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STANFORD UNIVERSITY BULLETINS

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STANFORD MEDICAL SCHOOL  MAY
APPROACHING STANFORD  JUNE
STANFORD OVERSEAS STUDIES  AUGUST
STANFORD TODAY  AUGUST
COURSES AND DEGREES  SEPTEMBER
SCHOOL OF LAW  JANUARY
INFORMATION  FEBRUARY
SUMMER BULLETIN

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AUTUMN QUARTER, 1980

Sep. 29-30 (Mon.-Tues.) Registration
Oct. 1 (Wed.) Instruction begins
Oct. 2 (Thurs.) Conferring of Degrees
Oct. 21 (Tues.) Last day for Registration
Oct. 24 (Wed.) Last day for filing Advanced Degree Candidacy applications, A.M., M.S., M.F.A., Engineer, for April conferral
Nov. 27-30 (Thurs.-Sun.) Thanksgiving Recess (no classes)
Dec. 1 (Mon.) Last day for filing A.B., B.S., and B.A.S. applications for January conferral
Dec. 12 (Fri.) Last day for filing A.M., M.S., Engineer theses, and Ph.D. dissertations for Autumn Quarter
Dec. 15-19 (Mon.-Fri.) End-Quarter examinations

WINTER QUARTER, 1981

Jan. 5 (Mon.) Registration
Jan. 6 (Tues.) Instruction begins
Jan. 8 (Thurs.) Conferring of Degrees
Jan. 15 (Thurs.) Last day for filing Graduate Fellowship applications
Jan. 26 (Mon.) Last day for Registration
Jan. 30 (Fri.) Last day for filing Advanced Degree Candidacy applications, A.M., M.S., M.F.A., Engineer, for June conferral
Feb. 2 (Mon.) Last day for filing A.B., B.S., and B.A.S. applications for April and June conferral
Feb. 16 (Mon.) Observance of Washington’s Birthday (Holiday, no classes)
Mar 8 (Sun.) Observance of Founders’ Day
Mar 13 (Fri.) Last day for filing A.M., M.S., Engineer theses, and Ph.D. dissertations for Winter Quarter
Mar 16-20 (Mon.-Fri.) End-Quarter examinations

SPRING QUARTER, 1981

Mar 30 (Mon.) Registration
Mar 31 (Tues.) Instruction begins
Apr 2 (Thurs.) Conferring of Degrees
Apr 15 (Wed.) Last day for filing Undergraduate Scholarship applications, Matriculated Undergraduates
Apr 20 (Mon.) Last day for Registration
Apr 24 (Fri.) Last day for filing Advanced Degree Candidacy applications, A.M., M.S., M.F.A., Engineer, for September conferral
May 25 (Mon.) Observance of Memorial Day (Holiday, no classes)
June 4 (Thurs.) Last day for filing A.M., M.S., Engineer theses, and Ph.D. dissertations for Spring Quarter
June 5-10 (Fri.-Wed.) End-Quarter examinations
June 13 (Sat.) Senior Class Day
June 14 (Sun.) Commencement

SUMMER QUARTER, 1981

June 22 (Mon.) Registration
June 23 (Tues.) Instruction begins
July 4 (Sat.) Independence Day (Holiday, observed July 3, no classes)
Aug. 14-15 (Fri.-Sat.) Eight-week Term examinations
Aug. 15 (Sat.) Eight-week Term closes
Sept. 1 (Tues.) Quarter closes
Sept. 7 (Mon.) Labor Day (Holiday)

1981-82

Registration
Autumn: Sept. 28-29
Winter: Jan. 4
Spring: March 29
Summer (8-week session): June 21

Last day of Finals
Autumn: Dec. 18
Winter: Mar. 19
Spring: June 9
Summer: Aug. 14
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>HISTORY OF THE UNIVERSITY</td>
<td>6</td>
</tr>
<tr>
<td>DEGREES</td>
<td>8</td>
</tr>
<tr>
<td>Undergraduate Study at Stanford</td>
<td>8</td>
</tr>
<tr>
<td>Undergraduate Degrees</td>
<td>13</td>
</tr>
<tr>
<td>Advanced Degrees</td>
<td>14</td>
</tr>
<tr>
<td>COURSES OF INSTRUCTION</td>
<td>20</td>
</tr>
<tr>
<td>GRADUATE SCHOOL OF BUSINESS</td>
<td>21</td>
</tr>
<tr>
<td>SCHOOL OF EARTH SCIENCES</td>
<td>22</td>
</tr>
<tr>
<td>Applied Earth Sciences</td>
<td>23</td>
</tr>
<tr>
<td>Geology</td>
<td>34</td>
</tr>
<tr>
<td>Geophysics</td>
<td>44</td>
</tr>
<tr>
<td>Petroleum Engineering</td>
<td>49</td>
</tr>
<tr>
<td>SCHOOL OF EDUCATION</td>
<td>56</td>
</tr>
<tr>
<td>SCHOOL OF ENGINEERING</td>
<td>81</td>
</tr>
<tr>
<td>Aeronautics and Astronautics</td>
<td>96</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>109</td>
</tr>
<tr>
<td>Civil Engineering</td>
<td>114</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>128</td>
</tr>
<tr>
<td>Engineering-Economic Systems</td>
<td>148</td>
</tr>
<tr>
<td>Industrial Engineering and Engineering Management</td>
<td>158</td>
</tr>
<tr>
<td>Materials Science and Engineering</td>
<td>162</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>169</td>
</tr>
<tr>
<td>Operations Research</td>
<td>188</td>
</tr>
<tr>
<td>SCHOOL OF HUMANITIES AND SCIENCES</td>
<td>195</td>
</tr>
<tr>
<td>Undergraduate Program in African and Afro-American Studies</td>
<td>195</td>
</tr>
<tr>
<td>American Studies</td>
<td>199</td>
</tr>
<tr>
<td>Anthropology</td>
<td>202</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>215</td>
</tr>
<tr>
<td>Art</td>
<td>220</td>
</tr>
<tr>
<td>Asian Languages</td>
<td>232</td>
</tr>
<tr>
<td>Astronomy Course Program</td>
<td>241</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>245</td>
</tr>
<tr>
<td>Division of Marine Biology, Hopkins Marine Station</td>
<td>256</td>
</tr>
<tr>
<td>Bophysics Program</td>
<td>258</td>
</tr>
<tr>
<td>Committee on Black Performing Arts</td>
<td>259</td>
</tr>
<tr>
<td>Program in British Studies</td>
<td>260</td>
</tr>
<tr>
<td>Chemistry</td>
<td>260</td>
</tr>
<tr>
<td>Classics</td>
<td>267</td>
</tr>
<tr>
<td>Communication</td>
<td>277</td>
</tr>
<tr>
<td>Comparative Literature</td>
<td>288</td>
</tr>
<tr>
<td>Computer Science</td>
<td>294</td>
</tr>
<tr>
<td>Drama</td>
<td>308</td>
</tr>
<tr>
<td>Center for East Asian Studies</td>
<td>314</td>
</tr>
<tr>
<td>Economics</td>
<td>323</td>
</tr>
<tr>
<td>English</td>
<td>341</td>
</tr>
<tr>
<td>Food Research Institute</td>
<td>358</td>
</tr>
<tr>
<td>French and Italian</td>
<td>363</td>
</tr>
<tr>
<td>German Studies</td>
<td>374</td>
</tr>
<tr>
<td>History</td>
<td>386</td>
</tr>
<tr>
<td>Program in the History of Science</td>
<td>398</td>
</tr>
<tr>
<td>Program in Human Biology</td>
<td>399</td>
</tr>
<tr>
<td>Humanities Special Programs</td>
<td>407</td>
</tr>
<tr>
<td>Honors Program in Humanities</td>
<td>407</td>
</tr>
<tr>
<td>Master of Arts Program in Humanities</td>
<td>409</td>
</tr>
<tr>
<td>Graduate Program in Humanities</td>
<td>409</td>
</tr>
<tr>
<td>Medieval Studies</td>
<td>410</td>
</tr>
<tr>
<td>Human Language</td>
<td>413</td>
</tr>
<tr>
<td>International Relations</td>
<td>413</td>
</tr>
<tr>
<td>Language Laboratory</td>
<td>423</td>
</tr>
<tr>
<td>Center for Latin American Studies</td>
<td>423</td>
</tr>
<tr>
<td>Linguistics</td>
<td>425</td>
</tr>
<tr>
<td>English as a Foreign Language</td>
<td>433</td>
</tr>
<tr>
<td>Literature in Translation</td>
<td>434</td>
</tr>
<tr>
<td>Mathematical Sciences</td>
<td>435</td>
</tr>
<tr>
<td>Mathematics</td>
<td>436</td>
</tr>
<tr>
<td>Medical Microbiology</td>
<td>445</td>
</tr>
<tr>
<td>Modern Thought and Literature</td>
<td>445</td>
</tr>
<tr>
<td>Music</td>
<td>450</td>
</tr>
<tr>
<td>Philosophy</td>
<td>458</td>
</tr>
<tr>
<td>Physical Sciences (General Program)</td>
<td>469</td>
</tr>
<tr>
<td>Physics</td>
<td>470</td>
</tr>
<tr>
<td>Political Science</td>
<td>480</td>
</tr>
<tr>
<td>Psychology</td>
<td>493</td>
</tr>
<tr>
<td>Public Policy Program</td>
<td>505</td>
</tr>
<tr>
<td>Religious Studies</td>
<td>506</td>
</tr>
<tr>
<td>Center for Russian and East European Studies</td>
<td>512</td>
</tr>
<tr>
<td>Slavic Languages and Literatures</td>
<td>513</td>
</tr>
<tr>
<td>Social Thought and Institutions</td>
<td>520</td>
</tr>
<tr>
<td>Sociology</td>
<td>521</td>
</tr>
<tr>
<td>Spanish and Portuguese</td>
<td>535</td>
</tr>
<tr>
<td>Statistics</td>
<td>547</td>
</tr>
<tr>
<td>The Program in Structured Liberal Education</td>
<td>556</td>
</tr>
<tr>
<td>Western Culture Program</td>
<td>557</td>
</tr>
<tr>
<td>SCHOOL OF LAW</td>
<td>559</td>
</tr>
<tr>
<td>SCHOOL OF MEDICINE</td>
<td>561</td>
</tr>
<tr>
<td>Allied Medical Sciences:</td>
<td></td>
</tr>
<tr>
<td>Division of Physical Therapy</td>
<td>561</td>
</tr>
</tbody>
</table>
Biochemistry ........................................... 565
Cancer Biology Program .............................. 567
Genetics .................................................. 568
Health Services Research ............................ 569
Hearing and Speech
Sciences ................................................. 571
Medical Microbiology ................................. 573
Neurosciences Program .............................. 575
Neurobiology ............................................ 578
Pathology .................................................. 579
Pharmacology ........................................... 581
Physiology ............................................... 583
Radiology ................................................ 585
Structural Biology ..................................... 586
DEAN OF GRADUATE
STUDIES AND RESEARCH ......................... 588
Graduate Studies ...................................... 588
Chicano Fellows Program ........................... 588
Graduate Division
Special Programs ..................................... 589
Committee on Hydrology ............................ 590
Research ................................................... 591
Action Research
Liaison Office (ARLO) .............................. 591
Center for Research in
International Studies (CRIS) ................. 592
Inter-University Center for Japanese Studies
in Tokyo ............................................. 593
Inter-University Program for Chinese Language
Studies in Taipei ................................. 593
Center for Research on Women (CROW) ..... 593
Institute for Energy Studies ....................... 594
Institute for Plasma Research .................... 595
Space Sciences and Related Programs ........ 596
Stanford Synchrotron Radiation Laboratory (SSRL) .......................... 597
DEAN OF UNDERGRADUATE STUDIES
SPECIAL PROGRAMS ................................. 599
Program for Individually Designed Majors ..... 599
Program on Urban Studies ....................... 600
CONTENTS
Program in Values, Technology, and Society .... 602
Freshman-Sophomore Seminar Programs ....... 607
Extradepartmental Undergraduate Programs .... 608
Learning Assistance Center (LAC) ............... 608
Stanford Workshops on Political and Social
Issues (SWOPSI) ................................. 609
Student Center for Innovation in Research and
Education (SCIRE) .............................. 610
Undergraduate Special Programs ............... 611
LIBRARIES AND INFORMATION SERVICES .......... 612
Hoover Institution on War, Revolution and Peace .... 612
Libraries ................................................. 613
LOTS Computer Facility ........................... 615
Stanford Center for Information Technology .... 616
OTHER DEPARTMENTS, INSTITUTES,
AND PROGRAMS .................................. 619
African Studies ....................................... 619
Athletics, Physical Education, and Recreation .... 624
Stanford Linear Accelerator Center ............ 634
Stanford Overseas Studies ....................... 635
UNIVERSITY PUBLICATIONS ......................... 646
STATEMENT OF NON-DISCRIMINATORY POLICY ...... 647
APPENDIX ............................................. 648
INDEX .................................................. 653
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 8,500-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 1979-80 totaled approximately 11,865, of whom 6,635 were undergraduates and 5,230 graduates. The University awarded 4,030 degrees during 1978-79, of which 1,619 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 1979 it was 512.

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, law, and medical schools
were each ranked among the top three nationally in a 1974 survey of deans. Stanford ranks first nationally as the choice of National Science Foundation scholars.

A measure of undergraduate distinction is found in the increase in applicants. In the Fall, 1979, 11,787 students applied, of whom 2,454 were admitted and 1,557 enrolled. Stanford ranks second to Harvard in the proportion of those admitted who choose to enroll. The 1979 freshman class included 119 Blacks, 116 Chicanos, and 11 Native Americans, an all-time high. Forty-five 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 1,116 faculty members who make up the Academic Council there are eight Nobel laureates, 11 winners of the National Medal of Science, 62 members of the National Academy of Sciences, 100 members of the American Academy of Arts and Sciences, 30 members of the National Academy of Engineering, 11 members of the National Academy of Education, 11 winners of the National Medal of Science, and 4 Pulitzer prize winners. A 1978 survey of 4,000 faculty at four-year colleges and universities ranked Stanford among the four leading institutions nationally in across-the-board strength of faculty.
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 are graduated 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 is 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.

All candidates for the bachelor's degree, regardless of the date they matriculated, 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 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-a-vis the Requirement.

Courses available to fulfill the Writing Requirement for all students, regardless of the date they matriculated, are designated (DR:W) in this book.

THE DISTRIBUTION REQUIREMENTS

The Distribution Requirements have been revised for undergraduates entering Stanford in September, 1980, and thereafter. Following are a set of general remarks which apply to both the old and the new 1980 Requirements. Then the new and old Requirements are stated separately.

A. INFORMATION APPLICABLE TO BOTH OLD AND NEW DISTRIBUTION REQUIREMENTS

The Distribution Requirements are an integral part of undergraduate education at Stanford. Their purpose is to introduce students to a broad range of fields and areas of study within the humanities, social sciences, natural sciences, applied sciences and technology. Whereas the concentration of courses in the major is expected to provide depth, the Distribution Requirements have the complementary purpose of providing breadth to a student's undergraduate program. Fulfilment of the Distribution Requirements in itself will not provide a student with an adequate general education any more than acquiring the necessary number of units in the major will qualify the student as a specialist in the field. The major and the Distribution Requirements are meant to serve as the nucleus around which the student is expected to build a coherent course of study by drawing on the options available among the required and elective courses.

The Committee on Undergraduate Studies, under the authority of the Senate of the Academic Council, certifies courses which will fulfill the new Distribution Requirements in the required areas of study. The Dean of Undergraduate Studies is responsible for the administration of the Distribution Requirements within 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 AIC and in the Time Schedule; final choices should be made only after reviewing those details.

Students should be extremely careful to note which set of Distribution Requirements apply to them. This is determined by date of matriculation at Stanford. Finally, note that the Requirements are measured in courses, not units.

B. DISTRIBUTION REQUIREMENTS FOR UNDERGRADUATES ENTERING STANFORD IN AUTUMN QUARTER, 1980, AND THEREAFTER

To fulfill the Distribution Requirements undergraduates entering Stanford in Autumn Quarter, 1980, and thereafter must take ten courses certified for this purpose in eight areas as follows:

Three sequential courses in the Western Culture Program (students may not mix courses from different sequences for this requirement; students are encouraged to satisfy this requirement as early as possible, preferably in the first year);

One course in each of seven other subject areas which together embrace all areas of the undergraduate curriculum (see below for designated Areas numbered Two through Eight);
At least one of the courses in Areas Two through Eight must be designated as concentrating on a non-Western culture.

The subject areas of these Distribution Requirements are as follows:

Area 1: Western Culture (one three-course sequence)
Area 2: Literature and Fine Arts
Area 3: Philosophical, Social, and Religious Thought
Area 4: Human Development, Behavior, and Language
Area 5: Social Processes and Institutions
Area 6: Mathematical Sciences
Area 7: Natural Sciences
Area 8: Technology and Applied Sciences

NOTE: At least one course must be certified as concentrating on a non-Western culture.

Courses certified as meeting the 1980 Distribution Requirements carry a minimum of three units of credit. Normally, a single course will be certified as fulfilling only one Distribution Requirement. Exceptionally, a single course whose content is approximately equally divided between two areas of study may be certified as fulfilling either one of two Distribution Requirements. No single course may fulfill more than one Distribution Requirement for a given student.

For students entering Stanford in Autumn Quarter, 1980, and thereafter, courses which have been certified as satisfying the Distribution Requirements are listed in the Appendix at the back of this bulletin.

C. DISTRIBUTION REQUIREMENTS FOR STUDENTS ENTERING STANFORD FROM AUTUMN QUARTER, 1976, THROUGH SUMMER, 1979-1980

Students in this category must complete the Requirements in the following three areas:

1. The Humanities Requirement, consisting of three courses of at least three units each, chosen from those certified and so marked according to the notations listed below. While highly valuable on other grounds, courses in first-year language study, writing courses, and courses in creative and performing arts may not be certified for this requirement.

2. The Social Sciences Requirement, consisting of three courses of at least three units each, chosen from those certified and so marked according to the notations listed below, and chosen from at least two different departments.

3. The Natural Sciences/Mathematics/Technology Requirement, consisting of three courses of at least three units each, one course of which must be chosen from an area other than the mathematical sciences.

Courses shown in this book are annotated to show how they may be applied to the Distribution Requirements for students who entered Stanford from Autumn Quarter, 1976, through Spring Quarter of the academic year 1979-80. Notations regarding the Writing Requirement are applicable for all students, regardless of date of entrance.

Caution: With the exception of the Writing Requirement notations, the following symbols are valid only for students entering Stanford from Autumn Quarter, 1976, through Summer Quarter of the academic year 1979-80.

(DR:W) = Course applicable only to Writing Requirement (this notation valid for all students).
(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 by an individual student.

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 the pre-1980 Distribution Requirements will be found elsewhere in its section.

Notations 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.

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.

Note: Students who matriculated at Stanford prior to Autumn Quarter, 1976, must obtain Distribution Requirement information pertinent to them at the Academic Information Center.

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 (86 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 student pursuing a single degree, either the Bachelor of Arts (A.B.) degree or Bachelor of Science (B.S.) degree, formally may declare more than one major within either program. The student may do that either at the time of initial major declaration or, as may be more advisable given the planning required to complete more than one major, by amending the original declaration. If the student's degree is formally to reflect more than a single major:

1. the student must satisfy the requirements of each major;
2. the courses the student proposes to satisfy the requirements of one declared major may not overlap with those of another declared major, unless
   a) overlapping courses constitute introductory skill requirements (e.g., introductory mathematics or foreign language)
   b) overlapping courses enable the student to meet not departmental requirements but rather School requirements (e.g., for two majors within the School of Engineering);
3. at the time the student becomes a degree candidate (i.e., files to graduate) the major departments or programs—one cognizant of the courses the student proposes to satisfy the declared majors and of the limitation of number 2 above—must attest to the student's satisfaction of the pertinent major requirements.

Additional information about the option for multiple and co-equal majors within a single baccalaureate program is available at the Academic Information Center. The following paragraphs provide general guidance to the purpose, structure, and limits of the major.

Students electing the Bachelor of Arts and Science (B.A.S.) degree must fulfill without overlapping courses, as defined above, the requirements of one A.B. and one B.S. 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.
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 “Dean of Undergraduate Studies Special 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.

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.

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, law, medicine or allied health fields.

Location: 306 Old Union
Hours: Monday through Friday, 8:00-12:00 and 1:00-5:00
Phone: 497-2426.
Preprofessional phone: 497-1151.

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 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. 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, 9:00-12:00 and 1:00-5:00
Phone: 497-2207.

**UNDERGRADUATE DEGREES**

**BACHELOR OF ARTS (A.B.)**
**BACHELOR OF SCIENCE (B.S.)**
**BACHELOR OF ARTS AND SCIENCE (B.A.S.)**

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 at least one major department or program and received the recommendation of the department(s). (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.

The degree of Bachelor of Arts and Science (B.A.S.) is conferred, upon election by the student, upon candidates recommended by the Subcommittee on Academic Standing, Petitions, and Exceptions who have applied in advance for graduation. Candidates must fulfill requirements (1), (2), (4) and (5) above, and in addition fulfill requirement (3) in two major departments or programs, one leading to a Bachelor of Arts degree and the other leading to a Bachelor of Science degree.

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 Placement 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 (SWOPSI), Undergraduate Special Program, 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.

A student may formally declare more than one major within a single baccalaureate (A.B. or B.S.) program. The student may do so either at the time of initial major declaration or, as may
be more advisable given the planning required to complete more than one major, by amending the original declaration. Additional information about the option for multiple majors within a single baccalaureate program is available at the Academic Information Center.

Candidates who fulfill these requirements in the Schools of Earth Sciences and Engineering, or the Departments of Biological Sciences, Chemistry, Mathematics, 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 Registrar's Office, Academic Standing, Room 139, 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.

Students who complete the academic requirements of both degrees without completing the residence requirements for both, may elect to receive either degree in the major for which that degree is granted and have a notation on their transcripts that they have also completed the requirements of the other major. This does not require the completion of more than 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 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 in 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 in the department concerned.

Completed petitions should be submitted to the Graduate Program Office, Building 590, Room 104. The student does not apply through the Graduate Admissions Office.

ADVANCED DEGREES

RESIDENCE REQUIREMENT

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.

If a graduate student has completed academic requirements before fulfilling the residence requirement, he or she may wish to make a tuition deficiency payment to the University, rather than continue registering until residence is complete. Such a tuition deficiency is calculated in terms of the percentage of full tuition still lacking. For example, a doctoral student who has met 8.62 quarters of the 9.00 of full tuition required will have a tuition deficiency of .38 of a full quarter's tuition. The outstanding tuition payment will be calculated at the current year's tuition rates. Note: In the Summer Quarter when tuition is permitted on a unit basis, 15 units are required for the equivalent of a full tuition quarter. Information on the student's status with respect to residence may be obtained in the Graduate Program Office.

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.

CONTINUOUS REGISTRATION

Candidates for advanced degrees are required to enroll for at least three quarters of each year from the time of matriculation until receipt of the degree—the only exception to that requirement being for officially approved leaves of absence. To further expedite progress toward degrees, schools and departments have developed guidelines that enable the student to determine when he or she is making satisfactory progress.

Students should consult their department chairmen or, as appropriate, the School dean, in case the expectations of progress in the degree program are unclear. Students who fail to make satisfactory progress will be so informed by their department chairmen or School deans. Failure to correct deficiencies in a timely manner will be cause for dismissal.

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.

Masters' and Engineer candidates are expected to apply for candidacy not later than the end of the first four weeks of the quarter preceding the quarter in which they expect their degree. Doctoral candidates are expected to apply for candidacy before the end of their second graduate year at this University.

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

REGISTRATION CATEGORIES

(1) Advanced Graduate Registration (AGR): If the student has been admitted to candidacy, registered for all required courses and satisfied the residence requirement, but has not completed the degree, 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): Students who have been admitted to candidacy, completed their coursework and residence requirement and fulfilled the three quarters of Advanced Graduate Registration (AGR) may register in Terminal Graduate Registration (TGR) status.

Students who register “TGR” in any degree program will enroll in a special course (limited to TGR students) in their departments. The instructor for that course will be the student's advisor.

Work on the thesis or other remaining requirements will be evaluated each quarter by the advisor with an “N” or “N-” mark as a measure of continuing academic progress. A hold will be put on the registration of a student who receives two consecutive “N-” grades.

(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.

No official departmental or University requirement (e.g., University oral examination) may be met while a student is not registered. The sole exception to that rule shall be that a student may, without being registered, submit the thesis/dissertation in the quarter immediately following a quarter when the student was enrolled.
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.

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 classes 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 satisfied the requirements laid down by the faculty of the Graduate School of Business and the University. (Full particulars concerning these requirements will be found in the Graduate School of Business Bulletin.)

EDUCATIONAL SPECIALIST

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 Educational Specialist (Ed.S.) is conferred on candidates who have satisfactorily completed six quarters and 90 units of approved studies of which at least three quarters and 45 units have been done in residence at Stanford.

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 classes 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 academic requirements of the School of Education and the University residence requirement (see Doctor of Philosophy General Regulations). 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 Degree Program Office.

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.

The candidate will be charged a fee to cover the cost of microfilming the final project, binding the copies, and publishing the abstract. This fee is payable at the Cashier's office on or before the last day of classes in the final quarter.

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.

MASTER OF THE SCIENCE OF LAW

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 Master of the Science of Law (J.S.M.) is conferred upon candidates who have completed one academic year (26 term units) with distinction in accordance with the rules of the University and the School of Law.

To be eligible for candidacy a student must hold the J.D. or its equivalent. The degree is primarily designed for those qualified students who are at the Stanford School of Law for independent reasons (e.g., as teaching fellows) and wish to combine work toward the degree with their principal undertakings. (Full particulars concerning requirements may be found in the bulletin of the Stanford Law School.)

DOCTOR OF THE SCIENCE OF LAW

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 the Science of Law (J.S.D.) is conferred upon candidates who hold a J.D. or its equivalent, complete one academic year in residence, and as a result of independent legal research present a dissertation which is, in the opinion of the faculty of the School of Law, a contribution to knowledge. Such work and dissertation shall conform to the rules of the University and 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

By the end of the doctoral student's second graduate year at Stanford he or she is expected to have completed the major department's qualifying procedures and to apply to the University for candidacy. The department certifies the student's readiness for admission by appropriate signatures on the Application for Candidacy form that is then submitted to the Graduate Program Office. If the student's program includes a minor, the certification of that department is required also. If the student has no minor, the form must show at least three units of work taken or to be taken with at least four or more Stanford faculty members. Candidacy, when approved by the University Committee on Graduate Studies, is valid for five years (if not terminated earlier by the major department because of unsatisfactory progress) and may be renewed only by submission and approval of a new application or extended upon recommendation of the major department. Until such a recommendation is made by the department and approved by the University, a hold is placed on further registration.

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 the chair-
man's signature on the Foreign Language Report form. These forms are submitted to the Graduate Program Office.

UNIVERSITY ORAL EXAMINATION

A University oral examination is a requirement of the Ph.D. and is arranged through the Graduate Program Office after the candidate has been admitted to candidacy, shown special ability and a capacity for independent investigation to the satisfaction of the major school or department. The candidate must be registered the quarter the examination is taken. The examination will not exceed three hours, and will not be held during the first two weeks of any quarter or after the last day of classes in any quarter. The Request for an 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 the chairman, appointed by the Dean of Graduate Studies, presiding, and four or more faculty members appointed by the Dean of Graduate Studies to represent the major and minor departments (upon the departments' recommendation).

The candidate will be certified as having passed the examination if the Examining Committee casts 4 favorable votes out of 5, 4 votes out of 6, 5 votes out of 7, or 6 votes out of 8. Five members present and voting will constitute a quorum.

In the event the Committee votes to fail a student, the Committee chair transmits to the candidate's major department a written evaluation of the student's performance. Detailed guidelines are available in the file prepared for each examining committee.

DISSERTATION

Submission of a dissertation that demonstrates the candidate's capacity for independent advanced research to the satisfaction of the school or department concerned is a requirement of the Ph.D. 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 appoint this reading committee, using the Appointment of a Ph.D. Dissertation Reading Committee form. Each member of the reading committee signs the signature page of the final copy of the dissertation when he or she is ready to certify that the work is of acceptable scope and quality.

One member of the committee will read the dissertation in its final submitted form and so certify on the Certificate of Final Reading of Dissertation.

Three copies of the dissertation must be submitted to the Graduate Program Office on or before the last day of classes in the final quarter of candidacy.

The Graduate Program Office will arrange for the microfilming and binding of the dissertation. 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 are filed in the Stanford University Library, and one copy goes to the major department. Any extra copies may be submitted with the three required.

Directions regarding the preparation of the dissertation, and the abstract may be obtained from the Graduate Program Office. 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 classes in the final quarter.
Courses of Instruction

1980-81

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

Courses in this book are marked to indicate their availability to fulfill undergraduate Writing and Distribution Requirements for students entering from 1976-77 to 1980-81. Courses meeting these requirements for undergraduates entering in Autumn 1980-81 will be found in the "Degrees" section of this bulletin. 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 Session courses are eight weeks in length, except in certain departments 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.

Dean: Rene C. McPherson

Associate Deans: Charles A. Holloway, Robert K. Jaedicke

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


Associate Professors: Charles P. Bonini, John C. Cox, George M. Feiger, Robert J. Flanagan, George Foster, Jeffrey H. Moore, David S.P. Ng, James M. Patell, Jerry I. Porras, Adrian B. Ryans, David J. Teece, Dan R. E. Thomas, Steven C. Wheelwright, Dick R. Wittink, Peter L. Wright

Adjunct Professor: Henry E. Riggs


Senior Lecturers: Steven C. Brandt, George G. C. Parker


Courtesy Assistant Professor: Myra H. Strober

The Graduate School of Business, since its founding in 1925, has provided graduate education for careers in 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. Possible options within the MBA Program are specialties in Health Services Management and in Public Management, as well as programs leading to the joint JD/MBA degrees, and to the MBA degree and Doctorate in Educational Administration.

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, curriculum and faculty write to the Graduate School of Business, Stanford University, Stanford, California 94305 for the current bulletin.
Dean: Allan Cox
Associate Dean: George A. Parks
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: (1) to prepare students for careers in the fields of geology, paleontology, geochemistry, geophysics, petroleum geology, engineering, hydrology, petroleum exploration, and environmental studies; (2) to conduct research in the earth sciences; and (3) to provide opportunities for Stanford undergraduates to learn about our planet's history, to understand the natural resource base that underlies our economy, and to appreciate the geological and geophysical factors that contribute to the quality of our environment.

To accomplish these objectives the School offers a variety of programs adaptable to the needs of the individual student: a four-year undergraduate program leading to the degree of Bachelor of Science; a five-year program leading to the coterminal Bachelor of Science and Master of Science degrees in the social sciences, physical sciences, or engineering; a coterminal Master's degree in one of the Earth Sciences; and a graduate program offering the degrees of Engineer, Master of Science, and Doctor of Philosophy as described below. Details of individual degree programs will be found in the section for each department.

UNDERGRADUATE PROGRAM

For admission to the School of Earth Science there are no special examinations or pre-requisite course requirements. Any undergraduate student admitted to the University may declare a major in one of the Earth Science departments by contacting the appropriate department office. The student will be introduced to an academic advisor prepared to discuss career opportunities and courses in the earth sciences. Our objectives in advising are (1) to help the student define a career goal and (2) as the latter emerges, to help the student identify courses that will help gain entry into the chosen career. The curriculum is quite broad, and aside from essential basic courses, the selection of individual courses is left to the student and the advisor. Majors in all departments are required to take one or more courses in calculus, physics, and chemistry before graduation. Specific requirements for the Bachelor of Science degree are listed under each department. If the student takes the basic science and mathematics courses in high school or during the first year at Stanford, more time will be available during the student's senior year for participation in advanced courses, seminars, and research projects.

COTERMINAL BACHELOR'S AND MASTER'S DEGREES

The Stanford coterminal degree plan enables an undergraduate to embark on an integrated program of study leading to the master's degree before requirements for the bachelor's degree have been completed. This may result in more expeditious progress toward the advanced degree than would otherwise be possible, making the program especially important to earth scientists because the master's degree provides an excellent basis for entry into the profession. The coterminal plan permits students to be admitted to a graduate program as early as their eighth quarter at Stanford, or after earning 105 units. Under the plan the student may meet the degree requirements in the more advantageous of the following two ways: by first completing the 180 units required for the B.S. degree and then completing the three quarters required for the M.S. degree; or by completing a total of 15 quarters during which all of the requirements for the two degrees are completed. In either case the student has the option of receiving the B.S. degree upon meeting all the B.S. requirements or of receiving both degrees at the end of the coterminal program. Students are encouraged to discuss the coterminal program with their advisors during their junior year. Petitions for admission to the program are available in the Graduate Program Office and additional information is available in the individual departmental offices.

GRADUATE PROGRAM

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 admission 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.

APPLIED EARTH SCIENCES

Emeriti: Evan Just, Konrad B. Krauskopf (Affiliated Faculty), Charles F. Park, Jr. (Professors)
Chairman: Irwin Remson
Associate Chairman: Ronald J. P. Lyon
Associate Professor: André G. Journel
Senior Lecturer: George Mader

OFFERINGS

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

Undergraduate
- Environmental Earth Sciences
- Land Resources Planning
- Ore Deposits

Graduate
- Applied Geomathematics
- Applied Hydrogeology
- Engineering Geology
- Environmental Earth Sciences
- Extractive Metallurgy and Materials Processing
- Geostatistics for Natural Resources Evaluation
- Management Option (offered as an option in other programs)
- Ore Deposits and Exploration
- Petroleum Geology and 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.

A general degree in applied Earth Sciences is available for students with specialized objectives consistent with the scope of the department. 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.

UNDERGRADUATE PROGRAMS OF STUDY

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.

Course No. Subject Units

University requirements: 24
A.E.S. 130, 131, 132. Environmental Earth Sciences 15
A.E.S. 133. Measurement of Environment-Remote Sensing 3
A.E.S 284. Engineering Geology 4
Biol.Sci. 1. Introduction to Biology 5
One course in ecology (to be discussed with advisor) 3
Chem. 31. Chemical Principles 4
Chem. 135. Physical Chemical Principles (A CE course in Water Quality may replace Chem. 135) 3
C.E. 170. Man and His Environment or C.E. 171. Environmental Planning 3
Comp.Sci. 105. Introduction to Computing (Advanced students may substitute AES 192, Computer Applications in Geology and Applied Earth Sciences) 4
Geol. 1. Interpreting the Earth 5
Geol. 80. Introduction to Petrology 5
Geol. 102. Introduction to Field Geology 3
Geol. 121. Surface of the Earth 4
Geol. 193. Geomathematics III: Introduction to Probability and Statistics in Geology 3
Math. 19, 20, 21, 22, 23, or 41, 42, 43. Analytic Geometry and Calculus 15

* Joint appointment with Geology
** Joint appointment with Civil Engineering
Phys. 21, 23. Elementary Physics
(Students intending to enter graduate programs in science or engineering should substitute two courses from the Physics 51 series)
Electives 66
Total 180

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.

Course No. Subject Units
University Requirements 24
A.E.S. 130, 131, 132. Environmental Earth Sciences 15
A.E.S. 133. Measurement of the Environment—Remote Sensing 3
A.E.S. 145. Mineral Economics 3
Two courses from
Art 3. Introduction to the History of Architecture
Art 175A.B. Modern Architecture I, II
Art 176. American Architecture and Urbanism 8
Biol. Sci. 40. Introductory Biology 5
(Human Biology 2A, 2B may be substituted)
C.E. 170. Man and His Environment or C.E. 171. Environmental Planning 3
Comp. Sci. 105. Introduction to Computing 4
Econ. 1. Elementary Economics 5
Geol. 1. Interpreting the Earth 5
Geol. 80. Introduction to Petrology 5
Geol. 102. Introduction to Field Geology 3
Geol. 121. Surface of the Earth 4
Math. 19 and 20. Analytic Geometry and Calculus 6
Stat. 60. Introduction to Statistical Methods I 5
Urban Studies 160. Introduction to Urban Design 5
Urban Studies 175. Managing Local Government 4
Total 180

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 mineral resources, energy resources and environmental management. The programs lead to the advanced degrees, Master of Science, Engineer, and Doctor of Philosophy. Diplomas designate the program completed. Typical curricula are described below but individually-tailored, interdisciplinary curricula are encouraged.

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.

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.

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. The student must complete one core curriculum. The student then completes the 45-unit degree requirement with additional courses, research or the management or remote sensing options.

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 faculty of the department.

3. Either a written report or a thesis is required for all options.
CURRICULA RECOMMENDED FOR THE MASTER'S DEGREE

APPLIED GEOMATHEMATICS

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. Geomathematics I: Computer Applications in Geology and Applied Earth Sciences 3
Geol. 193. Geomathematics II: Introduction to Probability and Statistics in Geology 3
A.E.S. 194. Geomathematics III: Numerical Methods for Earth Sciences 3
A.E.S. 290. Geomathematics IV: Geostatistics for Exploration and Development 4
Geol. 293 Geomathematics V: Application of Statistical Methods in Earth Sciences 3
A.E.S. 294. Geomathematics VIII: Computer Applications in Earth Sciences 3
Math. 113. Linear Algebra and Matrix Theory 3
or Mech. Eng. 200A. Mathematical Methods 3
Math. 130. Ordinary Differential Equations 3
Computer Sci. 135. Numerical Methods 3
Total 28

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 Hydrology 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.

Course No. Subject Units
A.E.S. 135. Soil Science 4
A.E.S. 255. Introduction to Solute Transport 2
A.E.S. 257. Hydrogeology in Engineering Practice 2
C.E. 260. Engineering Hydrology 3
C.E. 261A. Groundwater Hydrology 3
C.E. 261B. Surface Water Hydrology 4
C.E. 287. Water Resources Systems 3
C.E. 270. Water Quality in Water Resources Development 3
Geol. 230. Hydrogeology 5
Geol. 232. Numerical Methods in Hydrology 2
Total 31

Additional course units may be chosen to further particular interests. An option is available for a minor in Applied Chemical Hydrogeology.

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 course (Geol. 121), General Geophysics (Geophys. 190), and either a physical processes in geology course or Applied Mechanics: Stress Analysis (Engr. 11).

The following courses must be taken for credit:

Course No. Subject Units
A.E.S. 284. Engineering Geology (A) 4
A.E.S. 285A. Geotechnical Practice (W) or A.E.S. 285B Engineering Geology of Quaternary Sediments (W) 3
A.E.S. 296. Engineering Geologic Mapping (Spr) 3
A.E.S. 386A, B.C. Seminars in Engineering Geology (A, W, Spr) 3
Geol. 221. Photogeology (A) 3
Geol. 230. Hydrogeology (W) 5
C.E. 190. Geotechnical Engineering (A) 4
C.E. 290. Soil Mechanics (W) 3
Geophys. 191. Geophysical Field Techniques (Spr) 4
C.E. 282B. Earthquake Engineering II (Spr) 3
Total units required 35

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:

Course No. Subject Units
A.E.S. 135. Soil Science 4
C.E. 291. Foundation Engineering 3
C.E. 292. Earth Structures 3
C.E. 293. Experimental Soil Mechanics 2
Geol. 182. Igneous and Metamorphic Rocks 4
Geol. 253. Sedimentary Petrology 4
Geophys. 274. Seismology 3
Geophys. 276A. Seismic Waves: Sources and Propagation 3
C.E. 284. Sedimentation Problems 3

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, chemis-
try, 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. Environmental Earth Sciences</td>
<td>9</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>Geol. 121. The Surface of the Earth</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>16</strong></td>
<td></td>
</tr>
</tbody>
</table>

A program comprising 29 additional units of graduate-level courses may be used to design a substantive, coherent program to meet individual interests and career objectives. Typical programs involve additional course work in Applied Hydrogeology, Engineering, Geology, Geostatistics for Natural Resources Evaluation, and Remote Sensing.

**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, alloying and casting 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. Generous substitutions are allowed to suit the interest of the student.

The metallurgical engineering management 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>Mat. Sci. 181. Thermodynamics and Phase Equilibria</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Mat. Sci. 182. Rate Processes in Materials, Mat. Sci. 185. Mechanical Behaviour of Solids or Mat. Sci. 205. Strength and Microstructure</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 229. Extractive Metallurgy Seminar, or Ch.E. 120. Separation Processes</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 229. Principals of Steelmaking, or Ch.E. 160. Chemical Engineering Plant Design</td>
<td>2-3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 150. Introduction to Mineral Extraction Processes, or A.E.S. 225. Surfaces and Interfaces</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29-31</strong></td>
<td></td>
</tr>
</tbody>
</table>

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

**GEOSTATISTICS FOR NATURAL RESOURCES EVALUATION**

All applicants to this program are expected to have an undergraduate background in Geology, Mining or Geophysics; or a B.S. in Mathematics or Statistics with interest focused towards applications.

The following courses constitute the core sequence:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required earth sciences or statistical background</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 192. Computer Applications in Geology (prerequisite Fortran)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 215. Mineral Economics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 290. Geostatistics for Exploration and Development</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 291. Practice of Geostatistics on Simulated Deposits</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>A.E.S. 293. Topics in Advanced Geostatistics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td><strong>26</strong></td>
<td></td>
</tr>
</tbody>
</table>

The student is expected to take introductory courses in some field of specialization such as ore deposits (AES 120), mine-planning (AES 294), petroleum exploration (AES 251), remote sensing (AES 133), environmental sciences (AES 130), or extractive metallurgy (AES 150). Other recommended courses:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp. Sci. 135. Numerical Methods</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Oper. Res. 240. Linear Programming</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Comp. Sci. 234. Numerical Methods of Optimization</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 293. Geomathematics V</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 294. Geomathematics VI</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Reading credits will be offered. A thesis or written report on a research subject is required for the M.S. degree. A summer job in exploration or a mine site may be required, depending on the previous experience of the applicant. A Ph.D. Program in Geostatistics is available for advanced research and/or applications.

**MANAGEMENT OPTION**

The student completes the 45-unit M.S. degree requirement with a minimum of 15 units from the following courses:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus. 200-01. Economic Analysis</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Bus. 210-11. Management Accounting or I.E. 133. Industrial Accounting</td>
<td>4-8</td>
<td></td>
</tr>
<tr>
<td>Bus. 220. Business Finance</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

Bus. 261-62. Decision Sciences
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 coterminal) 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>Mat. Sci. 181</td>
<td>Thermodynamics and Phase Equilibria (Win)</td>
<td>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. 220</td>
<td>Advanced Ore Deposits (Spr)</td>
<td>5</td>
</tr>
<tr>
<td>A.E.S. 290</td>
<td>Geostatistics for Exploration and Development (Spr)</td>
<td>4</td>
</tr>
<tr>
<td>Geophys. 191</td>
<td>Geophysical Field Techniques (Spr)</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</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 Mineralogy (Win)</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 171</td>
<td>Introduction to Geochemistry</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 (W) 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. 181</td>
<td>Igneous Petrology</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 182</td>
<td>Metamorphic Petrology (Spr)</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 193</td>
<td>Geomathematics III: Introduction to Probability and Statistics in Geology (W)</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

PETROLEUM GEOLOGY AND 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</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 250</td>
<td>Decision Analysis in Mineral Exploration</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 251</td>
<td>Oil Field Exploration and Development</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 252</td>
<td>Petroleum Geology</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 253</td>
<td>Sedimentary Basins</td>
<td>4</td>
</tr>
<tr>
<td>A.E.S. 295</td>
<td>Geomathematics VII: Decision Analysis in Petroleum Exploration</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. 278</td>
<td>Organic Geochemistry and the Geochronological Environment of Life</td>
<td>2</td>
</tr>
<tr>
<td>Pet. Engr. 150A</td>
<td>Well Log Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>Pet. Engr. 150B</td>
<td>Well Log Analysis II</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

Remote sensing depends on the response of various terrain materials and features to electromagnetic radiation (and force fields, like magnetism), how radiation from the sun is reflected, how thermal radiation is emitted, or how microwave radiation is emitted in passive mode or reflected in the active (radar) mode. All these interactions are influenced by the physical and chemical compositions from the radiation received remotely, usually after modification by passage through the atmosphere. For geoscience purposes we need to differentiate the responses of various rock and soil types, vegetation, and water bodies, so that meaningful patterns can be defined.

As a consequence the student requires basic training in a wide variety of subjects, from optical physics to computer processing of satellite and aircraft data, from a study of soils to that of trees and plants, in order to derive the geological information. Students may specialize in any aspect of this wide spread of studies, typically in conjunction with another curriculum, for example ore deposits, environmental geoscience, geomorphology, or geobotany.

The Remote Sensing Laboratory (in AES) has a dedicated PDP 11/34 computer with large disc storage, plus color TV and other (Tektronix) display devices. B/W TV digitized input, plus that available from a large digitizing table comple-
ment the graphics approach to the integrated use of quantified geological, geophysical and satellite data.

Most students interested in the remote sensing option enroll in one of the Applied Earth Sciences core curricula. If this is inappropriate, the student and advisor may develop a special applied Earth Sciences program such as Remote Sensing-Geomorphology or Geobotany for departmental approval.

The following courses are recommended for use in Special Programs or for approved substitutions in a basic 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)
Stat. 201 A,B. Data Analysis, A,W, (3,5)
Geol. 193. Geomath III: Introduction to Probability and Statistics in Geology, W, (3)
A.E.S. 290. Geostatistics for Exploration and Development, 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)
E.E. 261. Fourier Transforms and its Application, A, Sp, (3)
E.E. 263. Digital Filtering, A, (3)
E.E., 278. Introduction to Statistical Signal Processing, A, W, (3)

For those interested in Applications of Stochastic Processes, Dynamic Programming, etc.:
Stat. 152. Introduction to Operation Research I, A, (4)

For those interested in Hydrological Applications:

SPECIAL APPLIED EARTH SCIENCES PROGRAM
A program with 45 units of courses approved by the department faculty.

ENGINEER 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., Engineer, 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.

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 Program Office 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.

**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 taken for 3 units.)

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

Alternate years, given 1980-81

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 taken for 3 units.)

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

Alternate years, given 1980-81

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 deposits. Pre-requisite: 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 science and planning background presented throughout the sequence by an earth scientist and a city planner, supplemented by laboratories and field trips. A major field project extending throughout the course sequence involves the preparation of a land-use plan for a selected location in the San Francisco Bay Area. First-quarter topics include: environmental data, introduction to city and regional planning, land use determinants, analysis for urban planning, land capability systems, optimization, and weather and climate. Laboratories include use of topographic and geologic maps in planning, data and population projections, and urban land use studies. The field study involves reconnaissance of environmental and planning factors for the area selected for the land-use planning project. No prerequisites. (DR:T)

5 units undergraduates, 3 units graduates;
Aut (Mader, Remson) MWF 11; labs., seminars, and field trips by arrangement

131. Environmental Earth Sciences II—See course sequence description under 130. Topics include: geologic constraints to development, stream and air pollution, environmental systems analysis, responses to landslides and earthquakes, climatic water balance, history of cities, new towns, and visionary planners. Laboratories include computer storage of environmental data, optimization of planning decisions, use of multiple maps in regional planning, and stream pollution. The field project involves evaluation of land capabilities for different uses in the project area and preparation of a sketch plan. Prerequisite: 130 or consent of instructor. (DR:T)

5 units undergraduates, 3 units graduates;
Win (Mader, Remson) MWF 11; labs., seminars, and field trips by arrangement

132. Environmental Earth Sciences III—See course sequence description under 130, 131. Lectures on environmental impact studies, general plan preparation, location and space requirements for land uses, site planning, waste disposal and sanitary landfill, non-renewable resources and geologic hazards. Laboratories include use of air photos in planning, economics of mineral resources, and site selection for a new community. The field project involves preparation and presentation of general plans for the project area. Prerequisite: 131 or consent of instructor. (DR:T)

5 units undergraduates, 3 units graduates;
Spr (Mader, Remson) MWF 11; labs., seminars, and field trips by arrangement

133. Measurement of the Environment—Remote Sensing—Survey course covering the methods of rapid reconnaissance of the environment stressing those techniques suited to change-detection. Emphasis will be placed on
detection of various types of pollution of water and air, potential landslide areas, and evaluating the condition of coastal wet land environments. "Hands-on" use of computer to analyze LANDSAT satellite coverage of campus, Baylands or coastal areas, redwood forests, etc. Physics recommended. Sign class list in Maples Pavilion. (DR:X)

3 units, Win (Lyon) TTh 1:15-4:05

135. Soil Science—A survey of principal soil properties and processes, including properties of 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, Aut (Rubin) TTh 3:15-5:05;
Alternate years, given 1981-82

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 register for A.E.S. 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 (Parlee) MWF 2:15
Alternate years, given 1980-81

183. Field Practice in Geological Archaeology—This course treats the application of geology to archaeology from a field work standpoint. 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. Stress is placed on each student's involvement in actual problems that are introduced in extended field work. The class will be divided into teams, each consisting of 3 to 4 students. Each team will conduct an original research investigation and prepare a comprehensive report as a group effort. Each research project will involve an extended period spent in the field, perhaps aggregating a week. An introductory course in geology is desirable as a prerequisite. Travel costs must be shared by students. Class sessions are a mixture of seminars and laboratories. There are no formal lectures. (DR:T)

5 units, Spr (Harbaugh, Jackson)
TTh 3:15-5:05;
field trips by arrangement
Alternate years, given 1981-82

192. Geomathematics I: FORTRAN Computer Programming in Geology—An introduction to the use of computers in geology. Stress is placed on FORTRAN programming. Topics include the elements of FORTRAN, matrix algebra, least-squares surface fitting, simple machine contouring and other forms of graphic display, numerical solution of differential equations in finite-difference form, numerical classification methods, an introduction to simulation of dynamic systems. Applications include those to ore deposits, petroleum geology, paleontology, geomorphology, and flow of fluids. Work in the course consists mostly of developing and using computer programs. Prerequisite: facility in ordinary algebra and a working knowledge of introductory calculus. (DR:T)

3 units, Aut (Harbaugh) MWF 10:00

194. Geomathematics II: Numerical Methods for Geologists—A course intended for students in all fields of the earth sciences. Topics covered include an introduction to finite differences, 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, Aut (Tiller) TTh 11-12:15

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, Aut (Parlee) MWF 2:15
Alternate years, given 1981-82

215. Mineral Economics—For graduate students. Lectures the same as A.E.S. 145. 3 units, Win (Douglas) MF 11-12:30

220. Advanced Ore Deposits—Lectures, 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. Prerequisites: Geol. 163, 171, A.E.S. 120.
5 units, Spr (Einaudi) MWF 11; one lab by arrangement

222. Statistical Thermodynamics—(Enroll in Materials Science and Engineering 222.) 3 units, Aut (Bienenstock) TTh 1:15-2:30

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

226. Electrochemistry and Corrosion—(Enroll in Materials Sciences and Engineering 226.) 3 units, Spr (Stevenson) TTh 8:30-9:45

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. Concurrent enrollment in AES 227C recommended. Not offered unless enrollment is 5 or greater. Advanced work available under AES 299. Prerequisite: Geology 271 or equivalent; Geol. 272 or Mat. Sci. 181 recommended (may be taken concurrently). 1-3 units, Win (Parks) by arrangement

227C. Low-temperature Geochemistry—The geochemistry of weathering soil formation, and sedimentation with emphasis on processes of ore formation at low temperatures. Concurrent registration in AES 227A strongly recommended. Prerequisites: Geol 271 or equivalent; Geol 171, and Geol 272 or MatSci 181 recommended. 2 units, Win (Krauskopf) T 8-10

228. Extractive Metallurgy Seminar—Lectures, student seminars, and report preparation on selected topics in extractive process metallurgy designed to satisfy the special interests of the student, supplement areas not covered by formal courses, and survey the field of extractive and process metallurgy from several broad points of view. 2-3 units, Win (Parlee) MWF 2:15; alternate years, given 1981-82

229. Principles of Steelmaking—Systematic development of the physical chemistry underlying ironmaking and steelmaking process. Treatment generalized to promote understanding of the physical chemistry of other metals as well. Seminar treatment of important processes and new developments. 2-3 units, Win (Parlee) MWF 2:15; alternate years, given 1981-82

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 management recommendations. It is probable that one or more exploratory or development wells will be drilled on the basis of recommendations supplied by class members. Topics treated include interpretation of subsurface geology using information from well logs, preparation of well drilling and well 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

252. Sedimentary Basins—Analysis of the depositional framework, tectonic evolution, and economic potential of sedimentary basins. Topics covered include tectonic and environmental controls on facies relations, synthesis of basin development through time in terms of depositional systems and tectonic settings, and occurrence of energy resources. Term paper and weekend field trip are required. 3 units, Aut (Staff) to be arranged
253. Petroleum Geology and Exploration—Course covers basics of petroleum geology origin and occurrence of hydrocarbons and exploration for hydrocarbons. Subjects considered include thermal maturation history in hydrocarbon generation, significance of sedimentary and tectonic setting, principles of accumulation, geological and geophysical exploration techniques, economic considerations, and unconventional hydrocarbon resources.

