADIOLOGY

Chairman: Malcolm A. Bagshaw


Professor of Clinical Radiology: Frederic N. Silverman

Associate Professors: William R. Brody, J. Martin Brown, Ronald A. Castellino, Don R. Coffinet, Michael L. Goris, George M. Hahn, Clarence J. Karzmark, I. Ross McDougall, Lewis Wexler

Associate Professors of Clinical Radiology: William H. Marshall, Jr., Bruce R. Parker, James F. Silverman, M.D.

Senior Attending Physician and Clinical Associate Professor: David A. Goodwin

Assistant Professors: Malcolm F. Anderson, Paul R. Cipriano, Sarah S. Donaldson, Dieter R. Enzmann, Peter Fessenden, David M. Gross, Richard T. Hoppe, Alvaro Martinez, Peter S. Moskowitz, David A. Pistenma, Stuart W. Young

Acting Assistant Professor: Robert W. Jahnke

PROGRAMS OF STUDY

Although the Department of Radiology does not offer degrees, its faculty teaches a variety of courses open to medical students, graduate students and undergraduates. The Department also accepts students in other curricula as advisees for study and research. Graduate students in the biophysics curriculum, for example, may choose Radiological Sciences as a major and pursue their dissertation in this field. Undergraduate students may also arrange individual research projects under the supervision of Radiology faculty.

Radiology is a discipline which is focused around the use of radiation as a diagnostic, as a therapeutic and as a research tool. The fundamental and applied research within the Department reflects this broad spectrum: in diagnostic radiology as the discipline relates to anatomy, pathology and physiology; in therapeutic radiology and clinical oncology; in radiobiology and tumor biology; and in the application of nuclear medicine techniques to the study of physiology and pathology.

At the present time, the major areas of basic research investigation in the Department include: DNA breakage and repair in bacterial and mammalian cells by ultraviolet and ionizing radiation, effects of heat, drugs and radiation on the killing and repair of mammalian cells both in vitro and in vivo, a study of the phenomenon of reoxygenation in animal tumors after irradiation, studies of the effect of radiation on the microvasculature and blood flow in normal and malignant tissues, radiosensitization of tumors in vivo with a variety of drugs, studies of the late effects of radiation on a variety of normal tissues in young and adult animals, and an in depth investigation of the role of viruses in the etiology of animal and human tumors.

Courses offered by the Department which are open to undergraduate and postgraduate students are listed below.

COURSES

All courses (DR:X) unless noted otherwise.

101. Selected Readings in Radiology Research.

Aut, Win, Spr (Staff) by arrangement

154. Biosocial Aspects of Cancer—(Same as Human Biology 154.) This course is concerned with various aspects of cancer as a biological phenomenon and as a clinical, emotional and societal problem. The diagnosis and treatment of human neoplasms, their psychosocial and economic impact, the organization of cancer care and research will be discussed. There will be detailed considerations of the specific control mechanisms operative in vitro and/or in vivo and a delineation of their influence in an attempt to characterize the differences between normal and malignant growth. (DR:C)

3 units, Spr (Kaplan, Brown, Hahn)
W 7:30-9:30, alternate years, given 1979–80

201. Biological Effects of Radiation—(Same as Biological Sciences 201.) Basic physical and chemical events, relevant biochemical pathways and molecular targets, repair of molecular lesions, cellular and tissue radio-biological determinants, radiation dose modifier effects on tumors and specific tissues and organs, whole body effects, carcinogenesis, hazards, and per-
missible dose standards. Prerequisite: Biochemistry 200, or consent of instructor.

2 units, Win (Kalman, Staff) TTh 4:15, alternate years, given 1979–80

208. Experimental Nuclear Medicine—This is a course designed to familiarize the student with computer applications in medicine, particularly in the use of radioisotopes as tracers. Some knowledge of physiology and calculus desirable.

Spr (Goris) by arrangement

202. The Radiobiology of Radiotherapy—This course is intended primarily for residents or fellows in the Radiotherapy Division training program; however, medical or postgraduate students interested in radiotherapy can take the course. Focus is on the basic radiobiological processes underlying the treatment of malignant disease by radiation. Carcinogenesis and mutagenesis by radiation will also be covered. Limited to 4 students. Prerequisites: some familiarity with cell biology and physiology, and consent of instructor.

2 units, Spr (Brown) T or W 8, alternate years, given 1979–80

205. DNA Repair and Mutagenesis—(Same as Biological Sciences 205.) Interactions of mutagens and carcinogens with DNA. Response of living systems to damaged genetic material, including molecular mechanisms for CNA repair. Enzymology and DNA modification and repair. Inducible repair responses and “error-prone” mechanisms. Human hereditary deficiencies in DNA repair. Relationships of DNA repair and mutagenesis to carcinogenesis. Prerequisite: Biology 21 and/or consent of instructor.

3 units, Spr (Hanawalt, Freidberg, K. C. Smith) TTh 1:15, alternate years, given 1978–79

210. Clinical Nuclear Medicine—A lecture demonstration seminar approach will be used to familiarize students with nuclear medicine techniques which are used for medical diagnosis. Course material will include a brief review of basic physics relating to the use of radionuclides in medicine, instrumentation for their detection, and the application of specific tests to selected clinical cases. This will be viewed within the broader perspective of the pathological physiology of the disease studied and, where applicable, related to the use of supplementary techniques in other disciplines. Minimum of 6 students. Prerequisites: None.

2 units, Spr, Aut (Staff)

20 hours per week, by arrangement

211. Cellular Cancer Biology—Proliferation of malignant cell populations is governed by control mechanisms which are different, either quantitatively or qualitatively, from those of normal cells. The course focuses on specific control mechanisms, operative in vitro and/or in vivo, and delineates their influence on cells in an attempt to characterize the differences between normal and malignant growth. Prerequisite: Biochemistry 200.

2-3 units, Spr (Hahn, Kaplan, Brown) alternate years, given 1978–79

299. Research.

Any quarter, (Staff) by arrangement

STRUCTURAL BIOLOGY

Emeriti: Donald J. Gray, William W. Greulich, Hadley Kirkman, Robert S. Turner (Professors)

Chairman: Lubert Stryer

Professors: Robert A. Chase, Roger D. Kornberg, James A. Spudich, Lubert Stryer

Associate Professor: Donald L. Stilwell, Jr.

Assistant Professors: Paul C. Letourneau, Lawrence H. Mathers, Jr.

Lecturers: Masako Baba, Patricia Cross, Sylvia H. Friedberg

Clinical Lecturer: Reuben Stutch

Visiting Professors: Donald Duncan, Gershon Gitlin, Otto A. Mortensen

PROGRAMS OF STUDY

The Department offers courses in cell biology and histology which are open to medical students, qualified graduate students, and advanced undergraduates. The Division of Human Anatomy of the Department offers courses in gross anatomy and human embryology which are intended primarily for medical students. These courses are open to qualified graduate students and undergraduates insofar as space is available. The Division of Human Anatomy also provides facilities for physicians (or others with equivalent training) who wish to pursue advanced work.

ADVANCED DEGREES

The graduate program in Structural Biology leads to the Ph.D. degree. Remission of fees and a personal stipend are available to graduate students in the Department. Prospective applicants should write to the Department of Structural Biology for further information. The Department also participates in the Medical Scientist Training Program in which individuals are candidates for both the Ph.D. and M.D. de-
The research of the Department deals with the interplay of biological structure and function at the molecular and cellular levels. The current interests of the Department are mainly in the areas of cell membranes, cell motility, the cytoskeleton, and development.

**COURSES**

All courses (DR:X)

210. **Histology**—Structural and functional organization of cells, tissue, and organs, as seen with the light and electron microscopes.
   6 units, Win (Kornberg, Letourneau, Friedberg, Cross)

211. **Structural Biology**—An advanced course dealing with the structural basis of cell function. Major areas covered are cell membranes, contractile assemblies and the cytoskeleton, cell nucleus, and selected developmental systems. New techniques for the analysis of cell structure will also be discussed. Open to medical, graduate, and advanced undergraduate students. Prerequisite: Biochemistry 200.
   3 units, Win (Stryer, Spudich, Kornberg)

260. **Supervised Study**—Research or advanced tutorial for undergraduates.
   1-3 units, any quarter (Staff)
   by arrangement

270. **Structural Biology Seminar**.
   Aut, Win, Spr (Staff) by arrangement

299. **Research**.
   Any quarter (Staff) by arrangement

**DIVISION OF HUMAN ANATOMY**

All courses (DR:X)

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 pre-nursing, pre-physical therapy, and physical education.
   5 units, Spr (Stilwell)

201. **Human Anatomy**—Dissection, demonstrations, lectures. Enrollment normally limited to medical students.
   4 units, Aut (Mathers, Staff)

202. **Human Anatomy**—Continuation of 201. Prerequisite: 201.
   4 units, Win (Mathers, Staff)

203. **Clinical Correlations in Anatomy**—Clinical and case discussions in correspondence with 201, 202.
   1 unit, Aut, Win (Vistnes)

207. **Medical Embryology**—A survey of the normal and abnormal development of the human organism. Emphasis on mechanisms of development, tissue interactions, as well as descriptive embryology. Understanding of congenital defects from the viewpoint of the developmental sequence is stressed.
   3 units, Aut, Win (Gitlin, Mathers)

208. **Advanced Practical Anatomy**—Lectures and prosected 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.
   3 units, Aut, Win (Stilwell)

296. **Individual Work**—Specialized work carried on under supervision of one or more members of the staff.
   Any quarter, (Staff) by arrangement
OTHER DEPARTMENTS, INSTITUTES, AND PROGRAMS

ACTION RESEARCH LIAISON OFFICE (ARLO)

Co-Directors: Edith T. Eddy, William L. Le- land

The Action Research Liaison Office is a student-initiated program begun in 1974, and funded jointly by Stanford and off-campus sources. A resource center for the University and the community, ARLO’s goal is to facilitate student, faculty and community agency collaboration on research that enriches Stanford education and serves the needs of community groups. Specifically, ARLO helps community organizations and social service agencies formulate as research projects those questions of policy development, data analysis or program evaluation needed to fulfill their goals. Both undergraduate and graduate students incorporate these projects into their programs of study and receive academic credit for their work.

ARLO also helps students design their own projects when no appropriate project design already exists. The staff encourages students interested in specific topic areas to come to ARLO to identify community organizations whose interests match theirs.

ARLO promotes action research, as opposed to volunteer work or internship assignments. A student may participate in a project for one or more quarters. Upon completion of the project, the student gives the research results, usually in written form, to the sponsoring community group and the faculty supervisor.

ARLO can help the student find a faculty supervisor for the project. Academic credit and the final grade are not awarded through ARLO, but through normal departmental procedures of the faculty supervisor’s department.

ARLO projects provide students with field education opportunities that would otherwise be rare, enabling them to direct their research efforts toward the solution of real problems while satisfying credit requirements, and broadening their perspective on vocational possibilities. At the same time, ARLO stimulates the growth of a University-community partnership in the solution of social problems. The action research projects—designed and implemented in cooperation with representatives of the sponsoring organization—contribute information and analysis to advance socially constructive programs.

Students who are interested in exploring project possibilities or would like more information about ARLO should come by the ARLO office or call 497-1568.

AFRICAN STUDIES

Emeriti: St. Clair Drake (Anthropology and Sociology), William O. Jones (Food Research Institute)

Professors: Sanford M. Dornbusch, (Sociology), Charles A. Ferguson (Linguistics), James L. Gibbs, Jr. (Anthropology), Joseph Greenberg (Anthropology), Bruce Johnston (Food Research Institute), Robert B. Textor (Anthropology and Education), Sylvia Wynter, (African and Afro-American Studies)

Associate Professors: David B. Abernethy (Political Science) (on leave 1978-79), Kennell Jackson, Jr. (History), William Leben (Linguistics), Scott R. Pearson (Food Research Institute), Elizabeth Traugott (Linguistics), Hans Weiler (Education and Political Science)

Assistant Professors: J. Paul Irwin (History), A. Emile McAnany (Communication)

Lecturer: Elaine Kaufman (Linguistics)

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. 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 although a Bachelor of Arts Degree is offered in African and Afro-American Studies.

The African Studies faculty is available to advise students on work in African Studies throughout the University. A sampling of courses is listed below. (Because of frequent changes and addition of courses, students are advised to consult quarterly Time Schedule.)

COURSES

For (DR) notations, look under the department in which a course is taught.

The Black Experience in Fact and Fiction: Parallels/Divergencies, Relation/Opposition
to the Western Model—(Enroll in African and Afro-American Studies 101.) This seminar will use both "factual" and fictional texts to explore the complex relation/opposition of black literature and scholarship to the normative western model. It will be, in a sense, a trans-disciplinary approach to the study of comparative literature. Its main intention is to introduce students to an interdisciplinary/transdisciplinary model which will attempt to define both the perspective and the domain of Afro-American Studies.

5 units, Win (Wynter) TTh 2:15

Cultures and Societies of Sub-Saharan Africa—(Enroll in Anthropology 107.) Lectures, readings, films, and study of African cultural products provide an overview of the variations in cultural and social institutions as exemplified by the languages of sub-Saharan Africa; their linguistic and cultural ties; and the resulting contributions to Anthropological knowledge.

5 units, Win (Gibbs) MWF 11

Anthropology of Film—(Enroll in Anthropology 128.) Nature and the ethnographic film as a documentary form is examined through viewing and analysis of classical and current films; also explores uses of film and video tape as a tool for the analysis and presentation of cognitive, social, and kinesic aspects of culture and as a vehicle for anthropological research.

5 units, Spr (Gibbs) MW 10; T 7:30-10

Narrative Pattern in Oral Literature—(Enroll in Anthropology 251.) Seminar: problems and theories of origin, form, transmission and function of folktales and myths will be reviewed. Students will examine cross-culturally or from some other specific perspective patterns or collections of patterns primarily from native America, Africa, and Pacific Region. Reports on their findings will form the basis of discussion in the latter half of the quarter. Open to qualified undergraduate students.

5 units, Aut (Gerow) T 2:15-5:05


5 units, (Greenberg) alternate years

African Kingdoms, History and Societies—(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, the place of European missionaries within kingdom societies will be some of the special topics presented in lecture sessions.

5 units, (Jackson) alternate years

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 the Colonial rule and in the post-independence era. Two groups of writers are explored: the romanticists and the realists.

5 units, (Jackson) alternate years.

Undergraduate Colloquium, White Administrators in the Black Elite in Colonial Africa—(Enroll in History 249A.)


5 units, Win (Jackson) M 2:15-4:05

Class and Stratification in Pre-Colonial African History—(Enroll in 447A.)

5 units, (Jackson) alternate years

Linkages in Afro-American and African History—Common Topics—(Enroll in History 347A.)

5 units, (Jackson) by arrangement, alternate years

Graduate Seminar: Field Work in African History—(Enroll in History 447B.) This course will attempt to provide graduate students approaching a field 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.

(Jackson) by arrangement

Graduate Seminar: African Oral Historical Traditions—(Enroll in History 447.)

(Jackson) given alternate years

Graduate Colloquium: The Interpretation of African History—(Enroll in History 348B.)

(Jackson) given alternate years

Latin America and the African—(Enroll in History 182.) This course examines the economic, political and cultural ties that have existed be-
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, (Bowser)

The History of West Africa—(Enroll in History 148A.) State-Building, effects of transatlantic slave trade, European imperial domination, tendencies toward one-party and military regimes in the 1960s.

4-5 units, Aut (Irwin) MTWTh 10

Graduate Colloquium in African Religious History—(Enroll in History 248.)

5 units, Aut (Irwin) W 2:15-4:05

Graduate Colloquium: West African Revolutions in Colonial and Post-Colonial Africa—

(Enroll in History 147A.)

5 units, Spr (Jackson)

History—(Enroll in History 348.)

5 units, Win (Irwin) W 2:15

Undergraduate Colloquium: Religion and Social Protest in Colonial Africa.

5 units, alternate years

Graduate Seminar: Colonial Africa—(Enroll in History 448A.) Sub-Saharan Africa under European domination and problems of political, social and economic change; decline of old elites and the rise of new ones; reformulation of belief systems; development of nationalization and decolonization.

5 units, Win (Irwin)

The Arts in Africa—(Enroll in Art 131A.)

5 units, Win (Neather)

Tropical Africa: Domestic and International Politics—(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, problems in development planning, and efforts at Pan-African cooperation.

5 units, (Staff)

Southern Africa: The Domestic and International Politics of Race—(Enroll in Political Science 118B.) Examines the political histories of ten countries with special attention to South Africa, Angola, and Mozambique. Stresses the interaction of domestic and international politics, through an analysis of apartheid's international implications, regional transport networks, African liberation movements, the pattern of foreign investment, and military trends in the region.

5 units, (Staff)

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? What occurs when a weak state tries to reduce its dependence on a strong state? These questions will be examined through an historical analysis of European colonialism and through contemporary case studies, including U.S.-Peru, U.S.-Canada, France-Senegal, and the Soviet Union-Czechoslovakia.

5 units, given 1979-80

Practicum in Phonology and Morphology: Structure of an African Language—(Enroll in Linguistics 181.) Practice in problem-solving, using data from an African language. The course is designed to increase proficiency in dealing with linguistic evidence and to contribute to scholarship in lesser-known languages.

4 units, Spr (Leben) TTh 11:00-12:30

Structure of Hausa—(Enroll in Linguistics 283.) A sketch of Hausa syntax, morphology and phonology with emphasis on points of current theoretical interest. Prerequisite: Linguistics 215 and 230 or consent of instructor.

4 units, Win (Leben) MW 3:15-5:05

Beginning Swahili—(Enroll in Linguistics 190 A,B,C.) Swahili is the major lingua franca of East Africa. Conversation, grammar, reading.

5 units, Aut, Win, Spr (Staff) by arrangement

Intermediate Swahili—(Enroll in Linguistics 191A,B,C.)

3-5 units, Aut, Win, Spr (Staff) by arrangement


5 units, Aut, Win, Spr (Kaufman) by arrangement

Intermediate Yoruba—(Enroll in Linguistics 194A,B,C.)

3-5 units, Aut, Win, Spr (Kaufman, Staff) by arrangement

Beginning West African Pidgin English—(Enroll in Linguistics 188A,B,C.) Pidgin English is a major lingua franca in West Africa. Conversation, grammar.

3-5 units, Aut, Win, Spr (Kaufman, Staff) by arrangement

Beginning Hausa—(Enroll in Linguistics 185A,B,C.) Hausa is one of the three major languages of Nigeria and is widely used as a
lingua franca in parts of West Africa. It has an extensive literature, and is one of the African languages most widely studied by scholars.

3-5 units, Aut, Win, Spr (Staff)

by arrangement

Intermediate Hausa—(Enroll in Linguistics 186A,B,C.) Intensive reading from Hausa folk tales, current newspapers and other sources. Practice in reading and writing Ajami script. Topics in Hausa culture as related to the language.

3 units, Aut, Win, Spr (Staff)

by arrangement

(Other African languages such as Amharic, Kikuyu, and Twi may occasionally be taught on a tutorial basis if facilities are available.)

The World Food Economy—(Enroll in Food Research 103, Economics 106 or 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 the 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 (Staff) MWF 10

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).

3-5 units, Win (Kofi)

Economic Development Problems of Third World Economies with Colonial Heritage—(Enroll in Food Research 133 or Economics 127.) 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 monoeconomies, 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 or primary produce, commodity agreements and related problems. Contemporary theories of economic imperialism and dependency models of development will be analyzed.

5 units, Win (Kofi)

International Trade and Investment Policy—(Enroll in Food Research 166 or Economics 166.) This course is concerned with the formulation, implementation, effects, and possible improvement of selected governmental policies affecting international trade and foreign investment. Topics include policies affecting international trade in energy resources, influences of domestic agricultural policies on international commodity trade, issues underlying the international negotiation of reductions of barriers to trade, governmental responses to competition for imports, international implications of environmental control, special trade countries, and domestic and international impacts of multinational corporations. With respect to each topic, initial attention is focused on existing institutions and practices, and policy analysis is then carried out to suggest improvement in current regulations. Prerequisite: Economics 165 or consent of instructor.

5 units, Win (Pearson)

TTh 1:15-3:05

African History: Documentation and Methodology—(Enroll in Graduate Division Special Programs: Hoover Institution 241.) A survey of the location and nature of sources available: libraries, archives, and oral traditions. Interdisciplinary aspects of African history and special problems of methodology are studied.

5 units, any quarter (Gann or Duignan)

Communication Media and Social Change—(Enroll in Communication 256.) 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. Case studies and planning exercises.

3-5 units, Win (Mayo, McAnany)

T 4:15-6:05
ATHLETICS, PHYSICAL EDUCATION, AND RECREATION

Emeriti: Allen Elward (Director); Margaret C. Barr, Juell W. Guthrie, Ernest P. Hunt, Miriam B. Lidster, Marian S. Ruch (Associate Professors); C. Myron Sprague (Associate Director); William P. Fehring (Director of Intramurals)

Director: Joseph H. Ruetz
Associate Director: Pamela L. Strathairn
Associate Director of Athletics: Robert G. Young
Associate Director for Business and Finance: Donald J. Tobin
Assistant Director of Athletics: J. Raymond Young
Chairman of Physical Education and Recreation: Wesley K. Ruff
Director of Intramurals: Howard Dallmar
Director of Dance: Inga Weiss
Professor: John E. Nixon (Director of Professional Physical Education)
Associate Professors: Wesley K. Ruff, Pamela L. Strathairn

Sports Directors: Richard DiBiaso (Basketball-men), Dante Dettamanti (Water Polo), James Gaughran (Swimming and Diving), Anne Gould (Tennis-women), Richard Gould (Tennis-men), Sadao Hamada (Gymnastics-men), Jean P. Hellwell (Fencing), Payton Jordan (Track and Field), Frederick Sturm (Volleyball), Nelson Lodge (Soccer), Mark Marquess (Baseball), Dorothy McCrea (Basketball-women), Bruce Summerhayes (Golf), Jacqueline Walker (Gymnastics-women), William Walsh (Football)

Sports Assistant Coaches: Russell Charles (Football), Rodney Dowhower (Football), Denny Green (Football), Norbert Hecker (Football), D. Thomas Lovat (Football), Kenneth Maxey (Basketball-men), Timothy Miller (Basketball-men), George Seifert (Football), Douglas Single (Football), Claudia Thomas (Swimming), Fred vonAppen (Football)

Senior Teaching Associates: Carroll G. Diaz, Inga Weiss

Teaching Associates: Susan Cashion, Kathy S. Daggett, Kathleen Hill, Mary Margeret Neal, Elizabeth P. Weeks

Teaching Specialists: Jeffrey Hammett (Aquatics), Lois Melville (Equitation), Shirley H. Schoof (Physical Education), Wilhelm Steenbakkers (Sailing), Juan Valenzuela (Dance)

The Department of Athletics, Physical Education, and Recreation is responsible for the development and administration of the University’s programs in athletics, physical education, and physical recreation. These three programs encompass a spectrum of opportunities in aquatics, dance, exercise, and sports activity which extend from informal recreation through organized intramurals and basic instruction (including theory) courses to, and including, intercollegiate athletics.

Two major facility locations are utilized for students to elect enrollment in the activity and theory courses and intercollegiate athletics as well as participation in the club and recreation programs. Roble Gym near Lagunita Court includes facilities for: badminton, basketball, conditioning, fencing, soccer, folk dance, golf, modern dance, martial arts, posture, 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, conditioning, football, gymnastics, handball, lacrosse, martial arts, rugby, field hockey, squash, swimming, tennis, track and field, volleyball, water polo, and weight lifting with locker, dressing and shower facilities for men and women. The Riding School, Stanford Golf Course and driving range are additional facilities available for student use. Bowling lanes are located in Tresidder Union.

ACADEMIC DEGREES AND TEACHING CREDENTIALS

In cooperation with the School of Education, the Department provides 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 the Bachelor of Arts in Physical Education or Dance degrees, undergraduate students interested in the credential and/or master’s degree programs at Stanford should declare their intent early in their undergraduate careers and enroll in selected courses offered by the Department 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 coursework in physical education or dance from another accredited college or university may also apply. Information is available upon request from Professor John Nixon, School of Education.
ATHLETICS, PHYSICAL EDUCATION, AND RECREATION

See "School of Education" in this bulletin or Professors Ruff or Strathairn or Miss Weiss for further information.

INTERCOLLEGIATE ATHLETICS

In keeping with our cultural heritage and American university tradition, Stanford offers a broad intercollegiate athletic program. The primary purpose is to provide talented male and female students with a variety of opportunities for participating in individual and team competition with other colleges and universities. As a member of the Pacific Ten Conference (Pac-10) and the National Collegiate Athletic Association (NCAA), Stanford fields men’s varsity teams in baseball, basketball, cross country, fencing, football, golf, gymnastics, soccer, swimming and diving, tennis, track and field, volleyball and water polo. As a member of the Northern California Athletic Conference (NorCal) and the Association for Intercollegiate Athletics for Women (AIAW), Stanford fields women’s varsity teams in basketball, cross country, fencing, field hockey, golf, gymnastics, swimming and diving, tennis and volleyball.

Additional opportunities in athletic competition are provided through junior varsity teams (for men and women) in selected sports. In those varsity sports for which a women’s team has not yet been developed, women are encouraged to demonstrate their interest and talent through advanced physical education classes, men’s varsity teams or the club sports program.

PHYSICAL EDUCATION

The physical education program is diverse to accommodate the interests and needs of undergraduate and graduate students in general. A wide variety of aquatic, dance, exercise, sports and theory courses 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) develop performance skills and to encourage, through satisfying learning experiences, the participation habit; (3) provide opportunities for discovering and/or expanding experience in aquatic, dance, exercise and sports activities as potentials for avocational and/or vocational utilization; and (4) develop leadership competence in the area of physical activities.

All courses are open for enrollment by male and female undergraduate and graduate students. Only intercollegiate varsity teams are limited to undergraduate enrollment. Homogeneous skill groupings and limited class sizes enable the student, beginner through the advanced performer, to achieve success within the limits of individual motivation and potential. Prerequisite: ability and knowledge and space-availability during class-list signing are the only limitations.

Equipment—Specific information is available at the Department and during registration days. Fees—Fees are charged for enrollment in fencing, golf, sailing, skin and SCUBA diving, CPR, equitation, and the Club program. Academic credit—Students are free to enroll in as many physical education courses as they would like. However, only 12 units of the activity courses will be accepted toward graduation requirements.

CLUB PROGRAM

Students may initiate, organize and conduct physical activity clubs which supplement the Department’s normal program. Specific guidelines for the establishment of these clubs, as affiliates of the Department, have been set by the Department. Clubs, which meet criteria for inclusion in the formal curriculum, may apply for academic credit through the Chairman of Physical Education. Club Sport Teams compete against other college, university and/or club teams. Those requiring eligibility certification for their team members may make such arrangements with the Department. For further information, contact the Department.

INTRAMURAL SPORTS

Students interested in recreational opportunities through intramural competition may receive information from Mr. Dallmar. The full program includes formal tournament competition in many different sports leading toward the All-University Intramural championship as well as an informal program of scheduled competitions. Competing organizations, teams and individuals are urged to contact the IM Office at Encina Gym on Registration Day to obtain meeting dates and times to assure representation. Sign-up lists are often posted at the beginning of each quarter; early organization of competing groups is essential.

RECREATION

The Department provides facility-use time for faculty, staff and students to participate in sports and dance for general recreation. General recreation hours are publicized each quarter. For additional information, contact the Department.

COURSES

All courses are (DR:X)
AQUATICS ACTIVITY AND THEORY
All courses are coeducational.

48. Swimming I: Beginning—For nonswimmers or those who are so novice as to have self doubts. Includes instruction in the basic strokes and personal safety skills. Minimum goal, drown-proofing; optimal goal, learn to enjoy swimming as a recreational activity.
   1 unit, Aut, Win, Spr (Daggett, Hammett, Weeks)

49. Swimming II: Intermediate—Continued work on personal safety skills including basic rescues and water safety. Refinement of the basic strokes and conditioning.
   1 unit, Aut, Win, Spr (Weeks, Daggett, Hammett)

51. Water Polo: Basic—Introduction to and refinement of skills used in the sport of water polo.
   1 unit, Aut, Win, Spr (Weeks, Daggett, Hammett)

52T. Lifesaving—Content includes the Red Cross Basic Rescue and Water Safety and Advanced Lifesaving course requirements in preparation for Lifesaving certification. Prerequisites: strong basic strokes and skills test.
   2 units, Aut, Win, Spr (Daggett, Weeks, Hammett)

54. Cardiopulmonary Resuscitation: Red Cross Program.
   1 unit, Aut, Win, Spr (Daggett, Hammett)

55. Sailing: Basic—Extra fee assessed. Prerequisite: Swimming skills test.
   1 unit, Aut, Win, Spr (Dettamanti, Hammett)

148. Swimming III—Review and refinement of all strokes and personal safety skills. Extensive conditioning included.
   1 unit, Aut, Win, Spr (Steenbakkers)

152T. Water Safety Instructor Course—Content is the Basic Swimming and WSI courses resulting in American Red Cross certification for successful course completion. Includes learning to teach swimming and lifesaving. Prerequisites: current Red Cross Advanced Lifesaving Certificate, strong advanced swimming skills.
   3 units, Spr (Hammett, Weeks, Daggett)

153T. Skin and SCUBA Diving—A highly rigorous program for expert swimmers. Includes classroom lectures and a minimum of two skin and two SCUBA dives in open water. NAUI certificate for successful completion. Extra fee assessed for equipment. Prerequisites: medical clearance and skill test and consent of instructor.
   3 units, Aut, Win, Spr (Hammett, Staff)

253T. Advanced SCUBA/Sport Diving—Prerequisites: SCUBA certification and consent of instructor. Open water program developing competence beyond basic levels. NAUI certification available, extra fee.
   1-3 units, Aut, Win, Spr (Hammett) dhr

155. Sailing: Advanced—Extra fee assessed. Prerequisite: consent of instructor.
   1 unit, Aut, Win, Spr (Steenbakkers)

DANCE ACTIVITY AND THEORY
All courses are coeducational. Undergraduates intending graduate study in dance should confer with the Director of Dance, Inga Weiss, for selection from among the following courses to fulfill prerequisites for admission to and completion of the degree of Master of Arts in Education (Dance Specialization). Qualified undergraduate students can be admitted to advanced performance courses. Special sessions by guest artists in the areas of Ethnic and Contemporary Dance, Ballet and Music for the Dance are included in the program. Further information for Dance Degree Candidates may be obtained from the School of Education (Dr. John Nixon).

60. Dance Fundamentals—A course designed for students of all levels as an introduction to movement skills and forms covering a wide range of activity, supplemented with films. Resource materials for all dance techniques will be featured with special emphasis placed on movement vocabulary, rhythm, and concepts of motion.
   1 unit, Aut (Weiss, Staff) TTh 11:00-12:30

61. Modern Dance I—Exposure to modern dance technique and improvisation with development in flexibility, co-ordination, and movement vocabulary.
   1 unit, Aut, Win, Spr (Staff)

   1 unit, Aut, Win, Spr (Staff)

63. Modern Dance III—Challenging modern dance technique developing body awareness in movement and/or flow and rhythmic versatility. Prerequisite: 62 or consent of instructor.
   1 unit, Aut, Win, Spr (Staff)

71. Folk Dance I—Experiencing regional dances from many countries with emphasis on learning traditional folk dance steps and styling.
   1 unit, Aut, Win, Spr (Hill, Staff)

72. Folk Dance II—Extension of 71. Learning dances from familiar and new regions with
greater emphasis on specific styles and traditional folk dance forms.

1 unit, Aut, Win, Spr (Hill, Staff)

75. Mexican Folk Dance I—Selected regional dances of Mexico to be taught for technical and cultural understanding.

1 unit, Aut (Cashion) MWF 1:15

160. Modern Dance Technique: Advanced—Development of versatile dance techniques and disciplines for strong control and expressive use of movement and dynamics. Prerequisite: Consent of instructor.

1 unit, Aut (Weiss) MW 4:15-6:00

161. Contemporary Dance Forms I—Sequences for manipulation of movement and advanced techniques. Prerequisite: Consent of instructor.

1 unit, Win (Weiss) MW 4:15-6:00

162. Contemporary Dance Forms II—This class is an extension of 161, for more advanced performance. Prerequisite: Consent of instructor.

1 unit, Spr (Weiss) MW 4:15

163T. Improvisation and Composition—Modern dance technique and improvisation as a basis for creative development of solo and group compositions, dealing with the elements of time, space, energy, and qualities of movement.

2 units, Aut (Hill) MW 11:00-12:50

164T. Choreography I—Exploring the process of creating dances as a means of expression and communication. Applying basic principles of dance composition and discovering new dance dimensions and limitations through props, costume, and sound. Prerequisite: 163 and/or consent of the instructor.

2 units, Win (Hill, Staff) TTh 11:00-12:50

165T. Choreography II—Delving into new concepts of choreography through abstraction, stylization, and drama in movement. Emphasis on creative development of choreographic theme and ability to direct small group works.

2 units, Spr (Hill, Staff) TTh 11:00-12:50

166T. Folkloric Dance Workshop—A movement/lecture course exploring specific cultural dance forms involving their historical, philosophical, and ritualistic aspects. Each workshop may offer varying material. Contact dance faculty for emphasis of any particular quarter.

2 units, Aut, Win (Valenzuela, Cashion)

167T. Contemporary Dance Workshop—Emphasis on new approaches in design and improvisation, involving exploration of movement and the manipulation of creative concepts for performance in dance.

2 units, Spr (Weiss) MW 5:15-6:05

168T. Dance Seminar—Investigation of one's movement and conceptual potential through discovery of existing limitations in personal habits and attitudes. Emphasis on formulation of one's own evolving philosophy of movement. Lecture/Lab/Selected readings.

2 units, Spr (Hill, Staff) M 11:00-12:50

170T. Topics in Dance—A film/lecture course exploring the historical and ethnographical dimensions of dance as expressions of cultural values and world views. Study of dance research and recording methods such as film and labanotation.

2 units, Win (Cashion) MW

173. Folkloric Dance Forms: Advanced—Developing stylistic versatility in the execution of complex traditional folk dance forms from a wide variety of regions. Prerequisite: 72 and/or consent of instructor.

1 unit, Spr (Hill) W 11:00-12:50

175. Mexican Folk Dance II—Further understanding of Mexican dance and its relation to the culture with an emphasis on technique and style for presentation of exhibitions. Prerequisite: Consent of instructor.

1 unit, Win, Spr (Weiss)

260T. Dance Practicum—Fundamentals for the teaching of dance. Movement analysis and teaching assignments. Dance degree candidates only.

2 units, Aut (Weiss) TTh 11:00-12:50

261T. Dance Production Practicum—Analysis of the process involved with all aspects of performance and the staging of dance in schools and university theatres. Prerequisite: Consent of instructor.

2 units, Spr (Valenzuela, Staff)

262T. Dance Etudes and Styles—A workshop-seminar representing dance history's wide range of styles based on the development of instrumental music and trends in art and architecture. Prerequisite: 160 and/or consent of instructor.

2 units, Aut (Weiss) F 11:00-12:50

266T. A,B. Dance Repertory—Dance sequences, phrases, and constraining progressions, emphasizing fluency of movement, accuracy of timing, clarity of form, and dance accompaniment. Development of performance skills, teamwork for dancers, the training to function within a group. Prerequisites: Consent of instructor.

A. 2 units, Win (Weiss) TThF 11:00-12:50
B. 2 units, Spr (Weiss) F 11:00-12:50
267T. Dance Exploration for Educators—Exploring the concepts and relationships that exist between academics, art, music, dance and physical education. Study encompasses the elementary through the high school educational levels.

2 units, Win, Spr (Valenzuela) MWF 2:15

269. Individual Study in Dance Research—Dance degree candidates.

3-5 units, Aut, Win, Spr (Staff)

270. Badminton: Basic—Covers serves, clears, drops, smashes, and drives; rules, scoring and practice in game playing.

1 unit, Aut, Win, Spr (Schoof)


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

20C. Equitation: Beginning—Introduction to the fundamentals of English (forward seat) riding. Special fee.

1 unit, Aut, Win, Spr (Melville)

21C. Equitation: Intermediate—Continued development of skill in English (forward seat) riding. Special fee. Prerequisites: ability to walk, trot and canter securely and knowledge of leads and diagonals.

1 unit, Aut, Win, Spr (Melville)

22. Golf: Beginning—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 unit, Aut, Win, Spr (Diaz, Summerhays, Staff)

23. Golf: Intermediate—Improvement and perfection of previously learned fundamentals. Utilization of these skills in the game. Prerequisite: promoted from 22 or the equivalent or ability to score in the 60's for nine holes on a regulation length course.

1 unit, Aut, Win, Spr (Diaz, Summerhays, Staff)


1 unit, Aut, Win, Spr (Schoof)

30. Fencing: Beginning—Basic movements and practice in coordination and timing.

1 unit, Aut, Win, Spr (Helliwell, Staff)


1 unit, Aut, Win, Spr (Helliwell, Staff)

32. Tennis: Beginning—Covers fundamental strokes (forehand, backhand, service and volley), rules and scoring.

1 unit, Aut, Win, Spr (A. Gould, R. Gould, Neal, Staff)

33. Tennis: Intermediate—Review of fundamental strokes, introduction of the lob and overhead strokes, and utilization of strategy and tactics in game playing. Prerequisites: knowl-
edge of rules and scoring, average ability; in fundamental strokes.

1 unit, Aut, Win, Spr (A. Gould, R. Gould, Neal, Staff)

36. Basketball—Extensive use of drills to refine fundamental skills and utilize offense and defense tactics.

1 unit, Aut, Spr (McCrea, Miller)

37. Field Hockey: Basic—Focus on conditioning, stick work, individual tactics, team play, strategy and rules.

1 unit, Spr (Longstreth)

40. Soccer: Basic.

1 unit, Aut, Win, Spr (Lodge, Staff)

40A. Soccer: Intermediate.

1 unit, Win, Spr (Lodge, Staff)

41. Volleyball: Basic—For those with limited volleyball background. Extensive use of drills to improve skills and game playing strategy.

1 unit, Aut, Win, Spr (Sturm, Staff)

42. Lacrosse—Fundamental skills and tactics.

1 unit, Win (Longstreth)

101. Adapted Physical Education—Individualized programs or opportunities to accommodate the physically inconvenienced student.

1 unit, Aut, Win, Spr (Ruff)

102. Conditioning: Individual Program—Prerequisites: experience in conditioning programs and consent of instructor.

1 unit, Aut, Win, Spr (Daggett)

103. Weight Training: Individual Program—Prerequisites: experience in weight training and consent of instructor.

1 unit, Aut, Win, Spr (Ruff)

120C. Equitation: Jumping—Introduction to and development of jumping skill using low single fences, higher fences, combinations and courses. Special fee. Prerequisite: promoted from 21C or equivalent.

1 unit, Aut, Win, Spr (Melville)

122. Golf: Advanced—Focus on understanding of and refining the golf swing as well as increasing power and distance. Prerequisites: ability to hit the ball with relative accuracy and play on a full 18-hole course with an average score of 115 or better.

1 unit, Aut, Win, Spr (Diaz, Staff)

131. Fencing: Advanced—Concentration on practice of attacks. Individual lessons and some competitive experience. Prerequisite: promoted from 31 or equivalent.

1 unit, Aut, Win, Spr (Helliwell)

137. Field Hockey: Advanced—Emphasis on developing high level of ability in the fundamental and advanced skills and strategies for offense and defense. Prerequisite: promoted from 37 or extensive experience which has resulted in above-average ability.

1 unit, Win (Longstreth)

140. Soccer: Advanced.

1 unit, Win (Lodge, Staff)

PHYSICAL EDUCATION AND SPORTS THEORY COURSES

All courses are coeducational and open to all students who meet indicated prerequisites: Undergraduate students intending graduate study in physical education should confer with Professor Nixon (School of Education) early in their undergraduate years for a wise selection from among the following courses to fulfill most prerequisites for admission to the graduate program. See “School of Education” section for additional course offerings.

100. Individual Study—Students may pursue in-depth study in a number of topics related to the discipline of physical education and of recreation leadership. Prerequisite: consent of instructor.

3-5 units, Aut, Win, Spr (Ruff, Staff)

104. Analysis of Human Movement—Review of skeletal anatomy and study of the mechanical principles of stability, motion and leverage as they relate to efficient performance in aquatics, dance and sports.

2 units, Spr (Weeks) TTh 9-11

181T. Athletic Training—For students intending to teach and/or coach at the high school or college level. Scope includes the spectrum of prevention, care and rehabilitation of injuries associated with dance and sports activities. Prerequisite: consent of instructor and recent course in Human Anatomy.

2 units, Spr (Blanchard) MW 8

182T. Athletic Team Management—For student managers of intercollegiate teams. Prerequisite: consent of respective varsity team coaches.

2 units, Aut, Win, Spr (Staff)

183. Intramural Sports Management—For student managers of IM sports and competitive organizations. Consent of instructor.

1 unit, Aut, Win, Spr (Dallmar)

200. Individual Study—Opportunity for continued in-depth study of specific topics related
to the discipline of physical education. Prerequisite: consent of instructor.  
3-5 units, Aut, Win, Spr (Ruff, Staff) by arrangement

201. Seminar on Motor Learning—Graduate seminar on recent research in motor learning with special application to principles of teaching physical education activities and coaching competitive sports.  
3 units, (Nixon) by arrangement

209. Seminar on Contemporary Sociology—The study of sport as a social institution, its value orientations, major social concerns, modes of interaction and structural relationships with other social institutions.  
3 units, Aut (Staff) T 7-9 p.m.

SPORTS OFFICIATING
Each of these coeducational courses is concerned with the rules, scoring, records, responsibilities and limitations of officials for the respective sports. Course work includes practical experience in organizing meets and tournaments as well as development of officiating skill and technique in the game situation. Students have opportunity to receive official's rating as a means for securing employment as an official. See current Time Schedule for times that courses are offered; 1 unit each.