3 units, Spr (Staff) 1:15 MWF

255. Introduction to Solute Transport—A study of processes influencing transport of solutes through porous media; mathematical equations describing solute transport and numerical methods for their solution. The course is designed for earth scientists and for engineers interested in water and environmental problems. It 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, Aut (Rubin) Th 3:15-5:05
Alternate years, given 1980–81

257. Hydrogeology in Engineering Practice—A survey of applications of hydrogeology for engineering and environmental problem solving. The course stresses the practice of hydrogeology and is structured to complement A.E.S. 230. Through a combination of case histories of engineering problems and a review of technical approaches, students are exposed to aspects of hydrogeology, and in particular, to a consultant’s perspective. Topics covered include: evaluation, exploration and development of ground-water resources; ground-water quality; geophysical and well logging; and applications of hydrogeology in mining and in development of alternate energy sources. With sufficient student interest, the more technical side of development of ground-water resources (i.e., drilling technology, water well design, rehabilitation of water wells) can be covered.

2 units, Spr (Gilman) 7-9 p.m.

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

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

285A. Geotechnical Practice—Survey of current case histories in professional practice of engineering geology, environmental geology, and soil engineering. Includes discussion and practice in planning and management of projects, client relations and communications, and basic operations and skills in the field, laboratory, and office. Course is taught by staff of a local consulting firm, Earth Sciences Associates.

3 units, Win (Meehan) TTh 9
Alternate years, given 1980–81

285B. Engineering Geology of Quaternary Sediments—Analysis of several geologic settings or sites, varying from Mexico City, to the Lower Mississippi Valley, to the High Sierra, in which fluvial, lacustrine, or glacial sediments have had a major and well documented influence on the planning, engineering, and performance of civil works such as buildings, tunnels, land fills, and dams.

3 units, Win (Meehan, Rich) TTh 9
Alternate years, given 1981–82

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

290. Geomathematics IV: Geostatistics for Exploration and Development—The theory of spatially correlated random variables applied to the valuation of mineral resources. The basic tools of geostatistics for exploration and production planning are presented: variograms for analysis of spatial continuity, kriging for computing best linear estimates and their corresponding degree of reliability, simulations for elaborating numerical models of ore deposits. Various real case studies will be presented taken from the mining and petroleum industry, ground water survey and other earth sciences disciplines.

4 units, Spr (Journal) TTh 10-12

291. Geomathematics VI: Practice of Geostatistics on Simulated Deposits—The course is based on a simulated numerical model of a deposit. This model is perfectly known from a million pieces of data stored on disc. The stu-
students will work in teams. Each team will receive a fixed budget for drillholes and the same initial geological information, and will evaluate the deposit as they would do on a real project using maps, cross-sections and variogram analysis. Economic feasibility will be determined by study of in-situ variability of grades and other characteristics, kriging for estimation and in-situ geological resources, and variance correction for evaluation of mineable reserves. All results are checked against the known underlying reality. Prerequisites: AES 290 and experience in Fortran programming.

3 units, Aut (Journel) by arrangement

292. Geomathematics VI: Application of Computers in Geology—An introduction to a variety of applications of computers in the earth sciences. Major topics include representation of geological processes by means of dynamic computer simulation models, and incorporate concepts of dynamic stochastic models, Markov chains, representation of potential flow and diffusion flow, optimization, and adaptation of control principles. Major emphasis is also placed on mathematical mapping procedures including machine-contour mapping, digital filtering, mapping with Fourier series, and automated graphic display. Applications are diverse, and each student is expected to develop a programming application in his own field of interest. Facility in FORTRAN programming is assumed at the outset of the course. Prerequisite: AES 192 or equivalent experience in FORTRAN.

3 units, Win (Harbaugh) TTh 10-11:50

293. Geomathematics VII: Topics in Advanced Geostatistics—Topics for in-depth discussion will be chosen from the following: conditional expectations and other non-linear kriging estimators applied to the evaluation of local distributions of characteristics of a natural phenomenon; the multivariate normal and log-normal approach to problems of estimation; the technique of conditional simulations for building numerical models of a particular phenomenon; convex analysis for problems of production optimization with quality control; geometric probabilities for defining exploration targets; the transitive theory for assessing errors in geometric (volume-surface) evaluations.

3 units, Win (Journel) 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 photographic 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 2:15; lab. TTh 3:15-5:05; alternate years, given 1980-81

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 inertia 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 2:15; lab. TTh 3:15-5:05; alternate years, given 1981-82

298. Geomathematics IX: Decision Analysis in Petroleum Exploration—An introduction to analytical decision making in petroleum and fuel-resource exploration. Stress is placed on objective methods of estimating outcome probabilities in exploration and their use in financial analysis. Topics include the use of frequency distributions to estimate outcome probabilities, 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 the use of maturely explored "training" areas to make predictions for immaturely explored "target" areas. Financial topics include preparation of cash-flow forecasts, expected
monetary value analysis, devising and using utility functions, and decision-tree analysis. A work book manual of 22 problem sets serves as an introduction to the methods. In addition, extensive use is made of an oil-exploration simulation game played throughout the quarter to provide experience in the use of the methods in a competitive exploration environment, using actual oil-exploration data.

3 units, Win (Harbaugh) MWF 10

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

320A,B. 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, Win (Einaudi) by arrangement

386A,B,C. Seminars in Engineering Geology.

1 unit, Aut (Staff)

Win (Staff) by arrangement

390A,B,C. Research Seminar in Geostatistics—Discussion of classic and current research in geostatistics. Topics selected on basis of interest and timeliness.

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

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**GEOLOGY**

Emeriti: A. Myra Keen, Konrad B. Krauskopf, Benjamin M. Page, Charles F. Park, Jr. (Professors)

Chairman: George Thompson

Associate Chairman: William R. Evitt


Associate Professors: Gordon E. Brown, James C. Ingle, Jr., John G. Liou

Assistant Professors: David K. Larue, Gail A. Mahood, Elizabeth L. Miller

Senior Lecturer: Ernest I. Rich

Affiliated Faculty: Allan Cox, Marco Einaudi, Amos Nur, George Parks, Irwin Remson, George Thompson (Professors), Norman Sleep (Associate Professors), Warren Addicott, Robert Ballard, Frank Dickson, Paul Kerr, Keith Kvenvolden, David Pollard (Consulting Professors)

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**UNDERGRADUATE 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 62-65 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 62-65 units. Letter grades are required in geology core courses and in chemistry, physics, and mathematics. 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>G-1. Interpreting the Earth</td>
<td>Aut, Win, Spr</td>
<td>5</td>
</tr>
<tr>
<td>G-2. Earth History</td>
<td>Spr</td>
<td>5</td>
</tr>
<tr>
<td>G-50. Rocks and Minerals</td>
<td>Spr</td>
<td>5</td>
</tr>
<tr>
<td>G-102. Introduction to Field Geology</td>
<td>Sum</td>
<td>3</td>
</tr>
</tbody>
</table>

(Required basic science and mathematics courses, if not completed earlier, can be taken during this year.)

Junior Year

<table>
<thead>
<tr>
<th>Courses</th>
<th>Quarter</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-161. Crystal Chemistry and Mineralogy</td>
<td>Aut</td>
<td>5</td>
</tr>
<tr>
<td>G-163. Optical Mineralogy</td>
<td>Win</td>
<td>4</td>
</tr>
<tr>
<td>G-151. Sedimentary Geology and Petrology</td>
<td>Win</td>
<td>4</td>
</tr>
<tr>
<td>G-110. Structural Geology</td>
<td>Spr</td>
<td>5</td>
</tr>
<tr>
<td>G-152. Stratigraphy and Paleoecology</td>
<td>Spr</td>
<td>4</td>
</tr>
<tr>
<td>G-103A, B. Advanced Field Geology</td>
<td>Sum</td>
<td>12</td>
</tr>
</tbody>
</table>
Required basic science and mathematics courses can be completed during this year. Room available for electives from list of choices below.

Senior Year

G-181. Igneous Petrology  
Aut  
4

(Room available for electives from list of choices below during this year.) In addition to the 56 units of the basic curriculum above, the student is required to take a minimum of two courses from the list below: 

- Geos-143. Principles of Paleontology  
Win  
5
- G-171. Introduction to Geochemistry  
Aut  
4
- G-182. Metamorphic Petrology  
Spr  
4
- G-193. Geomathematics III  
Win  
3
- AES-120. Introduction to Ore Deposits  
Aut  
4
- Geop-150. Plate Tectonics  
Spr  
3
- Geop-190. General Geophysics  
Aut  
4
- Geop-180. Geologic Interpretation of Seismic Reflection Records  
Win  
3

This schedule assumes entrance in the geology program no later than the Winter Quarter of the sophomore year. Later entrance is possible but may result in scheduling difficulties. Students intending to declare a geology major later than the Winter Quarter of their sophomore year should first consult their geology advisor regarding the proper schedule. If the student enters in his or her junior year, it is imperative that all requirements in mathematics, physics, and chemistry have been completed as well as courses equivalent to Geology 1 and Geology 2 to avoid 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:

<table>
<thead>
<tr>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics</strong></td>
</tr>
<tr>
<td>1. For students entering Stanford with only high school algebra and trigonometry: Mathematics 19, 20, 21, 22, and 23 or Mathematics 41, 42, 43 (Analytic Geometry and Calculus)</td>
</tr>
<tr>
<td>2. For students entering Stanford with credit in analytical geometry: Mathematics 41A, 42A, and 43A (Calculus)</td>
</tr>
<tr>
<td><strong>Physics</strong></td>
</tr>
<tr>
<td>1. For students with average interest and ability in physics and with mathematical preparation through Mathematics 20 or 41 and concurrent registration in Mathematics 21 or 42: Physics 51 (Mechanics), 53 (Electricity), and 55 (Light and Heat)</td>
</tr>
</tbody>
</table>

2. For students with exceptional ability and interest in physics, advanced placement in mathematics, and concurrent registration in Mathematics 44: Physics 61, 62 and 63 (Advanced Freshman Physics)  

7

**Chemistry**

1. For the majority of students majoring in geology: Chemistry 31 (Chemical Principles) and Chemistry 135 (Physical Chemical Principles)  

8

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

**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, which 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.

**COTERMINAL B.S. AND M.S. PROGRAM**

A Stanford undergraduate majoring in Geology may be admitted to the University Division for the purpose of working simultaneously toward bachelor's and master's degrees provided:
The University's requirements for the Master of Science degree are stated in the section "Advanced Degrees" of this bulletin. The student must also be guided by the Counseling Questionnaire designed to ascertain their background in geology and the supporting sciences and mathematics. The response to this questionnaire will aid in the construction of the student's academic program. This program will be developed by the student and his or her Academic Advisor who will be appointed by the Graduate Committee of the department prior to registration with appropriate consideration of the student's background, interests, and professional goals.

As early as possible, preferably before the end of the second quarter at Stanford, the student is expected to select a Research Advisor when an area of specialization has been decided upon. In the event that the Academic Advisor would be the logical person to serve as Research Advisor, the Graduate Committee will appoint a new Academic Advisor, thus ensuring that the student shall be guided throughout by at least two faculty members. The advisors jointly supervise completion of the departmental requirements for the M.S. program as outlined below.

**Requirements**

- **Objectives**—It is the purpose of the Master's program in geology to continue a student's training in geology and to prepare the student for a professional geological career.

- **Procedures**—During the week prior to initial registration, students are required to fill out a Counseling Questionnaire designed to ascertain their background in geology and the supporting sciences and mathematics. The response to this questionnaire will aid in the construction of the student's academic program. This program will be developed by the student and his or her Academic Advisor who will be appointed by the Graduate Committee of the department prior to registration with appropriate consideration of the student's background, interests, and professional goals.

- **Admission**—For admission to graduate work in the department, the applicant must have taken the Aptitude Test (Verbal and Quantitative) of the Graduate Record Examination. Students who wish to change their degree objective from an M.S. to a Ph.D. may do so with the approval of the Admissions Committee of the department. Completion of the M.S. is not required for this change.

### MASTER OF SCIENCE

#### Objectives

- It is the purpose of the Master's program in geology to continue a student's training in geology and to prepare the student for a professional geological career.

#### Procedures

- During the week prior to initial registration, students are required to fill out a Counseling Questionnaire designed to ascertain their background in geology and the supporting sciences and mathematics. The response to this questionnaire will aid in the construction of the student's academic program. This program will be developed by the student and his or her Academic Advisor who will be appointed by the Graduate Committee of the department prior to registration with appropriate consideration of the student's background, interests, and professional goals.

- As early as possible, preferably before the end of the second quarter at Stanford, the student is expected to select a Research Advisor when an area of specialization has been decided upon. In the event that the Academic Advisor would be the logical person to serve as Research Advisor, the Graduate Committee will appoint a new Academic Advisor, thus ensuring that the student shall be guided throughout by at least two faculty members. The advisors jointly supervise completion of the departmental requirements for the M.S. program as outlined below.

#### Requirements

- The University's requirements for the Master of Science degree are stated in the section "Advanced Degrees" of this bulletin. The student must also be guided by the following departmental requirements:
1. The student must make up deficiencies in previous training as indicated by the Counseling Questionnaire or stipulated during the admissions process. Previous training should include courses approximately equivalent to those of the undergraduate curriculum leading to the B.S. degree in geology at Stanford.

2. The student must complete a minimum of 45 units of course work.
   a) Not more than 15 units of the 45 may comprise research and special problems courses.
   b) The courses must be junior, senior, or graduate level courses (courses numbered 100 or higher).
   c) The course list is selected by the student with his advisors using for guidance sample course lists for various areas developed by the Graduate Committee. The student is urged to make extensive use of seminars in his or her course program.

3. The student must complete a thesis describing his or her research. The research and thesis, which must be completed before the end of the sixth quarter at Stanford, should demonstrate that the student has developed proficiency in at least one field of geology and is prepared to begin a professional career. In order to complete the thesis on time the student should begin the research during the first year at Stanford.

4. Early during the thesis research period, and after consultation with the student, the Research and Academic Advisors will appoint a second reader for the thesis, the Research Advisor being the first reader. The two readers will determine jointly whether the thesis is acceptable for the M.S. degree in the department.

5. Once the thesis has been approved, the student will make a public presentation of his or her results at an appropriate forum.

Schedule—The calendar of events of a typical M.S. program is as follows:
Upon arrival: Fill out Counseling Questionnaire, appointment of Academic Advisor, begin to develop program.
Between 2nd & 3rd quarters: Selection of Research Advisor, planned course work, selection of thesis topic, submit short research proposal to Research and Academic Advisors.
First year: Begin thesis research, select second reader.
Between 3rd & 5th quarters: File for M.S. degree at Graduate Program Office.

DOCTOR OF PHILOSOPHY

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

Procedures and Requirements—Upon entering Stanford and prior to registration the student must fill out a Counseling Questionnaire (see Master’s Program for details). The Graduate Committee of the department will assign the student an Academic Advisor who, with the aid of a set of sample course programs for the various subfields represented in the department, will assist in designing a course program tailored to the student’s needs and interests. Before the end of the third quarter the student will select a Research Advisor and review his or her course program with him or her prior to finalizing it and filing it with the department office. In the event that the Academic Advisor is the logical Research Advisor, the Graduate Committee will appoint a new Academic Advisor so that the student will be guided throughout by at least two faculty members.

Courses—The student must successfully complete the courses that form his or her individualized academic program. The requirements include a minimum of four courses of at least three units each from four different faculty members at Stanford. The student should make extensive use of seminars in his graduate program. University rules require a minimum of 36 unduplicated units for the degree.

Qualifying Procedures of the Ph.D. Candidacy—The departmental procedure involves four steps: passing the Departmental Examination, preparing the research proposal, establishing the Research Advisory Committee, and passing the Research Examination. By University regulation, these four steps must be completed before the end of the student’s sixth quarter at Stanford. If the student is unable to meet this requirement, an explanatory petition re-
questing an extension must be filed with the Dean of the Graduate Division.

1. **Departmental Examination**—This is a written examination given each year at the beginning of the Winter Quarter. It consists of questions on broad areas of geology at the beginning graduate level. Students are urged to take it in the first year in residence and must pass it during the second year.

2. **Research Proposal**—Each student must prepare a research proposal describing the scientific goals of the intended Ph.D. research, the relevant literature, the investigative approach and the resources that are available for it, and the estimated time to complete the program. The proposal is normally expected to be completed before the student's fifth quarter at Stanford. It shall not exceed ten double-spaced typed pages. In general, the student will select the Research Advisory Committee while the research proposal is being prepared.

3. **Research Advisory Committee**—When the student has developed adequate research plans, a Research Advisory Committee is to be selected in consultation with the Research Advisor. The committee shall consist of 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 the student in establishing and accomplishing the research program.

4. **Research Examination**—The Research Examination is conducted by the Research Advisory Committee. It is an oral examination based on the Ph.D. research proposal prepared by the student.

Upon the satisfactory completion of the Departmental and Research Examinations, the department will certify to the University Committee on Graduate Programs that the student has successfully fulfilled the departmental requirements for candidacy for the Ph.D. degree. Responsibility for the remainder of the student's Ph.D. program passes from the Academic Advisor to the Research Advisor and the members of the Research Advisory Committee.

**Schedule**—The calendar of events in the Ph.D. program is normally as follows:
- **Upon arrival**: Complete Counseling Questionnaire, assignment of Academic Advisor.
- **Between 1st & 3rd quarters**: Selection of course program.
- **2nd and/or 5th quarter**: Departmental Examination.
- **Between 2nd & 5th quarters**: Selection of Research Advisor, preparation of Research Proposal, selection of Research Advisory Committee.

**Between 2nd & 6th quarters**: Research Examination, certification and petition for Ph.D. candidacy, admission to candidacy for the Ph.D.

**Between 2nd & 15th quarters**: Ph.D. research, defense of dissertation.

**Doctoral Dissertation**—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 must be concise and the student is strongly urged to prepare it in a format directly suitable for publication either in parts 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 University by the Graduate Program 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 research.
High school chemistry and physics strongly recommended. (DR: T)
5 units, Aut (Compton) MWF 8; lab. and field trips by arrangement
Win (Rich) MWF 8; lab. and field trips by arrangement
Spr (Brown) MWF 8; lab., and field trips by arrangement
Sum (Staff) MWF 9; 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. Geol. 1 strongly recommended as preparation. (DR: T)
5 units, Spr (van Andel) MWF 9; laboratory by arrangement

80. Rocks and Minerals—Identification, classification, and interpretation of igneous, sedimentary, and metamorphic rocks, based on their minerals, textures, and primary structures, and on present day observable processes. Laboratory work will emphasize use of a hand lens in making observations, and field trips will demonstrate rock structures and genetic associations. Prerequisite: Geology 1, with introductory chemistry strongly recommended.
5 units, Spr (van Andel) MWF 9; laboratory MW or TTh 1:15-4:00; 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: Geol. 1 and 2, or 80, or consent of instructor. (DR: T)
3 units, Sum (Ruetz) 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, 80, 102, 110, and 151; 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. Credit for 103A requires completion of 103B.
8 units (Miller) June 13-July 27

103B. Preparation of comprehensive geologic report on field area studied during 103A; work done on campus. Credit for 103B requires completion of 103A.
4 units (Miller) July 30-Aug. 10

105. Geologic Problems—Supervised reading, field and/or laboratory work, written reports thereon. (DR: T if taken for 3 or more units.)
1-10 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 102. (DR: T)
5 units Spr (Miller) MWF 11 plus field lab Thurs. or Sat.

116. Introduction to Physical Processes—(Enroll in Geophysics 160.) This course is aimed at providing students in structural geology, tectonics and general geophysics with an introduction to the basic equations which govern physical processes in the earth. The course will cover
143. Principles of Paleontology—Fossils and how they are studied; emphasis on principles. Reading and lectures on the nature of the fossil record, the use of fossils for geologic dating and correlation, the record of evolution, and the interpretation of ancient environments. Laboratory introduction to several major groups of fossil organisms. Term project or report. Prerequisite: 2 or consent of instructor. (DR:T)

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

150. The Oceans: An Introduction to the Marine Environment—The course provides an insight into the science of oceanography including the nature of sea water, the interplay between circulation of the oceans and atmosphere, the tides, waves, sea floor topography, and history of the major ocean basins. Particular attention is paid to the interface between continents and ocean basins: beaches, estuaries, and the continental shelves. Lectures and discussions include a broad view of the biology of the oceans emphasizing the sympathetic interaction between the distribution of inorganic constituents, oceanic circulation, and biologic productivity. The course closes by examining real and potential marine resources together with attendant legal conflicts. Lectures, occasional laboratory demonstrations and one coastside field trip required. 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 1980-81

151. Sedimentary Geology and Petrology—Inquiry into depositional systems and origins of sedimentary rocks. Topics explored include provenance and weathering, sediment transport and sedimentary 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 environments. Prerequisites: 1, 2, 101 and 102. (DR:T)

4 units, Win (Staff) MWF 9; lab. W or Th 1:15-5:05; field trips by arrangement

152. Stratigraphic Geology and Paleoecology—Rudiments of interpreting sedimentary rocks with emphasis placed on the utility of integrating paleontologic, sedimentologic, and geochemical evidence to reconstruct paleoenvironments. Characteristic variations of modern and ancient biofacies and lithofacies are traced in time and space. Concepts of biostratigraphy are interwoven with discussions of the dynamics of the marine ecosystem and evolution at the species 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. Prerequisites: 1, 2, 102, and 151. (DR:T)

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

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

5 units, Aut (Brown) MWF 10; lab. MW 1:15-4:05

163. Optical Mineralogy—A course to provide familiarity with polarizing microscope to study rocks and minerals. It covers fundamental principles of optical properties and systematic study of common rock-forming minerals. Prerequisites: 161. (DR:T)

4 units, Win (Liou) TTh 11 and 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 (Staff) MWF 9; Choice of one 3 hour lab. (1 unit) or 2 hrs of elementary thermodynamics (1 unit) per week, by arrangement.

181. Igneous Petrology—Origin of igneous rocks, emphasizing magmatic differentiation processes displayed in the chemistry of volcanic rocks. Subjects covered will include the relation of magma types to tectonic setting, physical properties of magmas, estimation of intensive parameters in magmas, role of volatile components, applications of trace elements and isotopes to petrogenesis, modelling of crystal fractionation and partial melting, relevant experimental data and phase diagrams, and classification schemes. Course is designed for seniors and new graduate students. Prerequisites: 183.

4 units, Aut (Mahood) TTh 11; labs. TTh 1:15-4:05

182. Metamorphic Petrology—Genesis of metamorphic rocks and the imposed physico-chemical conditions for their formation. Topics covered will include textures and structures of metamorphic rocks, chemistry, paragenesis and phase relations of metamorphic minerals, metamorphic reactions, role of oxygen fugacity and mixed volatiles in metamorphic recrystallization, metamorphic belts, ocean-floor and subduction zone metamorphism. Laboratory exercises include petrographic study of common metamorphic rocks. Prerequisite: Geol. 181.

4 units, Spr (Liou) TTh 11 and lab. TTh 1:15-4:05

185. Volcanology—Types of eruptions; eruptive mechanisms; models of emplacement of pyroclastic flows and characteristics of resulting deposits; classification of volcanic landforms and their relation to the composition and physical properties of the magma; characteristics of magma chambers; volcanic gases; eruptive histories of volcanic centers; relation of volcano type to tectonic setting. One four-day field trip is required. Prerequisite: G80 is required; G163 and G181 are helpful but not required.

4 units, Spr (Mahood) Three one-hour lectures and one three-hour lab. per week

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; introduction to stochastic processes and correlation analysis. This course may be followed by Geomathematics IV, V, or VI. Prerequisite: Introductory calculus. (DR:X)

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

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 stratigraphic, structural and environmental analysis. Characteristics of the various films and filters in common use and the geometry of the resultant imagery are evaluated. Simple photogrammetric equipment is employed to obtain
quantitative data from photos. Prerequisite: Knowledge of geomorphology and structural geology, or consent of instructor. (DR:X)

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

227. Quaternary Geology—Various aspects of Quaternary stratigraphy, methods of correlation of Quaternary deposits, climatic fluctuations and associated landforms. Current literature will be reviewed. Lecture-seminar format. Field trips will be included. Prerequisite: Consent of instructor.

3 units, Spr (Rich)

228. 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 bentonic 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 1981–82

242. Introduction to Palynology—Study of microfossils smaller than 200 microns, from Cambrian and younger strata, supplemented with lectures and discussions. Prerequisite: 242. (DR:X)

Aut (Evitt) units and hours by arrangement

244. Advanced Micropaleontology—Discussion and practice in use of marine microfossils (mainly bentonic 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 current examples of research in this field. Prerequisite: 241. (DR:X)

3 units, Win (Ingle), T 11; lab. TTh 1:15–4:05 or by arrangement; alternate years, given 1981–82

250. Ocean Basins—Physiography, tectonics and sedimentation of the modern and ancient ocean. Survey of the field with emphasis on familiarization with the current marine 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. Prerequisites: 1, 150, or consent of the instructor. (DR:T)

4 units, Aut (van Andel) MWF 9; alternate years, given 1980–81

251. 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: 1, 150, 151 or consent of the instructor. (DR:T)

4 units, Aut (van Andel) MTW 9; alternate years, given 1981–82
261. Rock Forming Minerals—Systematic examination of the structures, chemistry, physical properties, and paragenesis of the major rock forming silicates and related mineral groups. Review of the properties and structures of silicate melts and glasses with an introduction to crystal growth from the melt. Discussion of mineral geothermometry and geobarometry. Laboratories will be concerned with mineral separation techniques, measurement of basic physical properties, and characterization of minerals by powder x-ray diffraction and infrared techniques. Several labs will also be devoted to basic hand specimen identification.

4 units, Win (Brown) TTh 10; lab by arrangement; alternate years, given 1980–81

262. 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 1981–82

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 11, F 2:15

278. Organic Geochemistry—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 (Kvenvolden) 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, and lab, by arrangement

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 1981–82

327. Seminar in Quaternary Geology—Analysis of current problems, concepts and research in Quaternary Geology. Topics for discussion are selected on the basis of interests of participants.

2 units, Spr (Rich) by arrangement; alternate years 1981–82

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, Win (van Andel) by arrangement; given 1981–82

361. Seminar in Mineralogy. (DR:X)

1 unit, Win (Staff) by arrangement.

371. Seminar in Geochemistry. (DR:X)

1 unit, Aut (Staff) by arrangement

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

2 units, Win (Staff) by arrangement
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 1980–81

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

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

Chairman: George A. Thompson
Professors: Jon F. Claerbout, Allan V. Cox,
Robert L. Kovach, Amos M. Nur, George A.
Thompson. Affiliated: Tjeerd H. van Andel
Associate Professor: Norman H. Sleep
Assistant Professor: Robert J. Geller, Michael
O. McWilliams
Consulting Professors: Thomas Cantwell
Consulting Associate Professor: David M.
Boore

OFFERINGS AND FACILITIES
Geophysics is the branch of earth science
concerned with exploration of the earth and its
history by physical measurements. The under-
graduate 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 individu-
al student. Graduate programs give special-
zized training for professional work in explo-
rates, research, and education. The Depart-
ment of Geophysics is housed in the Ruth Watts
Mitchell Earth Sciences Building and the Sal-
vatori Laboratory of Geophysics. The depart-
ment 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 mechanics,
studies of geothermal areas, application of seis-
mology to study of present-day tectonics, near
field seismology, geophysical monitoring of the
San Andreas fault, paleomagnetic investiga-
tions, free oscillation and surface wave studies,
and major research programs in reflection seis-
mology and experimental and theoretical rock
physics. Graduate programs lead to the degree
of Master of Science and Doctor of Philosophy.

PROGRAMS OF STUDY
BACHELOR OF SCIENCE
The following course requirements for the
degree of Bachelor of Science in Geophysics are
in addition to the University requirements in
general studies. 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 (Geo-
physics 185, Section A, B, C, D, E, F, G, H, J)
during the senior year. Seniors in Geophysics
who expect to do graduate work are urged to
take the Graduate Record Examination as early as is convenient in their final undergraduate year.

CURRICULUM

Course No. Subject
Chemistry 31. Chemical Principles
Chemistry 135. Physical Chemical Principles, or
      Physics 170, 171,
      Thermodynamics
Electrical Engineering 141. Electromagnetic Fundamentals or
      Physics 120. Electricity and Magnetism
Geology 80. Rocks and Minerals
Geology 102. Introduction to Field Geology
Geology 110. Structural Geology
Geophysics 185 (A, B, C, D, E, F, G, H, J) Research Seminar
9 units of Geophysics chosen from the list below.
Math. 10, 11, 21, 22, 23 and 44, or 41, 42, 43 and 44.
      Analytical Geometry and Calculus
Math 130. Ordinary Differential Equations
Physics 51, 53, 54, 55 and 56.
Elementary Physics
Physics 110, 111. Mechanics

As electives in the Geophysics Curriculum the following courses are particularly recommended for the required nine units: 150, 174, 190, 195. Also recommended as Geophysics electives are: 102, 160, 180, 191, 262, 276, 280 and 284; Geology 103A and B.
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.
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, G, H, J).
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 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 2 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, a short two week course offered immediately prior to the Autumn Quarter of the second year is 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

**Autumn Quarter**
- Electrical Engr. 261. Fourier Transform and its Application 3
- Geophysics 174. Seismology 3
- Geophysics 190. General Geophysics 4
- Geophysics 380A. Seminar: Exploration Geophysics 1
- Geophysics 397. Contemporary Geophysics Seminar 1
- Pet. Engr. 150A. Introductory Well Log Analysis 3

**Winter Quarter**
- Comp. Sci. 106. Introduction to Computing 3
- Geophysics 150. Plate Tectonics 3
- Geophysics 180. Geologic Interpretation of Reflection Seismograms 3
- Geophysics 262. Rock Physics 3
- Geophysics 397. Contemporary Geophysics Seminar 1
- Pet. Engr. 150B. Introductory Well Log Analysis 3

**Spring Quarter**
- AES 252. Petroleum Geology 3
- FORTRAN Short Course 0
Geophysics 191A. Geophysical Field Techniques 6
Geophysics 280. Data Analysis 3
Geophysics 397. Contemporary Geophysics Seminar 1

Second Year

Summer Session (Final two weeks only)
Geology 102. Introduction to Field Geology 3

Autumn Quarter
Geophysics 284. Reflection Seismology 3
Geophysics 380B. Seminar: Exploration Geophysics 3
Geophysics 397. Contemporary Geophysics Seminar 1

Normal course loads of 12-15 units will include additional elective courses in related fields, such as Petroleum Engineering, Geology, Applied Earth Sciences, Mathematics, Physics, Economics, Computer Science, and Operations Research.

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 their first year, candidates will take three quarters of Research Seminar (Geophysics 385, Sections A, B, C, D, E, G, H, J). 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, Materials Science, Physics of Solids, Thermodynamics. Students who wish to waive any of the required courses may 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 written qualifying examination which is given annually in January, by his or her second year; pass the Departmental Oral Exam by presenting and defending a written research paper or proposal by the end of the second year; 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; 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 one additional year in which to submit their dissertations.

COURSES

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

3. Earthquakes and Man—Earthquakes occur daily in California with the prospect that a large, destructive earthquake could occur during our lifetime. This introductory course provides insight into why and where earthquakes occur, the nature of earthquake ground motions and their effects on onshore and offshore structures (such as buildings and offshore oil platforms), earthquake risk and protective measures.

This course closes by discussing the possibility of man's activities on earthquake occurrences and discusses the possibility that through modern technology one can modify earthquake activity. Implications for energy resources will also be examined. Lectures, demonstrations and one Saturday field trip.

3 units, Spr (Kovach) TTh 10, field trip by arrangement


3 units, Aut (McWilliams) MWF 8; alternate years, given 1980-81

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, Win (McWilliams, Sleep) MWF 9

160. Introduction to Physical Processes—This course is aimed at providing students in structural geology, tectonics and general geophysics with an introduction to the basic equations which govern physical processes in the earth. Intuitive derivations, suitable for non-mathematically oriented students, of the equations governing the propagation of waves, the diffusion of heat, flow of fluid in porous media, gravity and electrical fields, and deformation of solids will be covered. Simple solutions will be derived with applications to basic aspects of stress, strain, seismic waves, faulting, folding, isostasy, role of pore pressure in tectonics and rock stability, magmatic intrusions, and volcanism. Particularly recommended for seniors and beginning graduate students in structural geology and tectonics who need to acquire familiarity with the basic mathematical modeling used in describing physical processes in geology and geophysics.

3 units, Spr (Nur) MWF 10

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, seismicity, tectonics and engineering seismology. Prerequisites: Math 130, Physics 55 or equivalent.

3 units, Aut (Geller) MTTh 1:15

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. Elementary well logging interpretation and correlation; economics of exploration and development of petroleum resources; introduction to reservoir engineering. Integration of seismic and other exploration data into exploration programs. Workshops in stratigraphic and structural interpretation of seismic sections and well logs, utilizing data from various oceans and continents.

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

185A, B, C, D, E, F, G, H, J. 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, Aut, Win, Spr (Kovach) by arrangement

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

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

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

2 units, Aut, Win (Thompson) by arrangement

185F. Research Seminar: Strong Motion Seismology—Current research concerning near field wave propagation, studies of source models, and interpretation of strong motion data.

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


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

185H. Research Seminar: Global Tectonics and Seismology—Current research in plate tectonic processes and application of seismology to this research.

2 units, Aut, Win, Spr (Sleep) by arrangement
185J. Research Seminar: Paleomagnetism and Tectonics—Current research in paleomagnetism, rock magnetism, global and regional tectonics.
2 units, Aut, Win, Spr (McWilliams) by arrangement

4 units, Aut (Kovach) 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 (McWilliams) MWF 9

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 (McWilliams) MWF 9

195. Physics of Planetary Interiors—A study of the available data of seismology, volcanology, geodesy, heat flow, high pressure laboratory work and solid state physics for developing up-to-date understanding of the properties and processes of the interiors of the terrestrial planets. Emphasis is placed on current unresolved problems, including the formation of the planets and their thermal histories.
3 units, Spr (Sleep) TTh 10-11:30

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

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; Math 131 and Physics 111 and 120 or equivalent; Fortran programming.

276A. 3 units, Win (Geller) MTTh 2:15
276B. 3 units, Spr (Geller) MTTh 2:15

3 units, Spr (Claerbout) MWF 9

3 units, Aut (Claerbout) MWF 10

301. Problems in Geophysics.
Any quarter (Staff) by arrangement

380. Seminar: Exploration Geophysics—This seminar gives master's candidates an opportunity to frame and pursue their thesis research. Second year students in the Exploration Program report on summer jobs and develop their independent research projects, culminating in a written report and oral presentation to the department.
3 units, Aut (Cox) by arrangement

385A,B,C,D,E,F,G,H,J. Research Seminars—The research seminar serves several purposes for the graduate student. It gives the master's candidate an opportunity to frame and pursue his thesis research within the context of one of the ongoing research projects in the department. It gives the first-year Ph.D. candidate a chance to participate directly in advanced research prior to making his or her 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 or her 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 (Claerbout)
   by arrangement

385B. Research Seminar: Geomagnetism—Current research in paleomagnetism, geomagnetism, and plate tectonics.
   2 units, Aut, Win, Spr (Cox)
   by arrangement

385C. Research Seminar: Seismology—Current research in seismology, seismicity, and earthquake source mechanisms.
   2 units, Aut, Win, Spr (Kovach)
   by arrangement

385D. Research Seminar: Tectonophysics—Research in areas of current interest in rock mechanics, tectonophysics, and related problems. Content varies from quarter to quarter.
   2 units, Aut, Win, Spr (Nur)
   by arrangement

385E. Research Seminar: Tectonics—Research topics on the origin, major structures, and tectonic processes of the earth's crust.
   2 units, Aut, Win (Thompson)
   by arrangement

385F. Research Seminar: Strong Motion Seismology—Current research concerning near field wave propagation, studies of source models, and interpretation of strong motion data.
   2 units, Aut, Win, or Spr (Boore)
   by arrangement

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

385H. Research Seminar: Global Tectonics and Seismology—Current research in plate tectonic processes and application of seismology to this research.
   2 units, Aut, Win, Spr (Sleep)
   by arrangement

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

397. Introduction to Contemporary Geophysics—Seminar on current topics of interest in geophysics with particular emphasis on active research programs within the department. Required of all incoming graduate students.
   1 unit, Aut, Win, Spr (Staff, Geller in charge) F 3:15

   2 units, Win (van Andel)
   by arrangement; not given 1980-81

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 or her 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.
Associate Chairman: William E. Brigham
Acting Assistant Professor: Roland N. Horne
Visiting Professor: John D. Bredehoeft

OFFERINGS

The study programs of the Department of Petroleum Engineering are designed to train graduates competent in the engineering technology of petroleum, mineral fluids, energy and water 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
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-situ shale gasification, solution mining, natural gas engineering, mineral resource management and development, and mathematical simulation of these systems. Undergraduate participation in both research and industrial practice is encouraged and aided. The main objective of this program is to produce mature engineers of 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. For the past five years, baccalaureate degree recipients have commanded the highest starting salaries of all baccalaureate and Master's 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 Laboratory of Petroleum Engineering, which is devoted exclusively to the department. The Lloyd Noble Building contains six laboratories for high temperature fluid flow and geothermal energy research, oil recovery research, adsorption studies, 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. Other 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.

**UNDERGRADUATE PROGRAMS OF STUDY**

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 this field. 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 pregraduate 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><strong>Total</strong></td>
<td><strong>180</strong></td>
</tr>
</tbody>
</table>

**GRADUATE PROGRAMS OF STUDY**

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 ex-
ceeds 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 accomplishment in research. A minimum of both extensive course work and two years of graduate work beyond the Master's degree is required for the degree.

Masters 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 a knowledge of basic principles and research methods in the general field of study by preparing a report, to be submitted to at least two faculty members.

Usual research subjects include oil and gas recovery, reservoir engineering, transient well-test analysis, flow of non-Newtonian fluids, geothermal energy, well log analysis, natural gas engineering, 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>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>
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<tr>
<td>Pet.E. 270C. Advanced Reservoir Engineering</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pet.E. 270D. Reservoir Simulation</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
Electives† 15
Total 45

† Electives are to be selected with the approval of the student's advisor.

The above course listing is typical, but other specific course listings are available in the department for students interested in concentrating on improved oil recovery, geothermal energy, environmental engineering, hydrology, oil transportation.

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 representing 15 units of research, meeting the approval of the supervising instructor and the University Committee on Graduate Studies.

Engineer (Management Option)

The objective is to broaden the student's training in professional engineering and to provide a background in business administration.

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), and in
cluding all the course requirements of the department's Master's degree except the research. If the candidate has received unit credit for such research, this credit ordinarily would be transferable to the Engineer degree. No more than 10 of the required 90 units may be applied to overcoming deficiencies in undergraduate training. The candidate is required to take a minimum of 36 units in Industrial Engineering and the Graduate School of Business. The following courses are suggested (other courses may be selected with advisor approval):

**BUSINESS**

Bus. 210-211. Accounting I and II 4 ea.
Bus. 220. Business Finance I 4
Bus. 240. Marketing Management 4
Bus. 303. Economic Forecasting 4
Bus. 321. Investment Management 4
Bus. 366. Management Information Systems Survey 4
Oper. Res. 240. Linear Programming 3

Additional units needed to make up the required 90 may be electives. 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.

**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
Math. 131. Partial Differential Equations—I 3
Math. 132. Partial Differential Equations—II 3
Mechanical Engineering 200A, B, and C.
Mathematical Methods in Mechanical Engineering 3 ea.
Mech. E. 201. Applications of Complex Variables 3
Comp. Sci. 106. Introduction to Computing 3
Comp. Sci. 135. Numerical Methods 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
App. Earth Sci. 251. Oil Field Exploration and Development 3
App. Earth Sci. 255. Introduction to Solute Transport 2
App. Earth Sci. 257. Hydrogeology in Engineering Practice 2
Geol. 232. Numerical Methods in Hydrology 2
Geol. 278. Organic Geochemistry and the Geochemical Environment of Life 2
Geophys. 180. Geologic Interpretation of Reflection Seismograms 3
Geophys. 190. General Geophysics 4
Geophys. 262. Rock Physics 3

**ENGINEERING**

Chem. E. 140. Fluid Mechanics 3
Chem. E. 150. Energy and Mass Transfer 3
Engr. 287. Methods and Experiences in Engineering Education 3
Engr. 289. Seminar in Fluid Mechanics 1
Ind. Engr. 232. Advanced Engineering Economy 3
Mech. E. 250A. Heat Transfer 4
Mech. E. 252A. Convective Heat and Mass Transfer 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 completes a minimum of 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 before the end of the academic year.

The departmental qualifying examinations usually are taken at the beginning of the 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 a dissertation which is a contribution to knowledge and the result of independent work.

The Ph.D. dissertation must be submitted in its final form within five calendar years from the date of admission to candidacy by the University Committee on Graduate Studies. Candidates for the degree who fail to meet this deadline will be required to reapply for admission to candidacy and retake the departmental qualifying and University oral examinations. They will be given one additional year in which to submit their dissertations.

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 9, 11

150A. Well Log Analysis I—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. This is the first part of a two-part course and concentrates on the electrical logs.

3 units, Aut (Sanyal) by arrangement

150B. Well Log Analysis II—This is the second part of the course. Concentrates on all non-electrical logs and various interpretive techniques.

3 units, Win (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) by arrangement


3 units, Win (Marsden) MWF 11


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

151D. Reservoir Fluids Laboratory—Physical properties of petroleum and its products, distillation, gravity, viscosity, surface tension, etc. 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, formation resistivity factor of porous media. 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) TTh 10-11:50

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

3 units, Spr (Horn) T 10-11:50, Th 11


1 unit, any quarter (Staff) by arrangement

170. Elements of Reservoir Engineering—Lectures, problems. Description and classifica-
tion 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: 151A and 151B.

3 units, Spr (Staff) MWF 9


3 units, Aut (Ramey) MWF 10


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 provide an optimum inspection of formations. Prerequisites: 150A and 150B 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. Appraisal of development and remedial work on oil and gas wells; appraisal of producing properties; 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, Kourt, Voss) S 9-12, or by arrangement


Any quarter (Staff) by arrangement

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

3 units, Win (Horne) MWF 10


3 units, Aut (Brigham) MWF 9


3 units, Win (Brigham) MWF 9

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

3 units, Spr (Staff) by arrangement

270D. Reservoir Simulation—Lectures, seminar. Advanced group study of reservoir computer simulation. Applications of electronic computing machinery to reservoir problems. Commercial simulators. Prerequisite: 270A and 270B.

3 units, Spr (Horne) by arrangement


3 units, Spr (Ramey) MWF 10


Any quarter (Staff) by arrangement

274. Introduction to Research Methods—Lectures, demonstrations, preparation and presentation of research proposals. Theoretical and experimental methods. Literature surveying and compiling.

3 units, Aut (Marsden) MWF 10


3 units, Win (Staff) by arrangement


3 units, Spr (Ramey) MWF by arrangement

280A. Improved Recovery Methods—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) 2:15-5:15

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. Laplace transform, Green’s function and method of images approaches. Prerequisites: Mechanical Engineering 200A or Mathematics 131, and consent of instructor.

3 units, Aut (Horne)


3 units, Spr (Marsden) MWF 11

Alternate years, given 1980-81

284. Non-Newtonian Fluids in Petroleum Production Engineering—Properties and applications of non-Newtonian fluids in both drilling, completing, cementing, fracturing, improving production of wells; transportation and recovery.

3 units, Spr (Marsden) MWF 9

Alternate years, given 1981-82

285A, B, C, D. Research Seminars—The research seminar serves the purpose of pursuing special, focused study in areas of research within the department. All graduate degree program students may use this opportunity to participate in advanced work in areas of particular interest prior to making a final decision on a thesis subject. Prerequisite: consent of instructor.

285A. Research Seminar—Special drilling, production, or reservoir engineering subjects.

1 unit, Aut, Win, Spr (Staff)

by arrangement


1 unit, Aut, Win, Spr (Sanyal)

by arrangement


1 unit, Aut, Win, Spr (Ramey, Kruger)

by arrangement


1 unit, Aut, Win, Spr (Ramey)

by arrangement

359. Teaching Experience in Petroleum Engineering—On the job training in teaching petroleum engineering. The student will prepare and present several lectures, problem sets, grade problems, and prepare laboratory experiments under the supervision of a regular course instructor. Performance will be evaluated by both students and the regular instructor.

1-3 units, any quarter (Staff) by arrangement


Any quarter (Brigham, Cinco-L, Dykstra, Horn, Horne, Marsden, Miller, Ramey, Sanyal, Standing) by arrangement

Dean: J. Myron Atkin

Associate Deans: Jack Thomas (Administration), Arturo Pacheco (Academic and Student Affairs)


Visiting Professors: Charles Benson, Bruno Bettelheim; Paul Peterson

Associate Professors: Edmund Fuenzalida, Wesley K. Ruff, Helen W. Schrader (by courtesy), Pamela L. Strathairn (by courtesy), Decker F. Walker

Assistant Professors: Michael Bratman (by courtesy), Lyn Corno, Daniel L. Duke, Joan E. Talbert. Acting: David Grossman, Nel R. Noddings, Barbara M. Pence, Joyce E. Reeves

Lecturers: Ray Bacchetti, Guy H. Browning, Fred Hargadon, Ronald B. Herring, Helen B. Krumboltz, Douglas P. Murray, Joel Smith, Carolyn P. Walker

OFFERINGS

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 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 or 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 doctoral 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 doctoral degree should consult also the University's general requirements described in the "Degrees" section in this bulletin, noting in particular, registration and residence requirements.

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 (SIDECA)
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 relevant administrative committee. Ordinarily candidates for the master's degree in the Curriculum and Teacher Education Area will have completed student teaching or another practicum, 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 Degree Program Office, 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 Degree Program Office, 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 Degree Program Office no later than the first two weeks

* 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.
of the quarter preceding the quarter in which degree conferral is expected.

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, English, French and Italian, German, History, Latin American Studies, Linguistics, Mathematics, 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:

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. (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 Degree Program Office, School of Education, no later than the first two weeks of the quarter preceding the quarter in which degree conferral is expected.

EDUCATIONAL 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 de-
gree 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 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." These three quarters may be taken consecutively (i.e., during a leave of absence or sabbatical) or during Summer Quarters. An effort will be made to accommodate special requests based on student needs.

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 Degree Program Office, School of Education, 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
- Music
- Physical Education
- Social Studies

International Development Education (SIDEQ)
- 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.

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 upon recommendation by the faculty of the School of Education and the University Committee on Graduate Studies. This degree is intended to meet the needs of (a) those who seek a comprehensive professional understanding of and competence in dealing with educational problems met by administrators, supervisors, guidance workers, and curriculum specialists; or (b) those who aspire to a scholarly preparation for teaching Education in colleges or universities.

Residence—Nine full tuition quarters of graduate registration (or the equivalent in partial tuition quarters) are required for the doctorate. Acceptable graduate work completed at other institutions may be included in the fulfillment of this requirement to a maximum of three quarters. (See sections on "Advanced 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. Admission to candidacy is granted by the School of Education and expires five years from the end of the quarter in which the candidacy is established.

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 administrative committee.

Complete information may be secured from the School of Education Degree Program Office.

**DOCTOR OF PHILOSOPHY**

The degree of Doctor of Philosophy (Ph.D.) is conferred by the University upon recommendation by 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 tuition quarters of graduate registration (or the equivalent in partial tuition quarters) are required for the doctorate. Acceptable graduate work completed at other institutions may be included in the fulfillment of this requirement to a maximum of three quarters. (See sections on "Advanced 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.

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 the School of Education's *Manual on Advanced Graduate Degrees* for procedures). Admission to candidacy is granted by the University Committee on Graduate Studies and expires five years from the end of the quarter in which the candidacy is established.

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 relevant School of Education Area Committee and administrative committee, and the University Committee on Graduate Studies. Complete information may be secured from the School of Education Degree Program 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 School’s advisor for the minor.

**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 on or shortly after registration day in the first quarter of residence.

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

**TEACHING CREDENTIALS**

The School of Education is authorized to recommend those students who complete the Stanford Teacher Education Program (see below) 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 (STEP) 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, Foreign Language (French, German, Spanish), Mathematics, Music, Physical Education, Science (Biology, Chemistry, Physics), and Social Science.

**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.

* Stanford does not offer training for a teaching credential at the elementary level (Multiple Subject Credential) at this time.
perience in supervised teaching. Persons who have been out of college for some time but now seek to prepare to teach, as well as recent graduates, are encouraged to apply. The number of candidates who can be admitted to prepare in a particular subject area is limited by the facilities of the University and by the number of school assignments available in that subject field.

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.

The Graduate Record Examination (Aptitude Test)—Required for admission.

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.

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) The course in special education.

h) Subject matter knowledge 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 DR.X.

The School of Education is primarily a professional graduate school. However, undergraduates are welcome in many courses numbered 100–299.

Course descriptions are arranged in numerical order and indexed by professional program areas.

"X" suffix denotes an Experimental Course which is offered only once or twice. With faculty approval it can then be offered as a regular course in the School of Education.