123W. Golf (Diaz)  131W. Fencing (Helliwell)  133W. Tennis (Neal)  136W. Basketball (McCrea)  137W. Field Hockey (Longstreth)  149W. Swimming (Thomas)

SPORTS THEORY AND TECHNIQUE
Each course is designed to develop an understanding of the skills and strategies of the respective sports as well as to increase teaching/coaching competency. Lecture-discussions of relevant theory in support of teaching methods and performance techniques, psychological-interpersonal relationship phenomena, training dimensions (i.e., pre-season, season and post-season) and conduct on quality interschool competition. Analysis of Human Movement and/or Foundations of Physical Education are highly recommended as prerequisites; therefore, prospective enrollees should confer with the respective instructors regarding interest in the following 2-unit, by-arrangement courses:

101T. Adapted Physical Education (Ruff)  133T. Tennis (Gould)  135T. Baseball (Marquess) Aut  136T. Basketball (Maxey)  137T. Field Hockey (Longstreth)  138T. Football (Walsh) Win  141T. Volleyball (Sturm)  149T. Competitive Swimming (Gaughran)  151T. Water Polo (Dettamanti)

180T. Sports Practicum—For the highly skilled student in a given sport who anticipates becoming a teacher/coach of that activity. Teaching opportunities under close, experienced supervision of specified teacher/coaches. Prerequisites: the respective theory and technique course or equivalent and consent of instructor.  
2 units, Aut, Win, Spr (Ruff, Staff) by arrangement

INTERCOLLEGIATE ATHLETICS
Varsity and junior varsity men's and women's teams in Pac-10 and NorCal competitive schedules for the highly talented and motivated undergraduate student. Most squads are limited in size and have prerequisite performance standards. Unless specified, team tryouts are open to men and women students.

116V. Gymnastics: Varsity.  
1 unit, Aut, Win, Spr (Hamada, Walker)  MTWThF 2:15  
117V. Track and Field: Varsity.  
2 units, Aut, Win, Spr (Jordan)  MTWThF 3:15  
118V. Cross Country: Varsity.  
2 units, Aut (Staff) MTWThF 3:15  
123V. Golf: Varsity.  
2 units, Aut, Win, Spr (Summerhays)  MTWThF 2:15 and by arrangement

131V. Fencing: Varsity—Men's foil, epee and saber teams and women's foil team.  
2 units, Aut, Win, Spr (Helliwell)  MWTTh 3:15 p.m. and T 7:00-9:45

133V. Tennis: Varsity.  
2 units, Aut, Win, Spr (A. Gould, R. Gould)MTWThF 2:15

135V. Baseball: Varsity.  
2 units, Aut, Win, Spr (Marquess, Staff) MTWThF 2:15

136V. Basketball: Varsity.  
1 unit, Aut, Win (DiBiaso, Maxey, Miller) men's team  MTWThF 3:30-6:30

Win, MTWThF 6:30-8:30 p.m.  
Win, MTWThF 1:00-3:30
137V. Field Hockey: Varsity—Women's team.  
1 unit, Aut (Longstreth) MTWThF 2:15  
Spr, MWF 2:15

137J. Field Hockey: Junior Varsity—Women's team.  
1 unit, Aut (Staff) MTWThF 2:15

138V. Football: Varsity.  
2 units, Aut, Spr (Walsh, Staff) MTWThF 3:15

140V. Soccer: Varsity.  
1 unit, Aut (Lodge) MTWThF 3:15  
Spr, MTWThF 2:15

141V. Volleyball: Varsity.  
1 unit, Aut (Sturm) MTWThF 1:00-3:30  
Win, MTWThF 6:30-8:30 p.m.  
Spr, MTWThF 1:00-3:30

149V. Swimming: Varsity.  
2 units, Aut, Win (Gaughran, Thomas) MTWThF 3:15

150V. Diving: Varsity.  
2 units, Aut, Win (Staff) MTWThF 2:15

151V. Water Polo: Varsity.  
1 unit, Aut (Dettamanti) MTWThF 2:15  
Spr, MWF 3:15

CLUB PROGRAM

Student initiated, organized, and conducted physical-activity groups have been affiliated with the Department for many years in several of the oriental martial arts and sports activities. Most of the clubs assess dues for their current members. Clubs, which meet the criteria for academic credit, are scheduled for regular instruction times as published each quarter in the Time Schedule. Other affiliated clubs are assisted in locating appropriate facilities for their recreational activities. For additional information, contact the Department.

DANCE CLUBS—These student organized and conducted dance groups enable recreation and instruction opportunities supplementary to the Department's regular program.

ORIENTAL MARTIAL ARTS CLUBS—Each club in this program is unique in its physical skills and philosophical basis. The clubs encourage the uninitiated to observe a variety of class work prior to commitment to any of the following martial arts which have current affiliation:

Aikido—Japan's modern non-violent martial art. A way of life that unifies life energy (ki). Partnered practice includes specific blending movements, centering, ki extension, and techniques of flowing spherical motion which teaches one to be in harmony with others and with oneself.

Japan Karate—Stresses the basic of Karate-do and the development of human character through physical and mental discipline. Instruction and coaching in team and individual competition for advanced students.

Judo—Beginning and advanced instruction. Competitive workouts for advanced students.

Kenpo Karate—Instruction at beginning intermediate and advanced levels in a Chinese martial arts system emphasizing speed and flexibility. Exploration of philosophical as well as physical principles. Group classes and individual instruction.

Tai Chi Chuan—A highly sophisticated system of exercise composed of a series of self-defense postures specially designed to promote physical and mental fitness. Tai Chi Chuan has often been considered by many people to be one of the most priceless treasures of the Chinese civilization.

SPORTS CLUBS—These student organized and conducted sports groups enable recreation, instruction and competitive opportunities supplementary to the Department's total program of athletics, physical education and recreation. Teams desiring formal affiliation in Pac-10, NCAA, Norcal and/or AIAW conferences may be so certified upon request. Current sports clubs include:

Badminton, Bowling, Crew (men), Crew (women), Cricket, Cycling, Ice Hockey, Lacrosse (men), Lacrosse (women), Racquetball, Rugby (men), Rugby (women), Sailing, Skiing, Soccer (women), Softball (women), Squash, Track (women), Water Polo (women), and Wrestling.

COMMITTEE ON BLACK PERFORMING ARTS

Chairman: John H. Cochran (Drama)

Committee in Charge: Kennell Jackson, Jr. (Vice-Chairman, History), Irvin Brown (Psychology), Sylvia Wynter (African and Afro-American Studies), Kim Euell and Clinton Killian (Student Representatives)

Music Instructor: To be announced, Les Williams (Athletics, Physical Education and Recreation.)

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 co-operation of the departments and the Com-
committee, students are able to take relevant courses in dance, drama and music. Consult Time Schedule for courses offered through the following departments: African and Afro-American Studies, Drama, Music, and Athletics, Physical Education and Recreation.

CENTER FOR RESEARCH ON WOMEN (CROW)

Committee in Charge: Diane Middlebrook, Associate Professor of English, Director; Marilyn Yalom, Lecturer in Modern Thought and Literature, Associate Director; and members of the Policy Board.

Affiliated Faculty: Arthur Bienenstock, Professor, Materials Sciences and Engineering/Applied Physics; Elizabeth Cohen, Professor, Education/Sociology; Carl Degler, Professor, History; William Kays, Professor, Mechanical Engineering; Herbert Leiderman, Professor, Psychiatry; Eleanor Maccoby, Professor, Psychology; Diane Middlebrook, Associate Professor, English; Dorothy Atkinson, Assistant Professor, History; Estelle Freedman, Assistant Professor, History; Myra Strober, Assistant Professor, Graduate School of Business

The Center for Research on Women (CROW) is an educational and research organization whose major objectives are the following:

1) To conduct research on women and gender-related issues.
2) To stimulate gender-related research among Stanford faculty members, graduate and undergraduate students.
3) To develop and sponsor courses on women and gender-related issues within the Stanford curriculum.
4) To disseminate research and educational findings to the larger Stanford community.

At present no degrees are offered. However, CROW publicizes courses on women from within individual departments and coordinates interdisciplinary Women's Studies Courses.

COURSES


5 units, Spr (Freedman, Gelpi, Yalom and Staff) MTWTh 1:15, not offered 1978-79

142. The Female Experience: Victorian Heritage, Part II—(Enroll in Anthropology 142 or Modern Thought and Literature 142.) This course presents an examination of social and political thinkers during the period 1850-1920, according to their conceptions of the sexes. Readings will include: Marx, Engels, Mill, Nietzsche and Freud and others.

5 units, Spr (Collier, M. Rosaldo, and Staff)

See departmental listings for other courses on women.

CHICANO FELLOWS PROGRAM

Committee-in-Charge: Renato Rosaldo (Anthropology), Chairperson; Albert M. Camarillo (History), Albert H. Hastorf (Psychology), Arturo Pacheco (Education), Mary Pratt (Spanish)

The Chicano Fellows Program offers undergraduate courses by Fellows and Associate Fellows. The program also provides information on other courses concerning Chicano culture, community, identity, and history which are offered elsewhere in the University. While the Fellows Program offers neither a graduate program nor an undergraduate major, it does offer courses, coordinate relevant course offerings, and provide counseling for undergraduate students. The Fellows may be consulted for ways of incorporating course offerings listed below into regular undergraduate majors at Stanford.

Chicano Fellows are graduate students in various disciplines at Stanford. They are chosen yearly on the basis of academic merit and serve as teacher-advisors for undergraduates during the period of their fellowship. Their courses are often innovative and experimental; they are usually given as discussion groups rather than as lecture courses.

Course offerings are coordinated by the Administrative Assistant of the Chicano Fellows Program. Students should check with the Administrative Assistant of the Program for Chicano related courses at the beginning of a quarter in which they wish to enroll because a number of courses are accredited by the Program after the catalog goes to press.

COURSES

All courses (DR:X)

For 1978–1979 individual course listings, please check with Administrative Assistant, Chicano Fellows Program, 590R Old Union.
CHICANO-RELATED COURSES
OFFERED BY DEPARTMENTS
For (DR) notation, look under the respective department.

EDUCATION
216. Cultural Pluralism and American Educational Policy.
   3 units, Aut (Castaneda)
242. Bicultural Processes in Education.
   3 units, Win (Castaneda)
303A. Philosophical Analysis: Cultural Pluralism.
   4 units, Aut (Pacheco)

ENGLISH
162B. Creative Writing for Bilingual Students.
   5 units, Win (Islas)
   5 units (Islas)

HISTORY
   4-5 units, Aut (Camarillo)
262S. Undergraduate Seminar: Topics in Chicano History.
   5 units, Aut (Camarillo)

LINGUISTICS
252. Variation in Spanish.
   5 units, Spr (Lavandera)

SPANISH
100B. Advanced Conversation for Bilingual Students.
   3 units, by arrangement with Professor Ybarra
130B. Mexican and Chicano Cultural Readings.
   3-5 units, Aut (Ybarra)
131B. Latin American Cultural Readings.
   3-5 units, Win (Ybarra)
132B. Hispanic Cultural Readings.
   3-5 units, Spr (Staff)
249. The Latin American Essay.
   3-5 units, Win (Ybarra)
   3-5 units, Win (Ybarra) given 1979–80
251. Taller de Teatro: Theater Workshop.
   3-5 units, Spr (Ybarra)

EXTRADEPARTMENTAL UNDERGRADUATE PROGRAMS

The programs below are extradepartmental undergraduate programs sponsored by the Dean of Undergraduate Studies. They include the Freshman Seminar Program, the Learning Assistance Center (LAC), the Stanford Workshops on Political and Social Issues (SWOPSI), the Student Center for Innovation in Research and Education (SCIRE), and the Undergraduate Special Programs. These programs are governed by university advisory committees and offer a variety of courses and services to undergraduate students. An undergraduate is limited to a total of twelve courses or thirty-six units of these courses combined to count toward graduation, with the exception of Freshman Seminars. No more than twenty-seven (27) of these thirty-six (36) units may be taken in any one extradepartmental program. See the program descriptions below for additional information.

FRESHMAN SEMINAR PROGRAM

Dean’s Advisory Committee in Charge: John D. Goheen (Director of the Program 1978-79), Tab Bowers, Nancy Cartwright, Alexander L. Fetter (ex officio), Henry S. Levinson, Thomas C. Moser, Benjamin D. Paul, Emily M. Sachar, Kathryn Thoelecke (ex officio), Robert M. Wildman

Freshman seminars, with topics drawn from many fields, provide stimulating small-group learning experiences. They are taught by qualified members of the Stanford community and run for one or two quarters.

Approximately 90 seminars will be offered 1978-79; each seminar will have eight to twelve students. 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 Re-quirement, and others may count toward the University’s Distribution Requirement.

APPLICATION AND ADMISSION PROCEDURES

All incoming freshmen will receive in June a copy of Approaching Stanford which includes descriptions of the seminar offerings for the following academic year. Students register for seminars by mail during the Summer. Correspondence regarding the program should be addressed to the Academic Information Center, Old Union, 306, Stanford University, Stanford, CA 94305.

LEARNING ASSISTANCE CENTER (LAC)

Director: Carolyn Walker

The Learning Assistance Center (LAC), offers courses and services designed to teach study, reading, and tutoring techniques. Students may enroll in credit courses or noncredit workshops, or drop in at the Center any time during the quarter for individual help. The LAC is located at 123 Meyer Library (Telephone: 497-2207) and is open 9-12 and 1-5 Monday through Friday.

COURSES

All courses are (DR:X), except LAC 8 and 9, and are offered either for a grade or for pass/no credit. None of the courses may be repeated for credit.

Graduate students who enroll in lower division courses may sign up for 100 level courses (e.g., 106 instead of 6) for a limited number of units. They will be expected to complete additional work.

1. Learning Skills—Teaches time management, note-taking, concentration and memory, listening, study-reading, library use, and test taking. In addition to bi-weekly lectures, students meet individually with peer counselors to work on specific study behavior changes.

   2 units, Aut, Win, Spr, Sum (Kueny)

6. Effective Reading—Introduction to the techniques of effective reading, with emphasis on memory and concentration, comprehension, vocabulary development, and the analysis of prose. Includes study of the theory of reading rate improvement, and its bearing on comprehension improvement, and a lab section in which students practice drills designed to double reading rate while maintaining good comprehension. (Not open to students enrolled in LAC 8 or 9).

   2 units, Aut, Win, Spr, Sum (Bihn, Staff)

Note: the rate improvement section of this course is available separately in a self-managed format. See “Services” below.

8. Critical Reading and Writing I—(Same as English 1.) Designed to improve the interrelated skills of reading and writing. Reading sessions will concentrate on the techniques listed under LAC 6, exclusive of rate improvement. Writing sessions will focus on the elements of the essay, with emphasis on grammar, mechanics, syntax, diction, unity, and coherence. Satisfies one half of the Writing Requirement. (DR:W) (Not open to students enrolled in LAC 6.)

   5 units, Aut (Walker, Black/Walker, Harris)

9. Critical Reading and Writing II—(Same as English 2.) Continuation of LAC 8/English 1. Reading sessions will concentrate on the critical analysis of argument and the identification of assumptions, tone, bias, and intent in both fiction and non-fiction prose. Writing sessions will focus on patterns of exposition, the development of argument, and the research paper. Satisfies one half of the Writing Requirement (DR:W). Prerequisite: LAC 8 or consent of the instructor.

   5 units, Win (Walker, Black/Walker, Harris)

120. Peer Tutoring Training—Teaches learning skills and theory to students who wish to tutor in the University. Includes instructor interviews and video-taping of tutoring.

   1 unit, Aut, Win, Spr (Kueny)

170 Series. Peer Counseling Techniques—Courses in this series are designed to teach the principles and practice of basic attending skills and their application to specific contexts. Students may enroll in only one course in the series for credit.

170. Basic Attending Skills—Designed to teach verbal/non-verbal attending and communication skills through instruction, role-play, and video-taped practice. Open only to RA’s and students enrolled in Psychology 184.

   1 unit, Aut, Win, Spr, Sum (Kueny)

171. Peer Counseling: Learning Skills—Same as 170 with additional instruction in the theory and practice of study skills counseling. These students will work closely with the instructor of LAC 1.

   2 units, Aut, Spr (Staff)

172. Peer Counseling: Chicano—Same as 170 with additional instruction in the theory and
practice of peer counseling Chicanos.
2 units, Aut, Win (Velez)

173. Peer Counseling: Asian Americans—
Same as 170 with additional instruction in the
theory and practice of peer counseling Asian
Americans.
2 units, Aut, Win, Spr, Sum (Pao)

174. Peer Counseling: Bridge—Same as 170
with additional instruction in the theory
and practice of peer counseling in the Bridge
Community.
2 units, Aut, Win, Spr, Sum
(D'Andrea, Staff)

175. Peer Counseling: Career Develop-
ment—Same as 170 with additional instruction
in the theory and practice of career counseling.
2 units Spr (Filice)

SERVICES
1. Peer tutors in specific academic subjects.
2. Short noncredit workshops on time-
management, grammar, test preparation,
text anxiety, and vocabulary.
3. A quarter-long self-managed reading rate
improvement course. Not for credit.
4. Individual meetings with staff and peer study
skills counselors available on appointment or
drop-in basis.
5. Reference material and study guides on
reading and study skills.

STANFORD WORKSHOPS
ON POLITICAL
AND SOCIAL ISSUES
(SWOPSI)

Stanford Workshops on Political and Social
Issues (SWOPSI) is an extradepartmental pro-
gram initiated by students in 1969 to harness the
research capabilities of Stanford and put them to
work in searching for solutions to urgent social
and political problems.

SWOPSI workshops are led by community
members and Stanford faculty, students and
staff; each course is sponsored by a faculty
member. The program offers credit for ap-
proximately 18 workshops each quarter.
SWOPSI classes are small; enrollments of 8 to
10 students allow for personal contact between
students and instructors and for high student
involvement.

Workshops combine academic analysis with
direct exposure to the issue. Some workshops
conduct community-based research and publish
the research findings and policy recommenda-
tions. A report from the workshop “Logging
Policy in California” was influential in state
legislation. A recent workshop developed a solid
waste recycling plan for the campus. In other
workshops, students work in a clinical place-
ment such as a day care center, a school for
children with learning disabilities or the county
Commission on the Status of Women. All work-
shops seek to acquaint the community-at-large
with the issue under study; workshop findings
form the basis of publications, public forums, or
concrete legal, political or community action.

SWOPSI classes are innovative educational
experiences. Workshops take an interdiscipli-
ary approach to problem solving, give students
a substantial voice in the conduct of workshops
and encourage cooperative group work.

Workshops are open to both undergraduates
and graduates as well as interested members of
the community. Participation by people with
diverse backgrounds and differing perspectives
enhances the possibility of a comprehensive
analysis of the issue and the development of
imaginative solutions to problems.

Any person interested in organizing, leading
or participating in a workshop should contact
the SWOPSI office at 497-4305. Workshops for
fall quarter are listed in a catalog distributed in
the reg packets. Winter and spring quarter
catalogs are available during advance registra-
tion through the residences or the SWOPSI
office, 590-A Old Union.

THE STUDENT CENTER FOR
INNOVATION IN RESEARCH
AND EDUCATION
(SCIRE)

The Student Center for Innovation in Re-
search 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 pro-
jects in several ways. The staff works with in-
terested students, developing and refining
project ideas. Members of the academic com-
munity 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 five students and four
faculty members.

SCIRE projects allow undergraduates to di-
rectly 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 planning academic programs, SCIRE is currently working in some new areas relevant to undergraduate education. Policy Board members can identify educational problem areas and organize task forces to work on ways to resolve them.

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’s Internship Program enables non-freshmen undergraduates to earn credit for off-campus learning experiences which significantly augment or extend an area of faculty instruction. The internship program consists of a part-time field placement and related coursework, which may be taken prior to or simultaneously with the fieldwork.

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 projects such as these. The program has developed an Innovation Fund which is used to make grants of “seed money” to support exciting educational projects developed by students. The stress of the fund is on ideas which are likely to have a long-term impact upon undergraduate education.

Students who have academic project ideas, an interest in task forces, a desire to work and learn off campus, or innovation fund proposals should come by the SCIRE office, 590-A Old Union, or call 497-4504. The office is open Monday through Friday from 8 to 5.

UNDERGRADUATE SPECIAL PROGRAM

Director: Laura S. Selznick

Undergraduate Special Courses are sponsored by the Office of the Dean of Undergraduate Studies. They widen the range of opportunities 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 courses. These courses 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.

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. (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 enrollment restriction based on race, creed, sex, or national origin will be approved.

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 teach-
ing or presentation of course materials—should file with the Committee a form obtained from the Program Office, 590-A Old Union, indicating:

1. A statement of course objectives.
2. The planned approach and an outline of general requirements and/or prerequisites.
3. Specific requirements, definition of special projects, method of evaluation and intended grading system.
4. A reading list identifying required and suggested readings.
5. A week-by-week syllabus which is as detailed as possible and which links readings, lectures, discussions and projects.
6. The name of the instructor(s) and any others who will assist in teaching the course, and statement of the qualifications of these individuals.