"S" suffix denotes a Special Course, given only once, by the School of Education. It is not included as a regular offering. This designation is intended particularly for courses taught by
100. Practicum in Education—For undergraduates who are interested in questions of educational policy and practice and who wish to test their ideas and talents in a variety of educational opportunities within neighboring institutions and local schools. Supervised teaching, tutoring, project, and internship experiences are possible.  
2-3 units, Aut, Win, Spr (Chenoweth) dhur

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

110. Introduction to Models in the Social Sciences—(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. (SSE)  
5 units, Aut (March) TTh 8-10

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 (Thoresen) M 3:15-5:05

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 (Staff) M 3:15-5:05

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, Spr (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, Win (Walker) MW 1:15-3:05

147. Social Structure of World Society—(Same as Sociology 152) This course 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 course will utilize a mixed lecture-discussion format. (IDE)  
5 units, Spr (Inkeles) MWF 11

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) TTh 4:15-5:30

155. Development of Measuring Instruments—Intended for persons planning to develop achievement tests, reasoning tests, or questionnaires for research and evaluation, and for teachers wishing to improve classroom examinations. Planning the test, writing items, item tryout and criticism, qualities desired in tests and interview techniques. Lectures, case studies and practical exercises. (PSE)  
3 units, Aut (Staff) TTh 4:15-5:30

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, Aut (Nixon) MWF 10-10:50
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)
4-5 units, Spr (Herring) by arrangement

170. Sex and Education—(Same as Sociology 112.) Examines gender as a critical variable in educational institutions and labor markets. Interdisciplinary approach to issues such as the distribution of power in schools, the determinants of occupational choice, the relative payoff of schooling for women and men, the causes of differential behavior and treatment between the sexes in schools and in the work force, and the legal redress of inequalities. Readings, lectures and discussions on theoretical, empirical and policy materials. Coordinated with the Center of Research on Women's (CROW) Wednesday noon lecture series. The three primary disciplines in the course will be economics, history and sociology, but professors of psychology and the law will also take part in the analysis. (SSE)
3-4 units, Spr (Cohen, Strober and Tyack) MW 2:15-3:05; W 12-1:00 and one hour by arrangement

171. Women and Competence: Responding to Social Change—(Same as Psychology 154 and Undergraduate Special 71.) In this cross-disciplinary course students examine gender role behaviors and apply psychological techniques to strengthen or change self-selected socialized responses. Self-management skills based on research in social learning are designed to help students learn positive ways to exert more control over their environments and deal with such problems as double binds, socialized fears, autonomy and identity. Open to graduates and undergraduates. Enrollment limited. Prerequisite: consent of instructor. (SSE)
4 units, Aut, Win (H. Krumboltz) TTh 2:15-4:05

172. Status Attainment: Education and Work—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, Sum (Talbert) TTh 1:15-3:05

177. Physiology of Exercise—Physiological adaptations of the human organism to exercise stress. Limited to those persons who have had or are taking Anatomy. (CTE)
2-3 units, Spr (Ruff) TTh 9-10

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

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—This course is designed with the intention of teaching students how to philosophize in a serious way about educational values and methods. We will use a combination of lectures on the critical and analytical methods of philosophy; reading and discussion of representative articles in philosophy and education; the development of analytical and logical skills through paper-writing. Philosophy is neither so obscure nor so simple as some persons imagine; we will learn together how to think more clearly about the conceptual and normative assumptions underlying the issues of concern to us as educators. (SSE)
4 units, Aut (Staff) MW 3:15-5:05
204B. Introduction to Philosophy of Education: Curriculum Focus—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 (Staff) MW 1:15-3:05

205. Ideology and Education—Philosophical analysis of the concept of "ideology" as it has been developed in critical social theories from Marx to the present; in particular, we will focus in class lectures and discussions on the claim that all education is ideological, and we will raise the question of whether or not there is any non-ideological way of setting and evaluating educational goals. The second half of the course will focus on a comparative analysis of ideology and education in several distinct national contexts: U.S.A., Cuba, Tanzania. (SSE)

4 units, Win (Pacheco) MW 10-12

206A,B,C,D. Workshop on Problems of International Development Education—This course sequence is designed as a core workshop throughout the year for A.M. students in SIDEC and, with the consent of the instructor, other interested students. 206A is required for all first year SIDEC students (A. M. and Ph. D.). (IDE)

3 units, Aut (Carnoy, Fuenzalida, and Staff) M 12-2 and by arrangement

3 units, Win (Carnoy, Fuenzalida, and Staff) M 12-2:05

3 units, Spr (Fuenzalida, Carnoy, and Staff) M 12-2

206D. Workshop on Problems of International Development Education IV.
3 units, Sum (Staff) M 2:15-3:05, W 2:15-4:05

210. Sociology of Education—(Same as Sociology 210.) Introduction to sociological approaches to educational phenomena. Topics include school organization and environment, the relationship of education to adult roles, the impact of social class and ethnicity on classroom learning and the social structure of the classroom. Course work includes reading and evaluating social science research. Features short written assignments and individual feedback. Course 210 will meet with course 310. (SSE)

4 units, Win (Cohen and Talbert) MW 1:15-3:05

211. Introduction to Philosophy of Social Science—(Same as Philosophy 166.) Intended for upper division undergraduates who are majoring in one of the social sciences, and for beginning graduate students in related areas such as education. The course will begin by focusing upon the differences various writers have noted between the natural and social sciences, and will then move on to several topics of importance in the social sciences: explaining human action, the functional explanation of social phenomena, and holistic versus reductionist orientations. Examples from contemporary social science research literature. (SSE)

4 units, Win (Phillips) TTh 1:15-3:05

212. Practicum in Ethnographic Futures Research—Same as Anthropology 269.) (Undergraduates register for Anthropology 69.) Instruction and guided practice in the rationale and conduct of Ethnographic Futures Research (EFR), a non-directive, semi-structured, open-ended technique for eliciting from a sample of interviewees their middle-range perceived and preferred alternative cultural scenarios for a given social group. EFR is an auxiliary technique for research on sociocultural change; a means of augmenting conventional planning and policy-making approaches; and an educational technique for both interviewer and interviewee. Instruction will include ways of combining EFR with conventional ethnography and with a variety of other futures research techniques. No prerequisites, but Education 287 recommended. (IDE, SSE)

3-5 units, Spr (Textor) MW 2:15-3:45, and by arrangement

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. Prerequisites: Basic statistics, Communications 207 (or equivalents), Communications 256. (IDE)

3-5 units, Spr (Searle) 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, Spr (Gage) MW 3:15-5:05

SCHOOL OF EDUCATION
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) TTh 3:15-5:05

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, Win (Staff) MW 4:15-6:05

219. Artistic Development of the Child—Designed to introduce student to research in the behavioral sciences having relevance for understanding of the child's artistic development. (CTE)
4 units, Win (Eisner) MW 9-11

220A,B,C. The Social Sciences and Educational Analysis—Relationships among economics, 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 economics for one additional unit of credit. (APA, SSE)
4-5 units, Aut (Levin) TTh 9-11

220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education—(Same as Political Science 187P.) 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 (Peterson) MW 11-12:30; and by arrangement

220C. The Social Sciences and Educational Analysis: Introduction to the Sociology of Education—(Same as Sociology 143.) 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)
5 units, Spr (Meyer) MWF 9-10

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 of Complex Organizations—Introduction to the nature of managerial work in various types of organizations including but not limited to educational institutions. Five topics are examined from the viewpoint of the manager: leadership, change, decision making, conflict resolution, and communication. Case studies of management oriented problems form an integral part of the course. (APA, SSE)
4 units, Aut (Bridges) 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, Win (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, SSE)
4 units, Spr (Tyack) TTh 1:15-3:05

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

A. 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)

3 units, Aut, Spr (Coladarci) W 7-10

B. 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) MW 9-11

C. 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 constructing 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 (Staff) TTh 8:30-10

228. Literature and Research in Higher Education—A review of research strategies for the study of higher education, preparation of research proposals and research design, culminating in the preparation of proposals for a doctoral dissertation. The course is especially designed for second-year doctoral students trying to develop a dissertation problem and proposal. (APA)

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

230X. Educational Research: An Introduction—The role of research in education, the definition of productive questions and hypotheses, and a survey of major research strategies and data gathering techniques. Attention given also to semantic dimensions of research and to ethical considerations in planning and conducting inquiries. (ALL AREAS)

3 units, Aut, Spr (Coladarci) W 7-10

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. Major emphasis on improving writing skills. Enrollment limited. (PSE)

3 units, Aut (Thoresen) M 2:15-4:05

and by arrangement

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

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

and by arrangement

235. Management of Chronic Stress—(Same as Psychology 160.) Introduction to conceptual models of chronic stress in home, work, and community environments. Particular attention to methods and programs to assess as well as to alter chronic stress. Using a cognitive social learning model, psychosocial factors will be emphasized in considering the etiology, maintenance, and modification of stress, along with biochemical-physiological processes. The “Type A” Behavior Pattern will be examined as one perspective of chronic stress in humans. Intended for students (upper division undergraduates or graduates) interested in psychosocial as well physiological factors in health-related problems, especially intervention methods. (PSE)

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

and by arrangement

236X. The Education of the Exceptional Child—Purpose: The central aim of the course is to 1) provide comprehensive insights into the strengths and weaknesses of the exceptional child; 2) enhance awareness of formal and informal means of assessing cognitive, affective, and perceptual strengths and weaknesses; 3) foster the planning and implementation of educational strategies to satisfy the assessed needs of the student; and 4) introduce relevant legislation and the implications it holds for management of the exceptional child. (CTE)

2-3 units, Spr (Staff) by arrangement

237S. Educational Research for Teachers and School Administrators—the purpose of this special course is to encourage practicing teachers and administrators to conduct studies
in their areas of concern and to show how such studies may be defined, planned, carried out and disseminated. Each participant is asked to define and plan a study during the summer with the assistance of the instructor, who also will be available to enrollees during the 1981-82 academic year for continuing advice and assistance in carrying out their studies. Course content will include attention to the general nature of educational research, the generation of good questions, strategies and techniques relevant to research interests of class members, and predictable problems of "field" research.

3 units, Sum (Coladarci) TTh 11:30-12:30

238A,B,C. Counseling Psychology: Supervised Applications—Supervised counseling interventions at 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 (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)

2-4 units, Aut, Win, Spring (Browning, C. Walker) by arrangement

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

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

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) TTh 3:15-5:05


3 units, Sum (Duke) MW 2:15-3:30

246A. Secondary Teaching Practicum—Training and practice in specific skills in teaching. (CTE)

1-15 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. 1-13 units, Aut (Staff) by arrangement

246C. 1-13 units, Win (Staff) by arrangement

246D. 1-13 units, Spr (Staff) by arrangement

247. Affective Education—Students will play a role in both structuring the course and selecting topics from the following: Anxiety, stress, and courage, values and evaluation; receptivity; intuition, creativity; morality and moral development; caring; survey and evaluation of affective programs. (CTE)

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

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) T 1:15-4:05

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: Statistics 160 or special permission of instructor. (MME)

8 units, Sum, (Staff) MTWTh 10-12

250A. 4 units, Win (Staff) MWF 11-12:30

250B. 4 units, Spr (Staff) 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 (Staff) 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) TTh 1:15-3:05

251. Experimental 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. Students with an undergraduate mathematics major or equivalent preparation should enroll in Education 252A. (PSE)
3-4 units, Aut (Snow) MW 2:15-4:05

254. Anthropological Research Methods with Implications for Education—(Same as Anthropology 192.) Seminar on anthropological research methodology generally, and practicum on ethnographic methodology specifically. All ethnographic methods are covered, but emphasis is upon participant observation and semi-structured ethnographic interviewing. All students develop general background by reading ethnographies, and all are encouraged but not required to develop ethnographic skill by the conduct of local field research on a topic of their choice, under the instructor's guidance. Educational implications are systematically addressed. (IDE, SSE)
3-5 units, Win (Textor) TTh 7-10, and by arrangement

255. Human Abilities—(Same as Psychology 153.) 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)
4 units, Sum (Walker) MW 1:15-3:05

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)
262B. 2 units, Win (Staff) dhr
262A. 2 units, Sum (Staff) dhr

263B, A. Curriculum and Instruction in Mathematics—Purposes and programs of mathematics in the secondary curriculum; teaching materials, methods. (CTE)
263B. 2 units, Win (Staff) dhr
263A. 2 units, Sum (Staff) dhr

264A, B. Curriculum and Instruction in Modern Languages—Methods, techniques of foreign language teaching, testing. Materials of foreign language teaching. (CTE)
264A. 2 units, Sum (Politzer) TTh 1:15-3:05
264B. 2 units, Aut (Politzer) TTh 4:15-6:05

265A, B. Curriculum and Instruction in Music—Theory and practice of vocal and instrumental instruction.
265A. 3 units, Sum (Staff) by arrangement
165B. 2 units, Aut (Staff) T 4:15-6:05

266A, B. 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)
266B. 2 units, Win (Staff) T 8-9:30
266A. 2 units, Sum (Staff) dhr

267A, B. Curriculum and Instruction in Science—Examination of possible objectives of secondary science teaching and related methods: selection and organization of content and instructional materials; laboratory and demonstration techniques; evaluation, tests; curricular changes; ties with other subject areas. (CTE)
267A. 3 units, Sum (Staff) MTWTh 3:15
267B. 2 units, Aut (Staff) T 4:15-6:05

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, inservice 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)

269A. 3-6 units, Win (Duke) W 6:05-9:00 and by arrangement

269B. 3-6 units, Sum (Duke) MW 8:30-10:00 and by arrangement

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, (Staff) Th 7-9

274A, B, C. Ethics of Development in a Global Environment (EDGE)—(Same as Engineering 297A, B, C, Political Science 140A, B, C, Anthropology 133A, B, C, Social Thought 197A, B, C, Graduate Special 297A, B, C.) Theory and practice of development in a global setting. Open to graduates and undergraduates, appropriate to both foreign and American students. 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. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures analyzed in terms of appropriateness to development in both less developed and industrialized societies. Addresses need for linkage between the necessary specialization of academia and the inherently interdisciplinary and problem-oriented nature of our living societies. Development strategies viewed with recognition of need for improvement in quality of life within nations and among nations while also recognizing limitations of the earth's physical life support system and constraints in our cultural systems. 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, life-styles. Development examined in terms of relative satisfaction of human needs. Winter: Alternative development strategies including country case studies. Spring: The individual and social change; the economist, political scientist, educator, etc., as designer of alternatives and as policy and decision-maker. Lectures, discussions, workshops. (IDE)

274A, B, C. 1-4 units, Aut, Win, Spr (Cooper, Fagen, Fuenzalida, Lusignan, McWhorter, Siegel, Textor) Lectures M 7:30-9:30 p.m. and groups 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, Spr (Staff) MW 2:15-4:05

278. Introduction to Issues in Evaluation—An introduction to the basic literature and major theoretical and practical issues facing the emerging evaluation profession. Topics to be covered are evaluation as a branch of experimental science; models of evaluation; quantitative and qualitative approaches to evaluation; evaluation as related to decision-making and the political process; and professional standards of evaluation. (SSE)

4 units, Aut (Phillips) TTh 12-2:05

279X. Managing in Higher Education: The Roles of Principles, Ideas, and Skills—How the strands of principles, ideas, and skills come together in the practical tasks of managing. Organized around topics (e.g., problem diagnosis, planning and budgeting, decision-making); Draws on case studies, examples, and experiences to examine how theory and practice inform and influence one another. The main frame of reference will be universities, although much of what is covered will apply to all colleges as well. The main objective is to study managing—what it is and how one does it effectively in higher education. (APA)

3 units, Spr (Bacchetti) W 3:15-5:05
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

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 school 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, Win (Staff) M 4:15-6:05; W 4:15-5:05

287. Cultural Approaches to Alternative Futures—(Same as Anthropology 148.) Seminar exploring alternative middle-range futures of a community, a society, or the world from an anthropological perspective. Stress is laid upon developing ability to read the futures literature critically, and upon combining creative scenario-building with the rigorous use of explicit models and systematic data. In the context of global ecological and energy constraints, and socio-political imperatives, particular Western and non-Western cultures are examined in depth in terms of their adaptive capacity or vulnerability. Implications for the educator, planner, and policy-maker are addressed. Experiential techniques complement a lecture-and-discussion format. (IDE, SSE) 3-5 units, Win (Textor) TTh 2:15-3:45, and by arrangement

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 293.) 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) T 11-12 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 3:15-5:05

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) 4-5 units, Aut (Tyack) Th 10-12 and two hours by arrangement

303. Colloquium on Cultural Pluralism—Philosophical analysis of theories of plural-societies and the concept of cultural pluralism, focusing on theories of society that purport to explain the persistence of racial, cultural, and ethnic minorities as separate subgroups in both the U.S. and third world contexts. Related notions such as biculturalism, marginality, assimilation, acculturation, and cultural domination and dependence are also examined, with special reference to education and schooling. (SSE) 4 units, Spr (Pacheco) MW 10-12

304A. Philosophical and Educational Thought of the Pragmatists—(Same as Philosophy 216A.) Introduction to the influential philosophical and educational writings of C. S. Peirce, William James, and John Dewey. Topics discussed: the philosophy of pragmatism - Peirce on meaning and chance; James on truth and the "biological view of mind"; Dewey on truth, knowledge, body and mind; criticism of pragmatism, especially those of G. E. Moore and Bertrand Russell; the educational writings of James and Dewey; the contemporary scene: Peirce, Dewey, and Popper; Dewey and the open classroom. (SSE) 4 units, Win (Staff) TTh 2:15-4:05

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, Spr (Phillips) TTh 12-2:05

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 (Carnoy) TTh 2:15-4:05

and by arrangement

306B. Education and Political Change—Introduction to the analysis of the relations between education and politics from a comparative perspective. Of special interest are: alternative paradigms for the study of education and politics, international elements in educational development, the politics of educational planning and reform, processes and conditions of political learning. (IDE, SSE)

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

and by arrangement

306C. Education and Sociocultural Change—(Same as Anthropology 238.) (Undergraduates register for Anthropology 138.) Examines the role of education in modernization within a context of ecological and energy constraints, dependency, and culturally engendered value conflicts, utilizing a variety of theories and models of sociocultural change. Examines ethnocentric and ethical implications of "development" and, through in-depth case studies, seeks to promote empathic, culture-specific understanding of the needs of non-Western peoples whom development programs are intended to serve. (IDE, SSE)

3-5 units, Spr (Textor) TTh 2:15-4:05

and by arrangement

306D. 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) MW 2:15-4:05

and by arrangement

310. Sociology of Education—(Same as Sociology 310.) For doctoral and master's students. Meets with Education 210 (See course description). Emphasis on conceptualizing and analyzing applied sociological research in education. Features short written assignments, individual feedback and work with actual research data. (SSE)

4-6 units, Win (Cohen and Talbert) MW 1:15-3:05

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. Status Problems in the Classroom: Evaluation and Treatment—(Same as Sociology 242.) Classrooms with students from differing racial, cultural, linguistic and social class backgrounds often have status problems which impair the motivation, participation and learning of some students. We will use sociological and social psychological theory and research to examine these problems and their relationship to common teaching practices. From recent research students will learn some ways to evaluate and treat these problems. (SSE)

4 units, Aut (Cohen) MW 9-11

312B. Interaction Processes in Education—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)

Offered 1981-82

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)

2-4 units, Aut (Gross) W 1:15-3:05

315. Cultural Transmission—(Same as Anthropology 266.) Education in cross-cultural perspective: transmission of values; transmission of covert culture, implicit cultural assump-
tions; 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, Spr (G. Spindler,) T 7:00-10:00 and by arrangement

317. Psychological 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, Aut (Gage)

323A. Urban Policy-making in the Federal System—(Same as Political Science 289P.) The formulation and implementation of federal policies in urban contexts, analyzing the way features of local politics affect rational programs. Comparisons of education with other policy areas. (APA)

4 units, Spr (Peterson) MW 1:15-3:05, 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, Sum (Corno) MW 10-11:30

327. Research Practicum: Social Sciences in Education—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, Spr (Talbert) Th 1:15-4:05 and by arrangement

335. 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)

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 (Staff) by arrangement

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

338C. 1-6 units, Spr (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) MW 9-11

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, 3 units, Aut (Walker) M 7-10 p.m.

342B, 3 units, Win (Walker) M 7-10 p.m.

343. 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 recent 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 impli-
cations for classroom instruction, teacher training, and curriculum development. (PSE)
3 units, Win (Corno) MW 10-11:30

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 (Staff) MW 1:15-3:05

347. Problems of Teacher Education—Designed to enable students to formulate researchable problems and promising methods for the study of teaching. It will also examine some of the current issues affecting contemporary teachers, such as competency based teacher education, voucher systems, the influence of package curricula, and other such educational developments. (CTE)
3 units, Spr (Duke) MW 8:30-10

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, Sum (Eisner) MW 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 leads 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) T 9-10, Th 9-11

350A, B. Psychological Studies in Education—Introduction to psychological studies in education. Required of first-year doctoral stu-

356. Seminar in Physical Education Research—Critique of selected recent literature and research. (CTE)
3 units, Aut (Nixon) M 8-9:50, F 8-8:50

357. Seminar in Physical Education Curriculum—Research in physical education curriculum and instruction. (CTE)
3 units, Aut (Nixon) W 8-9:50, F 9-9:50

359. Seminar in Physical Education (Motor Learning)—Review of research concerning movement behavior, motor skills, motor education, and perceptual-motor acts related to sport, dance, designed exercises, and movement exploration in the physical education curriculum. (CTE)
3 units, Sum (Nixon) MTWTh 8-8:50

365. Seminar: Planning Policy-Oriented Research—Working seminar for doctoral students who plan to carry out policy studies. Emphasizes 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. Emphasizes and provides 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 who have identified a dissertation problem area and are prepared to begin work on a proposal draft. Consent of the instructor is required for enrollment. (APA)
3 units, Win (Strober) M 3:15-5:05

370. Legal Basis for Education—This seminar examines the legal context of elementary and secondary education, landmark court decisions and federal legislation affecting education, and the legal problems involved in administering local school districts. Fulfills the law requirement for the California Administrative Services Credential. (APA)
4 units, Win (Bridges) TTh 10-12

371. Seminar: Convergence and Divergence in Industrial Societies—(Same as Sociology 287.) Focus on the question of whether, and how far, the industrial and the "developing" societies are converging or diverging in their social and cultural patterns. The special theory of convergence will be reviewed and evaluated in relation to more general theories of social change. Particular attention will be given to the
family and kinship, education, social stratification and mobility, but other institutional complexes of interest to the students will also be considered. (IDE)

3 units, Spr (Inkeles) T 2:15-5:05

373. Higher Education Institutions in Developing Countries—This course analyses 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)

3 units, Spr (Inkeles) T 2:15-5:05

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

3 units, Win (Fuenzalida) W 2:15-4:05 and by arrangement

375X. Education and Work—The course will examine traditional models of socio-economic structure and educational change, concentrating on the relationship between education and work. Emphasis will be put on functionalist and dialectical models. The literature covered by the course will include work done in the U.S., Europe and the Third World. Specific case studies will be used to illustrate the models. The course is open to students from all areas. (IDE)

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

376X. Education, Economy and the State—This course will explore the assumption that the basis for public education is the public good by reviewing theories of the state and their implications for the provision of public education. (IDE)

5 units, Spr (Carnoy) M 7:30-9:30, plus dhr

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

4 units, Spr (Eisner) MW 4-6

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.

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 theory and/or psycholinguistics. (CTE)

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


4 units, Aut (R. Politzer) TTh 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, Aut (Staff) TTh 2:15-4:05

401B. Seminar in the History of American Education—Research seminar intended for students in history and social sciences of education preparing to write dissertations. It will emphasize how to pose researchable questions, how to employ alternative models of explanation, and how to write clearly and cogently. (SSE)

4 units, Aut (Tyack) by arrangement

408. Research Seminar on the Politics of Education—The seminar combines a systematic review of key methodological issues (conceptualization, assessment of different kinds of evidence, explanation and interpretation) with a thorough critique of seminar members' own re-
search designs and proposals. Consent of instructor required. (IDE, SSE)
5 units, Spr (Staff) M 4:15-6:05 and by arrangement
411A. Seminar in Child Development and Early Education: Research Instrumentation—Seminar 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)
1-3 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)
1-3 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)
1-3 units, Spr (Hess) Th 2:15-4:05
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, Win (Snow) TTh 1:15-3:05
419. Seminar in Research on Teaching—A critical examination of research on teacher behaviors and characteristics considered as either dependent or independent variables. Prerequisite: Education 317. (PSE)
4 units, Win (Gage) MW 3:15-5:05
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,B,C. 2-5 units Aut, Win, Spr (Bridges) 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, Aut (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 (Staff, Thoresen) T 7:30-9:30 p.m., biweekly
448X. Experimental Design for Evaluation—Advanced course on the application of experimental design concepts to field-based evaluation of educational and social programs. The student will gain experience in applying the concepts to actual problems. Stress will be on comprehensive and efficient designs for sample selection, curriculum development, and instrumentation. Prerequisites: Education 250D or equivalent. (PSE)
3 units, Spr (Calfee) MW 1:15-3:05
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 units, Sum (Nixon) MTWTh 9-9:50
461. Seminar in Art Education for Doctoral Students—Provides an opportunity for doctoral students in art education to examine and critique specific research studies, reports, and theoretical materials published in the field and to present for group critique ideas and proposals that are being considered for doctoral dissertations.
Students will assume a major responsibility in the selection of the content for the seminar and for the ways in which the content is examined. Open to doctoral students in the School of Education who have a serious interest in understanding the role of the arts in education. Consent of the instructor is required. (CTE)
2-4 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)
3 units, Aut (Walker) T 4:15-7:05
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)
4 units, Win (Staff) T 2:15-4:05

466. Doctoral Seminar in the Design and Evaluation of Educational Programs (DEEP)—Required of all doctoral students in DEEP. Intended to give students in DEEP the opportunity to become acquainted with research in this field. Students will be able to learn in a relatively intimate setting about research activities in which they are engaged and the kinds of problems that they believe to be important in the field. Intended to introduce doctoral students to research and scholarship related to the DEEP program at Stanford. All DEEP faculty participate, along with other Stanford faculty and outside speakers. Upon completing the seminar, students should be acquainted with the major problems addressed in this field and different ways these are addressed by current investigators. (CTE)
3 units, Win (Corno, Duke, Eisner, Noddings, Walker) T 4-6

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)
   0-4 units, Aut, Win, Spr (Staff) Th 10-12 and by arrangement

477. Organization and Style in Research Reporting—Some major considerations in preparing formal reports of scholarship and inquiry, including theses and dissertations. Emphasis on organization; the achievement of clarity, technical, ethical and legal consideration; alternative conventions in citations, references, bibliographies and appendices; general stylistic practices. (All Areas)
   2 units, Win (Coladarci) Th 10-12

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

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

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

493B. Practicum in Consulting on Methodological Problems in Educational Research—Discussion of Topics of current methodology interest. Practicum in consulting on actual projects being carried out by faculty and students. (MME)
   1-3 units, Aut, Win, Spr (Olkin and Staff) Th 11-1

496. Seminar in Social Studies Education—Seminar in social studies education for advanced degree candidates. Comprehensive analysis of social studies education for the purpose of identifying researchable problems. (CTE)
   2-4 units, Win (Gross) W 1:15-3:05

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.

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
223. Literature and Research in Higher Education
240. Curriculum and Instruction in Higher Education (See Curriculum and Teacher Education.)
279X. Managing in Higher Education
321. Organization, Administration, and Governance of Pre-School, Elementary, Secondary or Community College Institutions at the District and Building Levels
323A. Education and Public Policy: Federal Education Policy and Administration
326A. Topics in Financing Education
330X. Educational Research
365. Seminar: Planning Policy-Oriented Research
370. Legal Basis for Education
422A, B, C. Internship in Educational Administration
424. Structure and Functioning of Institutions of Higher Education
470E. Practicum in Evaluation (See Psychological Studies in Education.)
477. Organization and Style in Research Reporting

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

217S. Teaching a Global Perspective: Cross-Cultural Approaches
230X. Educational Research
236X. The Education of the Exceptional Child
239A,B. Observation and Directed Teaching of Study Skills and Developmental Reading in College
240. Health and Adolescence
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
249. Curriculum and Instruction in Higher Education
257. Introduction to Curriculum Problems
262B,A. Curriculum and Instruction in English
263C,A. Curriculum and Instruction in Mathematics
264A,B. Curriculum and Instruction in Modern Language
265A,B. Curriculum and Instruction in Music
266C,A. Curriculum and Instruction in Physical Education
267A,B. Curriculum and Instruction in Science
268B,A. Curriculum and Instruction in Social Studies
269A,B. Professional Development Seminar in Instructional Leadership
272. Classroom Observation
273. Linguistics and the Teaching of English as a Foreign/Second Language (Same as Linguistics 270.)
291. Methods of Teaching German (Same as German Studies 302)
293. Methods of Teaching French (Same as French 289.)
295. Language Laboratory Techniques (Same as Language Laboratory 215)
297. Overview of Reading Instruction for the Public Schools
314. Seminar in Citizenship Education
335X. Instructional Theory and Research
340. Curriculum Theories and Curriculum Change
342A,B. Curriculum Construction
344. Alternative Models of Elementary Curriculum
347. Problems of Teacher Education
345. Educational Connoisseurship and Educational Criticism
349. Professional Education of Teachers
356. Seminar in Physical Education Research
357. Seminar in Physical Education Curriculum
359. Seminar in Physical Education (Motor Learning)
360. Curriculum Development in the Visual Arts
383. Recent Developments in Foreign Language Education
385. The Role of Non-Standard Dialects in Education
386. Linguistic Theories of Language Acquisition and Language Teaching
388. Foreign Language Education and Bilingual Education in the Elementary School
393S. Cognitivist Influences on Curriculum Construction
459. Seminar on Physical Education Issues
463. Seminar for Doctoral Students in the Design and Evaluation of Educational Programs
465. Research Seminar in the Teaching and Learning of English
466. Doctoral Seminar in the Design and Evaluation of Educational Programs
470E. Practicum in Evaluation—(See Psychological Studies in Education.)
482. Seminar in Research Problems in Teaching and Learning of a Second Language
496. Seminar in Social Studies Education

INTERNATIONAL DEVELOPMENT EDUCATION (IDE) (SIDEC)

147. Social Structure of World Society (Same as Sociology 152)
161. Introduction to Teaching and Learning in Asia
206A,B,C,D. Workshop on Problems of Development Education
205. Personality and Social Structure (Same as Sociology 123)
212. Practicum in Ethnographic Futures Research (Same as Anthropology 259)
214. Evaluative Research Methods for Mass Media Projects in Developing Countries (Same as Communications 257)
217S. Teaching a Global Perspective: Cross Cultural Approaches
230X. Educational Research
276S. Education in the People’s Republic of China
287. Cultural Approaches to Alternative Futures (Same as Anthropology 269.)
306A. Education and Economic Development
306B. Education and Political Development (Same as Political Science 221)
### SCHOOL OF EDUCATION

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>306C</td>
<td>Education and Sociocultural Change (Same as Anthropology 238)</td>
</tr>
<tr>
<td>306D</td>
<td>Sociology of Development and Education</td>
</tr>
<tr>
<td>371</td>
<td>Seminar: Convergence and Divergence in Industrial Societies (Same as Sociology 257)</td>
</tr>
<tr>
<td>373</td>
<td>Higher Education Institutions in Developing Countries I</td>
</tr>
<tr>
<td>374</td>
<td>Higher Education Institutions in Developing Countries II</td>
</tr>
<tr>
<td>375X</td>
<td>Education and Work</td>
</tr>
<tr>
<td>376X</td>
<td>Education, Economics and the State</td>
</tr>
<tr>
<td>470E</td>
<td>Practicum in Evaluation (See Psychological Studies in Education.)</td>
</tr>
<tr>
<td>477</td>
<td>Organization and Style in Research Reporting</td>
</tr>
</tbody>
</table>

#### MATHEMATICAL METHODS IN EDUCATIONAL RESEARCH (MME)

- 230X. Educational Research
- 250A, B. Statistical Analysis in Education Research I
- 250C. Statistical Analysis in Educational Research II
- 470E. Practicum in Evaluation (See Psychological Studies in Education.)
- 477. Organization and Style in Research Reporting

#### PSYCHOLOGICAL STUDIES IN EDUCATION (PSE)

- 130. Counseling and Therapy: An Introduction (Same as Psychology 144.)
- 136. Behavior Modification: Introduction (Same as Psychology 139.)
- 154. Psychology of Reading (Same as Psychology 143.)
- 155. Development of Measuring Instruments
- 215. Psychological Foundations of Education (Same as Psychology 145.)
- 230. Educational Research
- 232. Science and Research in Counseling Psychology (Same as Psychology 253.)
- 234. Individual Counseling Psychology Methods
- 235. Management of Chronic Stress (Same as Psychology 160)
- 235A, B, C. Counseling Psychology: Supervised Applications
- 251. Experimental Methods in Educational Research
- 252. Introduction to Test Theory (Same as Psychology 245.)
- 255. Human Abilities (Same as Psychology 155)
- 311. Socialization and Social Institutions (Same as Psychology 245.)
- 316. Cognitive Psychology of Education
- 317. Introduction to Research on Teaching
- 338A, B, C. Internship in Counseling Psychology
- 343. Motivational Processes in Education
- 350A, B. Psychological Studies in Education
- 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
- 416. Seminar on Aptitude
- 419. Seminar in Research on Teaching
- 448X. Experimental Design for Evaluation
- 470E. Practicum in Evaluation
- 477. Organization and Style in Research Reporting

#### COMMITTEE ON SOCIAL SCIENCES IN EDUCATION (SSE)

- 109. Cultural Pluralism: Classroom and Curricular Strategies
- 110. Introduction to Models in Social Science (Same as Sociology 171 and Political Science 105)
- 170. Sex and Education (Same as Sociology 112)
- 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. Ideology and Education
- 206. Personality and Social Structure (Same as Sociology 123.)
- 210. Sociology of Education (Same as Sociology 241.)
- 211. Introduction to Philosophy of Social Science (Same as Philosophy)
- 212. Practicum in Ethnographic Futures Research (Same as Anthropology 269)
- 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
- 230X. Educational Research
- 231S. The Economics of Women's Education and Work
- 234. Anthropological Research Methods with Implications for Education (Same as Anthropology 192.)
- 278. Introduction to Issues in Evaluation
- 286S. Instructional Innovation and the Problem of Change: A Sociological Analysis
287. Cultural Approaches to Alternative Futures (Same as Anthropology 148)

301. Colloquium on the Historiography of American Education (Same as History 301.)

303. Colloquium on Cultural Pluralism

304B. Aspects of Explanation in Social Science

305. Philosophy and Empirical Research

306A. Education and Economic Development

306B. Education and Political Change (Same as Political Science 116.)

306C. Education and Sociocultural Change (Same as Anthropology 238.)

306D. Sociology of Development and Education

310. Sociology of Education (Same as Sociology 241.)

312A. Status Problems in the Classroom: Evaluation and Treatment (Same as Sociology 242A)

312B. Interaction Processes in Education (Same as Sociology 242B.)

315. Cultural Transmission (Same as Anthropology 266.)

327. Research Practicum: Social Science in Education (Same as Sociology 386.)

381. Practicum in Cultural Pluralism

470E. Practicum in Evaluation (See Psychological Studies in Education.)

477. Organization and Style in Research Reporting

SPECIAL COURSES, INDEPENDENT STUDY, DIRECTED READING, PRACTICA, RESEARCH, DISSERTATION

180. 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

480. Directed Reading For advanced graduate students. By arrangement

490. Directed Research For advanced graduate students. By arrangement
SCHOOL OF ENGINEERING

Dean: William M. Kays

Associate Deans: James L. Adams (Academic Affairs), Kenneth S. Down, John G. Linvill, Robert L. Street (Research), David M. Mason (Student Relations)

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

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

OFFERINGS

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 undue delay.

Transfer credit will be given for courses taken elsewhere whenever the courses are equivalent or substantially similar to Stanford courses. The policy of the School of Engineering is to study each transfer student’s preparation and make a reasonable evaluation of the courses taken prior to transfer. Inquiries may be addressed to the Dean of Engineering at Stanford.

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.

For further information please refer to the Undergraduate Handbook, obtainable in the Dean’s Office, School of Engineering.
CURRICULUM COMPONENTS

As an aid in program planning, the curriculum is described in terms of 8 components: Writing, University Distribution, Social Sciences, 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 most engineering programs.) Students who qualify for advance 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 "Degrees" section of this bulletin for details).

DISTRIBUTION REQUIREMENTS

See "degrees" 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.

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 an 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 theses topics. A list of courses appropriate for satisfying the Engineering mathematics requirement is available in the office of the Dean of Engineering.

ENGINEERING BREADTH

(36 units minimum)

Every undergraduate engineering program includes coursework selected from a variety of engineering disciplines.

Accordingly, each student chooses a minimum of 36 units of courses from at least six of the nine categories listed below. Four 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 or 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

Course No. Subject Units
Aero. & Astro. 100. Intro. to Aero & Astro. 3
Engr. 3. Applied Mechanics: Statics 3
Engr. 11. Applied Mechanics: Stress Analysis 4
Engr. 21. Mechanics of Fluids 4
Chem. Engr. 140 Fluid Mechanics 3
Mech. Engr. 33. Introductory Fluids Engineering 3
Physics 110. Intermediate Mechanics 3

More Advanced Courses
Civil Engr. 107. Mechanics of Fluids 3
Civil Engr. 114. Mechanics of Materials 4
Mech. Engr. 131B. Thermosciences 5
Physics 111. Intermediate Mechanics 3

2. ELECTROMAGNETISM, ELECTRIC CIRCUITS, AND DEVICES

Engr. 41. Circuits 3
Engr. 42. Electronics 4
Engr. 43. Electromechanics 3
Engr. 44. Basic Electronics 5

More Advanced Courses
Elec. Engr. 101. Circuits I 3
Elec. Engr. 111. Electronics 3
Elec. Engr. 141. Electromagnetic Fundamentals 3
Physics 120. Intermediate Electricity and Magnetism 3

3. THERMODYNAMICS

Engr. 32. Introduction to the Thermosciences 3
Chem. 135. Physical Chemical Principles 3
Chem. 171. Physical Chemistry  
Mat. Sci. 181. Thermodynamics and Phase Equilibria  
Physics 170. Thermodynamics, Kinetic Theory, and Statistical Mechanics

**More Advanced Courses**
Chem. Engr. 110. Equilibrium in Thermodynamic Systems  
Mech. Engr. 131. Thermosciences

4. MATERIALS SCIENCE AND PROPERTIES
Engr. 50. Introductory Science of Materials  
Chem. Engr. 170. An Introduction to Polymeric Materials  
Engr. 51. Materials Technology for Structural Applications  
Engr. 52. Electronic Properties of Materials  
Mat. Sci. 190. Atomic Arrangements in Solids

**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
Phil. 57. Introduction to Logic  
Phil. 160A, B. Symbolic Logic

**More Advanced Courses**
Comp. Sci. 103. Programming in Fortran  
Comp. Sci. 104. Programming in Algol W  
Comp. Sci. 106. Introduction to Computing  
Comp. Sci. 107. Programming Methods  
Comp. Sci. 111. Introduction to Computer Organization, Machine and Assembly Languages  
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  
I.E. 144. Computer Simulation

6. ANALYSIS AND CONTROL OF DYNAMIC SYSTEMS
Engr. 104. Dynamic Response  
Engr. 105. Control System Analysis and Design

**More Advanced Courses**
Engr. 206. Control Systems Design and Simulation  
Engr. 207. Digital Control I  
Indus.-Econ. Sys. 201A, B. Dynamic Systems

7. MASS AND ENERGY TRANSFER
Chem. Engr. 20. Introduction to Chemical Engineering  
Chem. Engr. 120. Separations Processes  

SCHOOL OF ENGINEERING

**More Advanced Courses**
Elec. Engr. 293. Energy Processes
Chem. Eng. 160
Civil Engineering 176. Small Scale Energy Systems
Engr. 161. Engineering Economy
E.I. 100. Organizations: Theory & Management
Indus. Engr. 108. Work Systems Design and Measurement
I.E. 133. Industrial Accounting
Mech. Engr. 102. Design Communication
Mech. Engr. 103. Manufacturing Technology
Oper. Res. 50. Models and Applications of Operations Research in Society
Oper. Res. 151. Introduction to Operations Research I
Oper. Res. 152. Introduction to Operations Research I
Oper. Res. 153. Introduction to Operations Research II
Operations Research 154

**More Advanced Courses**
Engr.-Econ. Sys. 231. Decision Analysis
Indus. Engr. 160. Analysis of Production Systems
Indus. Engr. 164. Production Engineering Problems
Indus. Engr. 208. Man-Made Systems
Mech Engr. 115A. Introduction to Product Design

9. TECHNOLOGY & SOCIETY
C.E. 133. Introduction to Urban Planning
C.E. 170. Man and His Environment
M.E. 30. Social Aspects of Nuclear Power
M.E. 115A. Human Values in Design
M.E. 180. Energy and Society
VTS 101. Contemporary Technological Society
VTS 105. Ethics and Human Values in Technological Society
VTS 106. The Nature of Technology in Modern Society
VTS 107. Technology and Modern Industrial Society
VTS 121. Technology in Society: Historical Perspectives
VTS 142. Information: The Communications Revolution in Contemporary Society
VTS 145. Man, Molecules and Society: Chemical Revolution to Biological Revolution
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, or Product Design.

Innovative Majors (General Engineering). Any student, aided by an advisor, may propose a 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, are required.

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 coursework; 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 or 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

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 or her 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

Course No. Subject Units
Chem. 173. Physical Chemistry 3
Chem. 174. Physical Chemistry Laboratory 3
Chem. Engr. 120. Separations Processes 3
Chem. Engr. 130. Chemical Kinetics: Theory with Applications for Reactor Design 3
Chem. Engr. 140. Fluid Mechanics 3
Chem. Engr. 160. Chemical Engineering Plant Design 4
Chem. Engr. 170. Introduction to Polymeric Materials 3
Chem. Engr. 180. Chemical Engineering Laboratory 5

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
C.E. 198. Senior Report 3
At least one of the following: 4
Geology 101. Framework of Geology
Geophys. 51. Earth Physics
C.E. 116. Concrete Mix Design
C.E. 140. Surveying
At least one of the following: 4
C.E. 133. Introduction to Urban Planning
C.E. 144. Construction Engineering & Management
C.E. 171. Environmental Planning
C.E. 181. Design of Steel Structures
C.E. 182. Design of Reinforced Concrete Structures
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.

ELECTRICAL ENGINEERING
E.E. 101, 102, 103 or 104. 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 181S. Computer Organizations 3
E.E. 189 or 274. Laboratory 3
Restricted Electives (any Elec. Engr. courses) 36

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

INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT
I.E. 100. Organizations: Theory and Management 4
I.E. 121. Statistics and Quality 4
I.E. 125. Work Design and Measurement 4
I.E. 133. Industrial Accounting 3
I.E. 141. Utilization of Computers 3
I.E. 144. Simulation 3
I.E. 235. Introduction to Financial Decisions 3
I.E. 260. Analysis of Production Systems I 3
I.E. 104. Organizational Behavior Problems, or 3
I.E. 134. Financial Analysis Problems, or 3
I.E. 164. Production Engineering Problems 2
I.E. 241. Evaluation of Industrial Projects, or 2
I.E. 242. Organization Design and Control, or 2

SCHOOL OF ENGINEERING 85
I.E. 261. Analysis of Production Systems II 3
Eng. 161. Engineering Economy 3

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 4
M.S. & E. 202A, 202B. 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
Phys. 57. 3
Stat. 110. 4

Restricted Electives: (science or engineering courses approved by M.S. & E.) 4

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

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 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. 131C. 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 3
A.A. 210A. Fundamentals of Compressible 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. Environmental Engrs. 3
C.E. 171. Environmental Planning 3
C.E. 176. Small Scale Energy Systems 3
C.E. 177. Planning Distributed Energy 2
C.E. 270. Water Quality 3
C.E. 276B. Environmental Impact of Power 3
C.E. 276C. Environ, Radiactivity 3
A.E.S. 130. Environ. Earth Sciences 5
M.E. 137. Air Pollution 3
M.E. 138. Noise Pollution 3
M.E. 180. Energy and Society 3

PRODUCT DESIGN
Mech. Engr. 103. Manufacturing Technology 3*
Mech. Engr. 112. Mechanical Systems 3
Mech. Engr. 115A. Human Values in Design 3
Mech Eng. 115B. Expression of Function 3
Art 60. Basic Design 3
Art 70. Basic Photography 3
Art 100. Design I 3
Art 164. Color 3

* Product Design Majors only required to take 3 unit class. 1 unit lab not required.

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
School of Engineering Advisory Committee on Engineering in Biology and Medicine: L. J. Leifer, Mechanical Engineering (Chairman); Robert L. Piziali, Mechanical Engineering; I-Dee Chang, Aeronautics and Astronautics; L. J. Leifer, Mechanical Engineering, J. D. Meindl, Electrical Engineering; Alan S. Michaels, Chemical Engineering; T. S. Nelsen, 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 approximately 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 admission and financial aid to the appropriate department 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. Faculty in Mechanical Engineering are doing research on neuromuscular dynamics, computer-aided clinical neurology, bone elasticity, knee mechanics, spinal stabilization, robotic aids for the disabled. Cardiovascular dynamics and haemodynamics are being studied in the Aeronautics and Astronautics department. Biomaterials research is available in the Department of Materials Science and Engineering. In the Electrical Engineering Department a superb integrated circuits facility is used in research on advanced medical instrumentation, such as ultrasonic imaging systems, Doppler-shift blood flowmeters and micropower implantable electronics for neural prostheses and biological microsensors. Also in Electrical Engineering advanced analysis techniques are applied to signal processing EKG, EEG, and X-ray image. Most research projects are carried out in collaboration with faculty of the Medical School or members of the local medical community.

A major new opportunity for bioengineering experience is now available in the Rehabilitative Engineering Research and Development Center, a Veterans Administration sponsored cooperative program with the School of Engineering.

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 these degrees are not encouraged. An interdepartmental committee must approve these special programs. 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.

**BACHELOR OF ARTS AND SCIENCE (B.A.S.)**

This degree is available to students who complete both the requirements for a B.S. degree in engineering and the requirements for a major or program ordinarily leading to the A.B. degree. More information is included in the Degrees Section of this publication.

**COTERMINAL 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 A.M., B.S. and M.S., or B.S. and A.M. The degrees may be granted simultaneously or at the conclusion of different quarters. Usually five years will be needed for a combined program.

1. **Coterminal 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) degree plus 45 units for the second Bachelor's degree.)

2. **Coterminal 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 or her graduate department.

Admission to the coterminal 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 Coterminal Degree Programs—A Stanford undergraduate may apply (using the white University petition form) for admission to the Coterminal A.B./B.S. Program during the student's tenth or eleventh quarter. The student may apply for admission to the Coterminal 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 several accredited liberal arts colleges in providing a program that leads to concurrent award of the A.B. degree by the first college and the B.S. degree by Stanford. These programs comprise three years of study by the first college, with some emphasis on mathematics and science, followed by two years of study of engineering at Stanford.

Students applying for admission to the dual-degree program should request transfer application forms from the Stanford University Admissions Office. The dual-degree program applicants are given careful consideration for admission to Stanford, provided they meet the following three requirements: 1) the recommendation of the coordinator of the liberal arts college, 2) a grade point average which is competitive with those of other transfer applicants, 3) a satisfactory scholastic aptitude test score. 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.

Occasionally by careful planning, 3 + 2 students may enter the combined B.S.-M.S. program if they meet the requirements. The Master's degree cannot be obtained sooner than at the end of 6 quarters of study at Stanford. 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").

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.

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
Acroelasticsity
Aerodynamics
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
Guidance and Control
Physical Gasdynamics
Propulsion
Transportation
Waves and Vibrations

ENGINEERING

Interdisciplinary Programs
Interdepartmental Programs

ENGINEERING IN BIOLOGY AND MEDICINE

Biomaterials
Orthopaedic Biomechanics
Neuromuscular Biomechanics
Rehabilitative Engineering
Biostatistics
Design for Medical Applications
Water Quality Control
Information Processing in and for Biomedical Systems
Integrated Circuits for Medical Electronics
Transport Phenomena in Biological Systems

CHEMICAL ENGINEERING

Newtonian and Non-Newtonian Fluid Mechanics
Polymer and Colloidal Suspension Rheology
Hydrodynamic Stability
Electrochemical Energy Conversion
Applied Chemical Thermodynamics and 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
Water Resources Engineering
(including elements of hydraulics, hydrology, hydromechanics and nuclear environmental 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 "Dean of Graduate Studies and Research" section of this bulletin.

INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT

Production Systems
Engineering Economy
Engineering Management
Man-Machine Systems
MATERIALS SCIENCE AND ENGINEERING
- Electrical and Optical Behavior of Solids
- Electron Microscopy
- Energy Storage
- Fracture
- Imperfections in Crystals
- Kinetics
- Magnetic Behavior of Solids
- Materials Synthesis and Processing
- Mechanical Behavior of Solids
- Phase Transformations
- Photovoltaic Materials
- Physical Ceramics
- Physical Metallurgy
- 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
- Dynamic Programming
- Simulation Methodology
- Inventory Theory
- Queueing 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 in the "Degrees" section of this bulletin, 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. 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.

ENGINEER

The degree of Engineer is awarded at the completion of a comprehensive two-year program of graduate study. It is intended for those who desire more graduate training than can be obtained in a Master of Science program. The program of study must satisfy the student's department and usually includes 90 units beyond the B.S. degree of which at least 60 must be devoted to advanced or graduate study in the major subject or closely related subjects. The presentation of a thesis is required. The University regulations for the Engineer degree are stated in the "Degrees" section in this bulletin, and further information will be found in the departmental listings.

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 graduate fellowships, research assistantships, and teaching assistantships each year. Information and application blanks may be obtained from the chairman of the appropriate department or division.

COURSES

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.


Associate Professors: C. Thomas Bowman, Bruce B. Lusignan, J. David Powell

Lecturers: Ellen W. Nold, Gerd Wallenstein

COURSES OF INTEREST PRIMARILY TO UNDERGRADUATES

All courses qualify (DR:T) under old University distribution requirement unless otherwise noted.

1. Introduction to Engineering—This course is intended to show what engineering is and what engineers do. It consists of lectures, demonstrations, case studies, problems, discussions, and field trips designed to cover the various phases of the engineering process; problem definitions, conceptualization, optimization, detailing, production, and commercial implementation.

Open to freshmen and sophomore engineering students and all non-engineering students.

3 units, Aut (Adams) TTh 10-12

2. People dynamics 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
for Math/Science/Technology. Pass/no credit. (DR:X)

2 units, 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, dry friction; hydrostatic forces; stability of equilibrium. Vectors and vector algebra are introduced and used in the course. Limited to freshman and sophomore students only. Prerequisites: high school algebra and trigonometry. Concurrent registration in Math 41 or 19 is required.

3 units, Aut (Cere) MWF 9
Winter (Shah) 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 only to freshmen and sophomores who have taken some mathematics and physics in high school.

3 units, Spr (Mayers) TTh 11-12:15

11. Applied Mechanics: Stress Analysis—Introduction to the mechanics of deformed structures under tension/compression, shear, torsion, and bending loads. Stress-strain relations, including thermal effects. Analysis of stresses, strains, and deformations of statically determinate and indeterminate structures. Alternative use of energy principles. Additional topics include pressure vessels, elasto-plastic frameworks, and buckling of columns. Prerequisites: 3, Math 21 or 42.

4 units, Win (Mayers) MWF 9; problem sessions by arrangement
Spr (Staff) MW 9; problem sessions by arrangement

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, Aut (Baganoff) MWF 9
Spr (Bershader) 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: Engineering 3, Physics 51, and Math 23 or 43; Engineering 12 recommended but not required.