Instructors who are not members of the Academic Council must obtain a sponsor's statement from a Council member indicating support for the course and the qualifications of the proposed instructor(s). The sponsor will be responsible to the Dean of Undergraduate Studies through the Committee on 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.

The Program Catalog is available each quarter at the Registrar's Office and at the Academic Information Center.

GRADUATE DIVISION SPECIAL PROGRAMS

Dean of Graduate Studies and Vice Provost: W. B. Carnochan
Associate Dean of Graduate Studies: Arthur B. C. Walker, Jr.

SPECIAL PH.D. PROGRAM

The Graduate Division Special Program is designed for unusually able and well-qualified students seeking Ph.D.'s whose study plans do not fall within the province of any one department.

Requirements are:

1. Prior admission to a doctoral program in a School or department at Stanford University.
2. Completion of a minimum of two quarters of full enrollment in that program.
3. Agreement of an eligible member of the Academic Council to act as committee chairman.
4. Agreement of three other Academic Council members to serve on the committee. They should be chosen to represent the student's various fields of interest and must be from at least two academic departments.
5. Filing of Declaration of Intention (Form G54).
6. Approval of the University Committee on Graduate Studies.

Further information on the program and details of application procedures are available from the Graduate Program Office, Building 590, Room 104.

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

401. Ph.D. Dissertation
   by arrangement

INTERDISCIPLINARY COURSES FOR GRADUATE STUDENTS

The following courses are open to all graduate students. There are no prerequisites.

241. African History: Documentation and Methodology—Offered by staff members of the Hoover Institution. A survey of the location and nature of sources available: libraries, archives, and oral traditions. Interdisciplinary: faculty from Engineering, Political Science, Economics, Education, Anthropology; encour-
ages convergence of engineering and natural sciences with the social and behavioral sciences in the study of development processes and the ethics implicit in development choices. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures analyzed in terms of appropriate to development in both less developed and industrialized societies. Present systems and planning processes examined in terms of their present day inequities and their consequences for future generations. Autumn: Major world trends—population, food, energy, technology, lifestyles. Development examined in terms of relative satisfaction of human needs. Lectures, discussions, work-groups. Winter: Alternative development strategies—country case studies. Lectures, discussions, work-groups. Spring: The individual and social change; the engineer, political scientist, educator, etc., as designer of alternatives and as policy and decision-maker. Work groups only. 2 units: pass/no credit. 3-5 units: pass/no credit or grade, small discussion groups and workshops, limited enrollment. A,B,C. 2-5 units, Aut, Win, Spr (Cooper, Fagenll, Lusignan, McWhorter, Siegel, Tector, Weiler) M 7:30-9:30 p.m. and by arrangement

NONMATRICULATED GRADUATE STUDY

Graduates of colleges and universities of recognized standing are eligible to apply for non-matriculated status in the Graduate Division of the University. Nonmatriculated status is granted to students of demonstrated ability who are not seeking an advanced degree from Stanford University, but who would benefit from course work at Stanford for a variety of reasons. Some schools and departments do not regularly permit nonmatriculated students to enroll in courses. Some programs also require full-time registration if nonmatriculated students are to take any courses. Details can be obtained from the Graduate Admissions Office. This status is granted for the current academic year only. Any extension of enrollment privileges into the next academic year requires approval in writing from the Office of the Dean of Graduate Studies. Applicants interested in nonmatriculated status for the summer quarter only need not apply through the Graduate Admissions Office but rather through the Summer Sessions Office and if approved will be permitted to register as summer visitors.

Nonmatriculated students will obtain academic credit for courses satisfactorily completed and may obtain an official transcript for the usual fee. They are eligible to use University facilities and services. In classes of limited enrollment, however, students in degree programs have priority over nonmatriculated students. Nonmatriculated students may apply for housing, but will not receive placement until the needs of all matriculated students have been cared for.

Applications forms for nonmatriculated status may be obtained from the Graduate Admissions Office.

HOOVER INSTITUTION ON WAR, REVOLUTION AND PEACE

Director: W. Glenn Campbell
Associate Directors: Richard T. Burress, Richard F. Staar, Darrell M. Trent
Consultant to the Director: Witold S. Sworakowski
Public Affairs Coordinator: George Marotta
Finance Officer: Rosemarie Smaltz

RESEARCH AND PUBLICATIONS

Honorary Fellows: Friedrich A. Hayek, Ronald Reagan, Alexander Solzhenitsyn
Consultant: Yuan-li Wu
Senior Research Fellows: Dennis L. Bark, Michael K. Block, John H. Bunzel, K. N. Chang, Robert A. Conquest, Alexander Dal-
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 one of the largest private archives in the United States, with outstanding area collections on Africa, East Asia, Eastern Europe, Latin America, the Middle East, North America, 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 a resident research staff of historians, economists, political scientists, and sociologists, and promotes basic research and documentary studies. Notable long-term research topics include public policy analyses, African colonialism, post-Mao China, the international communist movement, and non-Russian nationalities in the Soviet Union.

The Institution has expanded its domestic research and fellowship programs which have become comparable in size and quality to international studies. Scholars participating in the program conduct advanced research on current political, economic, and social issues. In addition, there are conferences, seminars, and lectures that deal with these issues.

Richard F. Staar directs the international studies program. He is editor of the Yearbook on International Communist Affairs and a series of monographs on the histories of ruling communist parties.

Thomas G. Moore is director of domestic studies. Research currently underway is concerned with income redistribution, government regulation, taxation, domestic energy problems, econometric analysis of crime, and social security.

In addition to its own research staff, the Institution has been visited 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 postdoctoral fellowships. Illustrative of this aim is the National Fellows Program, which includes a special category of Peace fellowships. For those selected, the program offers support for unrestricted research in modern history, political science, international relations, economics, and sociology.

The Institution also has a publications program, and since 1919 some 350 volumes have been published. The latest ones include Social

The many interrelationships with Stanford University include library cooperation, joint appointments, co-sponsorship of seminars and lectures, and courses offered by Hoover Institution scholars. Examples include senior fellow Seymour Martin Lipset on joint appointment with the political science and sociology departments; senior fellow Rita Ricardo Campbell lecturing in a human biology course; senior fellow James G. March on joint appointment with the Graduate School of Business and the departments of political science and sociology and, by courtesy, education; senior fellow (by courtesy) Alex Inkeles on joint appointment with sociology and, by courtesy, education. Two faculty members in political science, professors Heinz Eulau and Giovanni Sartori, are senior fellows (by courtesy). Professors Alexander Dallin in history and William J. Goode in sociology are senior research fellows. East Asian curator Ramon Myers is adjunct professor at the Food Research Institute; deputy archivist Robert Hessen teaches in the Graduate School of Business; and assistant director George Marotta offers an undergraduate seminar on U.S. foreign policy.

In addition, Peter Duignan, who is the Institution's curator on Africa, also serves as curator for the African program of the University as a whole. Curatorial functions on a University-wide basis for materials in Arabic, Turkish, and Persian are also performed at the Hoover Institution. The East Asian library also collects research materials in the Chinese and Japanese languages for all of Stanford University.

With the dedication of the Herbert Hoover Federal Memorial in July 1978, the Institution's complex now includes the Tower and two adjacent buildings.

COMMITTEE ON HYDROLOGY

Committee in Charge: Irwin Remson (Chairman), William E. Brigham, Joseph B. Franzini, Paul Kruger, 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 Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>AES 192. Geomathematics I: Computer Applications in Geology and Applied Earth Sciences</td>
<td>4</td>
</tr>
<tr>
<td>AES 194. Geomathematics III: Numerical Methods for Geologists</td>
<td>3</td>
</tr>
<tr>
<td>AES 284. Engineering Geology</td>
<td>4</td>
</tr>
<tr>
<td>Civil Engr. 203. Statistical Models in Civil Engineering</td>
<td>4</td>
</tr>
<tr>
<td>Civil Engr. 206. Stochastic Processes and Decision Statistics for Civil Engineers</td>
<td>4</td>
</tr>
<tr>
<td>Civil Engr. 226. Optimization Techniques in Civil Engineering (not offered 1978-79)</td>
<td>3</td>
</tr>
<tr>
<td>Civil Engr. 239. Seminar in Water Resources Planning (not offered 1978-79)</td>
<td>2</td>
</tr>
<tr>
<td>Civil Engr. 251. Environmental Fluid Mechanics I</td>
<td>4</td>
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<tr>
<td>Civil Engr. 252. Environmental Fluid Mechanics II</td>
<td>4</td>
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<tr>
<td>Civil Engr. 253. Fluid Mechanics of Closed Conduits</td>
<td>3</td>
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<tr>
<td>Civil Engr. 254. Sedimentation Problems</td>
<td>3</td>
</tr>
<tr>
<td>Civil Engr. 266. Engineering Hydrology</td>
<td>4</td>
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<tr>
<td>Civil Engr. 267. Advanced Hydrology</td>
<td>4</td>
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<tr>
<td>Civil Engr. 268. Water Resources Development</td>
<td>4</td>
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<tr>
<td>Civil Engr. 269. Water Studies Seminar</td>
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<td>Civil Engr. 270. Water Quality in Water Resources Development</td>
<td>3</td>
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<tr>
<td>Civil Engr. 273. Water Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Civil Engr. 273.A. Water Chemistry Laboratory</td>
<td>3</td>
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<tr>
<td>Civil Engr. 274. Water Microbiology</td>
<td>2</td>
</tr>
<tr>
<td>Civil Engr. 276. Nuclear Methods in Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Civil Engr. 276.B. Environmental Impact of Power Generation</td>
<td>3</td>
</tr>
<tr>
<td>Civil Engr. 276.C. Environmental Radioactivity</td>
<td>3</td>
</tr>
<tr>
<td>Elec. Engr. 292A. Environmental Systems Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 171. Introduction to Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 193. Geomathematics II: Introduction to Probability and Statistics in Geology</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 221. Photogeology</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 222. Intermediate Geomorphology</td>
<td>3</td>
</tr>
<tr>
<td>Geol. 230. Hydrogeology</td>
<td>3</td>
</tr>
</tbody>
</table>
Geol. 232. Numerical Methods in Hydrogeology 2
Geol. 250. Marine Geology-Ocean Basins 4
Geol. 283. Geomathematics V: Applications of Probability and Statistics in Geology 3
Pet.E. 151E. Core Analysis Laboratory 3
Pet.E. 170. Elements of Reservoir Engineering 3
Pet.E. 281. Applied Mathematics in Reservoir 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.

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 pass a qualifying examination specified by the Committee and have a grade point average in graduate work of at least a B. A minor in Hydrology is not offered for Ph.D. programs in other departments of the University.

PROGRAM FOR INDIVIDUALLY DESIGNED MAJORS

This program is intended for undergraduates who are interested in pursuing an area of scholarly inquiry which falls outside the purview of an established academic department or program of the University. It permits intellectually coherent majors designed by the students themselves with the assistance of faculty members of their choice. The Program for Individually Designed Majors is not an honors program. Any student in good academic standing is free 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” advisor. 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 Dean’s Advisory Committee on Individually Designed Majors will not consider proposals (or changes in previously approved proposals) unless they have the approval of the faculty advisory group.

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.

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 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 proposal must be signed by at least three faculty members, their signatures certify that they endorse 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 advisor giving his or her 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. Proposals may not be submitted until a student has actually registered at Stanford and is present on the campus.

**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 has established these specific requirements:

1) Each major shall consist of at least sixty (60) units, all in courses at or above the 100 level (or their 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.

These specific requirements are in addition to the general guidelines discussed in "The Major" in the "Degrees" section of this bulletin. Since each proposal is considered individually, the student and the faculty advisory group may request and exception to the specific requirements. Such a request must be included in the statement which justifies the major.

Several extradepartmental programs have administrative offices that provide advising services to students interested in individually designed majors of an interdisciplinary nature. Examples of such programs are Urban Studies, Medieval Studies within Humanities Special Programs, and Social Thought and Institutions. These programs do not grant undergraduate degrees, but encourage interested students to propose majors to the Dean's Advisory Committee for Individually Designed Majors. Students should see the relevant sections of *Courses and Degrees* for information on these programs. Additional information about the Program for Individually Designed Majors may be obtained at the Academic Information Center.

**INSTITUTE FOR ENERGY STUDIES**

*Chairman:* William C. Reynolds  
*Associate Chairman:* Thomas J. Connolly  

**Seminar Coordinator:** Holt Ashley  
**Executive Director, Energy Modeling Forum Project:** James L. Sweeney  
**Information Center Director:** Marian J. Rees

The Institute for Energy Studies is an interdepartmental activity that serves to stimulate, focus, and coordinate energy-related graduate research and educational activities within the various Departments and Schools.

The Institute maintains a special Energy Information Center which houses a unique collection of reports, journals, and special documents containing data pertinent to energy studies.

The Institute's Monday afternoon seminar is conducted with the joint sponsorship of the Electric Power Research Institute which is located in the Stanford Industrial Park.

A major role of the Institute is the provision of funds to faculty for initiation of new energy research. With these funds, a faculty member and his Ph.D. research students are able to carry their work to the point where support from an appropriate sponsoring agency can be obtained. Ph.D. candidates interested in working in the energy area should discuss the opportunities afforded by the Institute with their dissertation research advisor.

The Institute organizes student-faculty studies of important energy problems. Past studies have included Alternatives to Petroleum, Garbage Power for Santa Clara County, the Stanford Energy System, Biomass Energy for Hawaii, and Soft Energy Paths. These studies are conducted through the aegis of Engineering 235A, B; see description elsewhere in this bulletin.

In the Graduate School of Business, the Institute supports special energy-oriented MBA and Ph.D. training programs of the School. For more information, consult the Graduate School of Business.

The Institute administers a number of energy-related graduate fellowships and traineeships. These are allocated to the participating Departments. Interested students should apply directly to their Departments, indicating their interest in energy studies.

Academic programs important to energy problems are offered by many Departments in the Schools of Business, Earth Sciences, Engineering, Humanities and Sciences, and Law. A student interested in energy studies should apply to the Department most closely aligned with his or her interests. The Institute for Energy Studies is in the process of developing some ancillary programs to supplement the regular offerings of these Departments. It is expected that some programs will be available in 1978-79. It is anticipated that these will take
the form of the Engineer degree, and Energy Studies minor in a Departmental Ph.D. program, or possibly, a second Master's degree. In all cases, admission to the program and qualifications for the degree will be determined by the individual Departments. Information regarding the status of these degree programs, the Departments involved, admissions requirements, etc., can be obtained from the Institute for Energy Studies, Room 500C.

INSTITUTE FOR PLASMA RESEARCH

Executive Committee: Frederick W. Crawford (Chairman), Donald Baganoff, Daniel Bershad, Oscar Buneman, I-Dee Chang, Robert H. Eustis, Ronald K. Hanson, Sotiris P. Koutsoyannis, Charles H. Kruger, Morton Mitchner, Vahe Petrosian, Sidney A. Self, Peter A. Sturrock, 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, Bershad, Chang) conducts experimental and theoretical research on plasma and plasma flow at high density and moderate temperature, using shock tubes and advance interferometric and spectroscopic equipment.

The Gas Kinetics Group (Koutsoyannis) 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, Hanson, Koester, Kruger, Mitchner, Nakamura, Self) concentrates on experimental and theoretical research on flowing, high temperature gases related to such applications as magnetohydrodynamic energy conversion, air pollution, combustion, chemical kinetics, and lasers, and includes studies of diagnostic techniques and analysis of energy conversion systems.

The Experimental Plasma Physics Group (Crawford) 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 Solar-Terrestrial Physics Group (Wilcox) operates the Stanford Solar Observatory, and is engaged in observational and theoretical studies of the solar magnetic field and its interactions with solar activity, the solar wind, and geomagnetic responses.

The Space Science and Astrophysics Group (Petrosian, Stern, Sturrock, Walker, Underwood) is engaged in both theoretical and experimental studies: the experimental work is concerned primarily with x-ray spectroscopic observations of the solar corona, supernova 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. Recently, interest has focused on three-dimensional particle codes which simulate magnetic containment, such as in mirror machines and tokamaks.

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.

CENTER FOR RESEARCH IN INTERNATIONAL STUDIES

The Center for Research in International Studies (CRIS) was established in 1967 as a means of coordinating Stanford's numerous activities in the fields of international, comparative, and regional studies. Until 1974 it worked variously with the Presidential Committee and later the Commission on International Studies, but in that year the Commission was replaced by an Advisory Committee to the Director of CRIS.

CRIS provides the University with a means of planning, financing, stimulating, and coordinating a variety of activities and programs that relate to teaching and research in the international field. It is specifically concerned with the nature and quality of Stanford's curriculum in the sphere of international comparative, and foreign area studies and has played a leading role in the development of the new undergraduate curriculum in International Relations.
It is continuously and closely involved in the planning, support, and coordination of Stanford's foreign area and language programs and a variety of major research programs as well. CRIS also raises and administers funds from governmental, foundation, and private sources to support the University's activities in the international field and uses these funds in part to finance related faculty research, student fellowships, library development, and new faculty appointments.

The operations of CRIS are university-wide and extend to research and teaching activities in the Schools of Humanities and Sciences, Law, Business, Education, and the Food Research Institute. Relations with the various departments in the social sciences and humanities are especially close, as are those with the Hoover Institution on War, Revolution and Peace which is very heavily involved in international studies and research.

CRIS also administers on behalf of two consortia of major universities the Inter-University Center for Japanese Language Studies in Tokyo and the Inter-University Program for Chinese Language Studies in Taipei. Between them these provide the United States' most outstanding facilities for advanced professional training in the Japanese and Chinese languages.

CRIS is administered by a Director and Associate Director who work with a small administrative and secretarial staff. The Director has the advice and assistance of a Committee composed of faculty members and students representing many sectors of the International Studies community at Stanford. The offices are located in the Lou Henry Hoover Building (Telephone: 415 497-4581).

CRIS neither offers courses nor confers degrees. These academic functions are performed by the schools, departments, and programs with which CRIS is associated.

AREA STUDIES PROGRAMS

Stanford has four interdisciplinary language and area programs: East Asian Studies, Latin American Studies, Russian and East European Studies, and African Studies. These are separately organized as Centers responsible for coordinating the University's resources in all schools and departments for teaching and research relating to each of these areas. The relevant faculty members from these schools and departments constitute the staff of the four Centers. The great majority of area-related courses and seminars are offered by the school or department concerned, not directly by the Centers. Undergraduate degree programs are coordinated by staff associated with each of the area programs. Special graduate programs leading to the A.M. in Latin American Studies, East Asian Studies and Russian and East European Studies are available and are described separately in this bulletin. The area studies programs do not offer the Ph.D. but a qualified doctoral candidate may design a cross-disciplinary specialization which emphasizes the area interest within the student's interdisciplinary preparation for the degree.

UNDERGRADUATE PROGRAM

A special interdisciplinary program in International Relations, including an undergraduate major, 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 Program" in the School of Humanities and Sciences section of this bulletin.

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 disciplinary 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 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, or provides sufficient evidence of intending to enroll in a graduate program after attending the center; (b) will have successfully completed prior to attendance a minimum or two years of Japanese or its equivalent at the college level; and (c) takes a written screening examination in the Japanese language.

Stanford students attending the Inter-University Center for credit should enroll in Asian Languages J-400 Advanced Language Training (15 units per quarter). This course will be graded on a pass/no credit basis. For further information please write to:
Center for Research in International Studies
Room 200, Lou Henry Hoover Building
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 offerings at American institutions.

The purpose of the Program is to provide graduate and undergraduate students with intensive audio-lingual language instruction (usually 20 hours a week), as well as to further the students' familiarity with Chinese texts and materials preparatory or leading to research in given disciplinary or professional fields. The Program, however, is not a research institution but a language-training facility.

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.

Stanford students attending the Inter-University Program for credit should enroll in Asian Languages C400, Advanced Language Training (15 units per quarter). This course will be graded on a pass/no credit basis. For further information please address your inquiries to:
Center for Research in International Studies
Room 200, Lou Henry Hoover Building
Stanford University
Stanford, California 94305

LIBRARIES

Emeriti: M. Celeste Ashley (Drama Librarian); Joseph A. Belloli (Senior Reference Librarian); Virginia Bonnici (Physics Librarian); Edward Colby (Music Librarian); Florence Furst (Chemistry Librarian); Elmer R. Grieder (Associate Director of Libraries); Charles R. Gorham (Chief Gifts Librarian); Jennette E. Hitchcock (Chief Catalog Librarian); Anna Hoen (Reference Librarian, Lane Medical Library); Susan V. Lenkey (Rare Books Librarian); Clara S. Manson (Chief Librarian, Lane Medical Library); Jack Plotkin (Chief Circulation Librarian); Ruth Scibird (Curator of the Stanford Collection); Grace E. Stillson (Assistant Chief Catalog Librarian); Margaret Wells (Education Librarian); Margaret Windsor (Assistant Chief Librarian)

UNIVERSITY LIBRARIES

Director: David C. Weber
Assistant Director for Administrative Services: John C. Heyeck
Assistant Director for Collection Development: Paul H. Mosher
Assistant Director for Public Services: Dale B. Canelas
Assistant Director for Technical Services: to be announced
Building Projects Manager: Phillip D. Leighton
Library Development Officer: Susan G. Ross
Department Chiefs: Shere Connan (Serials); Elsi Goering (Personnel); Ralph Hansen (Acquisition); Olive James (Reference); Mary Meier (Service Operations); Elizabeth Salzer (Meyer Library); Florin Shasky (Special Collections); Gloria Stockton (Central Circulation); Carol Turner (Government Documents); Celine Walker, Acting (Science)
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 specialities. 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 are the guide series entitled "Guides to the Stanford University Libraries" and include information on orientation to physical facilities, scope of collections, and services offered. 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**

All courses (DRX)

**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)

**Slavic 184. Introduction to Slavic Bibliography**—Analysis of basic Slavic research tools and bibliographic research media with emphasis on Russian and Soviet materials. The approach will be historical and evaluative. The aim of the course is to acquaint students with reference sources, bibliographic search techniques, library use, and materials available in Stanford University libraries. Students will examine, evaluate and employ reference material. Knowledge of Russian and/or another Slavic language helpful. Open to graduate and undergraduate students. No final examination.