4 units, Aut (Franzani) MWF 9; lab. M 2:15 and one hour by arrangement
Spr (Hsu) MWF 9; lab. M 1:15 and one hour by arrangement

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 10
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 9
Aut (Helliwell) MWF 10
Win (Staff) MWF 10

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) MW 10
one 3-hour lab. weekly by arrangement

43. Electromechanics—Energy conversion, magnetic fields and devices, eletromechanical devices, rotating machinery, automatic control. Prerequisite: 41 or equivalent.

3 units, Win (Helliwell) TTh 11-12:15
Spr (Staff) TTh 10-11:15; 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; logic elements, 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 intended 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 (Shyne) MWF 11
Win (Sherby) MWF 11
Spr (Staff) 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

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 (Huggins) TTh 11-12:15

90. Energy in the U.S.—Presentation of energy resources, conversion techniques of liquid fuel and to electricity, energy policies, and extrapolations of energy use for the future. Traditional and alternative energy sources, environmental considerations, waste disposal, and nuclear proliferation. Course is aimed at nonscientists, and mathematical sophistication is at the algebra level.

4 units, Spr (R. Eustis)

95. Automotive Technology—An engineering description of today's automobile engine, the auto's use of the nation's energy supplies, and generation of air pollution; emission control technology, catalysts, engine modifications, and their effect on fuel consumption; a description of alternate power plants and fuels and the options they offer for the long term. No prerequisites.

3 units, Aut (D. Powell)
MWF 2:15-3:05

100. Teaching Public Speaking—An introduction to the theory and practice of teaching speech. Students will meet once a week in seminar to discuss readings and serve as apprentices in Engineering 103 and/or graduate short courses in speech. After successfully completing this course, students may become paid speech instructors in the Communications Project. (DR:X)

3 units, Win, Spr (Nold) by arrangement

101. Teaching Technical and Expository Writing—An introduction to the theory and practice of teaching writing to adults. Students will study the theory of the composing process and evaluation process, practice writing and evaluating, practice teaching others to write better in supervised field work. Admission by consent of instructor after the student's writing is reviewed. After successful completion of this course, students may become paid writing instructors in the Communications Project. (DR:X)

3 units, Spr (Nold) W 7:30-10 p.m.

102W. Writing for the World of Work—A course for engineers and science majors who wish to improve their writing in the forms and situations demanded by the work world of government, business and industry. Some prior experience with the work world (through summer and/or regular employment) strongly urged. Case studies of engineers and scientists in local firms; one writing exercise a week; tutorials required. (DR:X)

3 units, Aut, Win (Staff)

102S. Writing: Special Projects—A tutorial course for engineers and others working on special writing projects or rewriting old projects who wish to learn to write better in the process. (DR:X)

1-5 units, Aut, Win, Spr, Sum (Staff) by arrangement

103. Public Speaking—An introductory speech course focussing on the kinds of formal speaking required of engineers on the job. Special emphasis on impromptu speaking ("off the top of the head") and on extemporaneous speaking (rehearsed, with notes) and on the preparation and use of graphic aids. Final speech project
assessed by outside judges; practice speaking once a week; tutorials; videotape playback.

(DR:X)

3 units, Aut, Win, Spr, Sum (Staff)

one evening meeting per week


3 units, Aut (Cannon) MW 11-12:15


3 units, Aut (DeBra) MWF 9

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 problem-discussion session per week.

3 units, Aut (Ireson) MWF 10

Win (Ireson) MWF 10

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, Spr (Connolly) MWF 1:15

190. Problem Solving—An investigation of problem solving with particular emphasis on problem definition, creativity, and interpersonal and organizational 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. Open to undergraduates and graduates in any field.

3 units, Spr (Adams) TTh 10-12

given 1981-82

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)

1 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 Communication 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 (Bryson) 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, discrete compensation design, quantization errors, state variable design of digital controllers and observers. Laboratory experiments on a minicomputer analog computer system. Limited enrollment. Prerequisite: Engr. 105.

4 units, Aut (Bryson) TTh 11-12:15
Lab by arrangement
Win (DeBra) TTh 11-12:15
Lab by arrangement
Spr (Franklin) TTh 11-12:15
Lab by arrangement

208. **Digital Control II**—Design of digital control systems including multivariable controller/observers, steady state optimal techniques, s-plane frequency response methods. Parameter identification. Kalman filter implementation. Laboratory experiments on a mini-computer/ analog computer system. Prerequisite: 207.

3 units, Spr (DeBra) TTh 10;
Lab by arrangement


3 units, Spr (Bryson) MWF 8
(alternate years, given 1980–1981)


3 units, Aut (Osserman) TTh 11-12:15

220B. **Methods of Mathematical Physics**—(Same as Mathematics 220B.) Continuation of 220A.

3 units, Win (Keller) TTh 9:35-10:50

220C. **Methods of Mathematical Physics**—(Enroll in Mathematics 220C.) Continuation of 220B.

3 units, Spr (Keller) TTh 9:35-10:50

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) T1:15-2:05, Th 1:15-3:05
(alternate years, given 1980–1981)

227. **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
(alternate years, given 1981–82)

227A,B,C. **Ethics of Development in a Global Environment (EDGE)**—(Same as Anthropology 133 A, B, C, Education 274A,B,C, Graduate Special 297 A, B, C, Political Science 140 A, B, C, Social Thought 197 A, B, C.) Theory and practice of development in a global setting. Open to graduates and undergraduates, appropriate to both foreign and American students. 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. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures analyzed in terms of appropriateness to development in both less developed and industrialized societies. Addresses need for linkage between the necessary specialization of academia and the inherently interdisciplinary and problem-oriented nature of our living societies. Development strategies viewed with recognition of need for improvement in quality of life within nations and among nations while also recognizing limitations of the earth's physical life support system and constraints in our cultural systems. 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. Winter: Alternative development strategies including coun-
try case studies. Spring: The individual and social change; the engineer, political scientist, educator, etc. as designer of alternatives and as policy and decision-maker. Lectures, discussions, workshops.

297A,B,C. 1-4 units, Aut, Win, Spr
(Cooper, Fagen, Fuenzalida, Lusignan, McWhorter, Siegel, Textor)
Lectures M 7:30-9:30 p.m.
and groups by arrangement

298. Seminar in Fluid Mechanics—Inter-departmental seminar on problems in all branches of fluid mechanics, with talks by visitors, faculty, and graduate 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

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**AERONAUTICS AND ASTRONAUTICS**

Emeriti: Nicholas J. Hoff (Professor)
Chairman: Robert H. Cannon
Associate Chairman: Daniel Bershader


Associate Professor: J. David Powell
Adjunct Professors: Dean R. Chapman, Sotiris P. Koutsoyannis, Richard S. Shevell

Assistant Professor: Brian J. Cantwell


Consulting Professors: C. Frederick Hansen, Leonard Roberts, Vincent Salmon

**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
- Computational Fluid Dynamics
- 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
- Computational Fluid Dynamics
- Differential Games
- Geophysics
- Inertial Instruments
- Lasers
- Nonequilibrium Flow
- Nonlinear Structural Mechanics
- Optimal Control and Estimation
- Plasticity and Viscoelasticity
- Propulsion
- Structural Aeroacoustics
- Structures/Materials Systems Optimization
- Transportation Systems Analysis
- Wave Propagation
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 ($10^{-5}$ to $10^{-9}$ 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 tunable 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 3033 and with the campus academic computer system (LOTS). They are available to all students at no cost for their course work or unsponsored research. Three digital mini-computers and several analog computers are located in the Durand Building with interfacing equipment that permits combining the computers as hybrid facilities or running independently. The instructional facilities for courses such as E206,
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.

The Joint Institute for Aeronautics and Acoustics, co-sponsored by Stanford University and NASA-Ames Research Center in an ongoing program, was originated in October, 1973. JIAA's purpose is to provide long term cooperative research in conjunction with graduate education. In addition to acoustics per se, specializations encompassed by the Institute include: aerodynamics, fluid mechanics, flight dynamics, systems analysis, guidance and navigation, etc. The Stanford University faculty interfaces with the Center staff, utilizing unique research facilities and experienced leadership in long-term complex research as well as in resolving problems facing the aeronautics industry. Further information can be obtained about opportunities for research participation in the JIAA by writing its director, Prof. Krishnamurty Karamcheti, c/o the Aeronautics and Astronautics department at Stanford.

A program in Computational Fluid Dynamics (CFD) is operated jointly by the departments of Aeronautics and Astronautics and Mechanical Engineering. At the master's level this program is an option within the general structure of the master's requirements of each department. At this level, students interested in a still greater emphasis on CFD may register for the M.S. in Aerospace Engineering or Engineering Science (see below) and design a program in consultation with their respective advisors which meets their specialized needs. Students intending to seek a Ph.D. degree with an emphasis on CFD should prepare for the post-master's series in CFD (AA 214A-C) by planning a M.S. program strong in mathematics and numerical analysis (ME 200A-C or the equivalent) and in advanced fluid mechanics (e.g., AA 200A-B, ME 251A-B, AA 210A-B, ME 261, etc.) Choice of math courses, theoretical and experimental dynamics courses, and electives most suitable for the CFD program should be selected in consultation with the student's advisor. Research topics in CFD are supervised by a number of faculty members in the two participating departments, and utilize the large computer facilities of the NASA-Ames Research Center through a cooperative program with the University.

A brochure describing and illustrating the facilities and programs of the Aeronautics and Astronautics 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.

**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., AA 129, 295, 297, and 298). Insufficient grade points upon which to base the grade point average may delay expected degree award, 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 advisor, 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 Program 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.

PROGRAMS OF STUDY
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. For further information on this program, see the Freshman Handbook available from the Office of the Dean of Engineering.

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.

AERONAUTICS AND ASTRONAUTICS (45 Quarter Units)

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.
   AA200A1
   AA210A1 or AA206A (ME258A)
   AA240A1 and (AA240B or AA246 or AA247)
   or
   AA245A1 and (AA245B or AA246 or AA247 or AA249A)
   AA2421
   AA271A1 or AA279A
   AA2801 or AA283A1
   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.

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 leading 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 this bulletin.

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 this program on a Registration Day; no more than 18 units used for the proposed program may have been completed previously. 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 "Degrees" section of 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) Transportation, (o) Waves and Vibrations; and (2) 6 units of free electives. A list of courses currently accepted as approved electives can be obtained upon request to the department. Candidates for the degree of Engineer will be expected to have a minimum grade point average of 3.00 for work in courses beyond those required for the master's degree.

DOCTOR OF PHILOSOPHY

The University's basic requirements for the Ph.D. degree are outlined in the "Degrees" section of this bulletin. Departmental requirements are stated below.

Qualifications for candidacy for the doctoral 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 maintaining a high scholastic record 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 Autumn Quarter (following mid-term exams but before Dead week) or in the seventh 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.

University Oral and Dissertation—Each Ph.D. candidate is required to take the University Oral Examination after the dissertation is substantially completed (with dissertation draft in writing) but before final approval of his or her dissertation. The examination consists of a public seminar presentation of dissertation research, followed by substantive private ques-
tioning on the dissertation and related fields by the University Oral Committee (4 selected faculty members, plus a chairman assigned by the University Graduate Program Office representing the University at large). The University Oral normally occurs toward the end of the fourth graduate year. Once the Oral has been passed, the student finalizes his or her thesis for Reading Committee review and final approval. Forms for the Ph.D. Reading Committee and University Oral scheduling are obtained from the department's academic secretary and submitted with a one-page thesis abstract at least 3 weeks prior to the date approved for the Oral by the student's advisor.

Ph.D. Minor in Aeronautics and Astronautics—A student who wishes to obtain a Ph.D. minor in Aeronautics and Astronautics should consult the Department Office for designation of a minor advisor. A minor in Aeronautics and Astronautics may be obtained by completing 15 units of graduate level courses in the Department of Aeronautics and Astronautics, following a program (and performance) approved by the department's Candidacy Committee.

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 $10,000 or more for the nine-month academic year. Students who have demonstrated research capability are eligible for half-time research assistantships. The stipend for half-time research assistants, on the basis of 20 hours of work per week, ranges from $375 - $525 per month, plus tuition. Research assistants are normally given the opportunity of full-time summer employment at twice the above cited half-time rate. 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.

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: Math 41, 42 or consent of instructor. (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 habit-ability of spacecraft. Human behavior under flight conditions. Recent advances in space biology will be included. (DR:T)

3 units, Win (Billingham, Greene, Holton, Johnson, Lawless, Quattrone, 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 (Cantwell, Chang) 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, Win (Bershader) MW. 2:15-3:30, alternate years, given 1980-81

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 density, 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) MW 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 (Ashley, Cantwell, Lomax) MW 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

200A. Applied Aerodynamics—Physical discussion of gas flow over various shapes of aeronautical interest. The origin of pressures and forces on bodies, with emphasis on drag; laminar and turbulent boundary layers. The inviscid idealization and its usefulness for estimating airloads on streamlined wings and bodies; steady and unsteady aerodynamics. Introduction to the dynamics of flight; equations of motion for rigid flight vehicles and the needs for aerodynamic information associated with their applications. Use of aerodynamic and propulsion-system data to estimate static and dynamic performance of vehicles in the atmosphere. Prerequisites: 100 and 210A or equivalents.

3 units, Win (Ashley) MWF 10:00

200B. Applied Aerodynamics—Continued discussion of flight dynamics; large- and small-amplitude dynamic stability and response; open-loop modes of the rigid flight vehicle and their relationship to handling qualities; integrated treatment of the aerodynamics of stability derivatives. Aerodynamics of propellers and rotors; principles of rotorcraft and short-takeoff vehicles. Introduction to internal aerodynamics; cascades. Introduction to computational fluid dynamics; paneling methods; finite-difference solution of the fluid equations. Further treatment of bluff bodies and other special topics, as time permits. Prerequisite: consent of instructor.

3 units, Spr (Ashley, Cantwell, Lomax) MW 10:00

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; Kirchoff 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) MW 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, Spr (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 criteria and measurement practice; use of basic acoustic instrumentation such as microphones, 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) TTh 11-12:15 plus lab. by arrangement; alternate years, given 1981-82

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: 210A and B or equivalent or consent of instructor.

3 units, Win (Chang, Karamcheti) MWF 2:15, alternate years, given 1980-81

206A. Fluid Dynamics—(Enroll in Mechanical Engineering 258A.)

206B. Fluid Dynamics—(Enroll in Mechanical Engineering 258B.)


3 units, Win (Chang) MWF 10, alternate years, given 1981-82

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 131B or C or equivalents.

3 units, Aut (Baganoff) MWF 1:15

210B. Fundamentals of Compressible Flow—Continuation of 210A with emphasis on more general flow geometry, treatment of nonsteady flow, and introduction of viscosity and energy addition to selected flows. Review of solution methods for the linearized potential equation; relation to physical acoustics and wave

3 units, Win (Cantwell) MW 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 vibrationally 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 1981-82

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 meteors are examined and active areas of research involving gas-material interactions are identified.

2 units, Spr (Nachtsheim) MW 12, alternate years, given 1981-82

214A. Numerical Methods in Fluid Mechanics—Analysis of numerical methods used to solve the Eulerian and Navier-Stokes equations. Relationship between time-accurate and relaxation techniques. Higher order implicit and explicit methods combined with splitting methods. Spectral and pseudospectral methods including the effects of aliasing errors. Accuracy, stability and programming complexity. Prerequisites: ME 200A and ME 200B, or equivalents approved by instructor.

3 units, Win (Staff) MW 9

214B. Numerical Computation of Transonic Flow—Relaxation methods, including successive overrelaxation; alternating-direction/implicit methods, and multigrid techniques. Transonic potential flow; viscous boundary layer methods; coupled inviscid external flow and boundary layer codes. Development of weak solutions; coordinate transformations and automatic grid generation; practical applications to airfoils and wings. Comparisons with experiment and development of computer codes. Prerequisite: AA 214A.

3 units, Win (Staff) MWF 1:15

214C. Numerical Computation of Euler and Navier-Stokes Equations—Treatment of shock waves and rotational flow phenomenon in computational methods cast in generalized coordinates. Convergence and stability requirements; calculation of convection and diffusion processes in high Reynolds number flows; approximate factorization of Euler and Navier-Stokes equations; practical applications, comparison with experiments, and computer code development. Prerequisites: AA 214A.

3 units, Spr (Staff) MW 9

217. Geophysical Fluid Dynamics—(Enroll in Mechanical Engineering 260.)

218. Similitude in Engineering Mechanics—(Enroll in Mechanical Engineering 206.)


223. Atomic Radiation in Gas Dynamics—A brief review of fundamental atomic structure theory will be given, including elementary spectroscopy, angular momentum coupling, the vector model of the atom, and semiclassical radiation theory. Elementary theories of impact and static line broadening will be presented, along with the practical treatment of line shapes by means of the Lorentz, Doppler, and Voigt profiles. The distinctive aspects of discrete spectral features (line or bound-bound radiation) as compared to continuous features (photoelectric and free-free radiation) will be discussed. Course will emphasize practical computation via simple models, and include
demonstration and practice problems. Prerequisite: familiarity with elementary quantum mechanics.

2 units, Aut (Armstrong) TTh 3:15, alternate years, given 1981-82

224. Rate Processes in Energetic Gas Systems—Reaction rate coefficients are derived in terms of inelastic collision cross sections. Effects of excited states on overall rate coefficients are considered. Collision induced vibrational excitation is treated classically, semiclassically, and quantum mechanically, for both small and large perturbation conditions. Effects of rotation coupling are discussed, and approximations for simple available energy theories of dissociation are presented. Applications to direct energy conversion, combustion, gas lasers, upper atmospheric pollution are considered.

3 units, Spr (Baganoff) MWF 1:15, alternate years, given 1981-82

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 1981-82

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, Spr (Spreiter) TTh 2:45-4:00, alternate years, given 1981-82

228. Radiation Transport in High Temperature Gases—Basic concepts in radiative transfer in high temperature gases, dealing with problem formulation at temperatures such that atomic and ionic absorption processes are important. Discussion of simple applications drawn from aeronomy and surface heat transfer will start from elementary first principles. Examples will be formulated to illustrate some of the following topics: The radiative transfer equation for the specific intensity of radiation; independent absorption mechanisms of high temperature gases, e.g. line and continuum absorption; Rosseland and Planck mean opacities; equilibrium species composition of the hot gases.

2 units, Spr (Armstrong) Th 3:15-5:05


3 units, Aut (Chang) TTh 11:00-12:15, alternate years, given 1980-81

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—excluding 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 1981-82

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. Laplace 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, Win (Schmitz) MWF 3:15, alternate years, given 1981-82

232. Special Topics in Rotary-Wing Aircraft—Potential methods are introduced for the
aerodynamic analysis of rotary-wing aircraft. These are generalized to develop the classical vortex analyses, and are applied to the incompressible flow problem. Acceleration potential methods are extended to the linear compressible problem and finally to a non-linear compressible aerodynamic formulation. These techniques are then used to formulate the discrete frequency noise of rotary-wing aircraft and horizontal axis windmills. Linear and non-linear formulations are explored and used to predict rotor impulsive noise. Other sources of rotor noise are reviewed and surveyed as to their relative importance commercially. Techniques are introduced to handle the aeroelastic problems of rotating elastic blades. Modal and finite element methods are compared. Effects of aeroelastic couplings on the stability of rotating blades are explored. Ground and air resonance problems of the helicopter are also addressed. Primary emphasis is on a basic understanding of the principles involved. Prerequisite: AA 230, AA 231.

3 units, Aut (Schmitz) MWF 3:15, also Spr, alternate years, given 1981-82

240A. Analysis of Structures—Elements of one- and two-dimensional linear and nonlinear elasticity theory; reduction to strength of materials theory; strain-functional variational principle; direct and indirect methods of the calculus of variations applied to deflection and stability analysis of beam, ring, plate, and shell elements. Prerequisite: Civil Engineering 114 or equivalent.

3 units, Aut (Mayers) 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 nonuniform planforms; stress-functional variational principle with applications to redundant structures, torsion of thin-wing sections, and shear lag in "sheet-stringer" construction; thermal effects; introduction to stress/strain-functional (Reissner) variational principle and application to stress/deflection analysis of beams, plates, and pressurized shells. Prerequisite: 240A or consent of instructor.

3 units, Win (Mayers) MWF 11

240C. Analysis of Structures—Unified approach to structural analysis; application of variational formulations to kinematically and constitutively nonlinear analysis of beam, plate, and shell structures under static dynamic, and thermal loadings; bending, buckling and post-buckling of conventional, stiffened, sandwich and composite structures. Role of variational formulations in finite-difference and finite-element analysis of complex structures. Prerequisite: 240B.

3 units, Spr (Mayers) MWF 10, alternate years, given 1981-82

241A,B. Introduction to Aerospace Systems Synthesis and Analysis—The total development of new aircraft systems is explored with emphasis on commercial aircraft; the underlying economic and technological factors that create markets for new aircraft from both rational and historical viewpoints; methods of determining market demands and system mission performance requirements; techniques of optimizing configurations to comply with requirements with emphasis on the interaction of the various disciplines such as aerodynamics, structures, propulsion, guidance, payload, and ground support; parametric studies; applied aerodynamic and design concepts for use in configuration analysis including airplane layout, wing design, high lift systems, drag, stability and control requirements, and tail sizing. Application to a hypothetical aeronautical system; applied structural fundamentals with emphasis on fatigue and fail-safe considerations; design load determination; weight estimation; propulsion system performance and installation; engine types; environmental problems such as noise and smoke; performance estimation including takeoff, climb, cruise, and landing. Direct and indirect operating costs prediction and interpretation; future types of aircraft including V/STOL, supercritical wing, uncompromised cargo and SST; aircraft functional systems such as hydraulic, electrical, environmental control; avionics; importance and achievement of aircraft reliability and maintainability.

241A. 3 units, Win (Shevell) MWF 2:15
241B. 3 units, Spr (Shevell) MWF 2:15

242. Classical Dynamics—Acceleration and rotation reference frames. Kinematics of rigid body motion; Euler angles. D'Alembert's principle, equations of motion. Inertia properties of rigid bodies. Dynamics of coupled rigid bodies. Lagrange's equations and their use. Dynamic behavior and simple stability, including small departures from equilibrium or steady motion, are considered throughout the course. Prerequisite: Engineering 12 or equivalent.

3 units, Aut (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 9

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 9, alternate years, given 1980-81

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 (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, 200A, Engineering 105 or equivalents.

3 units, Spr (Cannon) MW 11-12:15


3 units, Aut (DeBra) MWF 8, alternate years, given 1981-82


3 units, Win (DeBra) MWF 10, alternate years, given 1981-82


3 units, Spr (Cannon) MW 11-12:15, alternate years, given 1981-82
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 (Powell) TTh 2:45-4

3 units, Spr (Powell) TTh 2:45-4

3 units, Aut (Breakwell) MWF 11, alternate years, given 1980-81

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 (Breakwell) 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 orbit analysis; non-linear resonances. Prerequisite: 279A.
3 units, Spr (Breakwell) MWF 10, alternate years, given 1980-81

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 11:12:15

283A. Airbreathing Propulsion Systems.—Design and performance of airbreathing engines. Topics covered will include: physical parameters of airbreathing engines including ramjets, turbojets, and turboprops; design of supersonic inlets and nozzles, analysis of cascades; ideal and non-ideal cycle analysis of engines, off design performance, component matching; fuel injection, ignition and combustion systems, thrust augmentation systems.
3 units, Aut (Cantwell) TTh 1:15-2:30

283B. Airbreathing Propulsion Systems.—Fluid flow phenomena which play an important role in determining the non-ideal performance of air-breathing engines. Topics covered will include: inlet boundary layer flows, distance to transition, separation, shock boundary layer interaction, blade aerodynamics, secondary flows in cascades, compressor stall, wake flows, wake interactions; turbulent detonations and deflagrations, two-phase flow, turbine cooling, nozzle flow, jet mixing and jet noise.
3 units, Win (Cantwell) TTh 1:15-2:30

286. Advanced Space Propulsion—Topics selected from recent developments in rocket propulsion: Solid-fueled ramjet, ducted rocket, hybrid rockets, dual-fuel and mixed-mode rockets, advanced space propulsion concepts, combustion, ablative heat transfer, electric propulsion and applications to satellite control and station-keeping.
3 units, Aut (Chang) TTh 1:15-2:30 alternate years, given 1981-82

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

291A. Linear Transforms and Their Applications to Engineering Problems I—Introduction to linear integral transforms; Fourier, Laplace, Hankel, Mellin transforms. Applications to boundary 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 11-12:15, alternate years, given 1980-81

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 1981-82

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 (DeBra) W 4:15

298. Seminar in Fluid Mechanics—(Enroll in Engineering 298.)


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


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

CHEMICAL ENGINEERING

Chairman: Channing R. Robertson
Professors: Andreas Acrivos, Michel Boudart, George M. Homsy, Robert J. Madix, David M. Mason, Channing R. Robertson
Associate Professor: Curtis W. Frank
Adjunct Professor: Alan S. Michaels
Assistant Professor: Gerald G. Fuller
Senior Lecturer: Robert H. Schwaar

*The curriculum leading to the B.S. degree in Chemistry is described in the School of Humanities and Sciences section in this bulletin.

Lecturer: Manesh Shah
Consulting Professors: C. Richard Brundle, Floyd L. Culler, Robert M. Kendall

PROGRAMS OF STUDY

BACHELOR OF SCIENCE

The B.S. Chemical Engineering program consists of the basic 36-unit engineering depth requirement (described under the "Degrees" section 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, polymer science, process analysis and control, plant design, and applied chemical kinetics. In addition, this program includes courses in physics, mathematics, chemistry, and basic 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 the prospective program with his or her advisor, especially if transferring from chemistry, physics, or another field in engineering. With some advanced planning, the student can usually arrange to attend one of the overseas campuses.

MASTER OF SCIENCE

A Master of Science program comprising an academic year of appropriate course work is available to accommodate students wishing to 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 three quarters of broad study subject to the specifications stated below.

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 four lecture courses selected from the Chemical Engineering 200-lecture 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 under the "Engineering Majors" section of this bulletin, except Ch.E. 140, 150, 160, and 170, 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. 270-278, or for the Colloquium, Ch.E. 300. Note, however, that the student should register for Ch.E. 300 and attend the Colloquia. Students wishing to obtain research experience should choose a research 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, may not 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 departmentally appointed graduate advisor, and a tentative program for the entire academic year should be worked out by the student and advisor at their first meeting of the academic year.

Minimum Grade Requirement—All courses taken to satisfy the M.S. degree requirements must be taken for letter grades, if offered, with the minimum letter-grade equivalent of 3.00 for students enrolled in the terminal master's program in chemical engineering.

ENGINEER

The degree of Engineer is awarded upon completion of six quarters of study plus the requirements listed below.

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-lecture series. The remaining electives must be advanced technical courses chosen with the consent of the departmental 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, and a minimum letter grade equivalent of 3.00 must be maintained. After completion of this series of courses and at least three 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 or she so wishes, may be examined on the 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 requirements listed below.

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 three 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 278. 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, and a letter grade equivalent of a 3.00 average must be maintained.

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 beginning of the Spring Quarter. This examination shall be used as the basis for deciding whether or not these students will be allowed to choose research 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 are permitted to choose a research advisor and begin their Ph.D. research in the 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 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, which has already been approved by his or her research advisor, to the Reading Committee. No sooner than four weeks after this date, the student’s University Oral Examination will be scheduled. This exam, based on the candidate’s thesis research, is 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, Polymer and Colloidal Suspension Rheology, Hydrodynamic Stability, Electrochemical Energy Conversion, Applied Chemical Thermodynamics and 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 January 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 ethanol syntheses, energy from municipal refuse, coal gasification, and others having an impact on U.S. energy resources. The second part of the course focuses on the kinetics of chemical reactions with applications in catalytic conversion. Also considered are the concentration and temperature dependencies of reaction rates and the interpretation of batch reactor data. Rate processes are introduced in the last 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. Prerequisite: Chemistry 20. 3 units, Spr (Frank, Homsey, Robertson)

**CHEMICAL ENGINEERING**

31. 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, flow field fractionation. Prerequisite: 110 or equivalent. (DR:T) 3 units, Spr (Fuller) MWF 10

130. Chemical Kinetics: Theory with Applications to Chemical Engineering—Reaction rates, chain and catalytic reactions. Coupling between chemical and physical variables. Ignition and explosion. Reaction networks. Operating characteristics of the following types of chemical reactors: batch, semi-batch, continuous stirred tank, and tubular-flow. Ways of op-
Chemical reactions, heat transfer, pumping and production costs; construction in the compression; estimation of capital expenditures. Application of chemical engineering principles to equipment design for separation processes, manufacture and oil refining. Topics include: preparation of flowsheets and material balances; free-surface phenomena; free-surface phenomena; free-surface phenomena.

**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)

3 units, Win (Boudart) (MWF 2:30-3:45)

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: senior standing in chemical engineering or consent of instructor; Mechanical Engineering 33 or Engineering 21; 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, Aut (Acrivos) TTh 8:00-9:15

155. Process Analysis and Control—Examines the dynamic behavior of simple plant units in order to appreciate the need for design of their controllers. Emphasis is on arriving at stable closed-loop control systems. Physical systems with first, second and higher order dynamic behavior are analyzed, together with the response characteristics of instruments and controllers. Standard methods of root locus and frequency response to design stable systems are discussed, followed by digital computer simulation techniques of controller designs for simple, as well as complex, interacting and distributed parameter systems, encountered in practice. Prerequisite: Mathematics 130. (DR:T)

3 units, Aut (Shah) MF 11-12:15

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 (Schwaar) TTh 3:15-5:05

165. Thermodynamics of Combustion Systems—Focuses on the fundamentals of combustion processes, integrating the student's background in thermodynamics, transport processes and chemical reaction theory. Reviews will be provided of chemical equilibrium, chemical kinetics, multicomponent transport, and computational methods prior to presentations on two general-purpose computer codes for equilibrium and nonequilibrium systems. Solutions will be used to demonstrate the physical events associated with, for example, combustion limits, detonation waves, NOx formation, catalytic combustion, and wall quenching. Prerequisite: Senior standing in chemical engineering or consent of instructor. (DR:T)

3 units, Spr (Kendall) MW(F) 8:30-9:45

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

180A,B. 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 areas corresponding to the appropriate lecture course. These are: separations and diffusional mass transfer (steady diffusional mass transfer), chemical reaction kinetics (batch reactor, tubular reactor, stirred tank reactor), fluid mechanics (laser-Doppler velocimetry, flow past spheres), energy transfer (transient and steady conduction, double pipe heat exchanger, radiative energy transport) and polymer materials science (glass transition temperature, differential scanning calorimetry, viscoelastic creep). Eight of the thirteen experiments must be performed.

180A. 3 units, Win (Michaels, Robertson)

180B. 3 units, Spr (Frank, Homsy)

TTh 12-1 plus laboratory section 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, 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. (DR:T)

3 units, Aut (Homsy) MWF 9:00

201. Bioengineering—This course covers the analytical and experimental aspects of selected biological and physiological problems as viewed from a chemical engineering perspective, with emphasis on transport phenomena. Topics to be treated are: 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, Aut (Robertson) TTh 11:00-12:15

204. Kinetics of Chemical Processes—Elementary steps; sequences at the steady-state. Reaction networks. Theoretical principles and applications to the study of chain and catalytic reactions. (DR:T)

3 units, Aut (Boudart) MWF 2:15-3:30

205. Transport Processes in Reacting Systems—Analysis of physical problems of engineering interest where transport of mass, energy and momentum in multicomponent systems is accompanied by homogeneous or heterogeneous chemical reactions. Topics include behavior of conventional reactors operating under isothermal or nonisothermal conditions; nonisothermal porous catalysts; thermal properties of reacting fluids; combustion and electrode, corrosion, and photochemical kinetics; and oscillatory reactions. Course will be supplemented by a few lectures by industrial specialists. (DR:T)

3 units, Spr (Mason) TTh 1:30-3:05

209. Reactive Processes on Surfaces—This course will examine advanced topics concerning the reactions occurring on and with solid surfaces. Particular emphasis will be placed upon reactive interactions between species bound on surfaces and the thermodynamic description of adsorbed layers. Includes structure of surfaces, surface-bulk precipitation, thermodynamics of adsorbed layers, bonding at surfaces, evaporation and condensation, surface compound formation, surface intermetallic alloys, surface passivation and reactive scattering from surfaces. (DR:T)

3 units, Spr (Madix) TTh 9:30-10:45

210A,B. Viscous Flow Theory (With Applications to Heat and Mass Transfer)—An intensive course dealing with the fundamental principles of momentum, heat and mass transfer and their application to problems of physical interest. Derivation and analysis of the Navier-Stokes equations, the energy equation, and the equation for mass transport; flows at small Reynolds numbers and Stokes' law; the method of matched asymptotic expansions; laminar boundary layer theory; hydrodynamic stability and the Orr-Sommerfeld equation; interfacial instability. (Each Course DR:T)

210A. 3 units, Win (Acritos) TTh 8:00-9:15

210B. 3 units, Spr (Acritos) TTh 8:00-9:15

212. Polymer Science—Emphasizes the use of statistical mechanics in the analysis of several problems in polymer physics. Two major topics covered are statistical thermodynamics of polymer solutions and configurational statistics of model and real polymer chains. (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.; colloidal state; distinguishing characteristics of colloidal systems; classical means of preparing colloidal dispersions; phenomena of diffusion and sedimentation, and colloid osmotic pressure; origins of colloid stability, 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; practical applications of colloidal phenomena in the chemical industry. (DR:T)  
3 units, Win (Michaels) (M)WF 1:15-2:30

217. Introductory Polymer Chemistry: Theory and Practice—A review of the principal methods of polymer synthesis, with emphasis on molecular polymerization mechanisms and reaction kinetics, and the role of mechanism and kinetics in influencing polymer composition, structure, and ultimate properties. Condensation-, radical- and ion-initiated-chain polymerizations; heterogeneous and stero-regulated polymerizations; copolymerization. Bulk, solution, emulsion, and suspension polymerizations. Application of the principles of polymer synthetic chemistry to the design of large-scale industrial polymer manufacturing processes. The objective of this course is to provide the chemist, chemical engineer, and materials scientist with an appreciation of the physical and organic chemistry of macromolecule formation, and the manner in which this chemistry is exploited by the rubber, plastics, and chemical industries. (DR:T)  
3 units (Michaels) given 1981-82

270-278. 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  
(Acrients)

271A,B,C. Adsorption and Catalysis  
(Boudart)

272A,B,C. Applied Chemical Thermodynamics and Kinetics  
(Mason)

273A,B,C. Bioengineering  
(Robertson)

274A,B,C. Colloid and Interface Chemistry  
(Michaels)

275A,B,C. Surface Reactivity  
(Madda)

276A,B,C. Physical Chemistry of Polymers  
(Frank)

277A,B,C. Stability of Fluid Motions  
(Homay)

278A,B,C. Polymer and Colloidal Suspensions and Microrheology  
(Fuller)

280. Introduction to Graduate Research—A course consisting of a series of seminars given by the faculty in chemical engineering to acquaint prospective Ph.D. students with current research topics. Required of first-year students in the Ph.D. program. (DR:X)  
1 unit, Aut, Win (Staff) Alternate  
Th 1:15-5:05

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, John W. Fondahl, Joseph B. Franzini (on leave Spring Quarter), James M. Gere, George Herrmann, En Y. Hsu (on leave Autumn Quarter), Paul Kruger, Perry L. McCarty, Henry W. Parker, George A. Parks, Haresh C. Shah, Robert L. Street, William Weaver, Jr.

Associate Professors: Jarir S. Dajani (on leave Winter and Spring Quarters), Helmut Krawinkler, James O. Leckie; Raymond E. Levitt, Leonard Ortolano, Boyd C. Paulson, Jr.

Adjunct Professors: Gilbert M. Masters, Paul V. Roberts

Assistant Professors: David L. Freyberg, Greig W. Harvey, Edward Kavazanjian, Jr., Anne S. Kiremidjian, Lyna L. Wiggins, Lily Y. Young
Lecturers: Arturo J. Bencosme, Oscar Hoffman, John Jessup, Michael C. Kavanaugh, E. Garrison Kost, Robert W. Medearis, Benjamin F. Stetson

Consulting Professors: John A. Blume, Ralph T. Cheng, I. M. Idriss, R. B. Matthiessen, Keshavan Nair, Theodore C. Zsutty

Visiting Professor: James A. Chaffers

OFFERINGS AND FACILITIES

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 construction, 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 coterminal B.S.-M.S. program should be explored by students desiring an integrated five-year program.

The Civil Engineering department, in collaboration with other departments of the University, offers graduate programs with particular strength in:

- Construction Engineering and Management
- 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
  - Water Resources Engineering (including elements of hydraulics, hydrology, hydro-mechanics and nuclear environmental 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 act as research or teaching assistants.

PROGRAMS OF STUDY

CONSTRUCTION

The Construction Engineering and Management program prepares technically qualified students for responsible management roles in all phases of the development of major constructed facilities. The program emphasizes management techniques useful in planning, coordinating and controlling the activities of diverse specialists—designers, contractors, subcontractors and client representatives—within the unique, project environment of the construction industry. In addition, the program offers subjects which focus on engineering aspects of heavy construction and, to a lesser extent, building and industrial construction. By appropriate choice of elective subjects, students wishing to work for a contractor, designer firm, construction management consultant, or the construction department of an owner’s organization can design an optimum program for their needs.

Subjects offered within the program include: estimating (building and heavy construction); equipment and methods; planning and control techniques; planning and control applications; managing human resources; project and company organizations; concrete construction; construction administration; real estate development; labor relations; 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 an advisor, can design a curriculum to meet individual educational goals.

The program leads to the degrees of Master of Science, Engineer and PhD. Opportunities are
available to support a limited number of post-master's students each year through the sponsored research activities of the Stanford Construction Engineering and Management Center.

The program maintains very close ties with the construction industry through the Stanford Construction Institute. Students participate in weekly discussions with visiting lecturers from all sectors of the U. S. construction industry.

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, energy, environmental planning 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.

Faculty members in the Infrastructure Planning and Management Program maintain very close ties with the Undergraduate Urban Studies Program; civil engineering students are encouraged to use appropriate Urban Studies courses as part of their graduate program.

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 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 water resources engineering and environmental engineering programs represent individual specialties, but can be integrated 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. Modern laboratories for water quality control, hydraulics and hydromechanics are well equipped and instrumented for advanced research and instruction.

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 Engineer-
ing Breadth are available 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, Hydro-mechanics, Nuclear Civil Engineering, Geotechnical Engineering, Soil Mechanics and Foundations, Structural 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 2.7 letter grade indicator (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.

CIVIL ENGINEERING

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 regulations will be found in the department handout entitled "Information and a Typical Timetable for the Ph.D. Degree."

The first year is represented by the M.S. program described above. The second year will be devoted partly to additional courses of graduate study and partly to the preliminary work toward a dissertation. The third and subsequent years will be applied to further course work and to the completion of an acceptable dissertation. Dissertation research in absentia is not permitted.

The program of study will be arranged by the prospective candidate at the beginning of the second year with the advice of a faculty committee whose members are nearest in the field of interest to that of the student. The chairman of
the committee will serve as the student's pro-
tem advisor until such time as a member of the
class has agreed to direct the dissertation re-
search. Insofar as possible the program of study
is adapted to the interests and needs of the
student within the framework of the require-
ments 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 can-
didacy.

FINANCIAL ASSISTANCE

The department maintains a large and con-
tinuing program of financial aid for graduate
students. Fellowship or scholarship awards for
the academic year range from $2,000 to $9,435.
A generous student loan program is available.
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. Re-
search assistantships are also available. En-
gineer and Ph.D. candidates may be able to use
research results as a basis for the thesis or dis-
sertation. Assistantships and other basic support
may be supplemented by fellowship and scholarship awards or loans. Continued support
is generally provided for further study toward the
Engineer or Doctor of Philosophy degree subject to performance of the student, avail-
ability of reasearch 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 En-
gineering 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 ad-
vised if the transfer is possible. If, after enroll-
ment at Stanford, students wish to continue to-
ward a degree beyond the one for which they
were originally admitted, a written application
must be made to the Department of Civil En-
gineering.

UNDERGRADUATE COURSES

All courses are (DR:X) unless noted otherwise.

107. Mechanics of Fluids—Dimensional
analysis and principles of similarity, including
application to hydraulic modeling, open chan-
nel flow, elementary hydrodynamics. Prerequi-
site: Engineering 21.
3 units, Win (Hsu) MWF 10

114. Mechanics of Materials—(Continuation
of Engineering 11). Advanced beam problems;
plastic bending, built-up beams, loads in non-
principal planes, shear center. Analysis of com-
 pared stresses. Statically indeterminate sys-
tems. Column theory. Prerequisites: En-
gineering 11 and Mathematics 43.
4 units, Spr (Kavazanjian) TTh 10:00
and W 1:15-3:05

116. Concrete Mix Design—Testing of aggre-
gates, design of concrete mixes including statis-
tical mix design, testing of concrete samples,
and physical properties of Portland cement con-
crete. Student reports and project. Course con-
sists of lecture followed by laboratory. Enrollment
limited to 22 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 al-
ternative transportation modes. The technology
and economics of vehicles, networks and termi-
 nals. Issues, concepts and methods of transpor-
tation system engineering and planning. Deci-
sion-making in transportation management and
planning. (Graduate Students enroll in 230).
Prerequisite: Math 43. (DR:T)
3 units, Aut (Dajani) MWF 1:15

133. Introduction to Urban Planning—The na-
ture of urbanization and evolution of urban-
forms; conceptual modeling of urban growth and
decay; the rational for planning; steps in the
planning process and basic studies of plan for-
amulation; estimating requirements for com-
mercial, industrial and residential land uses;
measures of plan implementation; and the ap-
 plication of the planning process to typical
problems of community growth and develop-
ment. (DR:C)
3 units, Aut (Staff) MWF 10

140. Surveying—Care and use of instruments;
leveling; topographic surveying; triangulation;
horizontal and vertical curves; engineering as-
tronomy. Enrollment limited to 54, with priori-
ty given to seniors in Civil Engineering.
4 units, Spr (Parker) TTh 11;
lab. MW 1-5:30 or TTh 1-5:30

143. Specifications and Contracts—Fundamental
concepts of contract law. Types and selection of construction contracts. Procedures
for advertising, awarding and administering construction contracts. Specifications and their cost impacts. Liability of engineers. Engaging professional services.

3 units, Aut (Fondahl) TTh 11-12:15
Win (Fondahl) MW 11-12:15

144. Construction Engineering and Management—Introduces techniques for coordinating decisions and actions of the various participants involved in the design and construction of civil engineering projects. Covers legal, contractual and behavioral determinants of company and project organization structures; markets for key construction resources and products; and techniques used in estimating, planning, coordinating and controlling time, cost, quality and scope. Limited to juniors, seniors, and graduate students.

3 units, Aut (Levitt) TTh 10 and M 2:15

145. Construction Equipment and Methods—Construction engineering fundamentals; equipment economics; selection and efficient application of equipment; design and simulation of construction operations; analyzing production output and costs. Prerequisites: Engineering 3 and 161.

3 units, Aut (Paulson) MWF 10 (Note: There will be one or more 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: Engineering 3 and 161.

4 units, Spr, (Staff) MWF 11 and W 3:15-5:05

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) MW 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. Open to all students. One year of college mathematics and CE 170 are recommended. (Graduate students enroll in 225.)

3 units, Win (Otrolano) MWF 9

172. Air Pollution—(Enroll in Mechanical Engineering 137.)

173. Energy and Society—(Enroll in Mechanical Engineering 180.)

174. Noise Pollution—(Enroll in Mechanical Engineering 138.)

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. Open to all students. (Graduate students enroll in 236.) (DR:T)

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

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 (Krawinkler) 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 and W 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 service ability requirements; design of simple structural systems for buildings. Prerequisites: Engineering 11 and C.E. 180 or equivalent.

4 units, Spr (Krawinkler) TTh 11 and 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.

198. Senior Report—Practice in execution of a simple engineering investigation; preparation of a written report on the investigation. Required of all candidates for the Bachelor's degree. During the third quarter prior to graduation, arrangements must be made with a faculty member to supervise the project and with the student's advisor; notification of these arrangements must also be given to departmental secretary. The course must be taken in one of two quarters prior to graduation. The investigative plan should be established in second week of the quarter in which the course is taken. The student's report must satisfy the requirements of a Communications Project writing tutor as well as the technical criteria of the faculty supervisor.

1 unit, Aut, 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)

201. The Creation and Solution of Environmental Models—Drawing on simple physical systems in the environmental and water studies context, the course focuses on the creation and solution of mathematical and numerical models for these systems or their subparts. Governing equations plus appropriate boundary and/or initial conditions are derived from physical principles. Solutions are obtained by application of ordinary and partial differential equation theory, Fourier series, Laplace transforms, numerical integration and finite difference techniques, and matrix algebra. Prerequisites: Mathematics 43, Computer Science 106 and 103, or equivalent experience and consent of instructor.

3 units, Aut (Street) MWF 11

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, Math 43.

4 units, Aut (Staff) TTh 9 and Th 1:15-3:05

206. Stochastic Processes and Decision Statistics for Civil Engineers—Description of stochastic processes; transportation models, structural dynamics models; harmonic analysis of processes; application of Markov chains to civil engineering problems; statistical decision theory; Bayes' theorem; optimization of decisions under uncertainty; utility functions; systems analysis. Prerequisite: a course in statistics or probability and CE 203.

4 units, Win (Kiremidjian) TTh 9:00 plus Th 2:15-4:05

220. Seminar in Infrastructure Planning and Management—Discussion by faculty and students on various aspects of infrastructure planning and management. Introduction to planning theory with emphasis on the alternative roles of the civil engineer/planner. Students will complete a short computer assignment using the LOTS computing facility. Course credit restricted to students in the graduate program in Infrastructure Planning and Management or by special permission.

1 unit, Aut (Staff) M 3:14-5:05

221. Economics and Infrastructure Planning—Applications of microeconomics in the planning and management of physical infrastructure. A survey of basic elements from theories of demand, production, input-output analysis, and welfare economics. Role of economics in environmental equality management and in benefit-cost analysis. Introduction to planning and evaluation in the face of multiple-objectives. Prerequisite: Math 43.

Students with no prior exposure to economics, matrix algebra and Lagrange's method of undetermined multipliers should co-register in CE 221A.

3 units, Aut (Ortolano) MWF 10

221A. Economics and Infrastructure Planning Tutorial—Intended for students enrolled concurrently in 221 who either (a) have had no prior exposure to economics or (b) want a review of the mathematical techniques used in 221. Topics include elementary microeconomics, elementary matrix algebra, and Lagrange's method of undetermined multipliers should co-register in CE 221A.

1 unit, Aut (Ortolano) Th 3:15-5:05. First five weeks of quarter only.

222. Planning and Management Methods I—Role of research and analysis in infrastructure planning; decision making under uncertainty; research design and problem formulation; theory construction and hypothesis formulation; sources of data; survey research;
measurement, scaling and instrument design; sampling, reliability and validity of measures; data preparation, processing and analysis using interactive statistical packages. Descriptive and inferential analysis of nominal and ordinal level data; measures of association, introduction to the general linear model. Weekly problem sets and three computer assignments. Prerequisites: CE 203 or Statistics 110, and CE 220 or consent of instructor.

3 units, Win (Wiggins) MWF 11

223. Planning and Management Methods II—Descriptive and inferential analysis of interval/ratio level data; measures of association including simple, multiple and partial correlation; planning applications of the general linear model and selected topics in econometrics; time series analysis; forecasting models; economic and demographic methods for projecting population; socioeconomic impact analysis. Prerequisite: CE 222 or consent of instructor.

3 units, Spr (Wiggins) MWF 11

224. Institutional Setting of Infrastructures—The effects of institutional structures and policies on the delivery of infrastructure services. Elements of planning and implementation theory; the role of bureaucracy; outcomes of different planning paradigms; the influence of federal policy-making and the erosion of federalism; locus of planning and implementation authority; involvement of legislatures in policy-making; the importance of citizen input; sources of implementation initiative; role of the private sector; comparison with other industrialized countries, western and Marxist, and with developing nations. Prerequisite: Graduate standing or permission of the instructor.

3 units, Spr (Wiggins) MWF 3:15-4:05

226. Workshop in Infrastructure Planning and Management—Topics vary from year to year. In 1980-81 the workshop will focus on a group project involving a pre- and post-implementation assessment of an ongoing infrastructure project. Anticipation of project effectiveness based on technical analyses and the transfer of prior experience. Follow-up analysis of project outcomes; measures of performance; survey and monitoring techniques; project revision in light of evaluation findings. Prerequisites: CE 222 and CE 223 or consent of instructor.

2 units, Spr (Harvey) T 1:15-3:05

227. Infrastructure Internship—Work experience in the planning offices of local governmental agencies and private consultants. Requires equivalent of one full-day per week in an office.

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

228. Environmental Planning—Same 171, with additional assignments for students who desire graduate credit.

3 units, Win (Ortolano) MWF 9

229. Infrastructure Planning in Developing Countries—The theory, practice, and context of infrastructure planning in the less developed countries; planning paradigms, methodological approaches, and data limitations; technology transfer, appropriate technology, and management strategies; project evaluation and the integration of infrastructure projects into comprehensive development plans; the issues of growth and equity and the socio-cultural dimensions of physical planning.

3 units, Win (Bencosme) TTh 1:15-2:30

230. 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. Travel behavior and transportation systems management. Prerequisite: graduate standing.

3 units, Aut (Harvey) MW 1:15-2:30

231. Advanced Methods of Transportation Analysis—Application of advanced techniques from engineering, operations research, econometrics and related disciplines to the systematic analysis of transportation problems. Evaluation and modeling of vehicles, traffic flow, and facility performance; representation of networks; dependence of transportation demand on facility performance; approximation of supply-demand equilibrium in transportation networks; relevance to transportation policy studies. Prerequisites: CE 130 or CE 230 and CE 203 or Statistics 110.

4 units, Win (Harvey) MWF 2:15-3:05

232. Seminar on Central Cities and Urban Redevelopment—Critical issues of design, ethics, and resource management involved in the redevelopment of American central cities. Major attention will be given to (1) how comprehensive planning efforts within such settings potentially affect the social and political cohesion of indigenous ethnic communities, and (2) how supportive infrastructure, sensitive to the diverse demands of multicultural environments, can best be developed. Case studies focusing on the programming and design of public buildings will be used to explore such issues as social needs and user requirements,
appropriate scale technology, and professionalism as a social responsibility. Enrollment limited to 15 students.

3 units, Spr (Chaffers) Th 1:15-3:05

234. Land Use Planning—Introduction to the study of urban and regional systems; location theory and site planning; the economics of land and development; demographic and economic models; urban growth and allocation models; the evaluation and implementation of land use control and development systems; institutional and technical aspects of the land use planning process.

3 units, Win (Dajani) MWF 1:15, offered 1981-82

235. Infrastructure and Land Use—The reciprocal impacts of infrastructure development and land use; alternative qualitative and quantitative methods for the exploitation of infrastructure/land use interactions; static and dynamic modeling of short- and long-run interactions between infrastructure investments and management decisions, on the one hand, and land use patterns, on the other. The implications of infrastructure design parameters on land use patterns. Prerequisites: CE 223 (may be taken concurrently) or consent of instructor.

3 units, Spr (Bencosme) MWF 1:15

236. Small Scale Energy Systems—Same as CE 176 with additional assignments for students who desire graduate credit.

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

237. Workshop in Community Energy Planning—Analysis of planning methodologies being developed for cities and counties; energy audits, local conservation and energy potential, establishment of goals and strategies. Case studies and student presentations. Enrollment limited with preference given to students in the master's program in Infrastructure Planning and Management. Prerequisite: CE 176 or 236.

2 units, Spr (Masters) T 3:15-5:05

238. Planning for Centralized Energy Systems—Case studies in electricity utility system planning. Methods of forecasting demand for electric energy; incorporating conservation and uncertainty into demand forecasts; choice of technology including political, environmental and cost considerations; the state role in determining need. The existing siting pattern for centralized electric generating plants; implications of federal regulations for siting decisions; analysis of resource consumption and residual production in environmental assessment; state-of-the-art siting techniques; impact of recent state siting legislation. Prerequisite: CE 203 or Statistics 110. Enrollment limited to 40 students, with priority given to graduate students in civil engineering.

3 units, Spr (Wiggins) MWF 2:15

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) MWF 9

241. Techniques of Project Planning and Control—Analytical techniques for planning and controlling the design and construction of projects. Provides additional concepts of networking techniques including treatment of uncertainty, subnetworks, resource allocation and leveling, time/cost tradeoffs and specification requirements. Also covers basic techniques for cost engineering, materials procurement and tracking, quality assurance, and document control. Prerequisite: 144 or equivalent.

3 units, Win (Fondahl) MWF 9

242. Applications of Project Planning and Control—Integration and application of methods and procedures for planning and controlling the design and construction of projects. Includes study of computer applications, relationship of information systems to organizational structure and behavior, and practical applications of techniques introduced in CE 144 and CE 241. Requires an individual term project and team efforts on problems and case studies. This course may be taken for an additional unit by students who wish to undertake a more extensive term project. Prerequisites: CE 241 and 250.

3 or 4 units, Spr (Paulson) MWF 11

243. Computer Applications in Construction—Emphasis on design, development and implementation of computer-based systems for construction engineering and management. Supporting topics cover computer hardware and software technology. This is a seminar-laboratory course requiring a team effort on an extensive term project. Prerequisites: Computer course equivalent to Computer Science 106 or Industrial Engineering 141, CE 144 and 240. Enrollment limited to 20, with priority
given to students in graduate construction program.

4 units, Win (Paulson) MW 2:15 and T 3:15-5:05


3 units, Spr (Fondahl) TTh 10-12

248. Construction Financing in Real Estate and Land Development—Study of the interrelationships between all of the variables that make up a successful real estate project; places heavy emphasis on the financial aspects involved in land acquisition, land development, construction, permanent lending, and project management. In addition, various aspects of joint venturing, including the control of functions and equity financing are discussed. 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 history, laws, institutions and social and economic forces affecting labor and industrial relations in construction; covers both union and open-shop sectors. Prerequisite: 144 or equivalent.

4 units, Win (Levitt and Paulson) TTh 1:15-3:05

250. Managing Human Resources in Construction—Study of human behavior: individual, in small groups, and in project and company organizations. Develops integrated theories of perception, motivation and learning with examples drawn from construction. Provides both independent and supervised exercises in group problem solving, using selected case material. Consists of one one-hour lecture and one two-hour group meeting each week. Prerequisites: 144 and 240. Enrollment limited to 40 students, with priority given to those from the graduate construction program.

3 units, Win (Levitt and Parker) Lecture T 9 Group meeting T, W or Th 3:15-5:05

251. Construction Project and Company Organizations—Provides a theoretical framework to analyze and design appropriate organization structures for projects and firms in the construction industry. Subject relates construction organization structure to key characteristics of the tasks to be performed, available technologies for production and administration, skills and motivation of the workforce, and the degree of uncertainty in the task environment. Considerable attention is devoted to issues in the structuring of matrix organizations for design tasks, and project organizations for construction tasks. Students will work in teams of four to develop written solutions to case problems.

3 units, Spr (Levitt) TTh 9-11

253. Estimating for Building Construction—Estimates and costs attached to construction of large buildings, such as apartment houses, warehouses, and other commercial and industrial structures. Enrollment limited to 20, with priority given to graduate students in the construction option. Prerequisites: CE 143, 144 and 145. Students may not receive full credit for both CE 252 and 253.

3 units, Spr (Jessup, Stetson) by arrangement

254. Heavy Construction Methods and Estimating—(Includes material formerly in 252 and 254.) Methods and equipment selection together with techniques for estimating and bidding heavy construction works. Construction engineering topics include rock excavation, tunneling, pile driving, conveyors, and temporary facilities. Estimating topics include site investigation, quantity take-off, work analysis, costing and bid preparation. Prerequisites: CE 145 and 255.

4 units, Spr (Parker) MWF 10

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: CE 145 or equivalent experience.

3 units, Win (Parker) MWF 11

258A,B,C. Seminar in Construction Engineering and Management—Weekly evening discussions of special topics with speakers from industry and government. Normally taken by construction graduate students each quarter for three quarters. Because lecture content builds upon required construction graduate courses, credit registration is restricted to students in the graduate construction program, or by special permission.

258A. 1 unit, Aut (Staff) by arrangement
258B. 1 unit, Win (Staff) by arrangement
258C. 1 unit, Spr (Staff) by arrangement

259A,B,C. Construction Problems—Analysis of group selected problems in construction techniques, equipment, or management, followed by preparation of oral and/or written re-
ports. Students are expected to consult specialists from the construction industry as well as make use of University facilities. Prerequisites: graduate standing in construction and consent of instructor. See CE 299 for alternative for individual studies.

259A. 1 to 3 units, Aut (Staff)
   by arrangement
259B. 1 to 3 units, Win (Staff)
   by arrangement
259C. 1 to 3 units, Spr (Staff)
   by arrangement

260. Engineering Hydrology—A first course in hydrology for civil engineers and other graduate students interested in water studies. An engineering analysis of the hydrologic cycle, emphasizing physical principles and applications in a variety of water resources engineering topics. Introduction to streamflow, groundwater, stochastic, and simulation hydrology.
   3 units, Aut (Kruger) MWF 9

   4 units, Aut (Freyberg) MWF 9 and W 2:15-4:05

261B. Surface-Water Hydrology—Techniques and models for the analysis of watershed hydrology, with a focus on the flow of water on and above the earth's surface. Steady and unsteady open-channel flow, overland flow, flood routing. Analysis of watershed models, with emphasis on calibration, parameter estimation, and practical application. Prerequisites: CE 201, 260, 107 or equivalents.
   4 units, Win (Freyberg) MWF 11 and T 2:15-4:05

261C. Soil-Moisture and Groundwater Hydrology—The flow of water in saturated and unsaturated porous media. Governing equations and their solution for such problems as infiltration and redistribution of soil water, evapotranspiration from soils, seepage and drainage, well hydraulics, and groundwater recharge. Prerequisites: Engineering 21, CE 201, 260, or equivalents; Geology 230 recommended but not required.
   3 Units, Spr (Freyberg) MWF 11

262. Transport and Mixing Processes in the Environment—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: Engineering 21, CE 201, and Computer Science 103 and 106; or equivalents and consent of instructor.
   4 units, Win (Street) MWF 1:15 and Th 12:15-1:05

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 flowing pipes; flow establishment, application of methods of characteristics to water hammer problems. Prerequisite: Engineering 21 or consent of instructor.
   3 units, Spr (Hsu) MWF 9

   3 units, Win (Franzini) TTh 11 and one hour by arrangement.

265. Water Resources Planning—Environmental, social and economic impact of water projects; methods of public involvement in water planning. Water conservation and relationships between water and energy. Planning and project evaluation in the face of multiple objectives. Course uses a group discussion format. Short written assignments and oral presentations are used to further develop students' communication skills. Enrollment will be limited to 20 students. Prerequisites: CE 260 and 221 or Economics 1 or permission of instructor.
   2 unit, Win (Ortolano) T 3:15-5:05

266. Water Resources Systems Engineering—Application of mathematical optimization techniques (e.g., linear programming) to the analysis and design of water systems. Consideration is given to both quantity and quality of water. Topics include reservoir and conduit sizing, time phasing of capacity expansions, and reservoir operations. Water quality issues are considered in the context of waste water treatment plant design and alternative schemes for the attainment of water quality standards. Course includes an introduction to
multi-objective programming and the combined use of simulation and optimization. Students will use the LOTS computing facility to solve selected problems. Prerequisites: CE 260 and Operations Research 152 or Operations Research 240 or permission of instructor.

3 units, Spr (Orotlano) TTh 9:30-10:50

269. Professional Seminar in Environmental and Water Studies—Discussion by faculty, students and visitors of study programs, professional opportunities, and research activities in the fields of environmental engineering and water resources engineering. All candidates for the M.S. degree in environmental and water studies are required to take this course.

1 unit, Aut (Frantini) W 4:15-5:30

269A. Seminars in Environmental and Water Studies—Discussions by faculty and students on study and research of water problems at Stanford. All post-M.S. students in water studies are expected to attend.

1 unit, any quarter (Staff) by arrange; enroll as appropriate for research seminar series.

269B. Seminar in Fluid Mechanics—(Enroll in Engineering 298.) 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

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; in-place control of natural water quality; quality requirements for various beneficial uses.

3 units, Aut (McCarty) MWF 8

271A. Water Quality Control I—Physical and chemical unit operations for water and wastewater treatment with emphasis on treatment process combinations for drinking water supply. Application of principles of chemistry, rate processes fluid dynamics, and process engineering to define and solve water treatment problems. Control of particulate and dissolved pollutants by flocculation, sedimentation, filtration, chemical oxidation, disinfection, and adsorption. Prerequisites: CE 270 and 273 and Engineering 21 or equivalents; or consent of instructor.

4 units, Win (Roberts) MWF 8 and T 1:15

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: CE 274 or equivalent and 271A.

3 units, Spr (McCarty) MWF 8

271C. Water Quality Control III—Analysis of advanced or specialized wastewater treatment flowsheets, including industrial problems. Emphasis on advanced treatment of municipal wastewater and processing of treatment residuals. Definitions of problems and objectives, and evaluation of alternatives for example cases. Use of these concepts in preliminary process design. Design-oriented class project and field trips. Prerequisites: CE 271A and concurrent requisition in 271B.

3 units, Spr (Roberts) TTh 9 and T 1:15-3:05 (Not offered 1980-81)

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: CE 274 or equivalent.

3 units, Spr (Young) TTh 11-12:15

273. Water Chemistry—A systematic presentation of chemical principles and application of those principles to the analysis and solution of problems in 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 (McCarty) MWF 8

274. Professional Seminar in Environmental and Water Studies—Discussion by faculty, students and visitors of study programs, professional opportunities, and research activities in the fields of environmental engineering and water resources engineering. All candidates for the M.S. degree in environmental and water studies are required to take this course.

1 unit, Aut (Frantini) W 4:15-5:30

276. Environmental and Water Studies—Discussions by faculty and students on study and research of water problems at Stanford. All post-M.S. students in water studies are expected to attend.

1 unit, any quarter (Staff) by arrange; enroll as appropriate for research seminar series.

277A. Seminar in Fluid Mechanics—(Enroll in Engineering 298.) 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

277B. Seminar in Fluid Mechanics—(Enroll in Engineering 298.) 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

278. Water Chemistry Laboratory—Laboratory application of techniques for the analysis of natural waters and wastewaters; special emphasis on advanced treatment of municipal wastewater and processing of treatment residuals. Prerequisites: CE 274 or equivalent.

3 units, Aut (McCarty) MWF 8

279. 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 be-
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: CE 273.

2 units, Spr (Leckie) by arrangement
Offered alternate years, given 1980-81

274A. Water Microbiology Laboratory—Experimental approach to understanding fundamentals of microbiology; topics include morphology, metabolism, microbial interactions and water quality parameters. Prerequisite: CE 273.

1 or 2 units, Win (Staff) TTh 9

275A. Water Quality Control Processes I—Laboratory and pilot plant studies of physical and chemical processes for the treatment of water and wastewaters. Prerequisites: CE 273 and 273A.

3 units, Win (Leckie) M 2:15-5:05, and Th 1:15-5:05

275B. Water Quality Control Processes II—Laboratory and pilot plant studies of biological processes for the treatment of water and wastewaters. Prerequisites: CE 274 and 273A (or equivalent) and 271B which may be taken concurrently.

3 units, Spr (McCarty) M 2:15-5:05 and Th 1:15-4:05

276. 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 (Kruger) MWF 10

277. Nuclear Environmental Engineering—A review of nuclear methods useful in environmental studies, the conflict of energy production and environmental quality, and the problems of environmental radioactivity. Topics included are: nuclear civil engineering, nuclear methods, application in water studies, fossil and nuclear fuel cycles, radioactive waste management, biological importance of ionizing radiation. (Open to undergraduates by permission of instructor. Term paper required for credit.)

3 units, Spr (Kruger) MWF 9


1 unit, Spr (Leckie) W 4:15

280A. Matrix Analysis of Framed Structures—Analysis of framed structures by matrix methods; flexibility and stiffness methods developed, with emphasis on the latter; orientation toward solution by digital computer. Optional concurrent registration in CE 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 Elements for 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; vibrations and instability; nonlinear analysis. Optional concurrent registration in CE 281B. Prerequisite: CE 280A or equivalent.

3 units, Win (Weaver) MWF 2:15


2 units, Win (Weaver) T 2:15-3:30

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 and design earthquake; importance of dynamic analysis of structures; geologic and soil
engineering problems; design of structures to minimize earthquake damage; risk analysis; earthquake codes. Prerequisite: CE 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 bi-axial 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


4 units, Aut (Kavazanjian) MWF 1:15, alternate years, given 1981-82

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: CE 190 or equivalent.

3 units, Win (Kavazanjian) 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: CE 190 or equivalent.

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

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: CE 190 or equivalent.

3 units, Spr (Clough) 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: CE 290 or equivalent.

3 units, Win (Kavazanjian) T 10; plus lab. by arrangement

295. Introduction to Geological Engineering—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: CE 190 or equivalent.

3 units, Aut (Kavazanjian) MWF 2:15; alternate years, given 1980-81

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: CE 180 and Engineering 12.

3 units, Aut (Gere) MWF 10


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 discretized structures. Mandatory concurrent registration in CE 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

390. Advanced Topics in Geotechnical Engineering—Bi-weekly seminar. Topics selected according to student and faculty interests. For post-Masters students or by consent of instructors.
3 units, Spr (Clough) TTh 3:30-5:00

397. Random Vibrations—Concept of random vibrations; description of the vibratory motion of probabilistic summary, concept of stationarity, ergodicity; correlation and autocorrelation; Fourier Analysis; spectral density function; input/output relationship for linear systems; transmission of random vibrations. Prerequisites: Post-M.S. standing.
2 units, Win (Shah) TTh 11

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


Assistant Professors: Abbas El Gamal, John L. Hennessy, Robert G. Mathews, John A Newkirk, Fouad Tobagi, Willem vanCleemput, Charles S. Williams

Courtsy Professors: Gene H. Golub, Donald E. Knuth, David G. Luenberger, John McCarthy

Courtsy Associate Professor: William Brody

Courtsy Assistant Professor: Geo. C.M. Wiederhold

Lecturers: Dennis Allison, Harry T. Garland, Frank Herman, Marcian E. Hoff, Matt Lehmman

Consulting Professors: Bruce Deal, Peter Eisenberger, Owen K. Garriott, Stig B.M. Hagstrom

Consulting Associate Professors: George E. Rossman, Noel P. Thompson, John F. Wakerly

Visiting Associate Professor: Leonard Adleman

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 master's 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. No time is lost in first completing the master's degree since a thesis is not required. (See sections 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 post-graduate 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
A student with some additional preparation in mathematics can usually complete the M.S. degree within two academic years. Adequate preparation in electrical engineering may be able to complete the M.S. requirements in only one academic year. 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.

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 normally includes the requirements for work toward the master's degree in Electrical Engineering.

The additional year allows time for a broader program, or a more concentrated program, or whatever arrangement of study may seem suitable to the candidate, his advisor, and the department. Advanced study at other universities, or in other departments at Stanford, may be allowed within the foregoing consideration. 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 dif-
fers from the Ph.D. primarily in looking toward professional engineering work rather than toward theoretical research. The candidate may select courses that are suitable for either the degree of Engineer or the Ph.D. degree, and decide later which program to pursue.

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 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 when applying for admission. Programs of at least 42 quarter units that meet the following guidelines will normally be approved.

1. A required sequence of courses in Computer Science and Electrical Engineering to provide depth in hardware and software design. Choose five courses from the following: EE282, EE381, EE382, CS142, CS143, CS145, CS246A.

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) Bioelectronics—EE 202, 208; (b) Communications—EE 279, 376A, 387; (c) Control Theory—ENGR 206, 207, AA 278A, EE 363; (d) Finance or Accounting—GSB 210 Management Accounting I, GSB 220 Business Fi-
The degree of Master of Science in “Electrical Engineering: Computer Engineering” is intended as a professional degree. Students who plan to be candidates for the Ph.D. degree are advised to enroll in the regular Master of Science in Electrical Engineering program.

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 areas listed below.

RADIO SCIENCE

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 Sensing with Microwave, Optical and Acoustic Waves
Radar Oceanography and Underwater Communications
Planetary Exploration
Satellite Communications Systems
Digital Signal Processing and Spectral Analysis Research for Radioscience Applications

SOLID STATE

Semiconductor and Solid State Physics
Electronic and Optical Properties of Solids
Crystal Preparation: Epitaxy and Ion Implantations
Solid State Devices: Physics and Fabrication
Physics and Chemistry of Surfaces and Interfaces
Applied Superconductivity
Electron Spectroscopy

Laser, Electron and Ion Beam Processing and Analysis
Generation of Focused Particle Beams
Solar Energy Conversion

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
Magnetoacoustic and Acoustoptic Phenomena
Acoustic and Optical Microscopy
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
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
- 600-799 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," that may be of special interest to Electrical Engineering undergraduates.

100. Seminar—Weekly discussion of special topics of interest to electrical engineering undergraduates: graduate schools, coterminal program, employment opportunities, alternative career paths, state of the art technology and research.

1 unit, Aut (Smith)


3 units, Aut (Tuttle)


3 units, Win (Tuttle)

Spr (Franklin)


3 units, Spr (Tuttle)

104. 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. Special topics include the Fast Fourier Transform, the sampling theorem, and effects of finite computer word length. Various real time digital filters are implemented in BASIC on a minicomputer. Design examples taken from telephony, laboratory data processing, and control system simulation. Prerequisite: 102.

3 units, Aut (Williams)

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. Prerequisites: One year of college engineering, mathematics or physics.

3 units, Spr (Eshleman)

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, Au (Gibbons)  
Win (da Rosa)
112. 3 units, Win (Gibbons)  
Spr (Pease)
113. 3 units, Au (da Rosa)  
Spr (Gibbons)

121. Digital Laboratory—Introduction to digital circuits and their application. Topics include measurement technique, logic families, switching speed, Boolean algebra, state machines, digital data transmission, analog and digital converters, and digital displays. Prerequisite: Eng. 42.

3 units, Win (Staff) 3-hour lab.  
weekly by arrangement

3 units, Spr (Marouf) 3-hour lab.  
weekly by arrangement

122. Analog Laboratory—Introduction to the design and measurement of active analog circuits. Projects include the design and construction of oscillators, regulated power supplies, preamplifiers and power amplifiers. Prerequisite: Eng. 42. Corequisite: 113.

3 units, Au, Spr (Staff) 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 digital circuits or microprocessors should take 183 or 281.

3 units, Win, Spr (McWhorter)  
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, Au (Waterman)  
Win (Quate)

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 or Physics 120 is a prerequisite.

3 units, Win (Waterman)

180. Systematic Programming—Introduction to systematic program design, use of a variety of data structures, recursion manipulation of text. Program correctness, informal verification, and testing. Modularization, scope concepts, and portability. Prerequisite: C.S. 104, 105, 106 or equivalent.

3 units, Au, 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 and multiple processes. Students will use the LOTS facility and will program and operate a small computer. Enrollment limited to 50. (Same content as Computer Science 111.) Prerequisite: CS 105 or 106 or equivalent. Corequisite: 180 or equivalent.

3 units, Au (Gill)
3 units, Spr (Williams)

181S. Introduction to Computer Organization, Machine and Assembly Languages for the Non-Specialist—Review of high-level language programming. Introduction to the LOTS facility; the organization of a simple digital computer; binary arithmetic; instruction execution; machine language programs; symbolic assembly language; the assembly process; subroutines; simple data structures: arrays, stacks; input-output programming; interrupts. Students will program and operate a small computer. Not intended for students with substantial programming experience. Not accepted as preparation for EE 282, 285, 382 and Computer Science Department equivalents. Enrollment limited to 50. (Same content as Computer Science 111S.) Prerequisite: CS 105 or 106 or equivalent.

3 units, Win (Staff)

182. Digital Computer Organization—Basic digital circuits; introduction to switching theory and logic design; computer arithmetic; memories, processors, control, input/output, and mass storage; data formats, addressing and instruction sets. Study of the logic control of a small computer. Prerequisites: 181 or 181S, or CS 111 or CS 111S (may be concurrent).

3 units, Au (Staff)
3 units, Win (Staff)
183. Digital Logic Laboratory—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. Prerequisites: 182 and 121 or equivalent.

3 units, Aut (Staff) plus 4 hour lab.
by arrangement
3 units, Win (Staff) plus 4 hour lab.
by arrangement

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 except individual work.

200A, B, C. Seminar—Special section of 201A, B, C (See description below) open to students holding assistantships and registering under limited tuition grants. Given for Pass Credit only.

200A. 0 units, Aut (Pantell)
200B. 0 units, Win (Manning)
200C. 0 units, Spr (Manning)

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. Given for Pass Credit only.

201A. 1 unit, Aut (Pantell)
201B. 1 unit, Win (Manning)
201C. 1 unit, Spr (Manning)

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.)

205. The Entrepreneurial Engineer—A seminar to further the knowledge base of prospective entrepreneurs with an engineering background. Major part of the content will include contributions made to the business world by engineering graduates. Speakers will include Stanford (and other) engineering and MBA graduates who have founded large and small companies in nearby communities. Contributions from faculty members and other departments, such as law, business and industrial engineering will also be made.

1 unit, Win (Melen)

208. Biological Information Processing—The primary purpose of this course is to acquaint the student with the basic signal processing elements occurring in biological systems, and how these elements can be assembled to execute fairly complex signal processing. The physiological basis of the signal processing is investigated so that a good sense of the signal magnitudes, propagation delays, etc. can be obtained. The signal processing capabilities of various neural networks are examined and compared to naturally occurring systems. Examples are taken from both lower animal and human systems. Peripheral signal processing, such as occurs in auditory and optical sensory systems, is discussed, as well as regulatory systems and the central nervous system.

3 units, Spr (White)

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)
Spr (Kincheloe)

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. Junc-
tion and surface effects in the p-n junction and MOS capacitor. Fundamentals of carrier transport, charge storage, and generation-recombination; application to the operation of MOSFET and BJT. First-order models that reflect phenomena of device operation and serve as useful tools for circuit analysis and design. Device modeling with emphasis on features and constraints of integrated circuit technologies. Prerequisites: 111, 112 for undergraduates, none for graduates.

3 units, Aut (Angell, Dutton)
Win (Lintott)

217. Electron and Ion Optics—Principles of geometric optics and optical properties of trajectories of electrons and ions in electric and magnetic fields. The paraxial ray equation and limits to obtainable current density. Aberrations including spherical aberration, chromatic aberration and astigmatism. Principles and limits of electron and ion optical instruments including various forms of electron microscopes, electron microprobes, electron lithographic tools and ion probes. Prerequisites: Recommended—Physics 51 or equivalent.

3 units, Win (Pease) alternate years,
given 1981-82

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)

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)

231. Lasers—Introduction to how lasers work, including transitions in atoms, stimulated emission and amplification, rate equations, regeneration and feedback, coherent laser oscillation, and laser applications. Uses primarily classical models for atomic transitions, with no quantum mechanics background required. Prerequisites: electromagnetic theory to a level of at least 142, and preferably some knowledge of atomic or modern physics at an advanced undergraduate level, such as Eng. 50, Physics 130-131, or EE 238.

3 units, Aut (Siegman)

232. Lasers—Continuation of 231. More detailed coverage of selected topics in lasers, optics, quantum electronics. Prerequisite: 231.

3 units, Win (Siegman)

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 (Spicer)

239A. Solid-State Theory—(Enroll in Applied Physics 239.)

239B. Solid-State Theory—(Enroll in Applied Physics 240.)

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 laminar 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)

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; waveguides, 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)

243. Integrated and Fiber Optics—Propagation of waves in dielectric thin films and cylindrical guides. Bit limitation rate due to material
displacement and multimoding. Step index and graded index fibers. Switching and modulation by integrated optics techniques. Prerequisite: 241.

3 units, Win (Pantell)

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)
plus 2 hours dhr

246. Microwave Circuit Theory—Basic concepts and theory of microwave circuits, with an emphasis on physics and a minimum of the mathematics of boundary value problems. Brief review of wave propagation on co-axial, stripline, and rectangular waveguides, and development of modal transmission line representations. Impedance matching with stubs and diaphragms. Scattering matrix representation of microwave components—directional couplers, hybrids, circulators, etc. Cavity resonator theory, including equivalent circuits and definitions of basis parameters such as Q, shunt impedance, and coupling factor. Elementary periodic circuits.

3 units, Win (Auld)

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 (Macovski, Goodman)
Spr (Bracewell)

262. Two Dimensional Imaging—Two dimensional autocorrelation, Fourier spectra, spatial frequencies, diffraction, antennas, Hankel and Abel transforms, circular symmetry, line integration, two dimensional impulses and sampling, restoration, principal solution, restoration with noise and correlation, reconstruction from line integrals, mapping instrumentation, applications to various fields. Prerequisite: 261 or equivalent.

3 units, Aut (Bracewell)

263. Digital Signal Processing—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, Win (Widrow)

264. Digital Filtering—An introduction to modern digital filtering techniques. Major topics include: an introduction to discrete-time state space system theory, filter approximation theory, s-plane to z-plane mappings, optimal design procedures for finite impulse response (FIR) and infinite impulse response (IIR) filters, and some aspects of hardware implementation. Prerequisites: Knowledge of z-transform theory, EE 263, EE 104, or consent of instructor. EE 261 is recommended.

3 units, Spr (Treichler)

271. Introduction to VLSI Systems—An introduction to large-scale nMOS design. Topics include stick diagramming, nMOS transistors, switch and gate logic, programmable logic arrays, two-phase dynamic design, finite state machines, scalable design rules, a layout description language, and speed and power considerations. Students must complete modest-sized nMOS projects through layout; promising projects will be fabricated. This course is intended for EE and CS students with background in computers, signal processing, or programming. Background in IC fabrication or physics is not required. Prerequisites: familiarity with the basic notions of circuits, logic, and digital systems; prior experience with timesharing facilities.

3 units, Aut (Newkirk, Mathews)
3 units, Spr (Newkirk, Mathews)

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, 181S or equivalent assembly programming experience.

3-4 units (normally 4 units undergraduates, 3 units, graduates)

Aut (Staff) 3-hour lab. by arrangement
Win (Staff) 3-hour lab. by arrangement
Spr (Staff) 3-hour lab. by arrangement
Sum (Staff) 3-hour lab. by arrangement

278. Introduction to Statistical Signal Processing—Review and elaboration of elementary probability theory: expectation, characteristic functions (transforms), limit theorems. Introduction to random processes: definitions and properties, covariance and spectral density, time average, stationarity, ergodicity, and linear system relations. Selected applications in noise analysis, communication systems, estimation theory. Prerequisite: elementary linear systems, transforms, and probability.

3 units, Aut (Gray)
Win (Tobagi)

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. Prerequisites: 102 and 278.

3 units, Win (Gray)

280A,B. Computer Applications Research—"Hands-on" experience in innovative, real-time applications of digital computers as signal processors or portions of control systems. Previous topics include interference cancelling in fetal electrocardiography, 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 181S or equivalent programming experience. Corequisite: 274.

3 units, Win (Gray)

281. Microcomputer Laboratory—Introduction to a specific microprocessor, the Zilog Z-80. Lectures covering the programming and design of a microcomputer system, accompanied by laboratory exercises. A final laboratory project is required. Prerequisites: 181 or 181S and 182 or equivalents, and some hands-on experience with TTL logic, such as 121 or 183.

3 units, Aut (Peterson) plus lab. by arrangement

Win (Gill)


3 units, Aut (enroll in CS311)
Spr (Staff)

284. Introduction to Discrete Mathematics—An introduction to the algebra and combinatorics required for the advanced study of digital systems and computer science. Sets, relations, functions and homomorphisms. Semigroups 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 (Staff)


3 units, Win (Staff)

286. Compilers—(Same content as Computer Science 143.) 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: 285.

3 units, Win (Owicki)

287. File and Database Systems—(Enroll in Computer Science 145)

288. Software Engineering Laboratory—An eclectic apprenticeship program in the folklore and craft of programming system design and implementation. Individual and group problem-solving, design methodology, project planning and management, and communication skills are emphasized. Practical and theoretical issues of computer systems are explored through projects, written reports, oral presentations, and class discussions. The approach is neither comprehensive nor formal. Students should have some knowledge of programming; concurrent enrollment in 285/CS142 is recommended.

3 units, Win (Staff)
292. Special Seminars—Each year special seminars and experimental courses are given on topics of current interest. See the Time Schedule and bulletins in the Department Office for detailed announcements.


3 units, Aut (da Rosa)


3 units, Win (da Rosa)

COURSES FOR GRADUATE STUDENTS

All courses (DR:T) if taken for 3 or more units except for individual work.

305. Seminar on Electronics in Medicine—Weekly seminars on the application of electronics technology to problems of medical practice or research featuring speakers from educational institutions or industry.

1 unit, Aut, Win (White)

310. Integrated Circuits Technology and Design Seminar—In-depth treatment of technology and circuit design problems in integrated circuits. Content is designed to parallel and complement topics in 312 (Aut), 313 (Win), and 314 (Spr).

1 unit, Aut (Plummer)

Win (Dutton)

Spr (Angell)

312. 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 since it is a prerequisite for 410 and 411. Those interested in the course as part of their breadth sequence may take it either Autumn or Spring Quarter. Prerequisite: 113 or equivalent.

3 units, Aut (Meindl)

3 units, Spr (Plummer)


3 units, Win (Dutton)

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 (Dutton)

315. Circuit Design and Simulation Laboratory—This lab provides a working knowledge of circuit and logic simulation computer tools and their use for circuit design. User-oriented programs (i.e. SPICE) are exploited for design. The problems of parameter specification including device and gate characterization are considered. Based on circuit characterization and simulation the effects of parasitics will be studied. Prerequisites: 113, 122 or equivalent.

3 units, Aut (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 (Spicer)

322A. Basic Quantum Mechanics—Introduction to the concepts of quantum mechanics; the postulates of quantum mechanics; observables, wave functions, and probability density; the Schrödinger equation; complementary variables and the uncertainty principle; the harmonic oscillator and particles in a box; the hydrogen atom; angular momentum; the matrix formulation of quantum mechanics; the Dirac
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 (Bates)

323. Acoustic Devices—Introduction to acoustic devices. Applications to nondestructive testing, medicine, and radar. Topics covered include wave propagation in isotropic materials, piezo electric transducers, diffraction and scattering from flaws in body tissue, surface acoustic waves, normal mode and coupled mode theory. Prerequisites: 142, 242 or equivalent.

3 units, Aut (Chodorow)

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)

325. Analog Signal Processing—Introduction to analog filters with emphasis on acoustic surface waves and related optical and semiconductor devices. Topics covered include CCS and ASW transversal filters, correlators, convolvers, the chirp Z transform, analog and digital coding, acousto-optical processors, and the storage correlator. Applications of these signal processing ideas to acoustic imaging, spread spectrum, and other communication systems, radar, and sonar will be discussed. Prerequisites: 142, and preferably 261.

3 units, Win (Kino) alternate years, given 1981-82

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 interaction of beams with circuits. 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. Backward wave effects and backward 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. Prerequisite: 326A.

3 units, Win (Chodorow)

326C. Microwave Electronics—Equivalent circuits and interaction in cavity type TWT's. Space harmonics in traveling waves, properties of the helix; large signal effects in electron devices; crossed field interactions (gyrotrons). Prerequisite: 326B.

3 units, Spr (Chodorow)

327A. Acoustic Waves in Solids I—(Enroll in Applied Physics 252.)

327B. Acoustic Waves in Solids II—(Enroll in Applied Physics 253.)

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, and the MOSFET. Prerequisites: 111-113, 216 and 328A (for 328B) required; 238 recommended but not required.

3 units, Win (Swanson) Spr (Swanson)

330. Photoelectric 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 coefficients of surfaces, etc. Registration by consent of instructor. Prerequisite: Physics 161 or Materials Science and Engineering 181.

3 units, Aut (Bates) alternate years, given 1981-82

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 1981-82

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, magnetometry, 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)
Will not be offered 1980-81

338A. Quantum Theory of Energy States in Solids—(Enroll in Materials Science and Engineering 233.)
338B. Electronic Transport in Solids—(Enroll in Materials Science and Engineering 234.)
338C. Photoelectronic Properties of Solids—(Enroll in Materials Science and Engineering 235.)

341, 342. Microwave Measurements Laboratory—Two quarter laboratory course sequence in microwave measurements. Course involves measurement techniques at microwave frequencies using modern equipment with the emphasis directed toward microwave tube applications. Topics covered in the first quarter of this course include power and attenuation measurements, waveguide components and discontinuities, slow-wave structures and cavities as well as familiarization with the use of a spectrum analyzer, network analyzer and related equipment. Attempts will be made, wherever possible, to interface the measurement equipment with a desktop computer. The second quarter of this course covers the measurement of microwave circuit parameters of components such as junctions, ferrite devices and traveling wave amplifiers. Noise figure measurement techniques and multisignal operation of traveling wave amplifiers will also be studied. Lectures and laboratory. Prerequisites: 241, 326C or equivalent.
3 units, Win (Konrad)
342. 3 units, Spr (Konrad)

346A. 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—phase-matching; slowly varying envelope, approximation—dispersion, diffraction, space-time analogy; harmonic generation; frequency conversion; parametric amplification and oscillation; and electro-optic light modulation. Prerequisite: 241, 242, 322A or equivalent.
3 units, Spr (Harris)

346B. Nonlinear Optics—Frequency conversion with focused, temporally compressed, and resonant beams; Green's function and Fourier methods; stimulated Brillouin and Raman scattering; acousto-optic modulation, frequency translation, and scanning; mode locking of lasers; nonlinear image conversion and complex wavefront conjugation; multiphoton absorption; laser induced interactions between colliding atoms, techniques for short wavelength generation. Prerequisite: 346A.
3 units, Aut (Harris) alternate years, given 1981-82

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 1981-82

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, plasma physics, and communications planning.
1 unit, Aut, Win, Spr (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 (Heullwell) alternate years, given 1980-81

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, Aut (Bracewell) given 1981-82

354. Introduction to Radio Wave Scattering—Integral and differential equations of radio wave scattering; exact, approximate and numerical solutions of single particle scattering for spheres and cylinders. Multiple scattering; formulation and solution techniques for equation of transfer in discrete media and scattering by continuous media in weak and strong regimes. Scattering from rough surfaces with large and small roughness scales. Applications to radar, radar astronomy, remote sensing, and biological media. Prerequisite: EE 241 or equivalent or consent of instructor.

3 units, Spr (Tyler) alternate years, given 1981-82

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, magnetioinonic propagation and dispersion. Sheath and probe theory, magnetic confinement, pinches, adiabatic motion, mirrors, pressures, stresses, magnetogasdynamics. Prerequisite: 241 or equivalent.

3 units, Aut (Buneman)

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 1980-81

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 and Math 113S.

3 units, Aut (Franklin) 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 (Morf)

365. System Identification—Construction of dynamic models from input-output data. Least squares, Ladder Forms, Extended Kalman Filter and Maximum Likelihood methods. Parameter estimation consistency and identifiability, identification of system structure. Adaptive Control. Examples selected from geophysics, economics, process control, array processing, distributed signal processing and control, etc. Experimental studies via computer simulations, project oriented.

3 units, Spr (Morf)

366. 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)

367. 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. Prerequisites: 278, 366.

3 units, Spr (Goodman) alternate years, given 1981-82

368. Digital Image Processing—This course covers various topics in the field of digital image processing, including: physical descriptions of continuous images; properties of the human
visual system; sampling and quantization of images; matrix representation of image forming and image processing systems; unitary transforms and image compression; and image enhancement and restoration. Prerequisites: 261, Math 114S.

3 units, Spr (Goodman)

369. 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 improving diagnosis. Prerequisites: Fourier transforms. 366 recommended.

3 units, Spr (Macovski)

370. Information Systems Seminar—Lectures and discussion of topics and research areas in information systems; sample topics are computational and statistical complexity, rate distortion theory, algebraic systems theory, simultaneous communications, and telecommunications policy.

1 unit, Aut (Williams)

Win (Staff)

Spr (Goodman)


3 units, Spr (Widrow)

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) alternate years, given 1981-82
382. Processor Design—Computer description languages; relationship of processor architecture to design; arithmetic algorithms; memory system design; issues in processor control including microprogramming, emulation and pipelining; processor performance evaluation. Prerequisites: 181, 182.
3 units, Win (Staff)
Spr (Staff)

383. Compiler Project—(Same content as Computer Science 243.) 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, optimization methods, and code generation. A significant project will be included. Prerequisites: 286 (CS 143).
3-6 units, Spr (Ullman)

384. Computer Communication Networks—Introduction to computer communication networks and data transmission systems. Introduction to circuit-switching, packet-switching and packet-broadcasting. Description of existing networks (ARPANET, SATNET, PRNET, ETHERNET, etc.) and their operational protocols. Special emphasis will be placed on design issues, modeling techniques, analysis, and performance evaluation. Same content as CS 344. Prerequisite: OR 153.
3 units, Spr (Tobagi)

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.
1-4 units, Aut, Win, Spr (McCluskey)

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.
1-4 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.
1-4 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.
1-4 units, Aut, Win, Spr (Owicki)

385F. Computer Communication Network Seminar—Student/faculty discussions of research problems in the design of computer communication networks. Specific areas include modeling and evaluation of various design alternatives. Particular attention is focused on packet-switching, packet-broadcasting, and integrated networks. Emphasis is placed on student presentations and Ph.D. thesis research.
1-4 units, Aut, Win, Spr (Tobagi)

385H. Programming Language Design and Implementation Seminar—Student/faculty discussions of research problems in the design and implementation of new and existing programming languages.
1-4 units, Aut, Win, Spr (Hennessy)

386A. 3 units, Win (Baskett)
386B. 3-6 units, Spr (Baskett)
(Enroll in C.S. 246B)

387. Error-Correcting Codes—Theory and implementation of codes for detection and correction of random and burst errors. Linear block codes, cyclic codes, hamming codes, BCH codes, and the Berklekamp decoding algorithm for BCH codes. Convolutional encoding and sequential decoding; the Viterbi algorithm. Prerequisites: Some knowledge of information theory (376A) and modern algebra (284) is useful.
3 units, Spr (Gill)

388. Computer System Evaluation—Performance criteria in computer systems, queueing theory, queueing models of multiprogramming, analysis of bottlenecks, measurements via hardware and software, simulation,
models of program behavior, storage devices, memory hierarchies, and file structures, allocation and scheduling of jobs and computer system resources. Same content as CS 247. Pre-requisites: 386A, Stat 116.

3 units, Aut (Staff) alternate years, given 1981-82

389. Programming Language Design—(Same content as Computer Science 242.) 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: 285.

3 units, Aut (Hennessy)

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: Practice Teaching—Open to a limited number of Electrical Engineering students who plan to make teaching their career. Qualified students conduct a small section of an established course taught in parallel by an experienced instructor. (Smith) by arrangement

397. Faculty Seminar—Discussion meetings arranged by a faculty member or initiated by interested students and sponsored by a faculty member.

1 unit, by invitation

400. Thesis and Thesis Research—Limited to students who have established candidacy for the degree of Engineer or Ph.D. A grade of P indicates satisfactory work; no letter grade is assigned.

By arrangement

410. Integrated Circuit Fabrication Laboratory—Laboratory fabrication of simple MOS or bipolar integrated circuits. The emphasis is on practical aspects of IC fabrication, including silicon wafer cleaning, photoengraving, chemical etching, oxidation, diffusion, implantation, chemical vapor deposition and vacuum evaporation. Enrollment is limited to students pursuing doctoral research programs in which the facilities of the IC lab will be used. Registration by consent of instructor. Prerequisite: 312.

3 units, Win (Plummer)

411. Integrated Circuit Process Characterization Laboratory—Experimental and computer simulation techniques for IC processing. This course complements 410 and provides experience in spreading resistance, ellipsometry, computer-controlled device parameter extraction and computer simulation of IC processing schedules. Enrollment is limited to students pursuing doctoral research programs in which the facilities of the IC lab will be used. Registration by consent of instructor. Prerequisite: 312.

1 unit, Win (Dutton)

412. Advanced Integrated Circuit Laboratory—Experimental projects and seminars on integrated circuit fabrication using epitaxial deposition, oxidation, diffusion, ion implantation and photolithographic processes with emphasis on techniques for achieving advanced device performance. May be repeated for additional credit. Prerequisites: 312, 410, 411, and consent of instructor.

3 units, Spr (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 1981-82

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)
430. Surface and Interface Seminar—A better fundamental understanding of the electronic structure of surfaces and interfaces is becoming increasingly important for many practical applications, e.g., semiconductor devices and metal catalysts. This seminar concentrates on electron spectroscopic methods and basic theoretical approaches for studying surfaces and interfaces. Faculty members and advanced graduate students, as well as invited speakers from outside the University, present material for discussion. 1 unit, Aut, Win, Spr (Spicer) (Lindau)

431. Quantum Electronics—Quantum theory of lasers and of the interaction of radiation and atoms. Coupling of radiation to atoms; stimulated transitions; the density matrix; quantum noise. Provides the quantum theory underlying the semiclassical approach of 231-232. Prerequisites: quantum theory to the level of 322B or Physics 231. A course in lasers, such as 231-232 is not a prerequisite, but background reading from this course material may be necessary. 3 units, Spr (Siegman) alternate years, given 1981-82


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 1980: Fast algorithms in estimation, detection, system identification, adaptive algorithms, selected topics in nonlinear estimation theory. 3 units, Aut (Kailath)

479. Topics in Statistical System Theory—Selected problems in statistical communication, stochastic control, statistical data processing, network and system realization and identification, stability theory. 3 units, Spr Will not be offered 1980-81.

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 content as CS 341. Prerequisites: 381, some familiarity with basic programming concepts. Co-requisite: 382. 3 units, Spr (vanCleemput)

482. Advanced Computer Organization—Topic in computer arithmetic; models of memory systems; single stream system concurrency detection and control; multiple stream system design, analysis and algorithms; relationship between processor architecture and organization. Prerequisites: 282 and 382. 3 units, Spr (Staff) alternate years, offered 1981-82

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 content as CS 343. Prerequisite: 386A. 2–4 units, Spr (Owicki) alternate years, given 1980-81.

484. Database System Theory—(Enroll in Computer Science 245.)

486. Advanced Computer Architecture—Machine mapping issues, design of image machines, including addressing, name space design, operations and formats; emulation, semantics, interpreters and levels of emulation. Image machine analysis and statistical usage. Information theoretic limits and canonical interpretive program forms for high level languages. Directly Executed Language (DEL) synthesis. Prerequisites: 282 and 382. 3 units, Spr (Flynn) alternate years, offered 1981-82

487. Digital Signal Processing Architecture & Circuits—The architecture, system design and hardware implementation of real time signal processors and digital filters. Signal processing operations including the Discrete Fourier Transform, Discrete Convolution, Cosine transform, Hadamard transform and the estimation of power spectra. Design of Finite Impulse Response and Infinite Impulse Response implementations of Low pass, high pass, bandpass and all-pass filters. Applications in speech processing, image processing, communication, sonar and radar signal processing. Possibilities for LSI implementation of signal processing and digital filter computation structures will be investigated. Prerequisites: 381, 382. Recommended: 263. 3 units, Spr (Peterson) alternate years, offered 1981-82

3 units, Spr (McCluskey) alternate years, offered 1980-81

ENGINEERING-ECONOMIC SYSTEMS

Associate Professors: David M. Eddy, Shmuel S. Oren, James L. Sweeney, Edison T. S. Tse.
Adjunct Professors: John T. McAlister, Jr. (on leave 1980-81), Robert E. McGinn
Assistant Professor: Carson E. Agnew
Lecturer: Gerd D. Wallenstein.
Consulting Professors: Robert E. Larson, James E. Matheson, Richard D. Smallwood, Leo van der Reis
Consulting Associate Professors: Edward G. Cazalet, Thomas A. Cotton, Mohamed Z. Ghanem, Peter A. Morris, D. Warner North, Edward J. Sondik
Consulting Assistant Professors: Daniel L. Owen, Patricia A. Owen
Visiting Assistant Professor: Robert E. Marks

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.

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.

MASTER OF SCIENCE

The degree of Master of Science requires a minimum of one academic year of study beyond the B.S. degree. University regulations governing the degree of Master of Science are described in the "Degrees" section of this bulletin. The department does not have a thesis requirement for the Master's degree. Department requirements provide great flexibility for meeting individual objectives. The Master's degree may be viewed as a terminal degree program to provide a professional focus, or it may be used as an exploratory vehicle to formulate and select a more advanced graduate school program. Course programs are approved individually by Engineering-Economic Systems faculty. In addition to meeting University requirements, M.S. programs must contain a total of 42 units of course work. This total must include at least 33 units of regular lecture courses, 21 units of which must be courses in Engineering-Eco-
ademic Systems with letter grades. Included in these courses must be at least 15 units of the department's core courses. An M.S. program must also contain at least 3 units of project work. (See "Courses" below for a list of courses that meet this requirement.) Finally, a grade point average of 3.0 must be achieved on the course program.

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.

**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 "Courses" below), (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.

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.

**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.

**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, on Congressional staffs, and in government agencies. Opportunities also exist to participate in economic and industrial planning in other countries.

The duration of an internship ranges from 6 to 24 months, depending on the time required to complete the project successfully. While interning, the student lives on location and works as an employee responsible to the company or agency concerned. The Engineering-Economic Systems faculty locates and screens suitable internship opportunities in a variety of areas, and reviews each proposed project to verify its educational value.

The student’s internship work in the field is mainly directed toward the successful solution of a real problem. Consequently, the student gains an appreciation for the approximations and compromises with rigor that characterize applied work in the field. Over 150 EES students have been on internships to date.

RESEARCH AND APPLICATIONS

It is important for students to receive experience in the application of system concepts in at least one specific problem area. This experience can be gained through the internship program, through applied research projects, and through special courses that concentrate on the application of system concepts to specific areas.

The major research programs of the department are listed below. Regular and consulting faculty who are active in these programs are indicated.

DECISION ANALYSIS

(Howard, Matheson, D. Owen, P. Owen)

This program is dedicated to advancing the discipline of decision analysis by extending the theoretical foundations, increasing the effectiveness of practice, and expanding the field of application. Decision analysis is a philosophy, a body of knowledge, and a professional practice for the logical illumination of decision problems; it simultaneously considers the uncertain, dynamic, and complex consequences of a decision, as well as the assignment of value to its consequences.

Many large and important problems covering the spectrum of business, government, medicine, and law, have been successfully treated by decision analysis. Applications have been made to such problems as new product introduction, plant expansion, nuclear power development, and independent waste treatment systems. Most of these applications have been made possible by the close liaison between the University program and the Decision Analysis Group at SRI International, at both the internship and post-doctoral levels. Internships are also available at a number of other consulting firms.

Much of the research in this program is conducted through the Decisions and Ethics Center directed by Professor Howard. Current research areas include: (1) the design of agreements to govern the actions of several participants to a venture, (2) the development of decision aids for use under the stress of emergency conditions, (3) the analysis of decisions and disputes involving risks of injury or death.

ECONOMICS

Economic Analysis (Agnew, Dunn, Luenberger, Sweeney)

Within the department, there is an active program of economic analysis. Its focus is the examination of the interfaces among theory, empirical data, policy issues and other economic applications. Specific areas of concentration change over time but a few representative examples can be identified: the economics of depletable resources; the impacts of government policies on economic growth; theories of local government expenditure policies; structural econometrics, with particular emphasis on passenger car use of gasoline; and projects listed under Energy Modeling and Analysis, Information Policy, and Systems Economics.

Systems Economics (Luenberger)

Systems economics is an emerging discipline that combines advanced theories of economics (in finance, general equilibrium theory, and decision theory) with the problem-solving viewpoint and techniques of systems analysis. The field is a response to the growing magnitude and complexity of economic decision problems in both the private and public sectors. Its orientation reflects the conviction that solution methods for these problems must simultaneously be solidly based on theoretical principles and capture the structural complexity inherent in actual situations. The theoretical basis is found mainly in economics, while the techniques for handling complex structure are found mainly in systems analysis.

The program sponsors student internships outside the university, conducts internal applications projects, and conducts Ph.D. dissertation research. Some current theoretical research topics include: (1) development of efficient algorithms, based on fixed-point theory, for calculating equilibrium prices, (2) develop-
ment of the "descriptor variable" approach to representation and analysis of complex dynamic phenomena, (3) development of "implicit mathematical programming," a theory combining control theory and mathematical programming to analyze dynamic investment problems, (4) a study of equilibrium storage theory, to explain the storage policies for commodities such as wheat, and (5) a study of futures markets using the concept of "rational expectations."

ENERGY MODELING AND ANALYSIS
(Sweeney)

The energy modeling activity centers around the Energy Modeling Forum (EMF) and involves the analysis and application of formal models in the study of energy policy issues. Sponsored by the Electric Power Research Institute, the Gas Research Institute, and the Department of Energy, the EMF is based at Stanford with Professor Sweeney as Director. A national activity, the EMF seeks to improve the application of energy models for policy and planning purposes and to improve communication between energy model builders and users. Ad hoc working groups, typically consisting of 40 energy experts with an equal number of modelers and model users (assisted by EES students serving as research assistants), are the foundation of EMF studies. Each group is organized around a single topic to which several existing energy models can be applied.

Internship opportunities in several offices of the Department of Energy are available to students after they have conducted energy-related research on campus. Interns have worked on decision-making for energy R&D investment, forecasting gasoline consumption, and various aspects of energy conservation, among other projects.

Current dissertation work includes: optimal stockpiling under a gaming strategy, energy and the environment, representation of uncertainty in models, development models of OPEC, oil and gas finding rates, and disequilibrium modeling under stochastic rationing.

HEALTH POLICY
(Eddy, Oren)

The health policy program emphasizes the analysis of clinical problems through the examination of the costs, risks, and benefits of medical procedures and through assessments of new medical technology. Emphasis is placed on the assessment of clinical technology and clinical decisions in order to improve the quality and control the cost of medical care as it is practiced. Projects are generally done in collaboration with sponsors. Current sponsors include the National Cancer Institute, the American College of Surgeons, the American Cancer Society, the Blue Cross/Blue Shield Association, the Kaiser-Permanente Health Group, Stanford University Hospital, the Congressional Office of Technology Assessment, the National Center for Health Services Research, and Blue Shield of California. Current projects include helping various organizations decide what to recommend for periodic checkups, performing case studies of specific diagnostic tests, and constructing dynamic probabilistic models of diseases.