2 units, Win (Zalewski)

**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 sources. 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. Proseminar in Art Historical Bibliography and Library Methods—An introduction to important reference works in art and architectural history. Familiarity with this material will be encouraged through frequent assignment of relevant bibliographical problems. A working reading knowledge of French, German and Italian is assumed. Primarily for art history graduate students, although junior or senior undergraduate majors who plan to continue in art history on the graduate level may enroll with the consent of the instructor.

4 units, Win (Ross)

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)

LOTS COMPUTER

FACILITY

Director: John McCarthy
Manager: Ralph E. Gorin

OFFERINGS AND FACILITIES

The LOTS (Low Overhead Time-Sharing System) Computer Facility supports instruction and unsponsored research programs on campus. The LOTS DECsystem 2050 is located in the Center for Educational Research at Stanford (CERAS) Building. A large number of terminals located at the CERAS Building and at the Terman Engineering Center provide access to the computer.

Interactive services available include a text editor, many programming languages such as FORTRAN, BASIC, PASCAL and SAIL, and Statistical Packages, e.g., SPSS, BMDP, MINITAB.

The staff of LOTS will provide limited advice on program development and system features for users of the computer. However, it is expected that users will do all their own programming and make necessary adaptions of available programs for their particular application.

Short courses on the use of major programming languages and utilities are offered each quarter by the LOTS staff. A schedule of the courses for each quarter is available from the LOTS office (CERAS Building, Room 105). Requests for information should be directed to the LOTS Manager's office, (extension 7-3214).

COURSES

All courses (DR:X). No registration required.

2. Getting Started at LOTS, Part I—A practical orientation designed for users who are familiar with computing concepts but who need a guide to the use of the LOTS facility. This one hour course includes information about obtaining accounts, an introduction to the file system, and a demonstration of the use of the editor to create and run a program.

0 units, Aut, Win, Spr, Sum

2. Getting Started at LOTS, Part II—A continuation of Part I. Covers advanced editor features. The course lasts one hour.

0 units, Aut, Win, Spr, Sum

10. An Introduction to FORTRAN—This course assumes that the student knows FORTRAN already and discusses the particular features of FORTRAN available at LOTS. Persons not already familiar with FORTRAN should consider taking the course Introduction to FORTRAN offered by the Stanford Center for Information Processing (SCIP), or Computer Science 103.

0 units, Aut, Win, Spr

11. Introduction to PASCAL—A one hour session dealing with the characteristics of PASCAL at LOTS. PASCAL is an ALGOL-like language gaining in popularity due to its clarity, simplicity and powerful data-structure manipulation and type definition facilities. Familiarity with some programming language is assumed.

0 units, Aut, Win, Spr

12. SPSS—A one hour orientation session designed for persons who are familiar with SPSS at some other computer facility. The version used at LOTS is similar to the version presently used at SCIP. If you are not already familiar with SPSS, the Stanford Center for Information Processing (SCIP) offers a course each quarter. No previous computer experience is required, but a knowledge of elementary statistics is necessary.

0 units, Aut, Win, Spr

13. SAIL—(an ALGOL-like language.) Introduces the student to the specifics of using SAIL at LOTS. Covers control structures, declarations, procedures, and input/output facilities. This one session course lasts one hour. Familiarity with an ALGOL-style language is assumed.

0 units, Aut, Win, Spr
20. PLOTTING—Introduces the student to the plotting software available for use with the Printronix Printer.

0 units, by arrangement

PROGRAM IN MATHEMATICAL SCIENCES

Committee in Charge: John M. Steele (Statistics), Chairman; Paul W. Berg (Mathematics), B. Curtis Eaves (Operations Research), John G. Herriot (Computer Science)

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 44, or equivalent; Advanced Calculus (101); Linear Algebra (113) or Linear Algebra and Its Applications (113S); Fundamental Concepts of Analysis (115); Modern Algebra (120); Differential Equations (130).

2. Computer Science (9 units); Introduction to Computing (105 or 106); Numerical Analysis (137A,B).

3. Operations Research (7-9 units); Introduction to Operations Research (151,153); or Linear Programming (240) and Models in Operations Research (250,251).

4. Statistics (12 units): Theory of Probability (116 or 116E); Statistical Inference (119, 120).

5. Electives (12 units): Four 100-level courses in the Mathematical Sciences of which two must be chosen from Mathematics 114, or Mathematics 114S; Mathematics 116, Computer Science 111, Computer Science 155 (or Computer Science 150 or Operations Research 245), Statistics 217. The choice of electives will be determined by the student's interest. In particular, students planning doctoral study in Operations Research are advised to take Mathematics 114 (or 114S) and 116.

All courses used to fulfill the major requirement must be taken for a letter grade, with the exception of courses offered Pass/No Credit only. The student must have an average grade of C or better in all course work used to fulfill the major requirement.

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 wave propagation and wave-particle interactions 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 Radioscience Laboratory (ionospheric and magnetospheric structure and radio properties); the Radio Astronomy Institute (the sun and other radio sources); the Center for Radar Astronomy (planetary surfaces and atmospheres, in-
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 Physics, Electrical Engineering, Geophysics, and Mechanical Engineering, 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 Physics, Electrical Engineering, Geophysics, and Mechanical Engineering 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.

**COURSES**

For (DR) notations, look under the respective department.

15. **The Nature of the Universe**—(Enroll in Applied Physics 15.)
   3 units, Aut (Petrosian), Spr (Stern) MWF 11

25. **Extraterrestrial Intelligent Life**—(Enroll in Applied Physics 25.)
   3 units, Win (Sturrock) TTh 2:15-3:30

   3 units, Aut (Underwood) MWF 1:15-2:05

102A,B,C. **Astronomy Laboratory and Observational Astronomy**—(Enroll in Astronomy 102A,B,C.)
   102A. 3 units, Aut (Knight) lecture M 4:15, laboratory by arrangement
   102B. 3 units, Win (Stern) lecture T 4:15, laboratory by arrangement
   102C. 3 units, Spr (Staff) lecture T 4:15, laboratory by arrangement

103. **Stellar and Galactic Astrophysics**—(Enroll in Applied Physics 103.)
   3 units, Win (Liang) TTh 2:15-3:30

105. **Extragalactic Astrophysics and Cosmology**—(Enroll in Applied Physics 105.)
   3 units, Spr (Petrosian) TTh 2:15-3:30

132. **Optical Methods in Engineering Science**—(Enroll in Aeronautics and Astronautics 132.)
   3 units, Aut (Bershader) alternate years, given 1978–79

150A,C. **Advanced Astronomy Laboratory**—(Enroll in Astronomy 150A,C.)
   150A. 3 units, Aut (Walker) lecture T 4:15 laboratory by arrangement
   150C. 3 units, Spr (Walker) lecture T 4:15 laboratory by arrangement

   3 units, Spr (Walker) by arrangement

211. **Physical Gas Dynamics**—(Enroll in Mechanical Engineering 262A.)
   3 units, Aut (Staff) MWF 10:00

227. **Atmospheric and Space Physics**—(Enroll in Aeronautics and Astronautics 227.)
   3 units, Aut (Spreiter) TTh 2:45-4:00, alternate years, given 1979–80

260. **Geophysical Fluid Dynamics**—(Enroll in Mechanical Engineering 260.)
   3 units, Aut (Spreiter) TTh 2:45-4:00, alternate years, given 1978–79

279A. **Space Mechanics**—(Enroll in Aeronautics and Astronautics 279A.)
   3 units, Win (Powell) TTh 9:30-10:45

279B. **Advanced Space Mechanics**—(Enroll in Aeronautics and Astronautics 279B.)
   3 units, Spr (Breakwell) MWF 10, alternate years, given 1979–79

348. **Ionospheric Processes**—(Enroll in Electrical Engineering 348.)
   3 units, Spr (Waterman) alternate years, given 1979–80

350. **Radioscience Seminar**—(Enroll in Electrical Engineering 350.)
   1 unit, Aut, Win (Lusignan) by arrangement
352. Wave Propagation in the Ionosphere and Magnetosphere—(Enroll in Electrical Engineering 352.)
   3 units, Spr (Helliwell) alternate years, given 1978–79
354. Theory and Application of Radio Wave Scattering—(Enroll in Electrical Engineering 354.)
   3 units, Spr (Tyler) by arrangement, alternate years, given 1979–80
356A. Astrophysics Laboratory I—(Enroll in Applied Physics 356A.)
   3 units, Sum (Walker) M 9-12 plus laboratory by arrangement
356B. Astrophysics Laboratory II—(Enroll in Applied Physics 356B.)
   3 units, Sum (Walker) T 9-12 plus laboratory by arrangement
360. The Sun and Solar-Terrestrial Relations—(Enroll in Applied Physics 360.)
   3 units, Aut (Sturrock) TTh 2:30 alternate years, given 1978–79
   3 units Win, (Petrosian) MWF 11:00, alternate years, given 1978–79
364. Plasma Astrophysics—(Enroll in Applied Physics 364.)
   3 units, Spr (Sturrock) alternate years, given 1979–80
365. Physical Processes in the Galaxy—(Enroll in Applied Physics 365.)
   3 units, Spr (Staff) TTh 2:15-3:30 alternate years, given 1978–79
   3 units, Aut (Stern) by arrangement

STANFORD CENTER FOR INFORMATION PROCESSING

Director: Charles R. Dickens
Deputy Director: Michael M. Roberts
Associate Directors: Wayne D. Bartlett, Cedric S. Bennett, Edgar S. Williams, William H. Yundt
Assistant Directors: Jon C. Sandelin, Gerald P. Weitz, Joseph W. Wells, Jr.

The Stanford Center for Information Processing (SCIP) is comprised of three major groups: The Campus Facility provides computing services to University faculty, staff and students for their research and course work. The Administrative Data Processing Group provides design and programming services for production programs of the University administration and Hospital. The SLAC Facility supports the high energy physics research program at the Linear Accelerator Center.

CAMPUS FACILITY SERVICES

SCIP's Campus Facility offers the following computing services to the University faculty, staff and student community: text editing (WYLBUR) and formatting (SCRIPT) programs to aid in preparing reports, theses, letters, manuscripts, data, etc.; several modes of batch processing including extensive facilities for submitting and retrieving results from jobs using terminals; interactive use of the computer through the ORVYL timesharing system; and online information collection and retrieval with SPIRES.

A comprehensive library of analysis programs and statistical routines is maintained to assist users in solving their data processing problems. Extensive data files are also available on a variety of subjects. Programming languages for use in interactive or batch mode include APL, ALGOL, BASIC, COBOL, FORTRAN, PL360, PL/I, SNOBOL, SORT, and SPIRES. Many other software packages that run under the IBM VS operating system are also available.

Campus services are provided through an IBM 370/168 computer located in Encina Hall. Pine Hall houses a remote processing station offering services to the campus community and terminals to utilize this system are located throughout the campus.

The staff of the Campus Facility will provide advice on program development and problem solving to present and potential users of the computer; however, users are expected to do their own programming and make use of the Consulting, Documentation, and Education services available to learn efficient use of the system.

The courses and seminars described below (and new ones that are developed each quarter) are offered to help new users learn to use the computer independently. The courses are non-credit but do require registration at Pine Hall. Some are orientation seminars to introduce you to the computer center. Others are beginning-level courses in the use of the computer for functions such as text editing, information retrieval, plotting, or statistical analysis. Others are more advanced seminars. Detailed descriptions of course offerings are published each
quarter by SCIP in a special flyer. Contact the Campus Facility Document Sales Office (Pine Hall, ext. 7-4877) to receive a copy of the flyer.

Research assistantships are available for graduate students and part-time work is sometimes available for undergraduates. Inquiries should be addressed to Director, Campus Facility, SCIP, Polya Hall (ext. 7-3907).

COURSES

All courses are (DR:X)

1. Introduction to Campus Facility Computing—Designed for anyone new to computing who intends to use the IBM 370/168 for the first time. Topics covered include different kinds of computer use, defining a program, and descriptions of interactive and batch computing. Computer languages, accounts, charges and documentation are discussed. A tour of the facility is given. This one-session course is repeated several times during the first week of each quarter and lasts approximately two hours.

   0 units, Aut, Win, Spr, Sum

2. IOPROGM—This 2-hour seminar explains the use of IOPROGM, a general purpose data set utility program. Tasks discussed include copying data sets, printing, punching or dumping data sets, changing data set formats, combining data sets. Programming knowledge is not required to use the utility effectively.

   0 units, by arrangement

3. Getting Started at the Campus Facility—Practical orientation designed for users who have had programming experience but need a guide to use of the Campus Facility. Batch and interactive languages and programs, accounts, rates, job processing procedures, and use of terminals are covered. A tour of the facility is given. This one-session course, lasting approximately one and one-half hours, is repeated several times during the first week of each quarter.

   0 units, Aut, Win, Spr, Sum

4. Tapes and TLMS—Presents guidelines for using magnetic tapes with emphasis on avoiding difficulties. The Tape Library Management System (TLMS) is explained, including procedures for submitting tapes to the library. A brief overview of tape utility programs and documentation is also presented.

   0 units, by arrangement

5. BASIC—Introduces the student to the timesharing language, BASIC. For the researcher who is not a sophisticated programmer, this language is valuable in solving small day-to-day problems. In addition, BASIC’s immediate and informative responses to programming errors make it an ideal language for beginning programmers. Through extensive use of examples, the student gains 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 is essential.

   0 units, by arrangement

10. WYLBUR—Intended to familiarize students with the use of the terminal and with the text editing capabilities of WYLBUR on the IBM 370/168. Both programming and non-programming applications of WYLBUR are covered. Students learn how to use WYLBUR for creating and manipulating all kinds of text, such as computer programs, data and manuscripts. Students who plan to use WYLBUR for preparing manuscripts need no prior programming experience; those who plan to use WYLBUR for preparing programs should know a programming language. Some typing experience will be helpful.

   0 units, Aut, Win, Spr, Sum

12. Introduction to Text Formatting with SCRIPT—An introduction to SCRIPT, a program useful to WYLBUR users producing a report, proposal, thesis or other manuscript on the computer. Presentation includes page and section numbering, page headings, footnote placement, creation of a table of contents and aids to producing an index.

   0 units, by arrangement

15. Introduction to FORTRAN—Provides a practical introduction to the FORTRAN language. No previous computer experience is needed. The WATFIV compiler is used exclusively in this course. A brief comparison of other FORTRAN compilers available on the IBM 370/168 is also presented. The student learns how to input and output data under format control, create SUBROUTINE AND FUNCTION subprograms and access program library facilities. Some attention is given to the numerical problems encountered when using a digital computer, and good programming practices are emphasized. The course should prepare the student to continue independent scientific computing.

   0 units, Aut, Win, Spr, Sum

18. Introduction to PL/I—Provides 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. Previous programming experience is not required; however, knowledge of elementary algebra is essential. Students primarily interested in interactive PL/C are encouraged to take the WYLBUR course before attending this course.

   0 units, Aut, Spr
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, by arrangement

26. SPSS—Introduces 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 statements, 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 is necessary.

0 units, Aut, Win, Spr, Sum

27. Plotting—Introduces the student to the plotting package available on the 370/168. Emphasis is on line graph plotting, bar graph and free-form design plotting are discussed briefly. Students learn to use the Calcomp drum plotter and the Versatec electrostatic plotter. Since the plotting system is a system of FORTRAN callable subroutines, it is essential that students have knowledge of FORTRAN.

0 units, by arrangement

28. PL360—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 architecture is advised.

0 units, by arrangement

30. Introduction to SPIRES—This course introduces 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 online SPIRES processor is also discussed. Students need no prior programming experience, but are expected to be familiar with common WYLBUR commands.

0 units, Aut, Win, Spr, Sum

31. SPIRES File Definition—Covers the file definition capabilities of the Stanford Public Information Retrieval System. Students learn how to describe file structures in SPIRES, to create SPIRES subfiles, to specify access or update restrictions for groups of file users, and to use SPIRES processing rules to describe input and file searching. 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, by arrangement

33. JCL and Data Management—Introduces the experienced programmer to the Job Control Language for OS/VS, and explains the job, execute and data definition statements in detail. Data management techniques; efficient use of disk and tape storage; and use of data set utilities are all included as topics in the course. Knowledge of a programming language and experience in using it are essential for students taking this course.

0 units, Aut, Win, Spr, Sum

34. Using the Linkage Editor and Loader—Covers Job Control Language as it applies to the creation and editing of load modules using the linkage editor and loader. The comparative use of these programs is discussed using FORTRAN examples. Extensive knowledge of, and experience with, a programming language are essential for students attending this course. The JCL and Data Management course, or knowledge of the job, execute and data definition statements, is strongly recommended.

0 units, by arrangement

35. APL—Introduces the APL language, an interactive mathematical language with powerful functions and concepts. Students learn to write their own programs as well as access a library of public programs. Prior programming knowledge is not required, but familiarity with high school level algebra is helpful.

0 units, Aut, Spr

37. SPIRES Data Base Management—A seminar intended for SPIRES file managers and those doing specialized searching and updating of data base files. Particular facilities of SPIRES discussed include SPIBILD, Global FOR and partial processing.

0 units, Aut, Spr
STANFORD LINEAR ACCELERATOR CENTER

Director: Wolfgang K. H. Panofsky
Deputy Director: Sidney D. Drell
Associate Directors: Joseph Ballam (Research Division), Richard B. Neal (Technical Division), Eugene B. Rickansrud (Business Services Division)


Associate Professors: Elliott Bloom, Roy Schwitters


Assistant Professor: David Hitlin

The Stanford Linear Accelerator Center (SLAC) is devoted to experimental and theoretical research in elementary particle physics and the development of new techniques in high energy accelerators and elementary particle detectors. The Center is located on 490 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 Department of Energy.

The two-mile long linear accelerator, which began operations for physics research during 1966, can provide an electron beam at energies up to 22 GeV and at beam intensities up to 30 microamperes average current. Positrons can also be accelerated to a maximum energy of about 14 GeV, at average beam currents up to about one microamperc. 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 GeV/c; a 40-inch diameter, cylindrical bubble chamber which operates in a hybrid mode with triggering counters; a streamer chamber operation in an 80" pole diameter magnet; and a large volume magnet with pole diameter of 54" which is used in spark chamber experiments. A large aperture superconducting solenoid (LASS) system has recently begun a study of multihadron events. An electron-positron storage ring facility (SPEAR) is engaged in a full research program with colliding beams each of 3.7 GeV energy. The SPEAR facility was used in the discovery of the psi particle for which the 1976 Nobel Prize in physics was awarded. Construction is underway on PEP, the Positron-Electron Project, a facility, designed to expand the field of investigation which has been opened by SPEAR. This is one of the major enterprises for high energy physics in the United States and is being managed jointly by SLAC and the University of California, Lawrence Berkeley Laboratory. The electron positron ring will allow interactions to be studied up to energies of 18 GeV in each beam when it becomes operational in 1980.

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 1978, 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 additions, the faculty offers lecture series on various aspects of high energy physics, and conducts seminars on topics of current interest. The SLAC Summer Institute on Particle Physics is an annual meeting which combines pedagogic lectures with a critical review of recent progress in high energy physics.

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 indi-
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.

STANFORD OVERSEAS STUDIES

Stanford Overseas Studies Programs offer a variety of overseas study opportunities to Stanford undergraduate and graduate students. General studies programs in Austria, Britain, France, Germany, and Italy provide courses for undergraduates in the history, politics, literature, art, and economics of each country. Programs in Germany, France, and Spain afford advanced undergraduates a chance to study in foreign universities. Graduate students can use the centers as a base for advanced research.

Students in Berlin, Tours, and Vienna live in student dorms and apartments and generally take courses specifically organized for Stanford students. Students with a strong language background can take courses at local universities in Berlin, Vienna and Tours. In Florence and at Cliveden, near London, students live in a residential center and take courses designed for Stanford students. In Bonn, Paris, and Salamanca, students are regularly enrolled in local universities and live in dorms and apartments.