INFORMATION POLICY
(Agnew, Cazalet, Dunn, North, Oren)

The information policy program is concerned with the analysis of national and international policies with respect to the creation, distribution, and utilization of information services and products in society. The program emphasizes the application of economics and system theory to the analysis of information policy in such fields as patents and copyrights, research and development, innovation and technology transfer, telecommunications and information services, the operation of information services markets, and the roles of information in the operation of markets generally.

The program includes student pre-internship studies as well as the sponsorship of internships at NASA Headquarters, the Senate Subcommittee on Communications, the Senate Subcommittee on Science, Technology and Space, the Federal Communications Commission, and firms in the information industries. Ph.D. dissertation research is funded by the National Science Foundation and by the National Aeronautics and Space Administration.

Recent dissertations have included studies of (1) the choice of contract structures by firms and individuals in information product markets facing uncertain demand, (2) product selection in markets for information services, (3) markets in which there are information intermediaries (brokers), (4) search and advertising in markets with imperfect information, and (5) the determinants of market structure in an information service market.

Current projects include studies of: (1) the effects of consumer information on innovation, (2) the role of information in the formation of contracts, (3) the economics of libraries and related information dissemination systems, (4) the theory of the firm in the presence of advertising and governmental relations expenditures, and (5) innovation and growth in multiproduct markets.
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. Faculty and students in the program have developed effective analytical approaches to problems such as: the design of a national housing allowance experiment; planning of electric power expansion; analysis of U.S. agricultural policy; the theory of instruction; land-use planning; word processing system evaluation; market forecasting systems; and water resource planning. Students have often been employed by local firms while working on these problems.

Social Analysis

This program is concerned with the political, legal, and economic arrangements that comprise our society. These arrangements and resulting institutions are examined from the perspective of ethics (what is right), as well as from the perspective of efficacy (what works in advancing the goals of human action.) This program is closely affiliated with the Decisions and Ethics Center.

Particular attention is focused on the role of government in society. To this end, the program examines the likely or past effect of government action, develops the ethical basis of law appropriate to a free society, explores the potential of voluntary systems in meeting human needs, and evaluates various economic and political theories.

A major emphasis of the program is on the use or abuse of technologies and natural resources in society. Current doctoral research includes: (1) ethical legal remedies for risk and harmful side effects posed by technology, (2) designing safety agreements for the sale of hazardous goods and services, (3) designing automated mechanisms to reduce transaction costs, (4) a critical review and reinterpretation of the "appropriate technology" literature, and (5) an ethical analysis of energy policy.

Technology policy analysis evaluates potential and actual consequences, both adverse and beneficial, arising from particular technological initiatives. The increasing scope of technological initiatives being taken has impacted on the world’s natural resource base and upon the lives and aspirations of human beings all over the world.

Technological initiatives, particularly in energy and information systems, have dramatic consequences on relations between nations in the developed world that largely have the technological capabilities, and nations in the third world that have an increasing proportion of the natural resources. Any broad technological choice requires adequate consideration of its social, economic, and political consequences on the impacted stakeholders around the world.

An iterative process for technological choice is being studied and developed. This process will (1) provide a broad background perspective for the future, (2) provide a set of technology policy exploratory centers to explore specific problems and alternative initiatives toward their solution, (3) provide facilitation to both institutions and individuals as they make transitions from former roles to future roles, and (4) help to launch new careers and facilitate new directions for professionals in mid-career in operational organizations. Organizations in both the private and the public sectors and in both developed countries and in the third world will be involved.

Internships are being established in technology policy exploratory centers as well as in operational institutions in the public sector and companies in the private sector in which specific new technological initiatives are being taken. It is expected that internships will be available both in the U.S. and in foreign countries.

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 $1100 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 $9970 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 $350 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 sequentially with basic courses and prerequisites falling early in the academic year.

**COURSES**

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: 221*, 225
   d) Modeling Process: 208†

2. **Optimization**: 242*, 243*, 248, 253, 263

3. **Economics**: 155, 212A*, B*, 214A, B, 258†, 315

4. **Decision Analysis**: 231*, 232, 236†, 238

5. **Applications and Research**
   a) Health Systems: 271†
   b) Energy Models: 283
   c) Social Systems: 287

6. **Other Courses**: 180, 292, 293, 294, 400 series

*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.

**ENGINEERING-ECONOMIC SYSTEMS**

**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 (Lincill) TTh 7:30-9:00


3 units Win (Lincill) TTh 7:30-9:00


3 units, Spr (Lincill) TTh 7:30-9:00

**201A. Dynamic Systems**—An introduction with about equal emphasis given to develop-
ment 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 migrations, national economics, price cycles, cultural media dynamics, Peter Principle of organizational hierarchies, Richardson's theory of arms races, Homans-Simon model of group interaction, population growth (DR:T)

4 units, Aut (Staff) 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 transference, the spread of epidemics, optimal resource allocation. (DR:T)

4 units, Win (Staff) 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, Spr (Smallwood and Morris) MW 2:45-4

221. Probabilistic Analysis—A self-contained development of probability theory that is both theoretically sound and suited to application. Appropriate either as a terminal course or as a foundation for further graduate work in applied areas. Theory presented axiomatically with emphasis on 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

225. Dynamic Probabilistic Models—The presentation and development of the concepts that underlie the general area of Markov processes, a useful set of models for describing systems exhibiting both dynamic and uncertain behavior. Emphasis on developing an understanding of the concepts and models so that they can become a useful tool for analyzing complex phenomena. Specific models to be addressed include discrete and continuous time, finite and countable infinite state, Markov and semi-Markov processes. Consideration of the application of dynamic programming to Markov decision processes, including policy and value iteration. Examples from queueing, consumer choice, reliability, and renewal theory among others. Prerequisites: 201A and 221, or equivalents.

3 units, Win (Smallwood, Morris) MW 1:15-2:30

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 (Tse) TTh 2:15-3:30


3 units, Spr (Oren) MW 9:30-10:45
248. Dynamic Programming—The discrete-time dynamic optimization problem. Bellman's principle of optimality. The basic computational procedure. Advanced computational procedures, including successive approximations, approximations in policy space, dynamic programming with shift vectors, and state increment dynamic programming. Dynamic programming for continuous time systems and the calculus of variations. Linear systems. Dynamic programming for stochastic and adaptive systems. Applications in system expansion planning, operations research, process control, power systems, environmental systems, and trajectory optimization. (DR:X)

3 units, Aut (Larson) MW 1:45-3:05

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.

3 units, Spr (Tse) TTh 9:30-10:45

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 units, Aut (Tse) TTh 11:00-12:15

ECONOMICS

155. Economics of Natural Resources—(Enroll in Economics 155.)

5 units, Spr (Sweeney)

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. (DR:S)

212A. 3 units, Aut (Staff) MW 9:30-10:45
212B. 3 units, Win (Staff) MW 9:30-10:45

214A,B. Public Policy Analysis—An approach to public policy analysis that draws on law, economics, and system analysis in developing a conceptual framework for policy formulation and evaluation. An introduction to legal reasoning and the U.S. legal system is given to provide a foundation for the development of well-defined implementation options for broadly stated policies. This approach is used to analyze a wide range of public policy issues through the use of case studies involving interaction among industry, consumer groups, governmental agencies, regulatory commissions, legislative bodies, and the courts. Cases are chosen that deal with issues that are still unresolved and concerning which extensive information exists in the form of industry filings, legislative hearing records, commission decisions, etc.

The course includes a study of alternative models of large-scale societal systems that can include nonmarket interactions among business firms, the government, and consumers. Neoclassical welfare economics is used as a reference point for this study.

The course also provides an in-depth study of the policy process in operation in several specific cases selected from the following areas: national science and technology policy, the regulation of telecommunications and information services, land-use planning, and local community service delivery. Prerequisite: 212A. (DR:S)

214A. 3 units, Win (Dunn) MW 11:-12:15
214B. 3 units, Spr (Dunn) MW 11:00-12:15

258. Systems Economics—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 prac-
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 (Luenberger) T 2:15-3:30

235. Seminar in Austrian Economics—The Austrian approach to economics, as expressed primarily in the writings of F. A. Hayek and Ludwig von Mises, recognizes the problems of coordination among individuals acting with incomplete and subjective information. Oriented around readings and informal presentation. Competition as a process; the role of the entrepreneur, capital, interest, money, inflation and the business cycle. Methodological issues in the social sciences, limitations of mathematics in economics, criticisms of the neoclassical paradigm, broad implications for public policy, and potential research areas from an Austrian perspective. Prerequisite: 212A and 212B, or the equivalent.

2 units, Aut (Staff) M 3:15-5

APPLICATIONS AND RESEARCH

271. The Analysis of Medical Policies—(Same as Human Biology 174 and Family and Community and Preventive Medicine 253). Project course in the quantitative analysis of medical policy problems. Each year the course will focus on a new problem that is current, important,
and difficult. Whenever possible the analyses will be performed for sponsors, decision makers who actually face the problem. Each analysis will involve (1) problem formulation; (2) a critical analysis of medical research literature, focusing on quality of research design and interpretation of research results; (3) construction of mathematical and economic models of clinical problems; (4) the application of decision theory; and (5) the presentation and writing of reports. Pairs or teams of students will pool quantitative and biological/medical skills to analyze policies. Prerequisite: Permission of instructor. Students should bring to the course experience in either quantitative policy analysis (e.g., EES 231 or equivalent) or medicine/biology (e.g., Medical School students, senior Pre-Med, or equivalent). Enrollment will be selective to ensure proper mixture of quantitative and medical skills.

4 units, Aut (Eddy) MW 3:15-5:05 alternate years; given 1981-82

283. Energy Policy Models—Design and application of formal models in the study of energy policy problems involving issues of individual choice, social welfare, technology tradeoffs, resource management, and uncertainty in a national or international setting. Emphasis on the integrated utilization of modeling tools drawn from diverse methodologies and the requirements for successful application in a policymaking context. Prerequisites: 212A and 242 or equivalent.

3 units, Spr (Weyant) MW 1:15-2:30

287. Voluntary Social Systems—Exploration of ethical theory, feasibility, and desirability of a social order in which coercion by individuals and government is minimized and in which people pursue ends on a voluntary basis. Topics addressed include: the ethics of rights, the non-aggression principle, property rights and homesteading, contracts, defense, and legal remedies; traditional arguments for government, the efficacy of various policies, and the hypotheses of reverse results; application of basic principles and examination of voluntary alternatives concerning crimes, pollution, help for the needy, education, consumer protection, foreign policy, and other issues; transition strategies to a more voluntary society.

3 units, Win (Staff) TTh 1:45-3:05

OTHER COURSES

180. Ethical Analysis of Policy Issues Raised by Technology—Review of general sources of social conflict such as involuntary physical interference, failure to meet expectations, economic distribution, and moral judgments. Examples will be given in which technology has a major role, e.g., pollution, product and workplace ac-

icidents, and social changes due to innovation. Justification of coercive legal measures and a comparative consideration of utilitarian, economic, and libertarian approaches. Theory will be applied to social issues raised by modern technology, such as environmental protection, company liability for accidents, risks posed by energy and chemical industries, medical lifesaving and experimentation, weapons, privacy, effects of technological scale and complexity on quality of life. Goal is to enhance understanding of the logic of normative analysis and the capability for independent thought. Prerequisite: Economics 51, or equivalent.

3 units, Aut (Staff) TTh 1:45-3:05

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

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 research. Topics may include areas of theory as well as areas of applications. Topics will be announced on a quarterly basis. In 1979-80 the following 3-unit seminar was held: Seminar on Information Policy (Dunn). (DR:X)

1 or more units, Aut, Win, Spr (Staff) by arrangement
Emeritus: Eugene L. Grant, Robert V. Oakford
(Professors)
Chairman: Henry E. Riggs
Professors: James L. Adams, Warren H. Hausman, W. Grant Ireson, David A. Thompson
Associate Professors: Robert C. Carlson, James V. Jucker
Adjunct Professors: Robert McGinn, Henry E. Riggs
Assistant Professors: Kathleen M. Eisenhardt, James E. Hodder
Affiliated Faculty: Professors: Frederick S. Hillier, Charles A. Holloway, Douglass J. Wilde, Richard S. Shevell, Arthur F. Veinott, Steven C. Wheelwright
By Courtesy: Gayton E. Germane. Consulting: Stewart P. Blake
Lecturer: Charles F. Banfe

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 degree 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 institutions.

Engineering Management is concerned with the knowledge and processes required to manage technically based enterprises.

BACHELOR OF SCIENCE

The program leading to the degree of Bachelor of Science in Industrial Engineering is stated earlier under the School of Engineering. This curriculum is planned to serve those students whose long-run objective is the planning, designing, and implementing of complex economic and technological management systems where a scientific and engineering background is necessary or desirable. The fundamentals of engineering are stressed. The Industrial Engineering program is designed to introduce the student to measurement and control theory, organization theory and behavior, management, economic analysis and modeling, facilities planning and design, and utilization of computers and information systems. The objective is to provide the student with systems concepts, the role and function of management, methods of analysis, and the human and economic factors that bridge the gap between pure engineering design and pure management. To achieve the objective, the student will take several courses in which group projects comprise an important part of the course. In these projects, the student has the opportunity to formulate and solve problems and implement solutions for firms and organizations in the surrounding community.

Many students completing the bachelor's program will wish to pursue graduate study in Industrial Engineering, in other professional schools—law, medicine, or business—or in fields related to Industrial Engineering such as economics, statistics, or operations research.

ADVANCED DEGREES

The 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 and to the degree of Master of Science-Engineering: Engineering Management.

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 require a minimum of 45 units beyond the equivalent of a Bachelor of Science degree at Stanford. All programs represent substantial progress in the major field beyond the equivalent of a bachelor's degree.

Any student admitted to graduate standing on the basis of a bachelor's degree in a field other than engineering must complete 45 units of work as outlined above, but must also have successfully completed or must complete the equivalent of 45 units of mathematics, 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.

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 Master 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, 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.

ENGINEERING:

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 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 $10,000 per 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 Management—A survey of classical and modern organization theory; concepts and functions of management; and the behavior of the individual, the work group, and the organization. Enrollment limited with preference given to IE/EM
majors. Graduate students are encouraged to take IE 203 instead. (DR:X)
4 units, Win (Eisenhardt) TTh 10-11:50
Spr (Eisenhardt) TTh 10-11:50

104. Organizational Behavior 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, and emphasis will be put on synthesizing feasible solutions to real problems. Restricted to IE majors in their senior year. Not open to graduate students. Designed as a sequel to IE 100. (DR:X)
2 units, Win (Jucker, Eisenhardt) TTh 12

107. Work and Society—Perspectives on work, particularly as conditioned by technology and transformed by technological change. Topics: historical studies of work in the pre-industrial world, the impact of the industrial revolution on work and community, philosophies of work and work-society relations, literary and sociological portraits of work life, and contemporary issues in the theory and practice of work, e.g., self-management and job-enrichment experiments, "worker rights", professional (especially engineering) ethics, work and government regulatory agencies, the ethics of corporate conduct, trends in work management, and differing social and cultural attitudes and approaches to work in the U.S., West Germany, and Japan.
4 units, Aut (McGinn) given 1981-82

121. Statistics and Quality—Basic statistics, including point and interval estimation, tests of hypotheses, and analysis of variance and elementary experimental design. Concepts and statistical methods employed in the assurance of product conformance to specifications in the industrial environment. Emphasis is placed on setting quality standards and using statistical methods and technology in design, design review, acceptance sampling, and process control. Prerequisite: Statistics 116. (DR:T)
4 units, Win (Thompson) MWF 11

125. Work Design and Measurement—Concepts and techniques of designing, improving and measuring work performance and productivity of humans and of man-machine systems. Operations analysis, work design and human factors engineering, work and effort measurement and job evaluation. Small group project performed in local industry by all students. Prerequisite: IE 121. (DR:T)
4 units, Spr (Thompson) MWF 10

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 (Staff) MWF 11 and one hour by arrangement

134. Financial Analysis 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, and emphasis will be put on synthesizing feasible solutions to real problems. Restricted to IE majors in their senior year. Not open to graduate students. Designed as a sequel to IE 235. (DR:T)
2 units, Win (Hodder, Riggs) TTh 12

141. Utilization of Computers—Background necessary for effective use of computers in industrial engineering and management problems; machine characteristics; automatic languages. The basics of data processing and information systems are stressed. Prerequisites: Computer Science 103 and 106 or equivalents. (DR:T)
3 units, Win (Jucker) MWF 1:15

144. Simulation—The design, creation, and analysis of simulations. The use of simulation for estimation, comparison of policies, and optimization. Emphasis is primarily on applications in the areas of production and management. Prerequisites: I.E. 121, I.E. 141, and O.R. 153. (DR:T)
3 units, Spr (Jucker) MWF 9

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. Restricted to IE majors in their senior year. Not open to graduate students. This course is designed as a sequel to IE 260. Prerequisite: I.E. 260. (DR:T)
2 units, Win (Carlson, Hausman) TTh 12-1.
191. Directed Study—Directed study on subject of mutual interest to student and staff member. Student must find a sponsor and submit a one-page description of plan. (DR:X)
1 or more units, (Staff) by arrangement

COURSES PRIMARILY FOR GRADUATE STUDENTS

203. Organizational Behavior and Management—A study of organization theory; concepts and functions of management; behavior of the individual, the work group; and the organization. Substantial emphasis on case and related discussion. Enrollment limited and restricted to graduate students. (DR:X)
3 units, Aut (Jucker) TTh 11-12:50

208. Man-Machine Systems—Design and analysis of human and man-machine systems with emphasis on man-machine interface design. Physiological considerations such as size, effort and skill; informational considerations, such as vision, audition, and tactile sensing; and intellectual considerations, such as subjective decision making. Special topics include interactive information systems, keyboard design, public information display (for passengers, patients, etc.) and the man-robot interface. (DR:T)
3 units, Aut (Thompson) MWF 10

216. Airline Management—This course is designed to be an action-oriented curriculum concerned with functional airline management in five basic fields: Marketing, Finance, Administration, Operations, and Planning. Airline management problems and techniques will be studied both academically and on airline field trips. There will be extensive use of case studies and project studies with airline executives. (DR:T)
4 units, Spr (Banfe) MF 3:15-5:05

234. Research and Development Management—The function of research and development in the business enterprise. The practical problems of project selection, integration of R&D with marketing, production, and financial management; selection and retention of scientists and engineers; establishment of research priorities; financial controls of R&D operations; R&D evaluation. An examination of the current state of the art in technological forecasting. Prerequisite: graduate standing or consent of instructor. (DR:X)
3 units, Win (Blake) M 2:15-5:05

235. Introduction to Financial Decisions—(Same as Economics 112.) This course focuses on the models and techniques in financial decision-making under uncertainty. Topics covered include risk measurement, expected utility theory, decision trees, and portfolio and capital market theories. The effects of taxation and inflation are also discussed. Recommended prerequisites: IE 235 and Econ 165. Enrollment limited and at discretion of instructor (preference given to students with recommended prerequisites). (DR:T)
3 units, Aut (Hodder) MWF 11
Win (Hodder) MWF 9

237. The Firm in the International Economy—(Same as Economics 167.) The response of firms to international economic forces. Exposure to exchange rate movements, trade barriers, and international taxation. Implications for accounting, financial and production practices. Recommended prerequisites: I.E. 235 (or equivalent); I.E. 133, 160, and Economics 165. (DR:X)
3 units, Win (Hodder) MW 3:15-4:30

241. Evaluation of Industrial Projects—This course focuses on the evaluation of industrial investment projects under uncertainty. The effect of resource rationing is also considered. Available techniques for addressing these problems are examined with regard to both their theoretical properties and practical applicability. Although the course is applications oriented, it assumes a solid background in financial theory and quantitative methods. Prerequisites: IE 235 and IE 144 or equivalents. (DR:T)
3 units, Spr (Ireson) TTh 11-12:15

242. Financial & Organizational Control—A survey of design strategies for rewards, structures, and performance evaluation systems in organizations. Approaches from economics/accounting, and the behavioral sciences are used. Prerequisites: IE 100 or IE 203 and IE 133. (DR:T)
3 units, Spr (Eisenhardt) MF 1:15-2:30

260. 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, determination of production lot sizes, and optimal timing and sizing of production capacity expansion. Prerequisites: OR 152, Engr 161, Stat 116 (required), and IE 121 (recommended). (DR:T)
3 units, Aut (Hausman) TTh 9:30-10:45
Win (Carlson) TTh 9:30-10:45
requirements planning and integrated systems. Prerequisites: I.E. 260 and O.R. 153. (DR:T)
3 units, Win (Hausman) TTh 1:15-2:30
Spr (Hausman) TTh 1:15-2:30

262. Analysis of Production Systems III—Design and operation of production—inventory systems. Production scheduling, shop shop scheduling, capacity planning, plant location, sequencing, assembly line balancing, multigoal optimization. The reading material will be drawn primarily from journal articles. Pre-requireite: I.E. 260. (DR:T)
3 units, Spr (Carlson) TTh 9:30-10:45

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. Enrollment restricted to graduate students. (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 (Operations: Theory and Management) is recommended but not required. Enrollment limited and at discretion of instructor and restricted to graduate students. (DR:T)
4 units, Win (Riggs) MWF 8 plus one hour by arrangement

271. New Enterprise Management—(Same as Graduate School of Business 353.) 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, ac-
tion-oriented business plans to launch new enterprisess. 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. Pre-requireite: I.E. 270. Enrollment limited and at discretion of instructor. (DR:T)
4 units, Spr (Staff) TTh 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

330. Doctoral Research Seminar in Financial Economics and Control—Topics from current published literature and working papers. Content varies with faculty and student research interests. Open to doctoral students with research interest in the application of financial, accounting, and economic theory to industrial engineering problems.
3 units, Aut (Hodder) MW 3:15-4:30

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 (Carlson) MW 1:15-2:30

MATERIALS SCIENCE AND ENGINEERING

Emeritus: O. Cutler Shepard (Professor)
Chairman: Richard H. Bube (Professor)
Associate Chairman: William D. Nix (Professor)


Adjunct Professors: Robert S. Feigelson, Klaus Heinemann

Assistant Professors: Alan K. Miller, Robert Sinclair

Lecturers: Alan L. Fahrenbruch, Claus G. Goetzcl, Glen B. Haydon

Consulting Professors: Farid Abraham, Robert I. Jaffe, Helmut R. Poppa, John Stringer

OFFERINGS

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 the 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. Coterminal 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 department occupies an area of 30,000 square feet in the Thomas F. Peterson Engineering Laboratory building. The laboratory includes modern facilities for teaching and research in physical metallurgy and materials science. Heat-treating furnaces and furnaces for crystal growing are available. Mechanical testing equipment includes hardness measuring devices, variable strain rate machines for mechanical deformation studies, creep machines and equipment for dynamic elastic modulus and internal friction measurements.

For studying the structure of solids there are laboratories for optical and scanning transmission electron microscopy. Facilities for X-ray diffraction and fluorescence, nuclear magnetic resonance, and standard electrical, magnetic and optical measurements are also available.

The department, together with Chemical Engineering and Electrical Engineering, participates in an Institute for Surface and Microstructural Research, a collaborative research effort between Stanford University and the Materials and Physical Sciences Branch of the NASA Ames Research Center. The Institute is housed in the Peterson Laboratory and involves several Auger microprobes.

The department, together with other engineering departments and the Departments of Physics, Chemistry, and Applied Physics, participates in an interdisciplinary Center for Materials Research. The Center provides equipment, service facilities, and funds for faculty and student research. In addition the Center provides 35,000 square feet of space for materials research in the McCullough Building.

Opportunities are also available for research at the Stanford Synchrotron Radiation Project (SSRP). Located at the Stanford Linear Accelerator, SSRP utilizes the extremely intense x-ray and ultraviolet synchrotron radiation produced in the electron-positron storage ring for a large variety of studies of solids, liquids, and gases. For more information, see the section describing SSRP in this bulletin.

UNDERGRADUATE PROGRAM OF STUDY

BACHELOR OF SCIENCE

The undergraduate Materials Science and Engineering program provides training in solid state fundamentals and in physical metallurgy. Students desiring to specialize in this field during their undergraduate period may do so by following the curriculum outlined earlier under the School of Engineering. The University’s basic requirements for the bachelor’s degree are discussed in the “Degrees” section in this bulletin. Electives are available so that students with broad interests can combine Materials Science and Engineering with work in another science or engineering department.

GRADUATE PROGRAMS OF STUDY

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.

**MASTER OF SCIENCE**

The University's basic requirements for the Master of Science degree are discussed in the "Degrees" section 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 average of B for course work.

The department offers a variety of 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 (18 units) except for students who have had equivalent courses at other universities.
   b) A minimum of 12 units of advanced course work (beyond the 180 series) in the department (excluding the 202 laboratory series, attendance-only seminars and research and special problems).
   c) 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. (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 may be used to satisfy the requirements for the Master's degree).

2. **Materials Engineering**
   Additional programs may be designed for those students who wish to obtain a working knowledge of Materials Science and Engineering applied to materials technology. These programs are normally viewed as terminal M.S. programs although transfer into the Ph.D. program may be possible in some cases. Illustrative course sequences are listed below.

### MECHANICS OF MATERIALS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS&amp;E 205</td>
<td>Strength and Microstructure</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 185</td>
<td>Mechanical Behavior of Solids</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 238</td>
<td>Fracture of Solids</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 249</td>
<td>Time-dependent Plasticity</td>
<td>3</td>
</tr>
<tr>
<td>ME 238A.B</td>
<td>Theory of Elasticity</td>
<td>6</td>
</tr>
<tr>
<td>ME 200A.B</td>
<td>Math. Methods (or equivalent)</td>
<td>6</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>45</strong></td>
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</table>

### ELECTRICAL, OPTICAL, AND MAGNETIC PROPERTIES OF MATERIALS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS&amp;E 188</td>
<td>Electrical, Optical, and Magnetic Properties of Materials</td>
<td>4</td>
</tr>
<tr>
<td>MS&amp;E 210</td>
<td>Semiconductor Materials Processing</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 215</td>
<td>Photovoltaic Solar Energy Conversion</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 222</td>
<td>Statistical Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 322A.B</td>
<td>Quantum Mechanics</td>
<td>6</td>
</tr>
<tr>
<td>ME 233</td>
<td>Quantum Theory of Energy States in Solids</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 234</td>
<td>Electronic Transport in Solids</td>
<td>3</td>
</tr>
<tr>
<td>E.E. 332</td>
<td>Optical Properties of Solids</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

### MATERIALS PROCESSING—EXTRACTIVE METALLURGY

This program is designed for students who wish to obtain a basic knowledge of Materials Science and Applied Earth Sciences, with particular focus on the Materials Processing—Extractive Metallurgy industry. The program has a concise central core of required courses combined with a liberal number of electives, so that the student may choose any of a number of possible facets of this broad field including research units. Students may elect to obtain their degree in either the Department of Materials Science and Engineering or the Department of Applied Earth Sciences.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS&amp;E 181</td>
<td>Thermodynamics and Phase Equilibria</td>
<td>4</td>
</tr>
<tr>
<td>MS&amp;E 182</td>
<td>Rate Processes in Materials</td>
<td>3</td>
</tr>
<tr>
<td>MS&amp;E 185</td>
<td>Mechanical Behavior of Solids or MS&amp;E 205</td>
<td>3</td>
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<tr>
<td>MS&amp;E 105 (AES 105)</td>
<td>Extractive Process Metallurgy, or MS&amp;E 207 (AES 207)</td>
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<tr>
<td>MS&amp;E 150 (AES 150)</td>
<td>Introduction to Mineral Extraction Processes, or AES 225</td>
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<tr>
<td>MS&amp;E 228 (AES 228)</td>
<td>Extractive Metallurgy Seminar, or Ch.E. 120</td>
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<td>MS&amp;E 229 (AES 229)</td>
<td>Principles of Steelmaking, or Ch.E. 160</td>
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<td>MS&amp;E 150 (AES 150)</td>
<td>Chemical Engineering Plant Design</td>
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<tr>
<td>MS&amp;E 150 (AES 150)</td>
<td>Introduction to Mineral Extraction Processes, or AES 225</td>
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<tr>
<td>MS&amp;E 226</td>
<td>Electrochemistry and Corrosion</td>
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The University's basic requirements for the degree of Engineer are outlined in the "Degrees" section 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 "Degrees" section 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 one year after admission.
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) Completion of 6 units of Materials Science and Engineering 202A, B, and C (Materials Science Laboratory), except for students who have had equivalent experience.
   c) 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 average of B 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 except for individual work.

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. (DR:X) 1 to 3 units, any quarter (Staff), by arrangement
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 recrystallization and liquid-solid and solid-solid phase transformations, property control by microstructural control. Prerequisites: 180 and 181. 3 units, Spr (Tiller) 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 51.

3 units, Win (Barnett) MWF 9

188. Electrical, Optical and Magnetic Properties of Materials—An introduction to electronic properties. Includes properties of waves, free electron model, energy bands, optical refraction and absorption, electrical conductivity, scattering processes, Hall and thermoelectric effects, junctions, and magnetic materials. Prerequisite: Engineering 52. Physics 57 recommended.

4 units, Win (Bube) TTh 8:15-10

200. Graduate Special Problems. (DR:X)
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 (Tiller) TTh 11-12:15

202A,B,C. Experimental Methods in Materials Science—Laboratory course involving experimental techniques in different areas of materials science. Typical experiments are listed below: 202A: Experiments on the thermodynamics and kinetics of materials including phase diagram determination, diffusion, oxidation, phase transformations. 202B: Structural characterization by optical microscopy, scanning electron microscopy, x-ray diffraction and electron diffraction. 202C: Experiments on the mechanical, electrical, optical and magnetic properties of solids. Prerequisites: previous concurrent registration in the Materials Science and Engineering 180 series or their equivalent. (DR:X)

2 units, Aut (Shyne) T 3
Win (Sinclair) W 3
Spr (Nix, Bates)

204. Workshop in Energy Storage—Topic areas will include both economic and technological aspects of current and proposed energy storage methods; small devices, large scale stationary energy storage systems, vehicular applications; scientific barriers and fundamental limits. Workshop format emphasizing student participation; output in form of coordinated report. Open to either undergraduates or graduate students, preferably in science or engineering.

3 units Win (Huggins)
TTh 8:30-9:45

205. Strength and Microstructure—Mechanical properties of solids as viewed by the materials scientist or physical metallurgist. Basic aspects of dislocation theory and the role of dislocations and other defects on mechanical behavior of solids. The elastic, anelastic, and plastic properties of solids, stressing the relation between the internal structure of solids and the corresponding mechanical properties. Methods of hardening materials and mechanisms of hardening. Specific mechanical properties such as fracture, fatigue, and creep. Application of the concepts developed will be made to materials useful in technology. The course is directed primarily toward non-materials science majors. Prerequisite: upper division or graduate standing in Engineering or Science.

3 units, Aut (Sherby) TTh 8-9:15


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 involving heat conduction and diffusion. Solution methods will include the use of eigenfunction expansions, integral transforms, and Green's functions. Prerequisite: Mathematics 130.

3 units, Spr (Barnett)
given 1981-82

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 opera-
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, Win (Tiller) MWF 11

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, Sum (Goetzl) TTh 10:30-12:00


3 units, Aut (Shyne) given 1981-82

222. Statistical Thermodynamics—Systematic development of the methods of statistical mechanics with application to problems in Materials Science. Prerequisite: 181.

3 units, Aut (Bienenstock) TTh 1:15-2:30

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


3 units, Win (Stringer) given 1981-82

228. Extractive Metallurgy Seminar — (Enroll in Applied Earth Sciences 228.) (DR:X)


230. Materials Science Colloquium. (DR:X)

1 unit, Aut (Huggins) F 3:30

Win (Tiller) F 3:30

Spr (Barnett) F 3:30

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: 188 or Electrical Engineering 322A.

3 units, Spr (Bates) TTh 1:15-2:30

234. Electronic Transport in Solids—Time dependent wave mechanics and wave packets. Electrical conductivity, mobility and scattering processes. Interpretation of the Boltzmann 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—Selected topics in photoelectronic properties of solids, including photoconductivity, luminescence, photovoltaic effects, and methods of photoelectronic analysis of ordered and disordered materials. Prerequisite: 233 or Electrical Engineering 322B.

3 units, Spr (Bube) given 1981-82

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, Win (Sinclair) TTh 2:15-3:30

237. Mathematical Theory of Dislocations—Continuum elastic theory of dislocations including the interaction of dislocations with other

3 units, Aut (Barnett) MW 10

238. Fracture of Solids—The stress fields about elastic cracks developed from both a conventional elastic and a dislocational approach. Energy of deformation and the Griffith-Irwin brittle fracture criterion, and the extensions to incorporate small-scale plastic yielding. Fracture toughness testing. Microscopic mechanisms of crack nucleation and propagation; mechanisms of ductile fracture.

3 units, Win (Nix) MWF 10


3 units, Win (Nix) given 1981-82

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) given 1981-82

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, Spr (Shyne) TTh 9-10:15

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, Aut (Nix) dhr


3 units, Spr (Shyne) given 1981-82

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 (Nix, Miller) 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 10-11:15

253. Transmission Electron Microscopy Laboratory—Experimental application of electron microscopy to typical problems in materials science, including specimen preparation, microscope 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) given 1981-82

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.)

281. Solution Thermodynamics and Phase Equilibria—Principles of phase equilibria, with
application to binary and ternary systems. Relationships between phase diagrams, solution thermodynamics and thermochemistry. Practical applications of phase diagrams.

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

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) given 1981-82

297. Principles of Electron Microscopy—(Enroll in Pathology 207)

300. Research.

Any quarter (Staff) 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


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

MECHANICAL ENGINEERING

Emeriti: Wilhelm Flügge, Henry O. Fuchs, Boynton M. Green, Miklós Hetényi, A. Louis London (Professors)

Chairman: William C. Reynolds (Professor)

Associate Chairman: Thomas J. Connolly (Professor)

Division Chairmen: George Herrmann (Applied Mechanics), Robert J. Moffat (Thermosciences) (The Design Division operates without a chairman.)

Laboratory Directors: Daniel B. DeBra (Guidance and Control), Robert H. Eustis (High Temperature Gasdynamics), Robert J. Moffat (Thermosciences), Larry J. Leifer (Smart Product Design)


Associate Professors: C. Thomas Bowman, Thomas J. R. Hughes, Larry J. Leifer, Robert L. Piziali, J. David Powell

Adjunct Professors: Dean R. Chapman, Ronald K. Hanson, Sidney A. Self

Assistant Professors: Brian J. Cantwell, John K. Eaton, Drew V. Nelson

Affiliated Faculty: John V. Breakwell (Dynamics), Daniel Bershad (Acoustics), C. C. Chao (Elasticity), I. D. Chang (Fluid Mechanics), Gene F. Franklin (Controls), James M. Gere (Structures), Matthew S. Kahn (Art), Krishnamurty Karamcheti (Acoustics), Jan W. Molenkamp (Art), Oleg D. Sherby (Materials), Robert L. Street (Fluid Mechanics), Walter G. Vincenti (History of Technology)


Consulting Professors: Frank R. Arnold, Floyd L. Culler, Anthony Leonard, Chauncey Starr, Harry T. Whitehouse

Acting Assistant Professors: Alicia A. Herrmann, R. Kent James, J. John Kim, Parviz Moin

Teaching Specialist: David W. Beach

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 division 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.

Various research projects are 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 inelastic 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, 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 Product Design Laboratory supports microprocessor application 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 (HTCL) is engaged in a variety of research activities relating to the practical generation of electrical energy from flowing plasmas, electrostatic precipitators, combustion, chemistry of pollutant
formation, and the development of laser-based diagnostics for high temperature gases. Facilities in the HTGL include a large MHD power channel with normal superconducting magnets, a shock tube, a variety of diagnostic devices for combustion gases and plasmas, and laboratory combustors, including a coal combustion facility. In addition, the Thermosciences Division has a small Environmental Measurements Laboratory which includes a variety of 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 Technology's IBM 3033. Free computation is available on the PDP-20 LOTS system. A Sigma V hybrid computer is also available as well as 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 conducts research, in cooperation with the NASA-Ames Research Center, in computational fluid dynamics, with emphasis on turbulent flows. 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, fluid mechanics and heat transfer.

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.

The Thermosciences Division faculty is 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. The Institute's Energy Information Center, a special library, is located adjacent to the Thermosciences Laboratories.

**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 "Degrees" section of this bulletin.

A program for Product Design is offered by the Design Division and leads to the degree of Bachelor of Science in General Engineering. It is recommended, however, that this should not be considered a terminal degree and that all students who elect this program continue on through the master's degree in this field.

**COTERMINAL B.S./M.S. PROGRAM**

Stanford undergraduates who wish to continue their studies through the Master of Science degree under the coterminal program should petition the department for entrance to the program at least one year before the coterminal commencement. A minimum letter-grade equivalent 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 coterminal program in Mechanical Engineering. Alternatively, a Stanford undergraduate may qualify for the coterminal 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**

The master's program normally consists of three quarters of full-time course work; no thesis is required, although many students become involved in research projects during the master's year, particularly 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 "Degrees" section of 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. His or her 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. 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. No thesis is required. However, students who desire some research experience during the master's year may participate in research through Mechanical Engineering 290, 291, and 292.

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 letter grade equivalent 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 a letter grade equivalent 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.

**Computational Fluid Dynamics**—A graduate program in Computational Fluid Dynamics (CFD) is operated jointly by the departments of Aeronautics and Astronautics and Mechanical Engineering. At the master’s level this program is an option with the general structure of the master’s requirements of each department. At this level, a student interested in a still greater emphasis on CFD may register for the M.S. in Engineering or Engineering Science and design a program, in consultation with his or her advisor, with a stronger component of CFD. Students intending to seek a Ph.D. degree with an emphasis on CFD may register for the post-master’s series in CFD (Aeronautics and Astronautics 214A,B,C) by planning a M.S. program in mathematics and numerical analysis (Mechanical Engineering 200A, B, C or equivalents) and in advanced fluid mechanics (Mechanical Engineering 251A,B, 261, etc.). Choice of math courses, theoretical and experimental dynamics courses, and electives most suitable for the CFD program should be selected in consultation with the student’s advisor.

**Product Design**—A graduate program in the field of Product Design is intended primarily for those students who have completed the undergraduate program in this field, and who are admissible to the graduate school. Graduate program applicants should have at least one year of commercial design experience. 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.

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<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
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<tr>
<td>M.E. 211A,B,C</td>
<td>Product Design Master’s Project</td>
<td>12</td>
</tr>
<tr>
<td>M.E. 214</td>
<td>Philosophy of Design</td>
<td>3</td>
</tr>
<tr>
<td>*Art 360</td>
<td>Master’s Project</td>
<td>6</td>
</tr>
<tr>
<td>I.E. 208</td>
<td>Man-Machine Systems</td>
<td>3</td>
</tr>
<tr>
<td>**Approved Electives</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Free Electives</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

45

*Taken jointly each quarter.

**Approved electives must be graduate-level courses. Students are encouraged to follow one of the following graduate design options. These are recommended electives and may require enrollment approval by the instructor.

**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. 214. Philosophy of Design
M.E. 216. Design of Optimal Components
M.E. 223. Design and Analysis of Dynamic Systems

**Biomedical Design**
M.E. 290. 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. 280A, 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.

**MASTER OF SCIENCE IN ENGINEERING OR ENGINEERING SCIENCE**

As described in 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 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.

**POST-MASTER'S DEGREE PROGRAMS**

The department offers two post-master's degrees: the Degree of Engineer and the Doctor of Philosophy. These programs are described below. It is very strongly urged that students anticipating working for a post-master's degree arrange to do some research work under M.E. 291 or 292 prior to attempting to make a supervision arrangement. Faculty members supervising post-master's research will generally require some such evidence that a student has research potential before committing themselves to supervision and a research assistantship. It is most efficient to carry out this preliminary research effort during the M.S. degree year.

At their first post-master's registration, students seeking post-master's degrees must report their status of faculty supervision to the department. A student who has not arranged for faculty supervision must petition for registration after completing 45 units of graduate work at Stanford.

**ENGINEER**

The basic University requirements for the degree of Engineer are discussed in the "Degrees" section in this bulletin. This degree represents nominally an additional year of study beyond the Master of Science degree, and includes a research thesis. This program is designed for students who desire to do professional engineering work upon graduation, and who desire an opportunity to engage in more specialized study than is afforded by the master's degree alone.

The admission standards for this program are substantially the same as indicated under the master's degree. However, since thesis supervision is required, and the availability of thesis supervisors is strictly limited, the department cannot admit a student to candidacy until the student has personally arranged with some member of the faculty to supervise a research project. This will frequently involve a paid research assistantship, and research assistantships are awarded by individual faculty members (usually from the funds of sponsored research projects under the direction of individual faculty members) and not by the department, so again a personal arrangement is necessary. Students studying for their master's degree at Stanford and desiring to continue to the Engineer degree ordinarily make such arrangements during their M.S. degree year. Students holding master's degrees at other universities will be admitted and allowed to register if they are sufficiently well qualified. However, the department cannot guarantee thesis supervision or financial assistance, and the student must make such arrangements during his or her first quarter or two of residence.

The departmental requirements for the degree include an acceptable thesis; up to 15 units credit will be allowed for thesis work. In addition to the thesis, 30 units of approved advanced course work in mathematics, science, and engineering are expected beyond the requirements for the Master of Science degree; the choice of courses is subject to the approval of the 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 in the School of Engineering section of this bulletin (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 "Degrees" section of this bulletin. The Ph.D. degree is intended primarily for students who desire to pursue a career in research, advanced development, or teaching; for this type of work a broad background in mathematics and the engineering sciences, together with intensive study and research experience in a specialized area, are the necessary requisites.

The department will allow a minor field of study, but does not require one. However, if a minor is waived, the candidate must show breadth of training by taking a group of courses in one or more related fields or departments as noted below.

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.

Prior to being formally admitted to candidacy for the Ph.D. degree the student must demonstrate his or her 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 (sponsor) 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 letter grade equivalent of at least 3.25. Courses used in the letter grade equivalent evaluation will be the same as those that would be used to meet the M.S. grade average requirement. Students entering Stanford with an M.S. from another school must have a 3.25 grade point average in the M.S. program at the previous school to take the examination in their first quarter at Stanford.

All students interested in the Ph.D. degree should consult the "Outline of Requirements for the Ph.D. Degree" which contains the current
requirements and is available from the Department Office.

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 Department 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 degrees at Stanford. Research assistantships are awarded by the individual faculty research supervisors and not by the department as a whole. Applicants for all three forms of assistance may obtain the necessary application forms from the Graduate Admissions Office.

Research assistants can, and normally do, carry out their thesis research work and write their theses as an integral part of the commitments of their assistantships.

**FRESHMAN LEVEL COURSES**

The following courses offered by the faculty of the Department are suitable for Freshmen.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.E. 30</td>
<td>Social Aspects of Nuclear Power</td>
</tr>
<tr>
<td>M.E. 101</td>
<td>Visual Thinking</td>
</tr>
<tr>
<td>M.E. 103</td>
<td>Manufacturing Technology</td>
</tr>
</tbody>
</table>

**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

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 3 and 32. Concurrent Engineering 12 suggested, but not required.

4 units, Spr (Johnson) MWF 9, Lab MTWTh 1:15-3:05 or 3:15-5:05


3 units, Aut (McKim, Staff) lec. and lab.
Sec. 1 MW1:15-3:05
Sec. 2 MW 3:15-5:05

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, Aut (Wilde) 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. Enrollment limited to 70. (Enrollment quotas and priorities established. Information in Department Office.)

4 units, Aut, Win (Barkan, Beach) T 9, Th 9-11; lab. T, W, Th or F 1:15-4:05 for first four weeks of quarter; additional hours by arrangement during last six weeks

104. Dynamic Response—(Enroll in Engineering 104.)

105. Control System Analysis and Design—(Enroll in Engineering 105.)

111. Stress, Strain and Strength—Review of free body diagram analysis and basic, elastic stress analysis. Static failure theories. Buckling (column, plate, local). Fatigue failure criteria and life prediction methods. Introduction to fracture mechanics. Corrosion, stress corrosion, corrosion-fatigue. Contact stresses and surface failures (fretting, pitting, wear). Discussion of design margins (safety factors) and product liability. Homework assignments will emphasize applications to mechanical design. Prerequisites: Engineering 3 and 11, Mechanical Engineering 103.

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 equivalent and Mechanical Engineering 111.

3 units, Win (Staff) TTh 1:15-3:05

113. Engineering Design—The design process involves the application of information from various sources in the creation of tangible ob-
jects 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 (Staff) 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 (McKim) MW 1:15-4:05


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

116A. Advanced Product Design—Small-scale projects carried to a high degree of refinement. Emphasis upon craftsmanship and aesthetics. Prerequisite: 115B.

3 units, Aut (Moggridge) TTh 11:00-1:05

116B. Advanced Product Design—New product innovation via need-finding. Prerequisite: 116A.

3 units, Win (McKim) 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 (Leifer) 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 (Parikh) MWF 10 plus one lec. hour and lab. one afternoon by arrangement

131C. Thermosciences—Continuation of 131B.

4 units, Spr (Reynolds) 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 (Sher) MWF 11


3 units, Aut (Bershader, Salmon) TTh 1:15-2:30


3 units, Aut (Piziali) TTh 11-12:15

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, Mathematics 21, and junior standing or consent of instructor.

3 units, Aut (Connolly) MWF 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 staff member. Student must find faculty sponsor and have approval of his advisor. (DR:X)

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.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>M.E. 105</td>
<td>Control System Analysis and Design (Enroll in Engineering 105)</td>
</tr>
<tr>
<td>M.E. 113</td>
<td>Engineering Design</td>
</tr>
<tr>
<td>M.E. 137</td>
<td>Air Pollution</td>
</tr>
<tr>
<td>M.E. 138</td>
<td>Noise Pollution</td>
</tr>
<tr>
<td>M.E. 161</td>
<td>Engineering Vibration</td>
</tr>
<tr>
<td>M.E. 176</td>
<td>Nuclear Energy (Enroll in Engineering 176)</td>
</tr>
<tr>
<td>M.E. 180</td>
<td>Energy and Society</td>
</tr>
<tr>
<td>M.E. 218</td>
<td>Smart Product Design</td>
</tr>
<tr>
<td>M.E. 250</td>
<td>Introduction to Heat Transfer</td>
</tr>
<tr>
<td>M.E. 255</td>
<td>Gasdynamics</td>
</tr>
</tbody>
</table>

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, characteristics. Prerequisites: background in linear algebra, advanced calculus, and ordinary differentiation equations.

3 units, Win (Reynolds) MWF 9


3 units, Spr (Ferziger) 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


3 units, Aut (Keller) TTh 9:35-10:50

205B. Methods of Mathematical Physics—(Enroll in Mathematics 220B.) Continuation of 205A.

3 units, Win (Keller) TTh 9:35-10:50

205C. Methods of Mathematical Physics—(Enroll in Mathematics 220C.) Continuation of 205B.

3 units, Spr (Keller) TTh 9:35-10:50

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;
provement of series. Prerequisites: Mathematics 106 or Mechanical Engineering 201 and Mathematics 131 or Mechanical Engineering 200B, 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.

210A. 4 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 (Leifer, McKim) dhr, given 1980–81

211B. 4 units, Win (Leifer, McKim) dhr, given 1980–81

211C. 4 units, Spr (Leifer, McKim) dhr, given 1980–81

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) 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 to 4 units, Spr (Wilde) MWF 10
218. Smart Product Design—Deals with the application of microcomputer technology to the design of "Smart" consumer products and industrial instrumentation. Computer hardware is dealt with at the functional unit level (I/O board, CPU board, keyboards, etc.), and at the discrete component level. Students are expected to write user programs in both high level and assembly languages. There will be an emphasis upon human factors and computer input/output. The first five weeks are devoted to developing individual product proposals and learning about smart product development. The second five weeks are spent on case studies and development of a function product emulation. Prerequisites: Electrical Engineering 181 or consent of instructor; Engineering 44 recommended. Registration is absolutely limited to 20.

3 units, Win (Leifer) T 1:15-3:05, Th 1:15-2:05
Spr (Leifer) T 1:15-2:05, Th 1:15-3:05

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. Prerequisites: Electrical Engineering 181 or consent of instructor; Engineering 44 recommended. Registration is absolutely limited to 20.

3 units, Spr (Leifer) MWF 12

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 (Roth) MWF 9, alternate years, given 1980-81

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 1980-81

MECHANICAL ENGINEERING 181

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 1980-81

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-quaternions methods to kinematic analysis and synthesis. A survey of current research and unsolved problems in kinematics.

3 units, Win (Roth) by arrangement


3 units, Aut (Kane) TTh 9:30-10:45


3 units, Win (Kane) TTh 9:30-10:45


3 units, Spr (Staff) TTh 9:30-10:45


3 units, Win (Kane) TTh 2:45-4:00, alternate years, given 1980-81

233. Nonlinear Oscillations—Derivation and classification of nonlinear differential equations governing various phenomena of mechanics. Phase plane trajectories and integrals of the equations of motion of autonomous systems. Response curves and stability criteria for forced oscillations of systems with nonlinear charac-
teristics. Systems with several degrees of freedom.

3 units, Spr (Breakwell) W 2:15-4:05 plus one hour by arrangement, alternate years, given 1980-81


3 units, Spr (Kane) TTh 2:45-4:00, alternate years, given 1981-82

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, Win (Staff) TTh 11-12:15

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, Spr (Staff) TTh 11-12:15


3 units, Aut (Herrmann) TTh 2:15-3:30, alternate years, given 1981-82

236B. Waves and Vibrations—Continuation of 236A. Stress-strain relations for materials loaded beyond the elastic range, including combined stresses. Perfect plasticity and work hardening. Stress analyses of simple structures including bending of beams, torsion. Limit analysis bound theorems. Shake-down. Simple stress distributions in two dimensions. Prerequisite: Civil Engineering 114 or equivalent.

3 units, Win (Lee) MWF 11, alternate years, given 1981-82

237. Free and Forced Motion of Structures—(Enroll in Aeronautics and Astronautics 244A.)
241A. Theory of Plates—Analysis of stress, deformation in plates bent by transverse loads. Applications to circular, rectangular, other shapes. Vibrations, buckling. Prerequisite: 111 or Civil Engineering 114.
3 units, Aut (Steele) MWF 1:15

241B. Theory of Shells—Axisymmetric deformation of shells of revolution. Asymptotic expansions; direct and bending stresses. Application to design of domes, pressure vessels, expansion joints and pressure sensing devices. Membrane theory for general surfaces; hyperbolic paraboloids. Prerequisite: 111 or Civil Engineering 114. 241A recommended.
3 units, Win (Steele) MWF 1:15

3 units, Spr (Stein) TTh 1:15-2:30

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 1981-82

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 (A. Herrmann) MWF 10, alternate years, given 1980-81

3 units, Spr (Chao) TTh 2:45-4

244. Instabilities of Deformable Solids—Concepts of stability and instability of deformable solids and structural elements. Criteria of stability and methods of analysis. Types of elastic static and dynamic instabilities. Gyroscopic and circulatory (nonconservative) systems. Instabilities of rotating systems. Effects of dissipation and time lag. Interaction with fluids, e.g. flow through pipes and impinging jets, as well as other bodies.
3 units, Spr (Piziali) M 3:15-5:05, alternate years, given 1981-82

245. Structural Fatigue—The mechanism of fatigue and occurrences of fatigue in service. Methods for predicting fatigue life and for protecting against premature fatigue failure. Use of elastic stress and inelastic strain analyses to predict crack initiation life. Use of linear elastic fracture mechanics to predict crack propagation life. Effects of notches, manufacturing processes, load sequence, irregular loading, multi-axial loading, and environment (temperature and corrosion) on fatigue behavior. The subject will be treated from the viewpoints of the designer seeking up-to-date methods of life prediction and the researcher interested in improving the understanding of fatigue behavior. Prerequisites: Undergraduate stress analysis and mechanical behavior of materials.
3 units, Spr (Nelson) MWF 2:15

247A. Strength and Microstructure—(Enroll in Materials Science 205.)