Stanford Overseas Studies also administers and/or participates in programs in Lima, Peru; Nairobi, Kenya; and Rome, Italy. Specific information about these programs should be obtained directly from the Overseas Studies Office.

All regularly enrolled Stanford students are eligible to attend an Overseas Studies Center. Language and preparatory course requirements vary for each center, however. In general, students can study overseas for one, two, or three quarters. Tuition overseas is the same each quarter as on the home campus and the overseas fee closely approximates the quarterly room and board fees on the home campus.

All courses taken overseas receive regular University credit. Courses taken at an overseas studies center will satisfy Distribution Requirements according to the "DR:" designation. Overseas courses do not automatically receive major credit in departments on the home campus. More information about departmental credit for overseas courses can be obtained at the Overseas Studies Office and at individual departmental offices.

Application deadlines for all centers (except Bonn, Paris, and Salamanca) are:

To begin Winter Quarter, 1978–79
June 2, 1978

To begin Spring Quarter, 1978–9
December 1, 1978

To begin Summer Quarter, 1978–79
March 9, 1979

To begin Autumn Quarter, 1979–80
March 9, 1979

To begin Winter Quarter, 1979–80
June 1, 1979

Application deadlines for Bonn, Paris, and Salamanca will be late in Winter Quarter, 1978–79. For more information about offerings, requirements, fees, and application deadlines, see the publication Stanford Overseas Studies, 1978–79 or the appropriate program folder, both available in the Overseas Studies Office, room 112, Old Union.

More detailed information about courses described below can be found in the Stanford Overseas Studies Course Abstracts. Courses are not listed for Bonn, Paris, or Salamanca since students will choose from among the courses offered at the University in which they are enrolled.

STANFORD PROGRAM IN BERLIN

Academic and administrative personnel:
Kurt Mueller-Vollmer, Director—Winter Quarter
Mark Mancall, Director—Spring Quarter
Gregory Mico, Language Program Coordinator and Resident Fellow
Hannelore Noack, Secretary
Gerbard Huber
Franz Neckenig

Berlin: Its History, Politics and Culture—Interdisciplinary approach will emphasize the historical, political and cultural development of Berlin in the last Century. (DR:S)

5 units, Win (Staff)

Social and Cultural Life in the German Democratic Republic—Will investigate the influence of the Communist Party in theory and practice on social and cultural development of Berlin in the last Century. (DR:A)

4 units, Win (Neckenig)

Marxisms and Socialisms—Examination of the dissimilarities and similarities among socialisms as they have developed at different times in different parts of the world. Marx's thought and the thought of some of his interpreters, including their views on such topics as art and aesthetics, law and politics, will receive special attention. (DR:S)

5 units, Spr (Mancall)
Berlin: The International Vortex—Analysis of international relations between socialist and non-socialist societies will highlight domestic sources of foreign policy and the influence of social theory and institutions on foreign policy. (DR:S)
- 5 units, Spr (Mancall)

Social Structure of the Federal Republic and the GDR—Comparative study of the two social systems will involve both an empirical analysis of social structure and consideration of the images (official and popular) that each society seeks to project. (DR:S)
- 5 units, Spr (Huber)

German Intellectual Life and Culture—Study of major cultural and literary movements from the Enlightenment and Romanticism to the time of the Weimar Republic. (DR:A)
- 5 units, Win (Mueller-Vottmer)

German Art and Social Reality in Berlin—Introduction to German art through representative examples of architecture, painting and sculpture will make reference to the dialectical relationship between the work of art and political and economic developments in German society. (Both courses can be taken independently.)
- German Art and Social Reality in Berlin, 1648-1871. (DR:A)
  - 4 units, Win (Neckenig)
- German Art and Social Reality in Berlin, 1871-1945. (DR:A)
  - 4 units, Spr (Neckenig)

German Thought from Lessing to Nietzsche—Concentration on the major works by Lessing, Schiller, Goethe, Heine, Marx and Nietzsche; will also provide students with an introduction to the main issues and problems of the period. (DR:H)
- 5 units, Win (Mico)

The Theatre as a Cultural and Social Institution—Plays and productions of the German theatre will be discussed in their historical, literary and socio-political context. Attendance at theatrical productions from the classical and modern repertory in both East and West Berlin will be part of the course. (DR:H)
- 4 units, Win (Mueller-Vollmer)

The Modern German Novel—This course will deal with novels by Mann, Kafka, Döblin, Grass and Frisch. (DR:H)
- 4 units, Spr (Mico)

GERMAN LANGUAGE PROGRAM

Intensive German—Grammar, composition, and conversation will be covered in a course designed to increase students' fluency in German language as rapidly as possible and to help them take advantage of the many opportunities in Berlin. (DR:X)
- 8 units, Win, Spr (Staff)

Intermediate German—A course designed for students who wish to improve their knowledge of the German language and begin reading texts from such areas as history, literature, politics, and economics. (DR:H)
- 5 units, Win, Spr (Staff)

Advanced German—This course is for advanced students who wish to expand their knowledge of the German language and to become more familiar with the finer points of German grammar and style. (DR:H)
- 5 units, Win, Spr (Staff)

Contemporary Berlin: Newspaper Reading—A conversation course using newspaper articles as a basis for the discussion of current events. Vocabulary will be expanded in the fields of politics, economics, sports, and the arts. (DR:H)
- 3 units, Win, Spr (Staff)

STANFORD PROGRAM IN BRITAIN

Academic and administrative personnel:
George A.B. Docker, Director
Pamela Murray, Domestic Bursar
Constance Richmond, Academic Secretary
Felix Aprahamian
Barry Axford
John Burnett
Paul Cheshire
Nicholas Crafts
Graham Crampton
Loraine Fletcher
Larry Friedlander
Christopher Game
Charles Harrison
Michael Hurst
Catherine Ing
Robert Keohane
Gerald Meier
Annette Morgan
Michael Neve
Rodney Shewan
Geoffrey Tyack
V. C. D. Vowles
Colin Wakefield
John Wood

141-143. The following three courses are part of the British history series offered at Cliveden. Students who have little knowledge of British history are strongly encouraged to take one or more of them.

141. The Foundations of Modern Britain, 1485-1715—This course concentrates on the more important constitutional, political, and
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economic changes between the 16th and 18th centuries which helped to shape and determine developments in subsequent times. The course will be concerned with issues, rather than events or persons. (DR:S)

5 units, Aut (Burnett)

142. British History, 1715-1850—A study of the evolution of modern British society, politics, and popular attitudes under the impact of the Industrial Revolution. (DR:S)

5 units, Win (Tyack)

143. British History, 1850-1945—This course will show how present day British society began to emerge in a period when Britain's world-wide supremacy was successfully challenged and her political role drastically changed as a result of two major wars and the rise and decline of an empire. (DR:S)

5 units, Spr (Tyack)

245. History of London—The course will set out to analyze the factors which have contributed to the growth and development of London from its earliest days up to the present. Field trips will be an integral part of the course. (DR:S)

5 units, Aut (Tyack)

129. A History of Science—A general survey of the history of science and the methods used to describe it; will look at the relation between science and religion and concentrate on Aristotelianism; Renaissance ideas such as Neoplatonism; the work of William Harvey; Rene Descartes and mechanical philosophy; life sciences and the arguments for a designed world; and Darwinism. (DR:C)

5 units, Aut (Neve)

247. Art and Society in 19th Century Britain—The aim of the course is to show how knowledge of art of the period can increase understanding of social change in 19th century Britain and to explore how historical factors influenced the type of art and architecture that was produced at that time. (DR:A)

5 units, Aut (Tyack)

248. City and Country in 19th Century Britain—The contrasts between life styles in industrialized urban centers and agricultural rural areas that became evident during the 19th century will be examined through a study of novels, autobiographies and works of social comment that will be discussed in the light of social and economic history. (DR:S)

5 units, Spr (Tyack)

110. Modern British Government and Politics—Introduction to the major political and administrative institutions of British government and how they work will include analysis of the ways in which these institutions have adapted to recent governmental and administrative reforms. (DR:S)

5 units, Aut (Game)

249. Nationalism in the British Isles—The course will trace the growth of Irish, Scottish and Welsh nationalism from the Middle Ages to the present featuring the ideology of nationalism, and the political institutions, language and culture, economic problems, and the impact of supra-national bodies like the E.E.C. (DR:S)

5 units, Win (Hurst)

137. International Relations and the E.E.C.—An overview of the changing perceptions and policies of Britain in the context of Europe between 1945 and 1978 will be followed by an analysis of the political organization of the European community and its relations with the superpowers and the developing world. (DR:S)

5 units, Spr (Morgan)

125. Race Relations and Politics in Britain—A study of the relationships between ethnic minorities and formal political institutions in Britain. (DR:S)

5 units, Spr (Axford)

139. Constitutional Law and English Legal Systems—The course will cover the essential characteristics of the British Constitution; the status, composition and function of Parliament; the English legal system (sources of law, the courts, judiciary and legal profession); and civil liberties in Britain. (DR:S)

5 units, Spr (Wakefield)

117. Economy of the U.K.—Dominance to Decline, 1850-1978—Survey of the growth of the first industrial nation and reasons for its decline will also grapple with problems of capitalistic development, in general. Related developments in Germany, the U.S. and Western Europe will be considered, as well. (DR:S)

5 units, Aut, Win, (Wood)

115. European Economic Integration—A study of the problems of regional economic integration in the European Economic Community focusing on trade issues, monetary affairs, and factors of production (DR:S)

5 units  Aut (Crafts)

148. Urban Economics and Policy in Britain and the U.S.—After showing the development of the theoretical basis of urban economics, the course will consider a variety of policy issues and problems. (DR:S)

5 units, Win (Cheshire, Crampton)

104. Education in England and Wales—An outline of the organization, institutions and curricula of the educational systems in England and
Wales will be presented and the effect of social change on patterns of education will also be examined. (DR:S)

5 units, Win (Vowles)

133. Poetic Form and Language—Introduction to English poetry through a study of the growth of the main poetic forms and the vocabulary and style proper to them with emphasis upon lyric poetry. (DR:H)

5 units, Aut (Shewan)

253. The Stage 1400-1900—A survey of theatrical production in Britain, including the history of stages, audiences, scenery, theater architecture, actors and acting, and the growth of the characteristic dramatic entertainments in each major period. (DR:H)

5 units, Win (Shewan)

254. The 20th Century Stage—A continuation of The Stage, 1400-1900, tracing the significant developments in British theatre, including foreign influences, from the turn of the century to the present. (DR:H)

5 units, Win (Shewan)

232. Selected 19th Century Novels—Course will consist of close reading of selected works of such authors as Dickens, Austen, Bronte, and Thackeray. (DR:H)

5 units, Aut (Fletcher)

233. The Late 19th Century Novel: Meredith, Moore and James—Discussion of some of the classic concerns of the novel—duty, self-realization, sex roles—in the work of three authors who contributed to the development of the novel as a self-sufficient poetic form. (DR:H)

5 units, Win (Shewan)

257. Romantic Poetry—Study and discussion of the poetry of the Romantic period will include attention to criticism as well. (DR:H)

5 units, Win (Ing)

261. The Figure in the Landscape: Man, Art and Nature, 1700-1840—The course shows how the development of taste and philosophies of natural beauty were influenced by the practice of artists, the observations of travellers, and the enthusiasms of critics and amateurs. Works discussed will belong to a variety of genres and will exemplify widely differing literary conventions. (DR:H)

5 units, Spr (Shewan)

258. 19th Century Narrative Poetry—This course will explore the rich variety of narrative verse written in “the age of the novel” and the changing role of the poet as sage, seer, autobiographer, satirist, and tale-spinner. (DR:H)

5 units, Spr (Shewan)

182C. Shakespeare: Major Works—Discussion of major works of Shakespeare will include the general development of his dramaturgy, nature of the theatre, history of performance, and criticism. Students will attend Shakespearean and other appropriate productions and will do some scenes in class. (DR:H)

5 units, Spr (Friedlander)

181E. Seminar in British Performing Arts—All students will attend plays, ballet, and opera in London, and depending on the resources available, one or more productions may be mounted at Cliveden. Class will read some modern plays, discuss performance as an art, and learn about performance techniques and styles. (DR:H)

5 units, Spr (Friedlander)

123. Church Architecture—Examination and analysis of architectural development of cathedrals, abbeys, and parish churches in England from the Dark Ages to the 19th Century will be accompanied by discussion of the social and theological context in which architectural change took place. Links between English and Continental architecture will be traced. Many churches will be visited. (DR:H)

4 units, Win (Tyack)

5. English Music from Elgar to Britten—Introduction to the basic elements of music and to the principal English composers in the first half of the 20th century will include Elgar, Delius, Vaughan Williams, Holst, Walton, and Britten. (DR:H)

3 units, Win (Aprahamian)

124. British Art Since World War II—Major figures such as Nicholson, Moore, Bacon, and Caro, the development of both figurative and abstract painting in relation to continental and American influences, recent developments in sculpture, and contemporary movements such as conceptual art. (DR:H)

4 units, Spr (Harrison)

Focus Program: The Political Economy of the New Europe

The focus program, The Political Economy of the New Europe, designed by Gerald M. Meier, Professor of International Economics at Stanford, intends to relate issues in international politics and economics to the context of “the new Europe.” The topics to be examined may range from problems of international monetary policy to social policy and socio-legal problems being faced by the European community in the 1970’s and 1980’s. Although primary emphasis will be on the economic and political problems of integration within Europe, these problems will also be studied in relation to the United States, Japan and the less developed countries.
The interdisciplinary nature of this program makes it germane to the studies of those majoring in political science, economics, international relations, and history, and to the professional training of those studying business and law. Prerequisites to participating in the focus program are Economics 1 and International Relations 35. Economics 165 or Economics 168 is recommended and preference may be given to students who have taken one of these courses. Deadline for applying for Summer Quarter, 1979, is March 9, 1979.

All students in the program will be required to enroll in the core lecture course, "The New Europe and New Issues in International Political Economy" and in one of two required seminars, either "The Economics of International Politics," or "The Politics of International Economics." Additional seminars will be offered as electives.

The New Europe and New Issues in International Political Economy—This course will cover a variety of issues associated with international integration. Guest lecturers will present special topics. (DR:S)

4 units, Sum (Meier, Staff)

The Economics of International Politics (DR:S)
4 units, Sum (Staff)

The Politics of International Economics (DR:S)
4 units, Sum (Staff)

STANFORD PROGRAM IN FLORENCE

Academic and administrative personnel:
Giuseppe Mammarella, Director
Carla Lekai, Assistant Director
Joan M. Mammarella, Language Program Coordinator
Lucia Benini
Ronald Bracewell
Franca Celli
Napoleone Colajanni
Robert D'Alimonte
Guelfo Frulla
Umberto Giovine
Paola Gori
Sergio Moravia
Renzo Pecchioli
Larry Ryan
Giovanni Scichilone
Maria Todorow

Italian History—The following two courses deal with history in a multidimensional perspective that stresses the close interdependence of economic, social, political, and cultural aspects of each period studied. Each course can be taken independently; there are no prerequisites. Both courses are taught in Italian at the University of Florence.

111. Italian History I: Middle Ages to 1530. (DR:S)
5 units, Aut (Pecchioli)

112. Italian History II: From 1530 to 1815. (DR:S)
5 units, Win (Pecchioli)

134. Western Europe After World War II—Political history of western Europe from 1945 to the present. Special emphasis on party politics in France, West Germany, Great Britain and Italy. Socialism, Communism, and the history of the Christian Democratic Party in Germany and Italy will be the main topics of discussion. (DR:S)
5 units, Aut (G. Mammarella)

60. Problems and Issues of Italian Contemporary Politics—A close look at the Italian political system and how it functions as seen by following the day to day political events of government through the news media. Guests for lectures and discussions will be current political figures. (DR:S)
5 units, Aut, Spr (Mammarella, Giovine, D'Alimonte)

203. The Crisis of European Consciousness—The works of authors such as Nietzsche, Proust, Dostoevsky, Kafka, Mann and Musil will be studied according to three themes: "the crisis of reason," "the crisis of man," and "the crisis of 'normality.' " The ideological and cultural origin of Fascism will also be examined. (DR:A)
5 units, Aut (Moravia)

117. Italian Economic Development Since W.W. II—Beginning with an appraisal of Italy's economic conditions at the end of the thirties, this seminar will discuss the reconstruction of the Italian economy in the general context of Italy's foreign relations, and its growth starting in the mid-fifties. The following recession and stagnation will be examined with special emphasis on the government's economic policy, and the positions of labor and political parties. (DR:S)
3 units, Aut (Colajanni)

119. The Italian Communist Party: Its History and Politics—A study of Italian Communist Party (PCI) policies from its origins to the present. The policies of the PCI will be compared to those of the International Communist Party and the original writings of Marx. The ideological development of the PCI during and after Fascism will also be studied. (DR:S)
5 units, Win (G. Mammarella)

15. Topics in Modern Astronomy—This course is intended to familiarize undergraduates, with or without scientific background, with the struc-
ture, 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 astron-
omy such as quasars, X-ray sources and pul-
sars will also be discussed. (DR:T)

3 units, Win (Bracewell)

Tutoring in Technical Subjects—To be ar-
ranged with Professor Bracewell.
Units to be arranged,
Win, Spr (Bracewell)

122T. Ideas and Technology in Western
Culture—Seminar examining historical litera-
ture regarding technology will attempt to relate
the intellectual underpinnings of technology
that developed during the Renaissance to the
broader history of ideas in Western society.
Specific topics include the origins of mechanis-
tic philosophy, the relationship of technology to
religious, political and economic ideas, the
growth of rational technology, and the historical
relationship of technology and science. (DR:B)

4 units, Spr (Bracewell)

180. Mediterranean Problems—After briefly
reviewing the historical background, students
will concentrate on developments in the
Mediterranean area between World Wars I and
II (particularly the partitioning of the Ottoman
Empire), the Cold War, and the more recent
problems associated with the Arab-Israeli
conflict. (DR:S)

5 units, Win (Giovine)

115. Renaissance Florence—A study of
Florentine civilization from Dante to
Machiavelli, including intellectual and political
history. Students visit important Florentine
sites of the Renaissance. Taught in Italian.
(DR:A)

5 units, Win (Frulla)

125. Art and Culture of the Greek World—A
discussion of the generally agreed upon se-
quences of "periods" in Greek Art between the
11th and 2nd centuries B.C. based on historical,
literary and archaeological evidence. (DR:H)

4 units, Aut, Spr (Scichilone)

126. Etruscan and Roman Culture and Art—
Introduction to the most important native cul-
tures of ancient Italy as interpreted by ar-
chaeological evidence and the study of art and
artistic trends. (DR:H)

4 units, Win (Scichilone)

121. Tuscan Art from Giotto to Leonardo—A
chronological analysis of the stylistic develop-
ment of Tuscan art from the 13th to 15th cen-
turies, including study of such masters as
Giotto, Donatello, Botticelli, and Leonardo.
(DR:H)

4 units, Aut (Todorow)

122. The High Renaissance and Mannerism in
Florence, Rome, and Venice—A study of the
stylistic trends, iconography, and social history
of Italian art, concentrating on Michelangelo
and Raphael but including such artists as Bron-
zino, Vasari, Titian, Tintoretto, and Caravaggio.
Particular emphasis will be given to the classical
influence on the artists studied. (DR:H)

4 units, Win (Todorow)

5. Italian Opera—An historical and aesthetic
introduction to some of the best Italian operas,
including Monteverdi's Orfeo, Mozart's Don
Giovanni, and Rossini's Barberie di Siviglia.
Taught in Italian. (DR:H)

4 units, Spr (Frulla)

109A. Italian Renaissance Society and Cul-
ture—A study of the flowering of arts and letters
beginning with Dante and concluding with
Machiavelli with attention to various writers in
between. (DR:H)

5 units, Spr (Ryan)

183G. Literary Translation—Study of com-
parative translations into English of works by
Dante, Petrarch, and other Italian authors; and
of translations into Italian of works by Shake-
speare and modern American authors. (DR:H)

5 units, Spr (Ryan)

Survey of Italian Literature—The following
three courses constitute an Italian literature
series offered partially in English and partially
in Italian. Each course can be taken indepen-
dently and there are no prerequisites.