247B. Fracture of Solids—(Enroll in Materials Science 238.)

248A. Introduction to Experimental Mechanics—Theory and applications of photoelasticity and strain gages. Mechanical testing using modern closed-loop, electro-hydraulic equipment. Comparison of test results with theoretical predictions of stress and strain distributions, buckling loads, limit loads, thermal stresses, etc. Experimental uncertainty analysis and statistical evaluation of data. Discussion of other methods of stress and strain determination (e.g., acoustoelasticity, brittle coatings, holographic interferometry, etc.). Students will also do a special project on use of strain gages “in the field.” Prerequisite: Strength of materials.
3 units, Win (Nelson) W 2:15-5:05 plus lab. by arrangement

248B. Experimental Mechanics—An exposure to advanced techniques with emphasis on dynamic test methods. Students will use a computer controlled servo-hydraulic actuator and a modern spectrum/model analysis unit. Emphasis will be on both transducers and data analysis. Prerequisites: 245A and 161 or equivalent, or consent of instructor. Limited enrollment.
3 units, Spr (Piziali) M 3:15-5:05 plus lab. by arrangement
HEAT TRANSFER, FLUID MECHANICS, AND TRANSPORT PROCESSES

250. Introduction to Heat Transfer—This is a course designed for graduate students who seek a one-quarter introduction to heat transfer. The course covers the fundamentals of conduction, convection, and radiative heat transfer, with applications in engineering analysis. Students who have had an adequate undergraduate preparation in heat transfer, should take Mechanical Engineering 253 and 252A,B instead. Prerequisites: Graduate standing. Some computer skills are desirable.

4 units, Win (Ferziger) MWF 10

251A. Advanced Fluids Engineering—Exact and approximate analysis of inviscid and viscous (laminar and turbulent) flows with applications in internal flow situations (duct, diffusers, turbomachines, etc.). Coverage includes fluid kinematics, global equations of mass conservation and momentum, forces in fluids, equations of inviscid flow (Euler’s and Bernoulli’s), methods for potential (irrotational) flow, lift and circulation.

4 units, Aut (Johnston) MWF 8

251B. Advanced Fluids Engineering—Continuation of 251A with emphasis on thin shear (boundary) layers. Theory of viscous flow, Navier-Stokes Equations, the boundary layer approximation, stability and transition to turbulence, thin shear layers in turbulent flow, turbulent and laminar detachment (separation). Viscous-inviscid interactions. Application to diffusers and other duct flows. Prerequisite: 251A.

3 units, Win (Johnston) MWF 11

252A. Convective Heat and Mass Transfer—Prediction of heat, mass, and momentum transfer in channel flows and boundary layers. Differential equation methods for fully developed and entry length laminar tube flows. Similarity solutions for laminar heat transfer with blowing and suction. Superposition methods for non-uniform boundary conditions. Development of the integral equations of the boundary layer; approximate and semi-empirical methods of solution. Introduction to mass transfer. Prerequisite: at least one survey course in heat transfer and one in fluid mechanics, i.e. 253 and 251A or equivalent.

3 units, Win (Moffat) MWF 10

252B. Convective Heat and Mass Transfer—Heat exchanger analysis and design. Theory of compact heat exchangers. Turbulent heat transfer in internal flows and boundary layers. Prerequisite: 252A.

4 units, Spr (Kays) MWF 8

253. Radiative Heat Transfer—Fundamentals of radiation heat transfer; analysis of gray-body and wavelength dependent systems; radiation from gases at high temperature, and particulate-laden gases; combined radiation and conduction. This is an advanced course intended for students with strong interests in heat transfer, particularly as applied in high-temperature energy conversion systems. Such students should also take Mechanical Engineering 252A,B to obtain depth in convective heat and mass transfer. Prerequisites: Graduate standing; an undergraduate course in heat transfer; some computer skills are desirable.

3 units, Aut (Eustis) MWF 9

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 (Staff) 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 1981-82

257. Fundamentals of Aerosols and Particulate Flows—Weekly two-hour seminars covering material to be selected from the following topics: aerosol characterization, transport properties—settling, diffusion, mobility, mechanics of two-phase flows, deposition by convective diffusion and impaction, coagulation, acoustics of aerosols, light scattering and experimental methods, fundamentals of particulate control devices—filters, cyclones, scrubbers, precipitators. Prerequisites: 251A or equivalent fluid mechanics.

2 units, Win (Mitchner, Self) by arrangement, alternate years, given 1981-82

3 units, Aut (Spreiter) TTh 2:45-4:00 given 1981-82

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, Win (Spreiter) TTh 2:45-4:00 given 1981-82

259A. Numerical Methods in Fluid Mechanics—(Enroll in Aeronautics and Astronautics 214A.)

259B. Numerical Computation of Transonic Flow—(Enroll in Aeronautics and Astronautics 214B.)

259C. Numerical Computation of Euler and Navier-Stokes Equations—(Enroll in Aeronautics and Astronautics 214C.)

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: 258B

3 units, Spr (Spreiter) TTh 2:45-4:00, alternate years, given 1980-81

261. Turbulence—Introduction to the basic concepts of turbulence structure, kinematics, dynamics, with emphasis on shear flows and mixing processes. Prerequisite: any graduate level series in fluid mechanics (251A, B or Aeronautics and Astronautics 210A, B, or equivalent).

3 units, Spr (Reynolds) MWF 9

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 (Mitchner) 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. Prerequisite: 262A or consent of instructor.

3 units, Win (Mitchner) MWF 3:15

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, Schrodinger's equation and its solutions. Prerequisite: familiarity with partial differential equations.

3 units, Spr (Mitchner) MWF 3:15 alternate years, given 1980-81

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 1980-81

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 (Hanson, Kruger, 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. Prerequisite: 263 or consent of instructor.

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 boundary layers. Advanced laboratory problems in heat transfer and fluid dynamics. Prerequisite: at least one graduate course each in heat transfer and fluid mechanics, 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 1980-81


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

271. Combustion and Pollution—Heat of reaction, adiabatic flame temperature, and chemical composition of products of combustion; production of pollutants in combustion systems; kinetics of reactions; emissions of oxides of nitrogen and carbon monoxide, explosions, fuel oxidation; propagation and structure of laminar premixed flames; detonations; reduction of pollutant emissions by modification of combustion parameters. Prerequisite: 262A or 270 or consent of instructor.

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 droplets and sprays; combustion of coal. Prerequisite: 271 or consent of instructor.

3 units, Spr (Bowman) MWF 2:15

273. Thermodynamics of Propulsion Systems—Analysis of the performance of propulsion systems from thermodynamic and dynamic points of view including rocket, ramjet, turbojet, and turbofan systems as well as piston, gas turbine and compound piston-turbine type engines. Prerequisite: 270 or consent of instructor.

4 units, Win (Bowman) MWF 1:15 plus one hour by arrangement

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 (Staff) 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, Spr (Connolly) MWF 1:15


3 units, Aut (Sher) MWF 10


3 units, Win (Sher) 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 (Sher) by arrangement

BIOMECHANICS

280. Biomechanics Seminar—Weekly seminar presentations by faculty and professionals who are actively involved in biomechanics and 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. (DR:X)

1 unit, Aut (Leifer) T 4:15-5:05

281. Orthopaedic Biomechanics—Engineering mechanics applied to the human musculo-skeletal 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, Spr (Piziali) WF 3:15-4:30, alternate years, given 1980-81

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, Win (Leifer) T 2:15-5:05, alternate years, given 1980-81

284. Dynamics of Viscous Fluids and Suspensions—(Enroll in Aeronautics and Astronautics 209.)

285. Biomedical Fluid Mechanics—(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.)

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, Peopledynamics Lab.)
1 unit, 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 (Roth) 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 (Steele) Th 4:15-5:30

297. Energy Policy Seminar—Weekly presentations and discussions on energy policy with emphasis on technological aspects. The status of various national programs for the advancement of energy technology will be reviewed. Views on the political, social and economic aspects of projects to which engineers devote their efforts will be presented. Prerequisite: graduate standing in engineering.
1 unit, Aut, Win, Spr (Connolly) by arrangement

298. Seminar in Fluid Mechanics—(Enroll in Engineering 298.)

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

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

OPERATIONS RESEARCH

Chairman: Arthur F. Veinott, Jr.
Associate Chairman: Frederick S. Hillier

Adjunct Professor: Walter Murray
Assistant Professor: Michael I. Taksar


Affiliated Associate Professor: Charles P. Bonini
Senior Research Associates: Zachary F. Landsdowne, Michael A. Saunders
Research Associates: Philip E. Gill, Dorothy B. Sheffield, John P. Weyant, Margaret H. Wright, Wesley D. Winkler

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 economic modeling.

The department's Systems Optimization Laboratory provides students with the opportunity to gain firsthand experience with computational methods, to participate in 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 50 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 socio-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>
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</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 degree 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 research, 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 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 desired, 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 a 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

All courses (DR:T) if taken for 3 or more units unless noted otherwise.

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. (DR:C)

3 units, Win (Manne) MWF 10
Spr (Hillier) MWF 10

150. Models and Applications of Operations Research in Society—Lectures same as 50, but a term paper is required. (DR:C)

3 units, Win (Manne) MWF 10
Spr (Hillier) 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, taxation, 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 (Cottle) MW 3:15-4:30

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.

3 units, Aut (Cottle) TTh 4:15-5:30

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.

4 units, Aut (Cottle) TTh 4:15-5:30

COURSES PRIMARILY FOR MASTER’S CANDIDATES

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 (Cottle) TTh 4:15-5:30

241. Numerical Methods of Optimization—(Enroll in Computer Science 234.) 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 and pricing techniques in linear programming, combinatorial search procedures, shortest path, other graph and polynomial algorithms, dynamic programming from the software point of view, trade-offs between solution time and storage needs. Students are expected to program algorithms dis-
cussed in class. This course is recommended as a complement to courses like Operations Research 340A. Prerequisites: Math 113; and some experience with computer programming and data structures (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 9:30-10:45

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 (Staff) TTh 9:30-10:45

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 queuing theory, inventory theory, Markov decision processes, dynamic programming, and reliability theory. Prerequisite: Statistics 217.

3 units, Spr (Iglehart) TTh 11:15-12:15

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 (Cottle) TTh 11:15-12:15


3 units, Spr (Iglehart) TTh 11:15-12:15


3 units, Spr (Eaves) MW 9:30-10:45

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, Spr (Iglehart) TTh 9:30-10:45

340B. Mathematical Programming—Introduction to nonlinear programming, large-scale linear programming, integer programming, and stochastic programming. Kuhn-Tucker theory, convex functions. Unified treatment of linear programming, quadratic programming, matrix and bimatrix games via linear complementarity theory and its pivotal methods. The decomposi-
and an introduction to algorithms therefor. Convex sets and functions. Theory of constrained optimization, optimality criteria, constraint qualifications, stability, Lagrangians, conjugate functions, duality. General algorithmic convergence theorems. Prerequisites: 340B and Mathematics 116 or consent of instructor.

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, Win (Dantzig) by arrangement

344. Methods of 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, Spr (Murray) by arrangement

345. Network Optimization—Same as 245.

3 units, Win (Staff) TTh 9:30-10:45

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


4 units, Win (Harrison) by arrangement


3 units, Aut (Taksar) TTh 9:00-10:15

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.

3 units, Aut (Veinott) TTh 10:30-11:45

357. Simulation—Same as 257.

3 units, Spr (Iglehart) TTh 2:45-4

Sum (Staff) MW 3:15-5
358. Queuing Theory—(Same as 258.) 3 units, Spr (Iglehart) TTh 11:00-12:15

3 units, Spr (Taksar) TTh 8-9:15

363. Theory of Information and Organization—(Same as Economics 282.) 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 (Arrow) MW 9-11

364. Game Theory and Economic Applications—(Same as Economics 283.) A systematic treatment of game theory and some of its applications in economic analysis. Non-cooperative games and cooperative games (including both market games and voting games). Alternative solution concepts. Prerequisite: Mathematics 115 and basic probability concepts.
5 units, Win (Staff)

365. Advanced Game Theory—(Same as Economics 289.) 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. Prerequisite: consent of instructor.
5 units, Win (Staff)

366A,B,C. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 386A,B,C, Psychology 283A,B,C, Business 494A,B,C.) This seminar aims to study a normative and descriptive decision making, particularly in the face of uncertainty. It will examine general studies on the way decisions are made and the problems arising in making decision analyses in applied policy contexts. The seminar will meet once every two or three weeks throughout the academic year.
A. 1-2 units, Aut (Arrow, March, Tversky, Wilson) by arrangement
B. 1-2 units, Win (Arrow, March, Tversky, Wilson) by arrangement
C. 1-2 units, Spr (Arrow, March, Tversky, Wilson) by arrangement

367. Single-Person Decision Theory—(Enroll in Business 467.) Axiomatic study of "rational" individual choice, with emphasis on choices made under uncertainty. Topics include: measurement theory, von Neumann-Morgenstern utility, Savage's axioms for utility and subjective probability, dynamic choice theory, conditional expected utility, Bayesian inference, and independence, exchangeability, and de Finetti's theorem. Time permitting, applications to decision analysis will be discussed. Prerequisite: Consent of instructor.
4 units, Win (Kreps) 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, Spr (Wilson) by arrangement

374. Polyhedral Combinatorics—An advanced course illustrating the use of the theory of linear inequalities to solve combinatorial problems. Topics include cut set polyhedra, lattice polyhedra, and Dilworth-Green-Kleitman theory on decomposition of partially ordered sets.
3 units, Win (Staff)

376A,B. 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.
A. 3 units, Aut (Eaves) by arrangement
B. 3 units, Win (Eaves) by arrangement

385. Simulation Methodology—An advanced seminar course covering recent literature in simulation methodology. Special emphasis will be given to problems arising in networks of queues.
3 units, Win (Iglehart) by arrangement

388. Optimization of Queuing Systems—This seminar will examine critically a number of recent studies concerned with the optimal design and control of broad classes of queuing systems. Emphasis will be placed on understanding the implications of the models; the extreme diversity and importance of their potential applications; the basic techniques used; difficulties inhibiting the generalization of extension of the models; and promising new areas for future research. Corequisite: OR 351 or consent of instructor. Note: OR 358 is not needed.
3 units, Spr (Hillier) by arrangement

390A,B. Advanced Topics in Operations Research—Two seminars will be offered, topics to be announced. Prerequisite: consent of instructor.
A. 3 units, Sum (Staff) by arrangement
B. 3 units, Sum (Staff) by arrangement

Any quarter (Staff) by arrangement
Dean: Halsey Royden
Associate Deans: J. Martin Evans, James N. Rosse, Arnice Streit, Norman K. Wessells
Assistant Deans: Sydney G. Burkhart, Janet C. Crews


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, Human Biology, 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 PROGRAMS

A student wishing to take a departmental major leading to the degree of Bachelor of Arts or Bachelor of Science should consult appropriate sections of the announcements given on the following pages. Further information concerning requirements may be obtained from the department concerned.

A student desiring to fulfill the requirements for the degree of Bachelor of Arts or Bachelor of Science in one of the special interdepartmental programs (see Humanities Special Programs and the Program for Individually Designed Majors in the following sections of this bulletin) should consult the Chairman of the Humanities Special Programs, the Dean of Undergraduate Studies (through the Academic Information Center), or the Chairman of the Dean of Undergraduate Studies’ Advisory Committee on Individually Designed Majors. For general statements of the requirements for the degree of Bachelor of Arts or Bachelor of Science in these programs, students should see the appropriate sections of the announcements following.

GRADUATE PROGRAMS

Candidates for the degree of Master of Arts, Master of Science, or Doctor of Philosophy should consult appropriate sections of the announcements following and should also consult the department in which they intend to specialize.

For regional, area studies, or other special graduate programs leading to the degree of Doctor of Philosophy, see listing under Graduate Division Special Programs.

UNDERGRADUATE PROGRAM IN AFRICAN AND AFRO-AMERICAN STUDIES

Emeritus: St. Clair Drake (Anthropology)
Chairman: Sylvia Wynter (Spanish and Portuguese, on leave 1980-81)
Committee-In-Charge: David Abernethy (Political Science), James Gibbs (Anthropology), Ewart Thomas (Psychology), Arthur B. C. Walker, Jr. (Applied Physics)
Participating Faculty: Frederick Bowser (History), Irvin Brown (Psychology), Clayborne Carson (History), Gregson Davis (Classics), Sandra Drake (English), Kennell Jackson, Jr. (History), Arnold Rampersad (English); Sandra Richards (Drama)

African and Afro-American Studies at Stanford is the systematic investigation of the history, culture and circumstances of peoples of African descent. This investigation examines the interrelationships, the parallelisms and divergencies between the black experience in the New World Diaspora - U.S.A., Latin-America, the Caribbean—as well as the linkages between the New World experiences and that of the place of origin, Africa. At the same time however, the investigation places a central focus on the United States Afro-American experience in its complex and contradictory relation to the mainstream American (United States) experience. The scholarly investigation therefore en-
which the Black experience has been rep-
analysis of the frames of reference through
inter-disciplinary perspective
focus from an
which have often been neglected by Western
teaching and research in these content areas,

ciplines intersect with the experiences, aspira-
scent. It recognizes the need for continued

tent with this perspective, this program of study

is an eclectic concentration in which major dis-

race-conscious environment.

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 science, it is the study

of African & Afro-American liberation move-

ments, African political systems and develop-

ment, and leaders such as Frederick Douglass,

Martin Luther King, Jr., Malcolm X, and Amil-
car 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 func-
tion of several factors, such as time and geog-

raphy, or status and position in society. Consis-
tent with this perspective, this program of study

is an eclectic concentration in which major dis-
ciplines intersect with the experiences, aspira-
tions and world views of people of African de-
scent. It recognizes the need for continued

teaching and research in these content areas,

which have often been neglected by Western

education.

Because of this, scholarly investigation will

focus from an inter-disciplinary perspective on

an analysis of the frames of reference through

which the Black experience has been rep-

resented and explored in mainstream scholar-

ship. The duality of the Black experience—
black and American—affords new insights into

the ongoing definitions of a universally applic-
able sociology of knowledge. The original

scholarship in the Black experience has much to

gain from interdisciplinary approaches. The

Program hopes to develop this kind of approach

concomitant with the theoretical development

of its offerings.

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 fo-
cuses 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

doing 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 re-

search 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 stu-

dent’s particular discipline. Pre-med majors, for

example, are offered a special course designed
to present information concerning particular

medical problems peculiar to Black people.

Opportunities for training and education be-
yond the A. B. parallel those open to any stu-
dent majoring in most Humanities or Social Sci-
ences disciplines. Majors typically pursue

graduate degrees in Humanities and Social Sci-
ence 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. Thirty units must come from

“Core” courses (listed below). Of those 30,

majors are required to take one Core Seminar

and two History courses (one African and one

Afro-American). An additional 20 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 to combine the A. B. or B. S. degree in a traditional discipline with the African and Afro-American major as a special interest. Students who complete the two majors with no overlapping courses will qualify to have both listed on their transcripts and diplomas as multiple majors. Students who complete the two majors with overlapping courses will have noted on their transcripts: "also completed the course requirements for African & Afro-American Studies."

**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 Communication), 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 program are offered under the program title. These courses are commonly offered only once a year. The Core Seminar, offered annually, is central to the Program. Its approach is interdisciplinary and it deals among other things with the problematic of the representation of the Black experience in mainstream scholarship. Its main concern is with the development of alternative theoretical paradigms that can more adequately account for the multiple variables of the Black experience and of the network of relationships by which it is constituted.

While these seminars are normally given by Chairperson Sylvia Wynter, other faculty, visiting scholars and graduate students will alternate bringing new visions and differing perspectives. The three basic Core Seminars will be offered in successive years (descriptions below).

The *Introduction to Afro-American Studies* (105) is an interdisciplinary course designed to provide a broad survey of the Afro-American experience. Although one professor assumes primary responsibility for the course, students will be exposed to the entire faculty of the Afro-American Studies Program and to their respective areas of interest. As an introductory course, 105 will introduce some of the themes that will be treated more in-depth in the Core Seminar. Interaction with professors will also help students to decide as to their future course of studies.

Courses will be offered in Black Performing Arts—Drama, Dance and Music. Emily De Pradines Morse and Les Williams will offer courses in Afro-Caribbean and Black American Dance, respectively. Several courses are offered annually in conjunction with the Black pre-professional organizations, such as "Black Perspectives in Law" (Spring) and "Black Perspectives in Medicine" (Winter). 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 course descriptions and (DR) information.

**AFRICAN AND AFRO-AMERICAN STUDIES**

101. Core Seminar: The Black/White Experience in Fact & Fiction—An exploration from interdisciplinary perspectives of the network of "imaginary social significations" through which every society organizes the self-perceptions of its different groups and individuals, on the basis of which we interact amongst each other and against the world. Fiction takes as its "raw material" the social reality we inhabit, a reality fashioned on the basis of these "imaginary social significations". The novel—from Cervantes' *Don Quixote* to Ralph Ellison's *Invisible Man*, by transforming this fashioned "reality" into fictional form displaces this "reality" making it "visible", thereby providing us with "knowledge" of these "imaginary social significations" which "think us", "invent" our self-perception, help to determine our action. (DR:A)

5 units (Wynter) given 1981-82
102. Core Seminar: The Sociology of Knowledge and the Black Experience—Using Carter G. Woodson’s *Miseducation of the Negro* and Fanon’s works as basic texts, this course will examine mainstream scholarship about the Black experience from the perspective of the sociology of knowledge with special emphasis on Karl Mannheim’s “situation” based concept of knowledge and on Michel Foucault’s definition of all knowledge as “a strategy of power”. (DR:A)
5 units (Wynter) given 1981-82

103. Core Seminar: Western Culture and the Black Diaspora—The Semiotics of Self and Other—This seminar will use narrative analyses of selected texts in order to examine the significations accorded Africa, the “negro” and the Black Diaspora in the signification system of Western culture. It will analyze the deconstruction of these significations both by some schools of modern Western scholarship and by counter-discourse of emancipatory movements in the Diaspora itself. (DR:A)
5 units, (Wynter) given 1981-82

104. Core Seminar: African & Afro-American Studies
5 units, Spr (Staff)

105. Introduction to Afro-American Studies—An interdisciplinary overview of the Afro-American experience, in a format combining weekly guest speakers, readings and in-class discussion. (DR:A)
3-5 units, Win (Staff)

165. Literature and Society in the Black Americas (North/South/Caribbean)—The analyses of literary and non-literary texts from the Black experience in different areas of the Black Americas will attempt to explore parallelisms and divergencies in their area treatment as well as the inter-relationships between the social and fictional realities. (DR:H)
5 units, (Wynter) given 1981-82

5 units, (Wynter) given 1981-82

165A, B, C. Independent Study
3-5 units, Aut, Win, Spr (Staff)

199A, B, C. Honors Project
3-5 units, Aut, Win, Spr (Staff)

205. Graduate Seminar: Conceptual Issues in Black Studies—A seminar to introduce students to the variety of conceptual, theoretical, and methodological problems that fall within the broadly-defined spectrum of investigations known as Black Studies. Presentations will be made by Stanford faculty and graduate students on their research interests.
3-5 units, Win (Staff)

ANTHROPOLOGY

06. Problems in Anthropology.
3-5 units, Spr (Gibbs, Yana, Gisoka)

90. Theory in Social Anthropology.
5 units, Spr (Donham)

5 units, Win (Donham, Gibbs)

157. Law in Radically Different Cultures.
3 units, Spr (Barton, Gibbs, Li)

COMMUNICATIONS

144/244. Broadcasting in Third World Countries.
3-5 units, Spr (Mody)

153/253. Underdevelopment, Media and Culture.
3-5 units, Spr (Mody)

251. Communications and Development.
3-5 units, Win (Rogers)

3-5 units, Aut (Mody)

ENGLISH

161A. The Afro-American Novel.
5 units, Aut (Drake)

5 units, Win (Rampersad)

161E. Recent Writing by Afro-American Women.
5 units, Spr (Drake)

165A. Interpretations of the Modern Experience.
5 units, Aut (Drake)

165B. Colloquium on National and International Identity.
5 units, Spr (Halliburton)

166. Modern Literature from Africa.
5 units, Spr (Drake)

169A. The Existential Hero in Modern Literature.
5 units, Win (Ruotolo)

HISTORY

146A. The United States and Africa.
5 units, Spr (Jackson)

147B. Women in African History.
5 units, Win (Jackson)
157. Introduction to Afro-American History.
5 units, Aut (Carson)

160. The American South, 1815-1900.
5 units, Aut (Degler)

5 units, Aut (Jackson)

257A. Undergraduate Colloquium: Black Politics and Social Movements in 1960s and 1970s.
5 units, Spr (Carson)

262A. Undergraduate Colloquium: American Workers in the Industrial Age.
5 units, Win (Carson)

347. Graduate Colloquium: Social History in Africa.
5 units, Aut (Jackson)

5 units, Spr (Jackson)

10 units, Aut, Win (Carson)

LATIN AMERICAN STUDIES
80. Culture and Society in Latin America.
5 units, Spr (Durham, Writh)

LINGUISTICS
05. Language in the U.S.A.
4 units, Win (Ferguson)

155. Introduction to Sociolinguistics.
5 units, Spr (Rickford)

162. Pidgins and Creoles—(Same as Anthropology 177.)
3-5 units, Aut (Fox, Frake)

185. Black English.
4 units, Aut, Spr (Rickford)

256. Topics in Sociolinguistics.
4 units, Aut (Nunberg)

285. The Structure of Hausa.
Given 1981-82

602A,B,C. Beginning Hausa.
5 units, Aut, Win, Spr (Staff)

603A,B,C. Intermediate Hausa.
5 units, Aut, Win, Spr (Staff)

606A,B,C. Beginning Swahili.
5 units, Aut, Win, Spr (Staff)

5 units, Aut, Win, Spr (Staff)

610A,B,C. Beginning Yoruba.
5 units, Aut, Win, Spr (Staff)

611A,B,C. Intermediate Yoruba.
3-5 units, Aut, Win, Spr (Staff)

POLITICAL SCIENCE
113A. The Politics of Development in Latin America.
5 units, Win (Packenham)

118A. Political Change in Tropical Africa.
5 units, Aut (Abernethy)

118B. Southern Africa: Race, Class and Political Change.
5 units, Win (Abernethy)

119. Socialism in Latin America.
5 units, Win (Fagen)

5 units, Spr (Abernethy)

SOCIOLGY
145. Race and Ethnic Relations.
3-5 units, Win (Hannan)

AMERICAN STUDIES

Policy Committee: Albert J. Gelpi* (English; Coe Professor of American Literature) Chairman; Barton J. Bernstein* (History), William Chace (English); Wendell Cole (Drama); David J. Danielski* (Political Science); Paul A. David (Economics; Coe Professor of American Economic History); Don E. Fehrenbacher (History; Coe Professor of American History); Alfred Frankenstein (Art); Estelle Freedman (History); Lawrence M. Friedman (Law); Henry S. Levinson (Religious Studies); Marion Lewenstein (Communication); Hubert R. Marshall (Political Science); Arnold Rampersad* (English); Bernard Siegel (Anthropology); David B. Tyack (Education); Morris Zelditch, Jr. (Sociology)

The American Studies Program is administered through the Department of Humanities Special Programs.

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. Ordinarily, the five courses in the

* Members of the Administrative Committee.
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 how the proposed courses comprise a coherent plan toward those ends.

Each major must also include in the program of study: (1) the introductory course, American Studies 50, to be taken as soon as possible after declaring the major; and (2) at least one core seminar, during the junior or senior year, but only after completing at least one course in each of the concentrations.

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 to fifteen 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.

AMERICAN STUDIES HOUSE

This undergraduate residence on Mayfield Avenue offers educational opportunities in American Studies that are open to majors, whether residents or not. Residents are assigned through the draw for undergraduate housing.

COURSES

See departmental listings for fuller descriptions and (DR) notations.

INTRODUCTORY COURSE

American Studies 50. American Literature and Culture to 1855—(Same as English 121.) A detailed study of important and representative works of American culture from 1630-1855. Close textual readings will be supplemented with discussions of the intellectual, theological and political history of the period. Required of all American Studies majors joining the program as of 1980-81.
5 units, Aut (Fliegelman)

AMERICAN THOUGHT AND IMAGINATION

American Studies 100. Reflections on the American Condition—(Same as English 128 and History 174.) Selected works of fiction and discursive thought combining the methods of historical and literary study, including The Education of Henry Adams, John Dos Passos' The Big Money and Daniel Bell's The Cultural Contradictions of Capitalism.
Given 1981-82
Art 130A. Art in 19th Century America.
4 units, Win (Frankenstein)
Art 130B. Art in 20th Century America.
4 units, Aut (Frankstein)
4 units, Spr (Turner)
Communication 139. Literature of the Press.
3 units, Aut (Lewenstein)
Drama 157. American Drama from 1920.
5 units, Aut (Cole)
Drama 355. American Drama Between the Wars.
4 units, Aut (Cole)
English 100H. Literature and Painting in America in the 20th Century.
5 units, Spr (Gelpi)
English 100M. American Lives.
5 units, Win (Islas)
English 120. The American Historical Novel.
5 units, Spr (Dekker)
English 122. American Literature, 1855-1917.
5 units, Win (Rampersad)
English 161A. The Afro-American Novel.
5 units, Aut (Drake)
5 units, Win (Rampersad)
English 161E. Recent Writing by Afro-American Women.
5 units, Spr (Drake)
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
<th>Term</th>
<th>Instructor</th>
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</thead>
<tbody>
<tr>
<td>English 162A</td>
<td>Contemporary Chicano Literature</td>
<td>5</td>
<td>Aut</td>
<td>Islas</td>
</tr>
<tr>
<td>English 179B</td>
<td>Faulkner</td>
<td>5</td>
<td>Aut</td>
<td>Moser</td>
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<tr>
<td>English 234D</td>
<td>American Fiction, 1917-1940.</td>
<td>5</td>
<td>Win</td>
<td>Moser</td>
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<tr>
<td>English 239</td>
<td>American Short Fiction.</td>
<td>5</td>
<td>Aut</td>
<td>Fields</td>
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<tr>
<td>English 256B</td>
<td>American Poetry, 1900-1945.</td>
<td>5</td>
<td>Win</td>
<td>Gelpi</td>
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<tr>
<td>English 256C</td>
<td>American Poetry, 1945-Present.</td>
<td>5</td>
<td>Spr</td>
<td>Fields</td>
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<tr>
<td>English 265</td>
<td>Literature of the American West, 1850-1940.</td>
<td>5</td>
<td>Aut</td>
<td>Momaday</td>
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<tr>
<td>English 285C</td>
<td>Dickenson and Tuckerman.</td>
<td>5</td>
<td>Win</td>
<td>Momaday</td>
</tr>
<tr>
<td>Music 5</td>
<td>Music in America</td>
<td>3</td>
<td>Spr</td>
<td>Cohen</td>
</tr>
<tr>
<td>Philosophy 105</td>
<td>American Philosophy, Its Sources, Its Influences</td>
<td>4-5</td>
<td>Spr</td>
<td>Hacking</td>
</tr>
<tr>
<td>Religious Studies 174B</td>
<td>Seminar: William James</td>
<td>5</td>
<td>Aut</td>
<td>Levinson</td>
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<tr>
<td><strong>AMERICAN SOCIAL ORGANIZATION AND BEHAVIOR</strong></td>
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<tr>
<td>American Studies 171</td>
<td>The Development of American Law—(Same as Political Science 183F.) 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.</td>
<td>5</td>
<td>Aut</td>
<td>Friedman</td>
</tr>
<tr>
<td>Economics 116</td>
<td>American Economic History.</td>
<td>5</td>
<td>Spr</td>
<td>James</td>
</tr>
<tr>
<td>History 152B</td>
<td>Urban Life and Culture.</td>
<td>5</td>
<td>Spr</td>
<td>James</td>
</tr>
<tr>
<td>History 153</td>
<td>Interpretive Overview of the United States</td>
<td>5</td>
<td>Spr</td>
<td>Degler</td>
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<tr>
<td>History 157</td>
<td>Introduction to Afro-American History</td>
<td>5</td>
<td>Aut</td>
<td>Carson</td>
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<tr>
<td>History 160</td>
<td>The American South, 1815-1890.</td>
<td>5</td>
<td>Aut</td>
<td>Degler</td>
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<tr>
<td>History 165A</td>
<td>The American Revolution and Early National Period from 1750</td>
<td>5</td>
<td>Aut</td>
<td>Staff</td>
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<tr>
<td>History 165B</td>
<td>19th-Century America</td>
<td>4-5</td>
<td>Win</td>
<td>Fehrenbacher</td>
</tr>
<tr>
<td>History 165C</td>
<td>The United States in the 20th Century—1890 to the Present</td>
<td>4-5</td>
<td>Spr</td>
<td>Kennedy</td>
</tr>
<tr>
<td>History 166</td>
<td>The American West</td>
<td>5</td>
<td>Spr</td>
<td>Camarillo</td>
</tr>
<tr>
<td>History 170</td>
<td>America in the 1960s: The Tumultuous Decade</td>
<td>5</td>
<td>Spr</td>
<td>Bernstein, Carson</td>
</tr>
<tr>
<td>History 173A</td>
<td>History of Women in America since 1860</td>
<td>5</td>
<td>Aut</td>
<td>Freedman</td>
</tr>
<tr>
<td>History 173B</td>
<td>History of Women in America since 1860</td>
<td>5</td>
<td>Win</td>
<td>Freedman</td>
</tr>
<tr>
<td>History 257A</td>
<td>Undergraduate Colloquium: Afro-American Politics in the 1960s</td>
<td>5</td>
<td>Spr</td>
<td>Carson</td>
</tr>
<tr>
<td>History 261A</td>
<td>Undergraduate Colloquium: American Workers in the Industrial Age.</td>
<td>5</td>
<td>Win</td>
<td>Carson</td>
</tr>
<tr>
<td>History 262</td>
<td>Undergraduate Colloquium: Chicano History</td>
<td>5</td>
<td>Aut</td>
<td>Camarillo</td>
</tr>
<tr>
<td>History 266S</td>
<td>Undergraduate Seminar: U. S. Foreign Relations in the 20th Century</td>
<td>5</td>
<td>Spr</td>
<td>Kennedy</td>
</tr>
<tr>
<td>History 270</td>
<td>Undergraduate Colloquium: Politics and Culture of Technology and Science in Modern America.</td>
<td>5</td>
<td>Win</td>
<td>Bernstein</td>
</tr>
<tr>
<td>History 272</td>
<td>Undergraduate Colloquium: 19th Century U. S. Social History.</td>
<td>5</td>
<td>Spr</td>
<td>Freedman</td>
</tr>
<tr>
<td>Sociology 155</td>
<td>Power Elites in American Society</td>
<td>3-5</td>
<td>Spr</td>
<td>Zelditch</td>
</tr>
<tr>
<td><strong>AMERICAN POLICY AND INSTITUTIONS</strong></td>
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<tr>
<td>American Studies 171</td>
<td>The Development of American Law—(Same as Political Science 183F.) See description under Social Organization and Behavior.</td>
<td>5</td>
<td>Aut</td>
<td>Friedman</td>
</tr>
<tr>
<td>History 158</td>
<td>History of Education in the United States—(Same as Education 201.)</td>
<td>3</td>
<td>Spr</td>
<td>Tyack</td>
</tr>
<tr>
<td>History 259</td>
<td>Undergraduate Colloquium: The Presidency from Washington to Lincoln</td>
<td>5</td>
<td>Aut</td>
<td>Fehrenbacher</td>
</tr>
</tbody>
</table>
History 269. Undergraduate Colloquium: Crises in American Foreign Policy. 5 units, Aut (Bernstein)

Political Science 1. Major Issues of American Public Policy. 5 units, Aut, Win (Marshall)

Political Science 10. American National Government. 5 units, Aut (Danelski)

Political Science 70. Politics and Public Policy. 5 units, Aut (Manley)

Political Science 180. Supreme Court and the Constitution. 5 units, Aut (Danelski)

Political Science 180C. Introduction to Public Policy Analysis. 5 units, Spr (Chubb)

Political Science 181. Conservatism and Constitutionalism. 5 units, Win (Horn)

Political Science 183. Civil Liberties in the United States. 5 units, Win (Danelski)

Political Science 183K. Criminal Law and the Criminal System—(Same as Law 107 and Sociology 61.) 5 units, Spr (Kaplan)

Political Science 192. Interest Groups and Political Parties. 5 units, Spr (Chubb)

Political Science 195. Seminar: The 1980 Presidential Primaries. 5 units, Aut (Eulau)

Political Science 207. Seminar: Governmental Decision-making and Natural Resources. 5 units, Win (Marshall)

Political Science 208. Seminar: Administrative Responsibility. 5 units, Spr (Marshall)

Political Science 284A,B. Public Opinion and American Democracy. 5 units, Aut (Sniderman) Win (Sniderman)

Political Science 293A,B. Seminar: Politics, Analysis and Public Policy. 5 units, Aut, Win (Chubb)

Sociology 105. Poverty and Public Policy in America. 3-5 units, Aut (Tuma)

given 1981-82

CORE SEMINARS

American Studies 214. American Autobiography.—(Same as English 100G.) The course will examine the sequence of classic American autobiographies from the 17th through the 20th century. 5 units, Aut (Fliegelman)

American Studies 215. British Origins of American Political Institutions—(Same as Political Science 197.) 5 units, Win (Danelski)

HONORS PROJECT

American Studies 250. Honors Project—Pre-requisite: consent of the chairman of American Studies. 5-15 units, any quarter (Staff)

ANTHROPOLOGY

Emeriti: St. Clair Drake, Bert A. Gerow, Benjamin D. Paul, George D. Spindler (Professors)

Chairman: Clifford R. Barnett


Associate Professors: George A. Collier, Michelle M. Rosaldo, Renato I. Rosaldo (on leave), Arthur P. Wolf (on leave)

Assistant Professors: Jane F. Collier, Donald L. Donham, William Durham, James A. Fox, Gilbert H. Herdt, John W. Rick, Sylvia Yanagisako

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 humanity 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 Pro-
gram 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 letter-grade equivalent 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 courses with courses from some other field (e.g., Classics) or 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 (15, 100-127); (b) Social and Cultural Anthropology (1, 5, 6, 11, 16, 128-169, 190, 192, 230-276); (c) Linguistic Anthropology (4, 171-180); Archeological and Biological Anthropology (2, 3, 182-188, 191).

**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 archeological sites, obtain training in museum methods by means of research with Stanford collections, and apply for funds to support summer field research in archeological 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.

**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 coterminal 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 coterminal program should consult the "Degrees" section of this bulletin. Coterminal 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 on inquiry to the Graduate Secretary of the Anthropology department. Successful applicants for the A.M. Program may enter during any quarter. Application deadlines: April 15 (for Autumn), 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 three quarters. 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 at Stanford or elsewhere, constituting 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. To provide a meaningful A.M. program within a one-year period, advance planning of coursework with an advisor is required.

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: Archeology, 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.

PhD MINOR IN ANTHROPOLOGY

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.

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 Administrator, School of Education.
GENERAL COURSES

These courses are open to all students and all are 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 human behavior and culture are advised to take Anthropology 1; those who are interested in introductory courses focused on specific areas of anthropological inquiry should choose from among the courses numbered 2 through 16.

1. The Individual and Society: Cross-Cultural Perspectives—What are the determinants of human behavior? This course of lectures examines human development in terms of the interplay of biological and psychological givenas and the requirements of living as social creatures within a particular cultural order. In particular, the focus is on theoretical approaches to understanding the interrelationship of individuality and society, ranging from approaches treating the social order as resulting from the fulfillment of individual needs to the polar opposite of treating individuals as constituted by their social order. Examines individuality in three or four very different societies, and explores the particular insights and limitations inherent in each of several approaches. (DR:A) 4-5 units, Spr (G. Collier, J. Collier) MTWTh 9

2. Biology and Culture in Human Evolution—(Same as Human Biology 135 and Anthropology 182.) This lecture course surveys the major stages of human evolution from Australopithecines to the present. The interaction of biological and cultural processes is emphasized as a key to understanding human origins and contemporary diversity. The course is divided into four major sections: Biological Evolution, Sociobiology, Cultural Evolution, and Models of Interaction. Topics covered include the hominid fossil record, genetic selfishness and altruism, sickle cell anemia, hunting and headhunting, incest avoidance, aggression and fertility regulation. The course may be taken as part of a sequence with Anthropology 3, 4 and 5 or it may be taken alone as an introduction to anthropology and human biology. (DR:C) 5 units, Aut (Durham) MTWTh 11

3. Human Prehistory—This course covers the aims, methods and data of prehistoric archeology. Traces the development of human society from early hunters through late prehistoric civilizations. Examine archæology sites and remains characteristic of the stages of cultural development for selected geographical areas, emphasizing methods of data collection and analysis appropriate to each. (DR:D) 3-5 units, Win (Gibbs, Yanagisako) MWF 1:15

4. Language and Culture—(Same as Linguistics 45.) Lecture course on evolutionary, differential, functional, and structural theories of language and culture. Functions of language in the speech community. Role of linguistic data in the analysis of society and culture. Language repertoires and rules of use. Linguistic evidence for culture history. (DR:A) 3 or 5 units, Spr (Fox) TTh 11-12:15

5. Symbolic Anthropology—(Same as Modern Thought and Literature 240A.) A survey of the outstanding theories of symbolism and how anthropologists have used them in treating the meaning of myth and rite, ceremonial exchange, social organization and identity. Focusing upon symbolic processes (and less on their contents), to examine the effective and cognitive components of symbolic behavior; the problem of meaning and identification; and the selection of methods and concepts for collecting and interpreting data needed for constructing a useful theory of symbolism in studying tribal societies. (DR:A) Given alternate years

6. Problems in Anthropology—(Formerly Anthropology 2.) A lecture course introducing students to divergent anthropological views of human nature, culture and society. Competing explanations of the incest taboo, warfare and aggression, male-female relations, initiation-ceremonies, ancestor worship, and the family will be discussed. Selected ethnographic films pertaining to those topics will be shown. Optional discussion sessions will be arranged. No prerequisites. (DR:A) 3-5 units, Spr (Gibbs, Yanagisako) MWF 1:15

11. Sex Roles in 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) 3-5 units, Win (J. Collier, M. Rosaldo) MWF 9

12. Sex and Gender—An introductory course of lectures on the cross-cultural study of sex and
gender. Focuses on the cultural and psychological development of gender identity in nonwestern societies. Part one surveys the psychobiological basis of sexual behavior and reproduction in lower mammals and humans from an evolutionary perspective. Part two examines the interplay between family structure, cultural ideology, and gender roles. Part three concentrates on the formation of gender identity (masculinity and femininity) and its consequences for normal eroticism and perversion. (DR:S)

5 units, Aut (Herdt)
MWF 9

13. Cultural and History—Seminars works in social thought, cultural history, and anthropolo-

ogy—Benedict, Huizinga, Marx, Weber, de Tocqueville, and Freud. Problems include: relation of cultural pattern and historical process; culture and social class; change as gradual transition and revolution. (DRA). Given alternate years

15. Anthropological Perspectives on American Culture—(Same as Modern Thought and Literature 115.) Areas of convergence and divergence in values, life styles, and psychocul-
tural attributes are analyzed for mainstream, minority, and variant cultural patterns in United States society. Processes of boundary maintenance and identity reference are dis-
cussed. Current social movements are placed in the perspective of counter-culturalism, margi-
nality, and cultural change. Field studies of relevant phenomena will be encouraged. (DRA)

3-5 units, Win (G. and L. Spindler)
TTh 1:15-2:30

16. Culture and the Sea: Maritime Orienta-
tions and Adaptations in Human Societies—
Introduction to maritime anthropology. The sea will be considered from an anthropological perspective with the purpose of learning something of man’s nature and mind from the diverse ways—ecological, conceptual, and sym-
bolic—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 sim-
pler 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, Spr (Frake)
MWF 12

70. Introduction to Linguistics—(Same as Lin-
guistics 10.) Theoretical foundation of linguis-
tics, with emphasis on application of theory to solution of homework problems from a variety of languages. Topics include: phonetics, phonol-
ogy, morphology, syntax, semantics, pragmat-
ics, universals, and language change. This course or its equivalent is required for many advanced courses in linguistics. (DR:A)

5 units, Aut (Sag) MWF 9, plus optional sections

90. Theory in Social Anthropology—Anthro-
pological interpretations of other societies have always contained assumptions about ourselves and about “Western” societies. The object of this course is to highlight that interplay and, specifically, to consider how underlying ass-
sumptions and implicit categories have influ-
enced the presentation of data in a set of major anthropological monographs. The course will concentrate on Karl Marx, Emile Durk-
heim, and Max Weber, along with a particular anthropological analysis of a nonwestern so-
ciety. (DR:S)

5 units, Spr (Donham) MWF 11

91. Archeological Field Methods—Field course involving students in actual archeological field research in the local area. The practical working methodology of the archeologist will be covered, primarily through excavation and site survey, although training in registration, pres-
ervation, and analysis of archeological remains will be included. Anthropology 191 is recom-
mended as preparation for this course, but is not a strict prerequisite. Prerequisite: Anthro 4, 183, 187, or consent of instructor. (DR:C)

Given alternate years

93. Pre-Field Research Seminar—Seminar designed to prepare students for anthropologi-
cal field research in both other societies and the United States. Students will be instructed in a broad range of data collection techniques including participant observation, interviewing, surveys, sampling procedures, life-histories, ethnohistory, and the use of documentary ma-
terials. Will also explore strategies of successful entry into the community, research ethics, interper-sonal dynamics, and the reflexive aspects of fieldwork. Prerequisite: an introductory course in anthropology or consent of the instruc-
tor. (DR:S)

5 units, Spr (Yanagisako) Th 3:15-6:05

94. Post-Field Research Seminar—Provides training and experience in coding, processing, and analyzing quantitative and qualitative re-
search data. Participants are expected to have
completed a full-scale report on a body of field data that will normally have been collected during the preceding summer. (DR:S)

5 units, Aut (Skinner) W 3:15-6:05

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

102. Native People of North America—Focusses on the many diverse cultural groups who inhabited North America before the European conquest. Deals with the prehistoric and historic contact periods as well as with the present-day situation of Native American peoples. (DR:S)

Given alternate years

103. Peoples of Mesoamerica—Survey of the Mayas, the Aztecs and their prehistoric neighbors, of how they fared under Spanish colonial rule, and of what their descendants are like today. May be taken in sequence with Anthropology 104. (DR:S)

Given alternate years

104. Native American Civilizations: The Incas, Mayas, and Aztecs—Compare and contrast three notable Native American civilizations from the point of view of theories of the development of civilization. How did they evolve? What were the ecological factors in their evolution? Did they influence one another? What were their economic, religious, and political institutions, and how did these differ from those of less-developed Native American societies? How do these civilizations compare in their organization and development to the pre-industrial civilizations of the Old World? The course will also trace the fate of these civilizations under Spanish colonial rule and examine the legacy of their cultural heritage for the Americas. (DR:S)

3 to 5 units, Aut (G. Collier, Fox)

TTh 1:15-3:05

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. (DR:S)

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) T 2:15-5

107. Resistance and Rebellion in Indigenous Latin America—This seminar will examine various ways in which indigenous peoples of Mesoamerica, the Andes, and the Amazon have resisted subordination under European colonial rule or within the societies of contemporary Latin American nations. In particular, the course will evaluate the relevance and validity for Indian resistance of various theories of what makes peasants conservative, rebellious, or revolutionary. (DR:S)

3-5 units, Win (G. Collier)

MW 1:15-3:05

108. African Societies in a Changing World—This lecture course examines the social institutions and cultural forms of black Africa in the wider context of colonialism, political independence, and national strategies of development. Topics explored include: shifts in patterns of marriage and family life, the emergency of new classes, the impact of Islam and Christianity, and the use of art and oral literature to consolidate and express ethnic power. Botswana, Ethiopia, and Liberia will be used as case studies, while supplemental material will be drawn from other Sub-Saharan African nations. (DR:S)

5 units, Win (Gibbs, Donham) MWF 10

110. Chicano Culture—Interdisciplinary approach to the study of Chicano life and culture. (Same as English 162G, History 64, Spanish & Portuguese 135.) Topics will include formation of the barrio, labor conflict, folklore and beliefs; forms and figures of cultural resistance (bandits, corridos, popular leaders); patterns of immigration; stereotypes and self-images in fiction, poetry, and teatro. (DR:A)

Given alternate years

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 culture 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, Spr (M. Rosaldo) MWF 9

117. Chinese Culture and Society—An introduction to the study of Chinese social structure, culture, and political economy during the 20th century. The emphasis is on the sources of revolutionary change and the anatomy of social transformation in the People’s Republic. (DR:S)
Given alternate years

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

122. Ecology, Industrialization, and Culture in Japan—Social and cultural ramifications of environmental destruction in Japan resulting from industrialization will be explored. Modes of coping with the impact of industrialization—social, political, legal, etc.—will be analyzed in relation to Japan’s cultural premises and traditional social structure and values. (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—The study of agrarian societies and cultures of Mediterranean Europe, with special emphasis on Italy, Greece, Spain and Portugal. Focus will be on ecology, land tenure and production, family and kinship, (beliefs and values). Consideration will be given to the relations between local communities and national and international forces that have historically shaped their adaptations. (DR:S)
5 units, Aut (Siegel) MW 11-12:15

SOCIAL AND CULTURAL ANTHROPOLOGY

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 the anthropological research. Prerequisite: Anthropology 1 is recommended. (DR:A)
Given alternate years

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 processes and stages of cultural development up through modern period. (DR:S)
Given alternate years

133A,B,C. Ethics of Development in a Global Environment (EDGE)—(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.) Open to graduates and undergraduates, appropriate to both foreign and American students. Theory and practice of development in a global setting. Encourages convergence of engineering and natural sciences with social and behavioral sciences in the study of development processes and the ethics implicit of development choices. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures, analyzed in terms of appropriateness to development in both less developed and industrialized societies. Addresses need for linkage between the necessary specialization of academia and the inherently interdisciplinary and problem-oriented nature of our living societies. Development strategies viewed with recognition of need for improvement in quality of life within nations and among nations while also recognizing limitations of the earth’s physical life support system and constraints in our cultural systems. Present systems and planning processes examined in terms of their present day inequities and their consequences for future generation. Autumn: Major world trends-population, food, energy, technology, life styles. Development examined in terms of relative satisfaction of human needs.
Winter: Alternative development strategies including country case studies. Spring: The individual (engineer, political scientist, educator, etc.) as designer of alternatives and as policy and decision maker. (DR:X)

1-5 units, Aut, Win, Spr (Cooper, Fagen, Fuenzalida, Lusignan, McWhorter, Siegel, Textor)

137. Applied Anthropology—Anthropologists are called upon to apply their findings and research skills to a variety of contemporary problems, including: planning and evaluating development projects in non-Western countries; developing and evaluating medical care delivery systems and education programs at home and abroad; assisting in the transmission of technological innovations and measuring their impact; carrying out environmental impact studies as required by federal law; 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. Prerequisite: At least one other course in anthropology or prior cross-cultural experience. (DR:S)

3-5 units, Win (Barnett) MWF 9

138. See Anthropology 238.

139. Seminar in Cultural Identity—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)

5 units, Win (Frake) TTh 11-12:15

143. Kinship and Social Organization—Analysis of interpersonal and group relations in terms of kinship; cultural notions of marriage, parenthood, the family, and intergroup principles of alliance and enmity. (DR:S)

Given alternate years

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 include the social consequences of crowding, rural-urban migration, pre-industrial urbanism, changing family and kinship patterns, urban ethnic communities and inter-ethnic relations, urban poverty and stratification, and crime. Lectures, readings, and group study sessions are employed to provide students with an expanded, comparative view of urbanism. (DR:S)

5 units, Win (Yanagisako) 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)

5 units, Aut (Siegel)

TTh 11-12:15

148. Cultural Approaches to Alternative Futures—(Same as Education 287.) Seminar exploring alternative middle-range futures—of a community, a society, or the world—from an anthropological perspective. Stress is laid upon developing ability to read the futures literature critically, and upon combining creative scenario-building with the rigorous use of explicit models and systematic data. In the context of global ecological and energy constraints, and sociopolitical imperatives, particular Western and non-Western cultures are examined in depth in terms of their adaptive capacity or vulnerability. Implications for the educator, planner, and policy-maker are addressed. Experiential techniques complement a lecture-and-discussion format. (DR:S)

3-5 units, Win (Textor) TTh 2:15-3:45, and by arrangement

151. Ritual and Mind—A course of lectures on the outstanding theories of symbolism and their use in understanding the cross-cultural study of ritual behavior and experience, social and personal identity, fantasy systems, and cultural communication. Focusing on symbolic processes we will examine: the cognitive and affective aspects of ritual; the relationship between public and private symbols; symbolic identification; and the different modes of interpreting their meanings. The aim is to provide an overall approach for understanding ritual and symbolism in human societies.