110A. Masterpieces of Italian Literature, I:
From the Origins Through Dante. (DR:H)

4-5 units, Aut (J. Mammarella)

110B. Masterpieces of Italian Literature, II:
1300-1500. (DR:H)

4-5 units, Win (J. Mammarella)

110C. Masterpieces of Italian Literature, III:
1800-1900. (DR:H)

4-5 units, Spr (J. Mammarella)

THE ITALIAN LANGUAGE PROGRAM

70,80,90. Intensive Italian—Grammar, con-
versation and composition for 10 hours per
week. Students enroll in Intensive Italian at the
appropriate level during their first quarter in
Florence (DR:X)

6 units, Aut, Win, Spr (J. Mammarella, Celli,
Benini, Gori)

Italian Language Continuation Courses—
Grammar, conversation, and composition are
presented in the context of a literary or social
issues theme. Students enroll in Language Con-
tinuation at the appropriate level during their
second and third quarters in Florence. (DR:H)

5 units, Aut, Win, Spr (J. Mammarella, Celli,
Benini, Gori)
Language Seminars—For advanced language students, these seminars include “La Storia” by Elsa Morante, The Italian Novel Through the Centuries and Storia della Lingua Italiana. (DR:H)

3 or 4 units, Aut, Win, Spr (J. Mammarella)

STANFORD PROGRAM IN TOURS

Academic and administrative personnel:
Paul LeMoa, Director
Claude Doubinsky Assistant Director
Anne Durand, Assistant Director
Paul Bachelard
Patrick Baleynaud
Jean Noel Billard
Joelle Blot
Robert G. Cohn
Wendell Cole
Christine Deluz
Laurence Doubinsky
Jean-Marie Girard
André Gorgues
Annie Guedez
Michelle Jonaron
Guy Lebducher
Françoise Perdoux
Claude Petitfrere
Jacques Roger

135. History of French Society, 1750-1815—The impact of the French Revolution upon French society will be studied in terms of the elements of continuity and agents of disruption within the social hierarchy, demography, customs, attitudes, and ideologies of the period. (DR:S)

5 units, Win (Petitfrere)

212. Medieval History: The Touraine in the 14th and 15th Centuries—Close study of historical documents will elucidate specific topics associated with the development of Tours and the surrounding area in the late Middle Ages. (DR:S)

5 units, Spr (Deluz)

134. The Left in Modern French Politics—This course will consider the development of the “Left” from the pre-World War I years, through its divisive years, to the unity of the “Left” and its present problems. (DR:S)

5 units, Aut (Petitfrere)

115. Economic Problems in a Society in a State of Growth—An investigation of the concept of economic growth will include its definition and measurement, short term and long range consequences, relationship to inflation, and its specific expression in the French economy. (DR:S)

5 units, Aut (Leboucher)

160. History of Urbanism in France—As a survey of “urbanism” from the Middle Ages to the contemporary period, the organization of urban space in both its splendor and disarray will be analyzed in order to develop an understanding of the present problems in city development and space organization and to formulate suggestions for possible solutions. (DR:S)

5 units, Aut (Girard)

116. General and Regional Economy of France—Contemporary French economy will be studied in terms of the diverse traditions and economic activities of the various regions of the country. The economy of the Tours region will provide a special focus of attention, and French international economics will also be discussed. (DR:S)

5 units, Win (Bachelard)

124. Contemporary French Politics—Two major aspects of the French political system, political institutions under the Fifth Republic and agents of political action (such as political parties and pressure groups), will be studied. Comparisons with the American political system will be an integral part of the course. (DR:S)

5 units, Win (Gorgues)

163. The French Legal System—This course will consist of a survey and analysis of the organization and functioning of the French legal system and the fundamental principles that underlie it. (DR:S)

5 units, Spr (Baleynaud)

136. French Foreign Policy, 1945 to the Present—France’s role in, and reaction to, the international problems produced by the Cold War and the ensuing policies of détente will be the focus of this course. (DR:S)

5 units, Spr (Billard)

143. French Society Through Its Cinema, 1918-1945.—Images of French society found in films made between 1918 and 1945 will be studied along with the specific language and esthetics of the medium of cinema. (DRA)

4 units, Spr (Guedez)

253. Philosophy and Politics in Contemporary France—This course will deal with the interaction between philosophy and politics among French intellectuals of the post-war generation especially in terms of contemporary thought about Communism. (DR:A)

5 units, Spr (L. Doubinsky)

165. Philosophy of the Enlightenment—This course will generally describe 18th century European philosophy, but it will also give special attention to the relationships between metaphysics, the theory of human knowledge,
120A. French Painting in the 19th Century I: From Neo-Classicism to Corot—The study of the genealogy of the successive movements during this period and of their relation to the civilizational context will be complemented by a close “reading” of significant pictorial works. Painters studied will include David, Ingres, Delacroix, Corot, and the School of Barbizan. (DR:H)
4 units, Win (Girard)

120B. French Painting in the 19th Century II: From Realism to Impressionism—This will be a survey of the chief painters of the Realistic school and Impressionism, including Daumier, Courbet, Manet, Monet, Renoir, Cezanne, Degas and others. The evolution and revolution of styles will be stressed. (DR:H)
4 units, Spr (Girard)

110. Masters of Twentieth Century Architecture—As an introduction to the major architects and architectural styles of this century, emphasis will be placed on Wright, LeCorbusier, Mies, and Gropius and their use of new technology and new materials, and the modern concern with urban planning. (Will be taught in English.) (DR:H)
4 units, Win (Cole)

Aspects of the Avant Garde in Paris, 1914-1940—Course will be concerned with the revolutionary artistic styles and experiments centered in Paris during the early to mid-20th century in the fields of architecture, film, drama and music. (DR:H)
4 units, Win (Cole)

FRENCH LANGUAGE 
AND 
LITERATURE

70,80,90. Intensive French—This course will be offered at three different levels roughly corresponding to elementary, intermediate and advanced language abilities. Classes will cover grammar, composition and conversation but will emphasize rapid acquisition of the verbal skills necessary to use the French language in daily life. Classes meet two hours a day, five days a week. (Distribution requirement fulfillment is yet to be determined. Consult with the A.I.C.)
8 units, Aut, Win, Spr
(Blot, Jomaron, Perdoux)

127. Colloquium on Translation—A practical approach to the problems of expression in English and French and of translation from one language to the other, through examples taken mostly from contemporary sources. (Distribution requirement fulfillment is yet to be determined. Consult with A.I.C.)
4 units, Win (LeMoal)

101. French Literature I: The 17th Century—Starting with a brief introduction to Renaissance humanism, this course will consider the Age of Classicism by focussing on the work of the French moralists and some of the more important plays of Corneille, Racine and Moliere. (DR:H)
4 units, Win (Cole)

102. French Literature: 19th Century Novel—The works of Stendhal, Balzac, Flaubert and Zola will be studied in detail not only for their intrinsic literary qualities but also because, taken together, they trace the progression of realism in French fiction. (DR:H)
4 units, Win (C. Doubinsky)

180. Celine and Genet: Visions of Evil—Voyage au Bout de la Nuit, Les Bonnes, Les Negres, Le Balcon and Les Paravents will form the basis for comparing the subversive visions of the world held by Celine and Genet. (DR:H)
4 units, Win (C. Doubinsky)

123. French Language Continuation—This will be an advanced language class dealing with more sophisticated grammatical analysis, composition and explication de textes. (Distribution requirement fulfillment is yet to be determined. Consult with the A.I.C.)
4 units, Spr (Staff)

100. French Literature I: The 17th Century—Starting with a brief introduction to Renaissance humanism, this course will consider the Age of Classicism by focussing on the work of the French moralists and some of the more important plays of Corneille, Racine and Moliere. (DR:H)
4 units, Win (C. Doubinsky)

101. French Literature I: The 17th Century—Starting with a brief introduction to Renaissance humanism, this course will consider the Age of Classicism by focussing on the work of the French moralists and some of the more important plays of Corneille, Racine and Moliere. (DR:H)
4 units, Win (C. Doubinsky)

102. French Literature: 19th Century Novel—The works of Stendhal, Balzac, Flaubert and Zola will be studied in detail not only for their intrinsic literary qualities but also because, taken together, they trace the progression of realism in French fiction. (DR:H)
4 units, Win (C. Doubinsky)

180. Celine and Genet: Visions of Evil—Voyage au Bout de la Nuit, Les Bonnes, Les Negres, Le Balcon and Les Paravents will form the basis for comparing the subversive visions of the world held by Celine and Genet. (DR:H)
4 units, Win (C. Doubinsky)

123. French Language Continuation—This will be an advanced language class dealing with more sophisticated grammatical analysis, composition and explication de textes. (Distribution requirement fulfillment is yet to be determined. Consult with the A.I.C.)
4 units, Spr (Staff)
STANFORD PROGRAM IN VIENNA

Academic and administrative personnel:
Siegfried Körninger, Director
Hedwig Thimig, Associate Director
Margaret Mehrl, Language Program Coordinator
Roswitha Benesch
Eva Mahrer
Helga Maly
Otto Morgenstern
Wendelin Schmidt-Dengler
Gottfried Scholz
Johannes Skriwan
Karl Wagner

124. History of the Austrian Republic from 1918 to 1938—Coverage of the political, social and economic history of the Austrian Republic from the end of W.W.I to the take-over by Hitler will focus on the Peace Treaty of St. Germain, League of Nations, rise of Austro-Fascism, Dollfus and Mussolini, and Anschluss. (DR:S) 5 units, Aut (Skriwan)

125. Contemporary Austrian History—The development of Austria since W.W. II will be studied in light of the Allied Occupation and Quadripartite Control, economic problems and Marshall Aid, State Treaty of 1955, Austrian neutrality and foreign policy, the problem of South Tyrol, and domestic affairs. (DR:S) 5 units, Win (Skriwan)

123. Austria and Southeastern Europe from 1526 to the Present—The role of Austria in the history of Southeastern Europe will be examined from the time of the Ottoman onslaught through the Christian liberation, the two World Wars and the Soviet aftermath. (DR:S) 5 units, Spr (Mahrer)

114. Austria as a Mixed Economy—A study of the particular blend of socialist and capitalist economics aimed to create a “qualitative market economy” in Austria. 5 units, Win (Morgenstern)

165. Survey of German Language Literature—An introduction to the major authors, works, and literary movements of German language literature, from the Middle Ages to the present. (DR:H) 4 units, Aut, Spr (Wagner)

167. Austrian Literature—A survey of the major Austrian literary works of the 19th and 20th centuries. (DR:H) 4 units, Win (Körninger)

145. Drama in Austria—A survey of typical Austrian dramatic forms which reflect the social and political conditions of their times during the 19th and 20th centuries. Students will attend performances in Vienna when possible. (DR:H) 4 units, Aut (Thimig)

146. European and Austrian Theatre History—A course concentrating on theatre history—the emergence of national theatres and theatre “revolutions,” such as Goethe’s in Weimar, Stanislavski’s in Moscow, and Reinhardt’s in Berlin—and on technical aspects of the theatre, such as set designs, acting styles, and administration. (DR:H) 4 units, Win (Thimig)

101. Art and Museums in Vienna: The Middle Ages—This course will study the development of European art and architecture from the 10th through the 15th centuries. The focus will be on works of art in Viennese museums and on representative architecture of the period in Vienna. (Enrollment limited to 20 students.) (DR:H) 4 units, Aut (Benesch)

102. Art and Museums in Vienna: The 16th to 18th Centuries—A study of the development of European art and architecture from the 16th to the 18th centuries. Special emphasis will be placed on works of art in the Kunsthistorisches Museum in Vienna and on Viennese architecture of this period. (Enrollment limited to 20 students.) (DR:H) 4 units, Win (Benesch)

103. Art and Museums in Vienna: The 19th and 20th Centuries—The major focus of this course will be on Viennese and Austrian art of the last two centuries, including comparisons with the mainstreams of European art during this period. (Enrollment limited to 20 students.) (DR:H) 4 units, Spr (Benesch)

5. Classical Music in Modern Vienna—Since Vienna ranks among the leading music centers of the world, this course will primarily study works being performed in Vienna while it is offered. Although musical pieces will not be studied chronologically, the course will constitute a good survey of various periods of European music. (DR:H) 3 units, Aut, Spr (Scholz)
THE GERMAN LANGUAGE PROGRAM
Distribution requirement fulfillment by language courses should be determined by consulting with the A.I.C.

70,80,90. Intensive German—Intensive German classes in Vienna will meet four hours a day, five days a week only during the first four weeks of each quarter. Depending on the language level, students will do progressively more difficult and sophisticated exercises in the language.

6 units, Aut, Win, Spr (Mehrl, Staff)

Language Continuation Courses—During the second part of each quarter, students will choose from among the following courses.

71,81,91. Grammar Review—This course will concentrate on certain grammatical problems which are known to pose difficulties or which students wish to discuss.

3 units, Aut, Win, Spr (Mehrl, Staff)

72,82,92. Reading Literary Texts—Short stories or excerpts from longer literary works by modern German, Austrian, and Swiss writers will be used to teach sentence structure, idiomatic expressions, grammar, and vocabulary.

3 units, Aut, Win, Spr (Mehrl, Staff)

74,84,94. Reading Practical Texts—The emphasis in this course is on the comprehension of more difficult factual texts, such as those in politics, history, economics, and music.

3 units, Aut, Win, Spr (Mehrl, Staff)

75,85,95. Drama Workshop—Students will work on pronunciation and intonation in this course through acting and improvisation. They will also become familiar with various acting styles and forms of expression.

3 units, Aut, Win, Spr (Thimig)

STANFORD PROGRAM IN PARIS
Leo Weinstein, Director

STANFORD PROGRAM IN BONN
Liaison, Professor Wigbert Holle, Director, Akademisches Auslandsamt der Universität Bonn

STANFORD PROGRAM IN SALMANCA
Isabel Criado, Director

STANFORD SYNCHROTRON RADIATION LABORATORY (SSRL)
Director: A. Bieninstock
Deputy Director: H. Winick

Associate Director: R. Gould
Consulting Directors: S. Doniach, W. E. Spicer

The Stanford Synchrotron Radiation Laboratory (SSRL) is a national facility now being used by about 300 scientists for research in a variety of disciplines utilizing the intense ultraviolet and x-radiation from the Storage Ring SPEAR at the Stanford Linear Accelerator Center (SLAC). The SSRL facilities are located at SLAC which is on Sand Hill Road, two miles west of the main campus. The laboratory is funded by the National Science Foundation.

Synchrotron radiation is electromagnetic radiation emitted by relativistic charged particles curving in magnetic fields. During the operation of SPEAR for studies of the high energy reactions of electrons and positrons, the emitted synchrotron radiation extends from the infrared to x-rays of 40 or 50 keV, with intensity 1000 or more times that which is available from conventional sources. The high intensity, broad bandwidth and other properties of the radiation (natural collimation, high polarization, pulsed time structure) offer unique research opportunities in physics chemistry, materials science, biology, metallurgy, and medicine. The following are examples of research programs underway or being planned:

Studies of electron core levels and valence bands by ultraviolet and x-ray photoemission.

Structural studies of solids, liquids and gases (including biological materials such as metallo-proteins by measurement of Extended X-ray Absorption Fine Structure (EXAFS)).

Studies of the structure of cellular organelles such as muscle filaments and photo receptor membranes by x-ray diffraction.

Surface physics studies by measurement of ultraviolet reflection, absorption, and scattering.

Two beam lines are now in operation capable of serving up to nine simultaneous experiments. The laboratory has a variety of general and specialized experimental equipment including two custombuilt, high-vacuum grating monochromators, six crystal monochromators, an automated four circle goniometer, four PDP-11 computers, and several detectors including one-dimensional position sensitive systems. A major three year expansion program is under-
way that will add from five to seven new beam lines over the next three years. These beam lines will have multiple branch lines with equivalent equipment to that described above.

SSRL facilities are available to all qualified users, and in particular are available to graduate students from Stanford (and other universities) for thesis research for the Ph.D. degree, with the approval of their departments.

THE PROGRAM IN STRUCTURED LIBERAL EDUCATION

Faculty: Mark Mancall, Director (Associate Professor, History), Richard Brody (Professor, Political Science), Bernard Cohen (Professor, Sociology), N. Gregson Davis (Associate Professor, Classics), Mark Edwards (Professor, Classics), Helene Foley (Assistant Professor, Classics), John Goheen (Professor Emeritus, Philosophy), Arvin Levine (Instructor, SLE), Julius Moravcsik (Professor, Philosophy), Peter Pesic (Instructor, SLE), Jon Reider (Acting Instructor, SLE), Halsey L. Royden (Professor, Mathematics), Lawrence Ryan (Professor, English), Charles Vigland (Acting Instructor, SLE), Mason Vearian (Professor, Physics)

STATEMENT OF PURPOSE

The Program in Structured Liberal Education (SLE) is designed specifically for freshmen interested in an integrated and interdisciplinary approach to the liberal arts and sciences, emphasizing intellectual rigor and individualized contact between faculty and students. SLE has three basic purposes: to present a coherent program of instruction for the freshman year; to develop the students' ability to ask effective questions of texts, teachers, the culture, and themselves; and to develop the students' intellectual skills in logical reasoning, critical reading, expository writing, and group discussions.

SLE stresses inquiry, criticism, and a tolerance for ambiguity. Neither the faculty nor the curriculum provides "ready-to-serve" answers to the questions being dealt with; rather, they encourage a sense of intellectual challenge, student initiative and originality.

APPLICATION AND ADMISSION PROCEDURES

Students will be selected for SLE in much the same way as for Seminars for Entering Students. Interested freshmen should apply for SLE during the summer preceding the academic year in which they will enroll.

SLE is designed as a three-quarter sequence, and all students applying should be willing to make a commitment for the entire program, although a student can withdraw from the program at any time.

Correspondence regarding the program should be addressed to Program in Structured Liberal Education, Old Union, Room 112, Stanford University, Stanford, California 94305.

OFFERINGS

SLE is a demanding program which consumes approximately 60% of the average academic workload students usually carry. Each quarter deals with a separate period of Western culture in the form of a nine-unit course. Autumn Quarter concentrates on the Greeks from Homer through Aristotle; Winter Quarter focuses on the Renaissance through the Scientific Revolution; and Spring Quarter treats the modern western world. Completion of the SLE Program satisfies the Distribution Requirements and the Writing Requirement that all undergraduates must fulfill for graduation.

091. SLE: 9 units, Aut (Staff)  
   TWh 3:15 and 7

092. SLE: 9 units, Win (Staff)  
   TWh 3:15 and 7

093. SLE: 9 units, Spr (Staff)  
   TWh 3:15 and 7

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 in 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 nonengineering students. They are taken by students from diverse departments.

Engr. 1. The Engineer in Modern Society
Engr. 3. Applied Mechanics I
Engr. 10. Aeronautics and Astronautics
Engr. 50. Introductory Science of Materials
Engr. 161. Engineering Economy
Chem. E. 20. Introduction to Chemical Engineering
C.E. 40. Elementary Surveying
C.E. 130. Transportation
C.E. 133. Introduction to Urban Planning
C.E. 170. Man and His Environment
C.E. 171. Environmental Planning
I.E. 100. Organizations: Theory and Management
I.E. 133. Industrial Accounting
I.E. 141. Utilization of Computers
M.E. 30. Social Aspects of Nuclear Power
M.E. 101. Visual Thinking
M.E. 102. Design Communication Workshop
M.E. 103. Manufacturing Technology
M.E. 137. Air Pollution
M.E. 138. Noise Pollution
M.E. 139. Environmental Measurements
M.E. 180. Energy and Society

Students interested in the broader relations between human values, technology, and society should also consult the Values, Technology, and Society (VTS) section of this bulletin.

THE PROGRAM ON URBAN STUDIES
The Committee on Urban Studies: Clay Carson, Assistant Professor of History; Jarir Dajani (Committee Chairman), Associate Professor of Civil Engineering; John Mollenkopf, Program Director; Richard Muth, Professor of Economics; Nancy Tuma, Assistant Professor of Sociology; Paul Turner, Assistant Professor of Art; Sylvia Yanagisako, Assistant Professor of Anthropology

GENERAL INFORMATION
The Program on Urban Studies is an undergraduate program that brings together students, faculty members, and outside specialists who are concerned with the people and problems of urban life. The Program is sponsored by the Office of the Dean of Undergraduate Studies and stresses two basic themes: developing a critical understanding of how cities evolve and thereby shape urban life, and developing the practical and analytical tools which can help improve the quality of urban life. The Program's curricular philosophy is based on the perception that our society's core problems have increasingly become urban problems, and on the belief that only disciplinary cross-fertilization can provide an adequate grasp of the complex interaction of forces which shape the urban setting. It draws not only on the strength of the University's curriculum in these areas, but also on the expertise of outside practitioners who can bring the insights of their careers to bear on urban issues. Urban Studies offers students two important opportunities: it enables undergraduates to examine our society's core problems through a number of disciplinary lenses, and it allows them to engage these problems in a practical way.

The Program on Urban Studies has five components: introductory core courses, advanced departmental courses, adjunct Urban Studies courses, the Junior Seminar, and some form of fieldwork (internships, special projects, Honors Thesis). The courses are organized into three areas of emphasis within urban studies: social sciences/policy analysis, engineering/planning, and architecture/urban design. Students planning their program in urban studies generally begin by taking appropriate core courses, and then choose a selection of advanced departmental and adjunct courses based on each student's individual area of interest. After completion of the introductory and concentration phases of the program, the Junior Seminar provides an intensive process of synthesizing different disciplinary approaches to the city. Finally, most students will undertake some form of fieldwork; Urban Studies provides many opportunities to engage in research problems, and encourages training in research methods in preparation for the experience.

Although Urban Studies is not a degree granting program, any student may propose an individually designed major in Urban Studies. The Individually Designed Major Program is administered by the Dean's Advisory Committee, which reviews proposals that are unique and interdisciplinary in nature. See page 581 for additional information. The Committee and the staff of the Program on Urban Studies assists students in formulating an interdepartmental major in Urban Studies, which involves preparing a proposal describing a self-designed program of study, for the approval of the Committee on Individually Designed Majors. Proposals must be completed by the beginning of a student's first quarter as a senior; however please note that students contemplating a major in Urban Studies should consult John Mollenkopf, Director of the Program, well in advance of this deadline.

Guidelines for Individually Designed Majors are available at the Academic Information Center. In addition to those guidelines, students should be aware to the guidelines of the Urban Studies Program, which require students proposing individually designed majors in Urban Studies to complete a minimum of sixty
units of courses above the 100 level, including five core courses and both quarters of the Junior Seminar. The remainder of the units will consist of the student's own selection of departmental courses, Urban Studies adjunct courses, and fieldwork, comprising an elective concentration in a disciplinary or interdisciplinary area.

THE CORE COURSES

Group A:
- Anthropology 146. "Urban Problems in Anthropological Perspective."
- History 152A. "The Making of Urban America" or 152B. "U.S. Urban Social History."
- Sociology 150. "Urban Sociology."

Group B:
- Applied Earth Sciences 130 or 131 or 132. "Environmental Earth Sciences I, II, III."
- Civil Engineering 133. "Introduction to Urban Planning."
- Civil Engineering 171. "Environmental Planning."

Majors in Urban Studies must complete two or three courses from Group A, and two or three courses from Group B, for a total of five core courses.

ADJUNCT COURSES

In order to supplement departmental offerings, the Program offers seven adjunct courses a year taught by working professionals. These courses are designed to help students see how concepts and techniques can be put to practice. Topics to be considered during 1978-79 will include public service architecture, housing policy, community organizations and advocacy networks, managing local government, and aging in the city.

Descriptions and details of current adjunct courses are available prior to each quarter from the Program offices in Room 371 of the outer quad (or call 497-3452). These courses are also listed in each quarter's Time Schedule. All courses are (DR:X).

DEPARTMENTAL COURSES

The following list of suggested departmental courses has been compiled to serve as a guideline for students designing a major in Urban Studies. However, each student in conjunction with his or her advisors will select courses according to the student's own area of interest within the field of urban studies, and may choose courses that are not included in this list. Full descriptions of the courses will be found in the relevant departmental listings.

Suggested departmental courses by area of concentration:

Social Sciences/Policy Analysis:
- Anthropology 132, 146, 147, 155, 156, 168, 235
- Computer Science 101, 103, 104, 105, 106, 107
- Economics 104, 116, 117, 141, 145, 147, 148, 149, 170, 171, 249, 250
- Engineering-Economic Systems 100, 110, 214, 249
- English 128
- Food Research Institute 100
- History 152AB, 165ABC, 268, 178, 279, 281, 378
- Psychology 121, 126A, 156, 169
- Political Science 107, 101, 105, 180, 195, 203, 207
- Sociology 131, 132, 143, 150, 160, 161, 162, 163, 166, 180, 181, 182, 183
- Statistics 60, 119, 120, 152, 153, 204
- Values, Technology and Society 101, 107, 142, 150, 171

Engineering/Planning:
- Aeronautics-Astronautics 135, 242, 420AB
- Applied Earth Sciences 130, 131, 132
- Civil Engineering 130, 133, 170, 171, 173, 174, 175, 176, 221, 222, 224, 227, 229, 232, 233, 234, 235
- Industrial Engineering 100, 101, 106
- Mechanical Engineering 101, 102, 111, 115, 137, 138, 139, 180
- Operations Research 151, 152, 153, 154
- Values, Technology and Society 141, 177, 180

Architecture/Urban Design:
- Art 101, 102, 107, 112, 128D, 175AB, 176, 275, 276, 277, 278, 279
- Civil Engineering 114, 133, 144, 145, 170, 171, 176, 180, 181, 182, 190
- Human Biology 106
- Mechanical Engineering 101, 102, 111, 115, 138, 139, 180
- Values, Technology and Society 141, 180

THE JUNIOR SEMINAR

100. The City as Human Experience: Politics of U.S. Urban Development—The first quarter of the Junior Seminar systematically assesses the different forces which converged to generate American urbanization over the last 150 years. It draws materials from historical, sociological, and political economy sources to examine such topics as the urban immigrant experience, the structure of urban politics, and the evolution of urban problems and conflicts.

5 units, Win (Mollenkopf) W 2:15-4:05
101. The City as Human Experience: Theories of Urban Design/Planning—The second quarter of the Junior Seminar systematically examines the urban design ideals which have motivated deliberate attempts to guide urban development. Beginning with Ebenezer Howard and the 19th century utopian city designers, the course analyzes the design conceptions of LeCorbusier, Paul Goodman, urban renewal, Jane Jacobs, the radical futurists (Soleri, Safdie), the Venturis, advocacy planners, and the urban design practices of socialist regimes in Cuba, China, and the left local governments in Italy.

5 units, Spr (Mollenkopf) W 2:15-4:05

FIELDWORK

Urban Studies students are encouraged to participate in internships or research projects, either by initiating and designing their own, with Program support, or by taking advantage of the numerous workshop and internship opportunities in the field of urban studies that are made available by ARLO and SWOPSI. (Accreditation for ARLO projects can be arranged through Urban Studies.) Interested students should consult the Program on Urban Studies, Room 371 of the quad, or telephone 497-3452.

PROGRAM IN VALUES, TECHNOLOGY, AND SOCIETY

Chairman: Nathan Rosenberg

Administrative Committee: Barton J. Bernstein, Edwin M. Good, Stephen J. Kline, Nathan Rosenberg, Walter G. Vincenti

Professors: Raymond B. Clayton (Psychiatry), Thomas J. Connolly (Mechanical Engineering) (on leave 1978–79), Edwin M. Good (Religious Studies), Eric Hutchinson (Chemistry), Stephen J. Kline (Mechanical Engineering), Robert L. Rabin (Law), Nathan Rosenberg (Economics), Walter G. Vincenti (Aeronautics and Astronautics)

Associate Professor: Barton J. Bernstein (History)

Adjunct Professor: William R. Kincheloe (Electrical Engineering)

Assistant Professors: Winston B. Davis (Religious Studies), Paul Turner (Art)

Lecturer: Avi J. Cohen

STATEMENT OF PURPOSE

Values, Technology, and Society (VTS) studies the ways in which technology affects and is affected by human values and social institutions in the contemporary world. The Program is rooted in the assumption that technology is a pivotal force in modern society, intimately bound up with the evolving character, problems, and potentials of the world in which we live. Thus VTS believes that it is vitally important to obtain a broad understanding of technology and of its human and social implications. To this end, various VTS courses approach the study of technology from a variety of humanistic and social scientific perspectives.

OFFERINGS AND FACILITIES

Several VTS courses are designed as an integrated sequence to provide a comprehensive framework fostering a better understanding of modern society. Integrated sequences of VTS courses may be used in a variety of ways:

(a) as coherent ways of satisfying the University Distribution Requirement;
(b) as part of student-designed concentrations to the major in Humanities (Humanities Honors Program);
(c) to fulfill the Technology and Society requirement in the School of Engineering;
(d) as minors to regular departmental majors.

Many VTS courses may be applied toward the fulfillment of the Distribution Requirement in any one of the two or three areas a particular VTS course satisfies, and some fulfill School of Engineering requirements in Technology and Society. For further information on which distribution areas a given VTS course satisfies, inquire at the VTS office, Building 370, Room 372, 497-2565.

At present there is no conventional four-year major in VTS. However, a student may elect to design an interdisciplinary major in VTS, or in a VTS-related area, in consultation with Program faculty and the Academic Information Center. Samples of such student-designed majors are on file at the VTS office.

VTS courses will be particularly valuable for undergraduates planning further study in graduate professional schools (e.g., business, education, engineering, law, or medicine) as well as for students wishing to relate the more specialized knowledge of their major fields to broad, technology-related aspects of life in modern society.

ADMISSION TO PROGRAM

OFFERINGS

VTS courses are designed primarily for un-
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.

HONORS PROGRAM IN VALUES, TECHNOLOGY, AND SOCIETY

Purpose of the Program
The VTS Honors Program aims to enhance the student's understanding of the interrelations among technology, social forces, and human and cultural values with particular reference to modern and modernizing societies.

Admission to the Program
The Program is open to students majoring in any field. Interested students must indicate their intention to pursue the Honors Program to the Administrative Committee no later than autumn quarter of their junior year, but they are urged to consult with the Chairman of the Program in their freshman or sophomore years.

Requirements of the Program
1. Foundation Courses—a total of three courses from the following two groups, at least one from each group (12 units, ordinarily freshman or sophomore year):
   I. Technology and Human and Cultural Values: VTS 101 and 105.
   II. Technology and Society: VTS 106, 107, and 121.
2. Resource and Methodology Courses—one course from the following group (outside the area of the student's major if it is in engineering or earth sciences) (3-5 units, ordinarily freshman or sophomore year): VTS 142, 145, and 180.
3. Advanced Courses—two courses from the following group (8 units, ordinarily junior year): VTS 122, 123, 145, 150, 151, 165, 171, 174. 
4. Honors Project—a critical essay or investigative project on a VTS topic of general importance. The topic must be approved by the Administrative Committee (12 units: 2 units spring, junior year; 5 units autumn and 5 units winter, senior year).
5. Academic Quality—both the Honors Program and the Engineering-Economic Systems Department of the School of Engineering together offer a coterminal program leading to a simultaneous Bachelor's Degree in VTS and Master's Degree in EES in five years. This program is intended to prepare individuals for careers dealing with the analysis, planning, operation, and control of complex technological-economic systems. By focusing on the interaction of technology with other areas of human activity, the VTS Program provides a particularly suitable undergraduate foundation for work in these increasingly important aspects of public and private policy.

The course requirements for the coterminal program fall into five categories: (i) a modicum foundation in mathematics, engineering, and economics; (ii) courses from the VTS Program; (iii) a VTS project; (iv) an individually designed concentration of courses in the humanities and/or social sciences; (v) graduate professional courses in the EES Department. Since the VTS project runs through the fourth and fifth years, and graduate and undergraduate courses will normally be intermixed during these years, both degrees can be awarded only at the end of fifth year, upon completion of the entire program. The Bachelor's Degree will not be awarded under this program if the requirements for the Master's Degree have not been met. Detailed requirements, sample programs, and other information can be obtained at the VTS office in Building 370. General requirements and procedures governing coterminal Bachelor's/Master's programs can be found under "Undergraduate Degrees" at the beginning of this volume.

To complete the coterminal program in five years, the student normally begins the program early in the sophomore year. The program can be started later if the student has already fulfilled some of the required courses.

FUNDAMENTAL COURSES

105. Human Values and Technological Society—Analysis and assessment of the status of human values in contemporary Western society, factors affecting this status, and its impact on the quality of life today. Values considered include moral and aesthetic, individual and social, spiritual and material. Topics: alternate value systems in relation to notions of human excellence, identity, spirituality, labor, interaction, and attitudes to Nature; "scientism" and "reductionism"; ethical and human value aspects of specific technologies and technology-related phenomena, e.g., energy, environment, communication, the scale of life, abortion and euthanasia, genetic counseling, population control policy, and hedonic technologies. Readings from Nietzsche, Marx, Rilke, Kafka,
Thoreau, Hardin, Mishan, Terkel, and Schafer. (DR:A)
4 units, Spr (Staff)

106. Technology, Humanity, and Nature—Technology as a form of human activity shaping society. Broad concepts necessary to comprehend the interaction of technology with other elements of society; technology's relations to human functions and capacities, natural resources, and cultural constraints; technology in historical and cross-cultural perspective; modern psychosocial theories and ecological concepts as the basis of decision-making in technological society; the dynamics of change and development in modern technology; technology and current social problems and potentials. Consent of instructor. (DR:C)
4 units, Spr (Kline) TTh 10 Section
W 2:15-4:05

107. Technology and Modern Industrial Society—(Same as Economics 113.) The interrelationships between technology and the nature and form of industrial societies over the past 200 years. Technological change as a socioeconomic process illuminating the history of industrial societies. Factors influencing the rate and direction of technological change and diffusion. Implications for economic structure and the growth of large-scale organizations. The impact of these changes on modern industrial man as producer and consumer. (DR:S)
4 units, Win (Rosenberg)
TTh 2:15-4:05

ADDITIONAL COURSES

121. Technology in Society: Historical Perspectives—Origins of contemporary industrialized civilization, 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; technological influences in nineteenth-century America; significance for today. (DR:C)
4 units, Aut (Vincenti) MW L15

122. Ideas and Technology in Western Culture—Seminar examining historical literature regarding technology in order to (1) learn something of the intellectual content of technology and (2) relate this content to the broader history of ideas in Western society. Specific topics include the origins of mechanistic philosophy, the relationship of technology to religious, political, and economic ideas, the growth of rational technology, and the historical relationship of technology and science. The main task is a research paper in some area of the subject of interest to the student. Enrollment limited to 16. (DR:B)
4 units, Win (Vincenti) TTh 2:15-4:05

123. Technology in California—Research seminar examining the role of technology in the social and economic growth of California from 1850 to 1920. Each student will do an in-depth research paper, utilizing primary sources insofar as possible, on a particular area of technology of interest to the student (e.g., mining, shipping, railroads, farming, lumbering, water supply, etc.). Enrollment limited to 8. (DR:C)
5 units, Spr (Vincenti) TTh 2:15-4:05

142. Information: The Communications Revolution in Contemporary Society—The nature of the communications revolution and its impact on technological society, present and future. Fundamental concepts of communications and information theory; impact of communications technology on education (the future of books, libraries, teaching, etc.), politics, urban problems, human values (privacy, etc.); cable TV; society as an interactive organism; communications and ecology; communications and the nature of consciousness. (DR:T)
4 units, Aut (Kincheloe) MWF 1:15

145. Man, Molecules, and Society: Chemical Revolution to Biological Revolution—Development of some current problems in the relations between the chemically and biologically based sciences and society, with primary emphasis on chemical aspects. Technological, alchemical, and philosophical antecedents of chemistry in historical context. Economic and social factors in the emergence of 18th century chemistry and its institutionalization in the 19th century. Impact of pharmaceuticals, plastics, and molecular biology on 20th century values. (DR:T)
3-5 units, Win (Clayton) MWF 1:15

150. Regulation, Welfare and Public Policy—(Same as Law 150.) This course has two principle 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 practical and theoretical limitations of 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 product safety and environmental protection. In addition, the role of the courts in controlling administrative discretion will be explored. (DR:S)
4 units, Spr (Rabin) MWF 1:15
151. Politics and Culture of Science and Technology in 20th Century America—(Same as History 270.) Analysis of the social, cultural, and political issues of modern American science and technology. Focal topics include: authority and work; professionalism and ideology; technology and capitalism; the arms race and the roles of scientists and engineers; the medical profession and the meaning of progress; and the limits to growth. Enrollment limited to 15. (DR: H)

3 units, Win (Bernstein)

160. Scriptorium: Calligraphy and Illumination—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 above points are brought out by teaching the foundational and italic hands; technical and craft aspects of calligraphy and illumination will be supplemented by analysis of great manuscripts. Students will produce samples of finished calligraphy for evaluation. Limited to 20 students, preference to seniors. Available only on a pass/no credit basis. (DR: X)

3 units, Aut (Hutchinson, Minto)

T 7:30-9:30 p.m.

165. Technology and Musical Expression—Interrelations between the technology that produces means of making musical sound and the expressive ways composers have used those means in Western art music, 18th century to the present. Focus on two cases: development of the piano in the 18th and 19th century, and electronic developments in the 20th century, especially electronic music and the uses of the digital computer. (DR: B)

4 units, Spr (Good)

171. Technology and Work—(Same as Economics 114.) Seminar on the relationship between technological development and the changing nature of work. Historical and theoretical examination of: the role of technology and other social forces in structuring the work process; and the changing character of the work experience. Critical evaluation of relevant literature including Marx and Braverman. (DR: S)

4 units, Spr (Cohen) TTh 2:15-4:05

174. Secularization—(Enroll in Religious Studies 36 or 136.) The alleged decline of religion in modern industrial society, with attention to the influence of English Puritanism on the demystification of politics, the decline of magic, and the growth of science, technology, and capitalism. (DR: A)

3-5 units, Win (Davis) MWF 1:15

175A,B. Modern Architecture I, II—(Enroll in Art 175A,B.) A two-quarter course tracing developments, 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. (DR: H)

4 units, Aut, Win (Turner) MW 11:00-12:15

180. 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 of 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 nonengineering student. Prerequisites: high school physics and junior standing or consent of instructor. (DR: T)

3 units, Spr (Staff) MWF 1:15

190A,B,C. Honors Project—Project for VTS Honors students. (DR: X)

190A. Submission of Proposal—Preliminary planning and study. Project proposal to be submitted to VTS Administrative Committee by middle of spring quarter of junior year.

2 units, Spr (Staff) by arrangement

190B. Continued Study and Writing—Regular meetings with tutor. Prerequisite: 190A.

5 units, Aut (Staff) by arrangement

190C. Final Work on Project—Regular meetings with tutor; participation in honors-project seminar. Project due in final form in first week of spring quarter. Prerequisite: 190B.

5 units, Win (Staff) by arrangement

191. Project for VTS/EES Coterminal Students—Project carried out in fourth and fifth years by students in coterminal A.B./M.S. program with Engineering-Economic Systems Department. Topic must be chosen and approved in winter quarter of fourth year. Project to be carried out for total of 12 units in spring quarter of fourth year and autumn and winter quarters of fifth year. Project due in final form in first week of spring quarter of fifth year. (DR: X)

3-5 units, Spr, Aut, Win (Staff) by arrangement

195. Special Topics in Values, Technology, and Society. (DR: X)

3-5 units, Aut, Win, Spr (Staff) by arrangement
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.

**Academic Staff Handbook**—available at the Provost's Office.

**Administrative Guide**—(guide to administrative organization, policies, and procedures) inquire at News and Publications Service.

**Advisory Board Rules for the Conduct of Hearings Under the Statement on Faculty Discipline**—available at the Academic Secretary's Office.

**Aeronautics and Astronautics at Stanford**—available at the Department of Aeronautics and Astronautics.

**African Studies**—available at the Center for Research in International Studies.

**Applied Physics at Stanford**—available at Graduate Admissions Office and Department of Applied Physics.

**Articles of Organization of the Faculty**—inquire at Academic Secretary's Office.

**Astronomy and Astrophysics at Stanford, Graduate Study in**—available at Graduate Admissions Office and Astronomy Course Program 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.

**ASSU Treasurer's Handbook**—inquire at ASSU Office.

**Black Students at Stanford**—available at Admissions Office.

**Charter of the Senate of the Academic Council of the Faculty at Stanford University**—available at the Academic Secretary's Office.

**Committee on Public Events: Policy Manual**—inquire at Office of Public Events.

**Conference Planning at Stanford**—available at the Director of Housing and Food Services Office.


**Endowed Professorships at Stanford University (1976)**—limited quantity—inquire at the Office of Development.

**Energy at Stanford**—Office of School of Engineering.

**Facts: Stanford University**—available at the Office of Development.

**Faculty Handbook**—available at the Provost's Office.

**Faculty/Staff Directory**—on sale at Stanford Bookstore.

**Financial Aids Information for Entering Undergraduates**—available at Financial Aids Office.

**Financing Graduate Study at Stanford University**—available at Graduate Admissions Office.

**Founding Grant, The, with Amendments, Legislation and Court Decrees**—(limited quantity) inquire at the President's Office.

**Graduate Study for Black Students at Stanford**—available at Graduate Admissions Office.

**Graduate Study for Chicano Students at Stanford**—available at Graduate Admissions Office.

**Graduate Study for Native American Students at Stanford**—available at Graduate Admissions Office.

**Guide to Stanford University Residence Halls Food Services**—available at Food Services Office.

**Information Bulletin**—(general administrative procedures; rules governing withdrawal, leaves of absence; fee listings, etc.)—available at Registrar's Information Window.

**Information for Prospective Graduate Applicants from Other Countries**—available at Office of Foreign Graduate Admissions.

**Information for Prospective Undergraduate Applicants from Other Countries**—available at Admissions Office.

**Intercollegiate Center for Classical Studies in Rome**—(administered by Stanford) available at Overseas Studies Office.

**Interdisciplinary Undergraduate Program in International Relations**—available from the Center for Research in International Studies.

**Library guides (available at any major library):**

- The Film Catalog
- Guide to Selected Reference Materials, Stanford University Libraries
- Guides to Stanford University Libraries (a series of loose-leaf information booklets).


**Selected Facts: Stanford University Libraries**

**Native Americans at Stanford**—available at Admissions Office.

**People Should Feel Good: Stanford Health Services**—available at Cowell Student Health Center.
Stanford University admits students of either sex and any race, color, or national and ethnic origin to all the rights, privileges, programs, and activities generally accorded or made available to students at the university. It does not discriminate against students on the basis of sex, race, color, or national and ethnic origin in the administration of its educational policies, admissions policies, scholarships and loan programs, and athletic and other University-administered programs.
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