5 units, Aut (Herdt) MWF 1:15

153. Anthropological Studies of Religion—A study of the prevailing approaches for understanding the meaning of religious behavior in tribal societies.

Given alternate years
155. Political Anthropology—A course of lectures treating political processes and institutions in traditional societies, ranging from simple trips to complex agrarian civilizations. Also treated are political evolution, socialmovements, revolutions and political symbolism. (DR:S)
3-5 units, Aut (J. Collier)
MWF 9

156. Law and Conflict Management—A lecture course focusing on 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:A)

Given alternate years

157. Law in Radically Different Cultures—(Same as Law 157.) (Graduate students register in Anthro 257.) Comparison of legal systems in Western, capitalist, secular, industrialized democracies with legal systems in radically different cultures. Using American law as a benchmark, this course examines comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt (religious law), and the Republic of Botswana (traditional law) in order to identify the historical, philosophical, social, and cultural factors which contributed to the development of different attitudes and practices regarding law. Issues considered are the passing on of status and property rights—especially at death, the handling of anti-social or "criminal" behavior, the handling of promises and contracts, and the use of law as an instrument of social change in the introduction of family planning. This course is open to law students, graduate students in other departments and to juniors and seniors. (DR:S)
3 units, Spr (Barton, Gibbs, Li, Merryman)
MTTh 2:15

161. Social Institutions and Economic Theory—This is a course on economics in radically different societies. Besides advanced societies, many other types of economic organization exist in the record of human existence: from hunters and gatherers in the Kalahari Desert to peasants in Imperial China to present-day farmers in underdeveloped countries. The purpose of the course is to confront this range of empirical material with a variety of elementary economic and social theory, including neoclassical, substantivist, and Marxist contributions to economic anthropology (DR:S)

164. Ecological Anthropology—(Same as Human Biology 134.) 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.). Topics include human population dynamics, fertility regulation, energetics, niche analysis, and resource management. Prerequisite: Anthropology 1 or consent of instructor. (DR:C)
3 or 5 units, Spr (Durham) MW 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)
3 or 5 units, Aut (Gibbs) MWF 10

166. Culture and Madness—An introductory course of lectures on anthropological perspectives on mental health and illness. The course surveys the role of sociocultural factors for understanding clinical psychiatric diagnosis, etiology, and treatment in the following areas: psychosomatic illness; schizophrenia; dissociated personality and altered states of consciousness; gender identity disorders. Each section examines the interaction between cultural context and the definition of normal and abnormal behavior, and the medical model of psychopathology. The final section reviews humanistic and social policy issues in psychiatric treatment. Prerequisite: Anthropology 1 and Psychology 1, or the instructor's consent. (DR:A)
5 units, Spr (Herdt) 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. The course is designed for non-anthropology majors who are interested in
biology and medicine and for social science majors with an interest in health and/or biology. (DR:C)

3 units, Aut (Barnett) MWF 11

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) W 3:15-6:05

LINGUISTIC ANTHROPOLOGY

171. Linguistic Field Methods—(Same as Linguistics 175). Practicum in linguistic analysis of one or more languages eliciting data in class from native speakers. Introduction to research and field methods. Limited enrollment. Prerequisite: introductory course in linguistics or consent of instructor. (DR:S)

Given alternate years

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

177. Pidgins and Creoles—(Same as Linguistics 162.) Lecture course on the formation of simplified contact languages (pidgins) and their subsequent elaboration. Emphasis on the relationship between language structure and function, language universals, and the relevance of political power, ethnic identity, and social structure in the contact speech community. Attention is given to other simplified languages and registers. Prerequisite: an introductory course in linguistics or anthropology, or consent of instructors. (DR:S)

Given alternate years

182. Biology and Culture in Human Evolution—(Same as Human Biology 135; lecture sequence same as Anthropology 2.) Prerequisite: Anthropology 1 and 90 or consent of instructor. (DR:C)

3 or 5 units, Aut (Durham) MTWTh 11

183. Geological Archeology—(Same as AES 183). This course treats the application of geology to archeology. 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 archeological exploration, including use of geophysical techniques. Stress is placed on the student’s involvement in actual problems that are introduced in a succession of weekend 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 archeological 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 weekends. (DR:A)

Given alternate years

185. Prehistoric Peoples and Cultures of California—A review of the major available literature in terms of methods, techniques and models of interpreting the life styles of the aboriginal inhabitants of the California culture area and their adaptations to diverse local environments. Such problems as dietary analysis, skeletal analysis and grave-lot analysis will be viewed with the space-time continuum of 7000 years. Relationships with adjoining culture areas (Great Basin, Northwest Coast, Southwest) and with the present-day Indians of California will be explored. Enrollment limited to about 15 students with previous archeological coursework or experience, or consent of instructor. (DR:S)

5 units, Aut (Gerow) M 2:15-5:05

187. Hunter-Gatherers in Archeological Perspective—(Same as Human Biology 183.) This course encompasses problems of the organization and subsistence of band-level hunter-gatherers, especially as approached through archeological investigations. Included
will be a survey of modern hunter-gatherers, providing background for prehistoric groups. The archeological record of Africa, Europe and the New World will provide examples of how archeological data is used to reconstruct the cultural systems of extinct hunter-gatherers. Artifact typology, settlement pattern analysis, modeling approaches, ethnoarcheological methods, and other techniques will be used to determine the similarity of early groups to their modern counterparts. (DR:C)

5 units, Win (Rick) 3:15-5:05

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:C)

Given alternate years

191. Method and Theory in Archeology—This course teaches analytical approaches to archeological data, along with theory that articulates this data with past human behavior. We will use ethnographic information and archeological data from Central California to form a program of research and analysis. One function of the course is to provide specific introduction to the field investigations conducted in the subsequent course Anthropology 091. By itself this course will be of value, but it probably will be most meaningful when taken with the fieldwork course. (DR:S)

Given alternate years

192. Anthropological Research Methods with Implications for Education—(Same as Education 234.) Seminar on anthropological research methodology generally, and practicum on ethnographic methodology specifically. All ethnographic methods are covered, but emphasis is upon participant observation and semi-structured ethnographic interviewing. All students develop general background by reading ethnographies, and all are encouraged but not required to develop ethnographic skill by the conduct of local field research on a topic of their choice, under the instructor's guidance. Educational implications are systematically addressed. (DR:S)

3-5 units, Win (Textor) Th 7-10, and by arrangement

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. Sex and Power—This seminar will be concerned with varieties of "sexual politics" and the kinds of political roles and claims available to persons of both sexes in different kinds of political and economic systems. The interaction between political action and culturally stereotyped views of what men and women are like will be discussed. The focus for 1980-81 will be on female political roles in the states and chiefdoms of Africa and Polynesia.

5 units, Spr (J. Collier, M. Rosaldo) T 2:15-5:05

238. Education and Sociocultural Change—(Same as Education 306C; undergraduates register for Anthropology 138.) Examines the role of education in modernization, within a context of ecological and energy constraints, dependency, and culturally engendered value conflicts, utilizing a variety of theories and models of sociocultural change. Examines ethnocentric and ethical implications of "development" and, through in-depth case studies, seeks to promote empathic, culture-specific understanding of the needs of non-Western peoples whom development programs are intended to serve. (DR:S)

3-5 units, Spr (Textor) TTh 2:15-4:05 and by arrangement

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 and kinship.

**Given alternate years**

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.

5 units, Aut (Befu) MW 3:15

244. **Family and Kinship Organization**—Seminar on the major issues anthropologists have confronted in the comparative study of family and kinship. Competing theoretical frameworks will be evaluated through an examination of such topics as descent, marriage, parenthood, domestic groups, and kinship change. Particular attention will be paid to the articulation of families, households, and larger kinship groups. Prerequisite: graduate standing 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.

Given alternate years

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, Win (Martorell)

252. **Symbolic Anthropology**—Major theoretical approaches (Marxist, structuralist, hermeneutic, psychanalytic) to the concepts symbol, culture, worldview, ideology, as these have developed historically and are being used in contemporary theoretical and ethnographic writings.

5 units, Win (M. Rosaldo) MW 11-12:30

253. **Religion**—(Same as Religious Studies 248). 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.

Given alternate years

255. **Political Anthropology**—Seminar focusing on theoretical approaches to the study of politics and political development in traditional societies ranging from bands to agrarian civilizations. Prerequisite: graduate status in anthropology, sociology or political science, or consent of instructor.

Given alternate years.

257. See Anthropology 157

260. **Topics in Urban Anthropology**—Seminar devoted to key issues in anthropological research on urbanism, urban communities, and urban-rural integration. Selected case studies will be employed to explore and evaluate a range of theoretical frameworks, concepts, and questions that have shaped anthropological research on urbanism.

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

262. **Economic Anthropology**—Seminar on the dominant issues in current attempts to analyze the economic organization of noncapitalist societies. Special attention will be devoted to competing theoretical approaches—particularly neoclassical, substantivist, and Marxist—to such topics as the social organization or production, the circulation of goods and services, the generation and maintenance of economic inequality, and the encapsulation of local economic units within larger social systems.

5 units, Aut (Donham) TTh 10-11:50

263. **Regional Systems in Agrarian Societies**—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, Win (Skinner) MW 1:15-3:05

264. **Advanced Ecological Anthropology**—Research seminar on the role of ecological models in the analysis of contemporary cultural diversity. Following a review of earlier efforts linking environments and social systems (e.g., cultural ecology, ethnoecology, systems analysis), current theory and research trends in ecological anthropology will be examined. Case studies will include (1) the use of optimal foraging theory for interpreting hunter-gatherer adapta-
265. Advanced Psychological Anthropology—Analysis of selected psychocultural processes, including attention to group and individual adaptations to rapid cultural change and urbanization. Prerequisite: consent of instructor.
5 units, Win (G. and L. Spindler)
Th 9-12

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.
3-5 units, Win (G. and L. Spindler)
T 7-10 p.m. plus by arrangement

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 and Grobstein)
Th 4:15-6:05

269. Practicum in Ethnographic Futures Research—(Same as Education 212; undergraduates register for Anthropology 69.) Instruction in the rationale of, and guided practice in the conduct of, Ethnographic Futures Research (EFR), a non-directive, semi-structured, open-ended technique for eliciting from a sample of interviewees their middle-range perceived and preferred alternative cultural scenarios for a given social group. EFR is (1) an auxiliary technique for research on sociocultural change; (2) a means of augmenting conventional planning and policy-making approaches; and (3) an educational technique for both interviewer and interviewee. Instruction will include ways of combining EFR with conventional ethnography and with a variety of other research techniques. No prerequisites, but Anthropology 145 is recommended.
3-5 units, Spr (Textor) MW 2:15-3:45, and by arrangement.

276. 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 3:15-5:05

HISTORY AND RESEARCH METHODS

280. Field Methods—(Undergraduates register for 180.) 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.
Given alternate years

5 units, Win (Greenberg) MW 10-11:50

5 units, Aut, Win, Spr (Gibbs)
W 3:15-5:05

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)

295. Seminar: Research Paper—Forum for guiding first-year graduate students in Anthropology in preparation of their required re-
search papers. Prerequisite: graduate standing in department.
5 units, Spr (J. Collier and Yanagisako) by arrangement

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

Emeriti: Marvin Chodorow, C. Chapin Cutler (Professors)
Chairman: Calvin F. Quate

Associate Professor: Arthur B. C. Walker, Jr.
Adjunct Professor: John M. Wilcox

Courtesy Professors: Gordon S. Kino (Electrical Engineering), Anthony E. Siegman (Electrical Engineering), William E. Spicer (Electrical Engineering)

Courtesy Adjunct Professors: Bertram A. Auld (Edward L. Ginzton Laboratory), H. John Shaw (Edward L. Ginzton Laboratory)

Lecturer: Bernardo A. Huberman, Robert M. White

Consulting: Richard G. Brewer, Peter M. Eisenberger, Stig B. M. Hagstrom (Professors)

Marvin Chodorow Fellow: Roger W. Falcone

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, 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, 1981. 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. From time to time, "Special Topics" courses are offered to emphasize new developments in the various research areas.

The University's basic requirements for the Master's degree are discussed in the "Degrees" section 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, 220 (or Electrical Engineering 241), 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 "Degrees" section 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, 221 (or Electrical Engineering 241, 242); 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."

ASSISTANTSHIPS

Research 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. This course is intended to provide an opportunity for nonscience majors to enhance their "literacy" about science (specifically physics) and technology. Through the use of case studies, several scientific/technological issues of contemporary interest are addressed; the interactions between science and technology are illustrated; and a broad exposure to the facts, concepts and paradigms of physics is acquired. Course includes both lectures and discussion groups. No prerequisites. (DR:T)
3 units, Spr (Quate)

48. Breakthroughs and Inventions in Science and Technology—(Enroll in Freshman Seminar 48.)
Aut (Cutler)

130. Introductory Biophysics—This course is designed for undergraduate and graduate students who wish to learn about the physical basis underlying selected topics in contemporary molecular biology. 3-dimensional structure of macromolecules—x-ray diffraction and electron microscopy. Elementary statistical mechanics of conformational changes in biopolymers—proteins and lipids. Kinetic theory—mobility, diffusion, enzyme reactions. Passive and active transport through membranes—ionophores, channels and receptors. Physics of nerve impulse propagation. Prerequisites: Biology 21, Chemistry 30 series, Physics 50 series, or equivalents. (DR:T)
3 units, Spr (Doniach) MWF 9

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 (Weissbluth) 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 inte-
igration, Tchebyshev polynomials, Padé approximants, fast Fourier transforms, Monte Carlo methods of integration, Newton-Raphson method, differential equations—Euler and Runge-Kutta methods, matrix inversion and solution of simultaneous equations, boundary value problems and eigenvalue methods, partial differential equations; (2) advanced numerical methods and introduction to non-numerical methods—optimization methods, linear programming, ill-conditioned systems; List processing, lambda conversion, recursive functions, Turing machines, introduction to LISP. Prerequisite: Mathematics 113 and 130, or equivalent. (DR:X)

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

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 Schrödinger formulations, multiplet structure by Racah methods, Hartree-Fock calculations, hyperfine couplings, group theory, vibrational-rotational structure, molecular orbitals, ligand-field theory as well as the physical content of various experimental methods. Prerequisite: Applied Physics 213 and Physics 131 or Electrical Engineering 322B. (DR:X)

232. 3 units, Win (Weissbluth) TTh 11-12:15
233. 3 units, Spr (Weissbluth) TTh 11-12:15

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 1:15

15A. Cosmic Evolution—(Enroll in Physics 15.)

Win (Staff)

50. Astronomy Laboratory and Observational Astronomy—(Enroll in Astronomy 50.) (DR:T)

Aut (Staff)

100. Introduction to Observational Astronomy and Astronomy Laboratory—This course is intended to provide the student of physical science or engineering with a comprehensive introduction to observational techniques in astronomy, including conventional optical and infrared observations, radio astronomy techniques, spacecraft techniques for observations in the ultraviolet, x-ray and gamma-ray bands of the electromagnetic spectrum, and in situ measurements of charged particles. Emphasis will be placed on measurement of fundamental astronomical parameters such as distance, temperature, mass and composition of stars. The lectures will be combined with observations at the Stanford Student Observatory where students will perform a series of fundamental observations using the 16-inch telescope and learn to identify spectra of various classes of stars. Prerequisites: one year of physics or concurrent registration in Physics 29, 57 or 63. (DR:T)

4 units, Spr (Walker) M 3:15-5:00, lab by arrangement


3 units, Aut (Staff)

alternate years, given 1980-81

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 of college physics at the Physics 50 series or equivalent level, or Applied Physics 101. (DR:T)

3 units, Win (Sturrock) TTh 2:15-3:30
104. Solar-Terrestrial Relations—(Enroll in Astronomy 104.)
   Aut (Staff) given 1981-82

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) MW 1:15-2:30

150A. Advanced Astronomy Laboratory—(Enroll in Astronomy 150A.)
   Aut (Walker) (DR:T)

190A, B, C. Independent Study In Astrophysics and Honors Thesis—(Enroll in Astronomy 190A, B, C.)
   (Staff)

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, Aut (Petrosian) alternate years, given 1981-82

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 UBV photometry of main sequence and giant stars, on photometry of variable stars, and on filter photometry of diffuse objects (planetary nebulae 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

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 UBV photometry of main sequence and giant stars, on photometry of variable stars, and on filter photometry of diffuse objects (planetary nebulae 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, Spr (Petrosian) alternate years, given 1981-82

   3 units, Spr (Petrosian) alternate years, given 1981-82

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 equivalent, or consent of instructor. (Physics 132 desirable.) (DR:X)
   3 units, Win (Petrosian) MWF 11 alternate years, given 1980-81

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) alternate years, given 1981-82

The following seminars will be offered in future years by members of the department and the Astronomy Program.

370A. Astrophysics Seminar: Supernovae, Supernovae Remnants, Neutron Stars and Pulsars

370B. Astrophysics Seminar: Galactic and Extragalactic X-Ray and EUV Astronomy
370C. Astrophysics Seminar: The Interstellar Medium and Stellar Evolution

370D. Astrophysics Seminar: Peculiar Stars

370E. High-Energy Particles in Astrophysics—Review of observational data concerning high-energy particles (cosmic rays) in the Galaxy and in the heliosphere. Inferences concerning the role of high-energy particles in pulsars, quasars and other objects. Theories of acceleration and propagation of high-energy particles. Prerequisite: consent of instructor.

3 units, Spr (Sturrock) by arrangement, given 1980-81

CONDENSED MATTER PHYSICS

All courses (DR:X)

172. Physics of Solids—(Enroll in Physics 172.) Spr

238. Electric and Magnetic Properties of Solids—(Enroll in Electrical Engineering 238.) Aut (Spicer)


239. 3 units, Win (Harrison) MWF 10
240. 3 units, Spr (Harrison) MWF 10


3 units, Aut (Harrison) MWF 10, alternate years, given 1980-81


3 units, Aut (Harrison) MWF 10, alternate years, given 1981-82

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 may 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) given 1981-82

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

385. 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) alternate years, given 1981-82

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, Aut (Doniach) TTh 11-12:15 alternate years, given 1980-81
390. 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 (Doniach) Th 4

ACOUSTICS—QUANTUM ELECTRONICS—MICROWAVES

All Courses (DR:X)

161. Intermediate Optics—(Enroll in Physics 161.)

Aut (Schawlow)

231. Lasers—(Enroll in Electrical Engineering 231.)

Aut (Siegman)

232. Lasers—(Enroll in Electrical Engineering 232.)

Win (Siegman)


3 units, Spr (Auld) alternate years, given 1981-82


3 units, Spr (Auld) alternate years, given 1980-81

254. Electron and Ion Optics—(Enroll in Electrical Engineering 326A.)

Aut (Chodorow)

255. Microwave Electronics—(Enroll in Electrical Engineering 326B.)

Win (Chodorow)

256. Microwave Electronics—(Enroll in Electrical Engineering 326C.)

Spr (Chodorow)

346A. Introduction to Nonlinear Optics—(Enroll in Electrical Engineering 346A.)

Spr (Harris)

346B. Nonlinear Optics—(Enroll in Electrical Engineering 346B.)

Harris given 1981-82

358A. Quantum Electronics Laboratory I—Combined lecture and laboratory course emphasizing laser theory and device operation. The lasers studied include He Ne, 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)

395. Experimental Techniques in Lasers and Optics—Weekly meetings with student and staff presentations to discuss experimental methods and practical topics in lasers, linear and nonlinear optics, laboratory techniques and related topics in electronics.

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

431. Quantum Electronics—(Enroll in Electrical Engineering 431.)

(Siegman) given 1981-82

ART

Emeritus: Isabelle K. Raubitschek (Associate Professor)

Chairman: Lorenz Eitner

Principal Advisor to Undergraduate Studio Majors: Keith Boyle

Principal Advisor to Undergraduate Art History Majors: Albert Elsen

Director of Graduate Studies in Art History: Dwight C. Miller
Professors: Keith Boyle (Painting), Elliot W. Eisner (Art Education), Lorenz Eitner (18th-19th century French art); Albert Elsen (Mid-19th -20th century European art, American art since 1940; on leave Spring 1980-81), Kurt W. Forster (Renaissance Art), Matthew S. Kahn (Design, Frank Lobdell (Painting), Dwight C. Miller (Baroque art), Nathan Oliveira (Painting/Printmaking; on leave Spring 1980-81, Autumn 1981-82), Michael Sullivan (Chinese art; on leave Spring 1980-81).

Associate Professors: Suzanne Lewis (Medieval art; on leave Spring 1980-81), Richard Randell (Sculpture), Paul V. Turner (Architectural history; on leave Autumn 1980-81).

Assistant Professors: Kristina Branch (Painting/Drawing); John-David P. LaPlante (Oriental Art; on leave Spring 1980-81), Jan W. Molenkamp (Design).

Senior Lecturer: Laura Volkerding (Photography)

Lecturer: Marriam C. Ring (Photography)

Visiting Assistant Professor: Melinda Takeuchi (Japanese art)

Visiting Lecturer: Alfred Frankenstein

OFFERINGS AND FACILITIES

The department offers courses of study in three areas: (1) in the history of art; (2) in the practice of drawing, painting, sculpture, design, printmaking, and photography; and (3) in art education. The undergraduate program of the department is designed to introduce students to the humanistic study of the visual arts. The courses are intended to increase the students' understanding of the meaning and purpose of the arts, of their historical development, their role in society, and their relationship to such other humanistic disciplines as literature, music, and philosophy. The work in classroom and studio is designed to intensify the students' visual perception of the formal and expressive means of art and to encourage insight into a variety of technical processes. The collections of the Stanford Museum and the exhibitions program of the Stanford Gallery supplement the regular academic program of the department.

PROGRAMS OF STUDY

Undergraduates may major in Art History or the Practice of Art (Studio). A freshman or sophomore intending to major in one of these areas should consult with an 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:

1. 8 units from the following: Art 1, Art 2, Art 3, Art 5 and Art 10.

2. 40 units in art history courses above the 100 level, including one seminar or colloquium. To insure 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.

3. Total units—48. These units must be taken for a grade, and may not be taken pass/no credit. University units earned by placement tests or advanced placement work in secondary school will not be counted within the 48 units.

4. 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 the History 1, 2, 3 sequence.

5. 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 "Degrees" section 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. Students of Oriental art will be required to demonstrate competence in one Oriental language (equivalent to three years of study) and reading knowledge of a second.
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 "Degrees" section 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/Drawnig, Sculpture, Printmaking, 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 plus one other ME course at or above the ME101 level
- 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.

**Overseas Campus Credit for Studio Art Courses.** A minimum of 52 of the 65 units required for the studio art major must be taken at the Stanford campus. This will allow a student to take art courses at an overseas campus, but will still require that the bulk of the work be done under the guidance of an advisor and an approved curriculum. In all cases, a student should meet with his advisor prior to planning his overseas campus program.

**Transfer Credit Evaluation.** Upon declaring a studio art major, a student transferring from another school must have his work evaluated by an Art Department advisor. A maximum of 13 transfer units will be applied toward the 65 total units required for the studio art major. This will allow a student to receive some credit for coursework completed elsewhere, but will still require that the bulk of the work be done under the guidance of an advisor and an approved curriculum. A student wishing to have more than 13 units applied toward the major must submit a petition to his advisor and then have his work reviewed by a studio committee.

**MASTER OF FINE ARTS**

Programs for the Master of Fine Arts degree are offered in the areas of painting, printmaking, sculpture, photography and product or graphic design.

The Graduate Program in Painting, Sculpture, Printmaking, 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 letter grade average of "B-" in at least 65 units of undergraduate work in art.
3. Formal admission to candidacy granted by the University Committee on Graduate Studies.
4. Portfolio Specifications—Painting and Sculpture: six or more slides of painting or sculpture and six or more slides of drawings. No actual work will be accepted. Printmaking: six or more slides of prints and six or more slides of drawing. Actual prints will be accepted only if candidates can arrange for delivery and pick up. Photography: twelve or more photographs. Design: twelve or more slides or photographs of creative work. Slides should be sent in the standard cardboard container received from processing (not in plastic sheets), and should be labeled with applicant's name; size, date and medium of work; with the top of the work indicated. A stamped self-addressed container should be included for the return of portfolios.
5. Applications and portfolios for the studio program must be submitted by January 15. They will be reviewed in February. Students accepted are admitted for the beginning of the following Autumn Quarter. No applicants for mid-year entrance will be considered.

The requirements for the degree of Master of Fine Arts in painting, sculpture, printmaking and photography are:

1. Completion of a minimum of two years (six full quarters) of graduate work in residence or its equivalent at this University.
2. First year graduate students are required to complete 18 units for the seminar, nine units of individual study with the faculty, and 27 units of work in their chosen field. After successfully completing the first year of study, students enter their second year on terminal graduate registration and continue to participate in the seminars and study with the faculty.
3. Students must participate in a weekly seminar in which their work is criticized and discussed in detail.

The requirements for the degree of Master of Fine Arts in design are:

1. Completion of a minimum to two years (six full quarters) of graduate work in residence or its equivalent at this University.
2. First year graduate students are required to complete 54 units of coursework chosen in consultation with an advisor. At least 18 of the 54 units must be in Art 360A, B, C and Mechanical Engineering 211A, B, C.
3. Students must participate in a weekly seminar in which their work is criticized and discussed in detail.

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 levels. For details with respect to this program consult the “Teaching Credential Program” listed in the “School of Education” section in this bulletin.

**COURSES IN HISTORY OF ART**

**BASIC COURSES**

1. **Introduction to Art**—A topical introduction to the history and appreciation of architecture, sculpture, and painting.
   - 4 units, Aut (Elsen) given each year

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, Win (Sullivan) given 1981-82

3. **Introduction to the History of Architecture**—A selective survey of Western architectural history, from antiquity to the 20th century. In each period, specific buildings and historical issues are examined, as well as more general principles relevant to the Study of Architecture.
   - 4 units, Spr (Turner) given 1981-82

5. **Introduction to Ancient and Medieval Art**—The formation of the Classical tradition in Ancient Greece and Rome and its transformations in the Middle Ages.
   - 4 units (Staff)

10. **Introduction to Art, Renaissance to Modern: Important Events, Issues and Personalities in European Art**—Main currents in the history of Western art from the Renaissance to the present.
    - 4 units (Staff)

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) given 1980-81

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) given 1980-81

22. **Introduction to the Art of Asia (14th Century Onward)**—Moguls, Mongols and Shoguns; the art of Asia from the 14th century onward.
    - 4 units, Spr (LaPlante) given 1981-82

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.

65. **Medieval Culture and Society**—(Same as English 65, History 65, Medieval Studies 65.)
    - 5 units, Win (Lewis, Ferruolo and Staff) given 1980-81

**INTERMEDIATE COURSES**

100A. **Ancient Art I**—Greek art from Protogeometric to the Parthenon. A selective survey of the art and architecture of Greece from c. 1000 B.C. to the height of the Classical period.
    - 4 units, Aut (Maxmin) given 1980-81

100B. **Ancient Art II**—Greek art of the 4th century and Hellenistic period.
    - 4 units, Win (Maxmin) given 1980-81

100C. **Ancient Art III**—Roman art.
    - 4 units, Spr (Maxmin) given 1980-81

100D. **Ancient Art IV**—The art of Archaic Greece, with emphasis on the development of sculpture, vase-painting and architecture in the 6th century B.C.
    - 4 units, Win (Maxmin) given 1980-81

102. **Ancient Art V: Greek Vase Painting**—An introduction to the study of Greek vases and their painters, with special attention given to the masters of Athenian black and red-figure.
    - 4 units, Aut (Maxmin) given 1980-81

104. **Early Medieval Art**—Development of formal and iconographical traditions in art and architecture under the patronage of major church and state institutions in Western Europe from the 4th through the 11th centuries.
    - 4 units, Aut (Lewis) given 1981-82
104A. Medieval Manuscript Illumination—An introduction to the study of the illustrated medieval book, its technical, stylistic and iconographical aspects, as well as problems of patronage and usage (May be taken as a sequel to English 209). (DR:H)
   4 units, Spr (Lewis) given 1981-82

105. 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 1980-81

105A. 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, Spr (Lewis) given 1981-82

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 (Lewis)

108. Netherlandish Painting—Rediscovery of the visual world 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 (Lewis)

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) given 1980-81

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) given 1980-81

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) given 1981-82

111. Michelangelo and the Art of His Time—A study of Michelangelo's life and of his works in sculpture, painting and architecture. (DR:H)
   4 units, Aut (Forster) given 1980-81

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 1980-81

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) given 1980-81

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, Spr (Miller) given 1980-81

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 (Miller)

   4 units, Aut (Miller) given 1980-81

116A. Masterpieces and Monuments of the Baroque Age.
   4 units, Win (Miller) given 1980-81

119. Political Ideology in 17th Century European Art in Court and Church—Monarchical eulogy and related political allegory; the art of religious propaganda of the age of the Counter-Reformation. (DR:H)
   4 units, Win (Miller) given 1980-81

120A. Modern Art I—Rococo to Revolution—Main currents in European art in the periods of the Enlightenment and Neoclassicism, Watteau, Boucher, Tiepilo, Chardin, Hogarth, Greuze, Fragonard, Robert, Piranesi, and early works of David, Goya, and Blake. (DR:H)
   4 units, Aut (Eitner) given 1980-81

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, and the landscape art of Turner, Constable. (DR:H)

4 units, Win (Eitner) given 1980-81

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 masters of Impressionism, particularly Monet and Renoir, 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, Aut (Eitner) given 1981-82

120D. Modern Art IV—Alternatives to Impressionism—European art 1890-1900, Cezanne, VanGogh, Seurat, Gauguin, Symbolism, Lautrec, Ensor, Munch. (DR:H)

4 units, Win (Elsen) given 1980-81

121A. Modern Art V—Twentieth Century Painting I, 1900-1920—Fauvism, Matisse, German and Austrian Expressionism, Picasso, and Cubism, Orphism, Futurism, and Abstraction.

4 units (Elsen)


4 units (Elsen)


4 units (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, (Elsen)


4 units, (Elsen)

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 (Elsen)

124. Picasso—This course will be given either as a colloquium or lecture course depending upon enrollment.

4 units, Win (Elsen) given 1980-81

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:H)

4 units, Aut (LaPlante) given 1980-81

125B. The Art of India.

4 units (LaPlante)

125C. The Art and Architecture of Moghul India

4 units (LaPlante)

126A. Introduction to Chinese Art.

4 units, Aut (Sullivan) given 1980-81

126B Introduction to Chinese Painting.

4 units, Win (Sullivan) given 1980-81

126E. The Meeting of Eastern and Western Art—The interaction between the art of the Far East, Europe, and America from the sixteenth century to the present day. (DR:H)

4 units (Sullivan)

125A. Ritual Bronzes of Ancient China

4 units, Spr (LaPlante) given 1981-82

128B. Chinese Ceramics.

4 units, Win (LaPlante) given 1980-81

128C. Buddhist Art in Asia. (DR:H)

4 units (LaPlante)


4 units (LaPlante)

128E. Japanese Ceramics. (DR:H)

4 units (LaPlante)

129A. Arts of Japan I—An introduction to the major Japanese art forms from prehistory to the 14th century A.D.

4 units, Aut (Takeuchi) given 1980-81

129B. Arts of Japan II—An introduction to the major Japanese art forms from the 14th century A.D. to the present.

4 units, Win (Takeuchi) given 1980-81

129C. Japanese Painting—An examination of the most important currents within the mainstream of Japanese painting, with emphasis
placed on the diversity of schools and styles in the Edo period.
4 units, Aut (Takeuchi) given 1980-81

129E. The Japanese Woodblock Print—History, technique and connoisseurship of Japanese prints from the Edo period to the present.
4 units Win (Takeuchi) given 1980-81

129F. Japanese Art in the Zen Tradition—Focuses on the development of Zen-related arts which flourished from the Muromachi through Edo periods.
4 units Spr (Takeuchi) given 1980-81

130A. Art in Nineteenth Century America—Major developments and personalities in painting in 19th century America.
4 units, Win (Frankenstein) given 1980-81

130B. Art in Twentieth Century America—Major developments and personalities in painting in twentieth century America. (DR:H)
4 units, Aut (Frankenstein) given 1980-81

134. History of Photography—A survey of the medium, from its introduction in 1839 to the present. Discussion will center on the works of photographers who made available techniques serve individual expression, although the social and scientific uses of photography through its history will be considered as well. The lectures well treat the history chronologically; required readings will be thematically directed.
4 units, Spr (Mozley) given 1980-81

4 units, Win (Turner) given 1980-81

4 units, Aut, Win, Spr (Maxmin) given 1980-81

175A. Studies in Greek Vase Painting.
4 units, Win (Maxmin) given 1980-81

175B. Studies in Roman Sculpture.
4 units, Aut (Maxmin) given 1980-81

175C. Studies in Medieval Art.
4 units, Win (Maxmin) given 1980-81

175D. Studies in Renaissance Art.
4 units, Win (Maxmin) given 1980-81

176. American Architecture and Urbanism—The development of architecture and city planning in the United States since colonial times, concentrating on those characteristics and problems which are distinctively American. (DR:H)
4 units, Spr (Turner) given 1980-81

ADVANCED UNDERGRADUATE AND GRADUATE COURSES

All Courses (DR:X) unless noted otherwise.

4 units, Aut, Win, Spr (Maxmin) given 1980-81

4 units, Win (Maxmin) given 1980-81

204. Studies in Early Medieval Art.
4 units, Aut (Lewis) given 1981-82

204A. Studies in Medieval Manuscript Illumination.
4 units, Spr (Lewis) given 1981-82

205. Studies in Medieval France.
4 units, Aut (Lewis) given 1980-81

205A. Studies in Medieval Britain.
4 units, Spr (Lewis) given 1981-82

4 units, Aut (Lewis) given 1980-81

206A. Colloquium on Chartres Cathedral—The colloquium will devote a whole quarter to the study of Chartres Cathedral, its art and cultural matrix, through a series of readings ranging from medieval texts to the most recent challenging interpretations of the 1970s.
4 units, Win (Lewis) given 1980-81

207. Studies in Medieval Architecture.
4 units (Lewis)

208. Studies in Netherlandish Painting.
4 units (Lewis)

4 units, Aut, Win, Spr (Forster) given 1981-82

211. Studies on Michelangelo.
4 units, Aut (Forster) given 1980-81

212. Studies in Renaissance Architecture.
4 units, Win (Forster) given 1980-81

4 units, Win (Forster) given 1980-81

214A,B. Seminar in Renaissance Art: Michelangelo—A two-quarter seminar devoted to Michelangelo's sculpture and painting in the autumn and his architecture in the winter quarter.
4 units. Aut, Win (Forster) given 1980-81

4 units, Spr (Forster) given 1980-81
215A. Studies in Artistic Culture in Italy During the 17th Century: Caravaggio, Bernini, Borromini, and Their Contemporaries.
4 units, Spr (Miller) given 1980-81

215B. Studies in 17th Century Art in the Low Countries: The Age of Rubens and Rembrandt.
4 units (Miller)

4 units, Aut (Miller) given 1980-81

216A. Studies on Great Masterpieces and Monuments of the Baroque Age.
4 units, Win (Miller) given 1980-81

217. Connoisseurship in 17th Century Italian Drawings.
4 units, Aut (Miller) given 1980-81

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, Spr (Miller) given 1980-81

4 units, Win (Miller) given 1980-81

4 units, Aut, Win, Spr (Eitner, Elsen) given 1980-81

221. Seminar on Nineteenth Century Art.
4 units, Spr (Eitner) given 1980-81

221A. Studies in Twentieth Century Painting From 1900-1920.
4 units (Elsen)

4 units (Elsen)

4 units (Elsen)

223. Studies on Rodin.
4 units (Elsen)

223A, B. Studies in Modern Sculpture.
4 units (Elsen)

223C. Seminar in Late Nineteenth Century Art.
4 units (Elsen)

224. Colloquium on Picasso: His Life's Work in All Media.
4 units (Elsen)

225A. Studies in Indian Painting.
4 units, Aut (LaPlante) given 1980-81

225B. Studies on the Art of India.
4 units (LaPlante)

225C. Studies on the Art and Architecture of Mughul India.
4 units (LaPlante)

226A. Studies in Chinese Art.
4 units, Aut (Sullivan) given 1980-81

226B. Studies in Chinese Painting.
4 units, Win (Sullivan) given 1980-81

226C. Studies of Meeting of Eastern and Western Art.
4 units (Sullivan)

226A,B. Seminar on Chinese Art. (DR:H)
4 units, Aut, Win (Sullivan)

226C. Seminar in Far Eastern Art. (DR:H)
4 units, (Sullivan)

227A. Studies on Ritual Bronzes of Ancient China.
4 units, Spr (LaPlante) given 1981-82

227B. Studies on Chinese Ceramics.
4 units, Win (LaPlante) given 1980-81

227C. Studies on Buddhist Art in Asia.
4 units (LaPlante)

227D. Studies on the Architecture and Gardens of Japan.
4 units (LaPlante)

227E. Studies on Japanese Ceramics.
4 units (LaPlante)

227A. Studies in the Arts of Japan I.
4 units, Aut (Takeuchi) given 1980-81

227B. Studies in the Arts of Japan II.
4 units, Win (Takeuchi) given 1980-81

4 units Aut (Takeuchi) given 1980-81

227D. Seminar: Japanese Literati Painting—Investigates the major artists and currents of scholars' painting in Japan. Prerequisite: Art 129B or 129C.
4 units, Spr (Takeuchi) given 1980-81

227E. Studies on the Japanese Woodblock Print.
4 units, Win (Takeuchi) given 1980-81

4 units, Spr (Takeuchi) given 1980-81

230A. Studies in Nineteenth Century Painting in America.
4 units (Frankenstein)

230B. Studies in Twentieth Century Painting in America.
4 units, Aut (Frankenstein) given 1980-81

4 units, Spr (Mozley) given 1980-81
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) given 1981-82

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, Aut (Ross) given 1980-81

238. Art and the Law—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. Course is restricted to graduate students in law, business and art history. Undergraduate senior art history majors need approval of the instructor. (DR:X)
5 units, Win (Elsen, Merryman) given 1981-82

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)

Any quarter (Staff) by arrangement

274. Studies on Baroque Architecture.
4 units, Win (Turner) given 1980-81

275A,B. Studies in Modern Architecture I, II.
4 units, Aut, Win (Turner) given 1981-82

4 units, Spr (Turner) given 1980-81
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 (Staff)

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 (Oliveira)

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.
3 or more units, Aut (Kahn)

167. Metallurgical—Projects in jewelry and small utilitarian objects. Emphasis on design and craftsmanship in metal construction and lost wax casting. Prerequisite: 162.
3 or more units, Win (Kahn)

170. Intermediate Photography—Perfecting skills and techniques acquired in basic photography. Prerequisite: 70 or equivalent.
3 units, Aut, Win, Spr (Staff)

171. Photo Essay and Photo Silk-Screening—For serious students of photography. Prerequisites: 170 and consent of instructor.
3 units, Aut, Win, Spr (Staff)

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 (Staff)

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

   Any quarter (Oliveira) by arrangement

   Any quarter (Randall) by arrangement

   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) by arrangement

264. Advanced Color.
   3 units, Spr (Molenkamp)

264. 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)

   Aut, Win, Spr (Staff) by arrangement

   Aut, Win, Spr (Lobdell) by arrangement

342. M.F.A. Project (Studio).
   Any quarter (Staff) by arrangement

360A, B, C. Master’s Project (Seminar): Design.
   Aut, Win, Spr (Kahn, Molenkamp) 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)

219. Artistic Development of the Child—(Enroll in Education 219.)
   4 units, Win (Eisner MW 9-11 given 1980-81

   4 units, Aut (Eisner) MW 9-11 given 1980-81

348. Educational Connoisseurship and Educational Criticism—(Enroll in Education 348.)
   4 units, Spr (Eisner) MW 9-11 given 1980-81

380. Curriculum Development in the Visual Arts—(Enroll in Education 380.)
   4 units, Spr (Eisner) MW 9-11 given 1980-81

461. Seminar for Doctoral Students in Art Education—(Enroll in Education 461.)
   2-4 units, Win (Eisner) T 7-10p.m. given 1980-81

ASIAN LANGUAGES

Emeriti: S. Wing Chan, Frederic Spiegelberg (Professors)
Chairman: John C. Y. Wang
Professors: Albert E. Dien, James J. Y. Liu, David S. Nivison, Makoto Ueda (on leave 1980-81)

Associate Professors: Kung-yi Kao (on leave Autumn and Winter Quarters), William A. Lyell, Susan K. Matisoff, John C. Y. Wang

Visiting Assistant Professor: Kazuko Arahari

Senior Lecturers: Yin Chuang, Hiroyasu Kubota, Hiroshi Sakamoto, Dorothy Shou

Lecturer: Kimie Nebrig

CHINESE-JAPANESE LANGUAGE AND AREA CENTER

Director: Albert E. Dien

Professors: Harumi Befu (Anthropology), Albert E. Dien (Asian Languages), Peter Duus (History), John G. Gurley (Economics, on leave Autumn and Winter Quarters), Nobutaka Ike (Political Science), Lawrence Lau (Economics), John W. Lewis (Political Science), Victor H. Li (Law), James J. Y. Liu (Asian Languages), David S. Nivison (Asian Languages and Philosophy), Robert C. North (Political Science), G. William Skinner (Anthropology, on leave Spring Quarter), Kurt Steiner (Professor Emeritus, Political Science), D. Michael Sullivan (Art, on leave Spring Quarter), Makoto Ueda (Asian Languages, on leave 1980-81), Lyman P. Van Slyke (History), Robert E. Ward (Political Science)

Associate Professors: Harry Harding, Jr. (Political Science), Harold L. Kahn (History), Kung-yi Kao (Asian Languages, on leave Winter and Spring Quarters), William A. Lyell (Asian Languages), Jeffrey Mass (History), Susan K. Matisoff (Asian Languages), John C. Y. Wang (Asian Languages), Arthur P. Wolf (Anthropology, on leave 1980-81), Lee H. Yearley (Religious Studies), Visiting: Toshiaki Tachibanaki (Economics)

Assistant Professors: Carl Bielefeldt (Religious Studies), John D. LaPlante (Art, on leave Spring Quarter), Daniel I. Okimoto (Political Science), Diana M. Paul (Religious Studies), Visiting: Kazuko Arahari (Asian Languages), Acting: Melinda Takeuchi (Art)

Senior Lecturers: Yin Chuang, Hiroyasu Kubota, Hiroshi Sakamoto and Dorothy Shou (Asian Languages)

Lecturers: Kimie Nebrig (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 “Degrees” section 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 qualification 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 University). They are described elsewhere in this bulletin.

Summer Program of Intensive Language Courses—A ten-week program, which begins at the same time as the University's general summer program and continues two weeks beyond it, is held each summer. Intensive instruction is offered, on three different levels, in both Chinese and Japanese. The intensive courses provide the equivalent in instruction to regular academic-year courses. (See courses Chinese 5, 25, 105, Japanese 5, 25, and 105 as described below.) For detailed information about these and other aspects of the summer program, apply directly to the Department of Asian Languages, preferably before the end of the preceding Winter Quarter.

COURSES NOT REQUIRING KNOWLEDGE OF AN ASIAN LANGUAGE

All courses (DR:H) unless noted otherwise.

42. Haiku—Seminar for Freshmen—The class will read and discuss representative Japanese haiku from the 16th century to the present. Works of Bashō, Buson, Issa, and other major poets will be treated in English translation. Students will exchange their interpretations of individual poems in class, collectively trying to reach for the ultimate meaning of each. Aspects of traditional Japanese philosophy and aesthetics will be touched on in the course of discussions.

3 units, Aut (Ueda) given 1982-83

46. Philosophical Chinese—(Same as Philosophy 46.) Introduction to classical Chinese and to Chinese philosophical concepts, through study of short philosophical texts and translations; for students who have had no previous work in a Far Eastern Language. Philosophers treated will include Confucius, Mencius, Hsū Tzu and Lao Tzu. This course is self-contained and does not assume that the student will do further work in the subject.

4 units, Win (Nivison) MWF 10

47. Philosophical Chinese—(Same as Philosophy 47.) Continuation of 46. Reading in Mencius and Han Fei Tzu.

4 units, Spr (Nivison) MWF 9

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 politi-
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.
5 units, Win (Duus and Van Slyke) MTWTh 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.
5 units, Spr (Duus and Staff) MTWTh 10

110 (257). Japanese-Western Literary and Cultural Interaction—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 257, in which case they will be required to do additional work.
4 units, Win (Ueda) given 1981-82

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. (DRA)
5 units, Win (Befu) given 1981-82

131. Chinese Poetry and Drama in Translation—Readings in traditional Chinese poetry and drama with emphasis on genre, theme, and style.
4 units, Aut (Liu) MWF 11

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. (Students who need to take this course to fulfill requirements may take 176 instead.)
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 (Staff) MTWTh 10

137. Japanese Literature in Translation—the Middle Period—An introduction to the major works of prose, poetry, and the theater from the Muromachi through the Tokugawa periods (1330-1868).
4 units, Win (Matisoff) MW 1:15-2:30

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 (Staff) MWF 1:15

142. Chinese Philosophy from Han through Sung—(Same as Philosophy 122.) Buddhism in China will be reviewed in this course but not treated in depth. Special attention will be given to the “Neo-Confucians” Ch’eng I, Ch’eng Hao, and Chu Hsi.
4 units, Spr (Nivison) MWF 1:15-2:30

143 (243). The Philosophy of Wang Yang-ming (1472-1529)—(Same as Philosophy 123.)
4 units, Spr (Nivison) given 1981-82

4 units, Spr (Nivison) given 1982-83

151. Chinese History in Translation—(Same as History 196.) A survey of the various modes of historical literature from earliest times, the development of historical consciousness and comparisons with other traditions. (DRA)
4 units, Win (Dien) MWF 1:15

152. Nomad Empires 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. (DRA)
5 units, Spr (Dien) MTWTh 1:15

154 (254). Undergraduate Colloquium: The Middle Period in Chinese History—(Same as History 294/394.) This course deals with the central social, political and economic developments of medieval China. Comparative dimensions will be pursued when possible, both within and beyond the bounds of Chinese history. Prerequisite: 91 or History 192A or their equivalents. (Graduate students may register under 254 in which case they will be required to do additional work.)
5 units, Win (Dien and Kahn) M 2:15-4:05
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) given 1981-82

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, Spr (VanderKamp) given 1981-82

179 (279). Classical Japanese Drama—The development of Japanese drama from pre-nō popular and ritual forms through nō, puppet theatre and kabuki. Readings will include works in translation from all three genre, but the greatest emphasis will be given to nō. Plays will be treated both as dramatic literature and in terms of performance. (Graduate students may register under 279, in which case they will be required to do additional readings in Japanese.)
4 units, Spr (Matisoff) given 1981-82

182 (282). Japanese Popular Religious Literature—Reading of literary works important for the religious consciousness they reflect or the function they served in spreading popular faith. Principal subjects will include miracle tales, medieval epic, nō plays, the poetry of Saigyō and Bashō, and one or two modern novels. (Graduate students may register under 282 in which case they will be required to do additional readings in Japanese.)
4 units, Aut (Matisoff) given 1981-82

197. Images of Women in Modern Japanese Literature—A study of modern Japanese novels that feature women performing various social roles. The novels, read in English translation, will include The Makioka Sisters by Tanizaki, The Setting Sun by Dazai, After the Banquet by Mishima, The Woman in the Dunes by Abe, and others.
4 units, Aut (Ueda) given 1981-82

254. Graduate Colloquium: The Middle Period in Chinese History—(Same as 154 and History 294/394 with additional work required.)
5 units, Win (Dien and Kahn) M 2:15-4:05

255B. Chinese and Western Theories of Literature—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, Win (Liu) T 2:15-4:05

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.
(DRX)
1. 5 units, Aut (Kao and Shou)
Section 1 MTWThF 9
Section 2 MTWThF 10
Section 3 MTWThF 1:15

2. 5 units, Win (Shou and Staff)
Section 1 MTWThF 9
Section 2 MTWThF 10
Section 3 MTWThF 1:15

3. 5 units, Spr (Shou and 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. (DRX)
1 to 2 units, Spr (Chuang) TTh 1:15

81, 82, 83. First-Year Cantonese—Conversation, grammar, reading and writing of the
most commonly used Chinese dialect outside China. (DR:X)

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 (Nivison) by arrangement
113. 5 units, Spr (Nivison) by arrangement

111A, 112A, 113A. Introduction to Classical Chinese—This course is intended for students who, in the judgment of the department, need some knowledge of classical Chinese but do not have or need the preparation usually expected in modern Chinese. Consent of the instructor and the chairman required.

111A. 3 units, Aut (Nivison) by arrangement
112A. 3 units, Win (Nivison) by arrangement
113A. 3 units, Spr (Nivison) by arrangement

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) given 1981-82
132. 2 units, Win (Kao) given 1981-82
133. 2 units, Spr (Kao) given 1981-82

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

211, 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.

211.5 units, Aut (Dien) MWF 9
212.5 units, Win (Dien) MWF 9
213.5 units, Spr (Dien) MWF 9

221. Historical Narration.

5 units, Aut (Dien) MWF 1:15

222. Philosophical Texts.

5 units, Win (Nivison) MWF 1:15

223. Literary Essays.

5 units, Spr (Liu) 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) given 1981-82

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 (Liu) 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 (Liu) 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 (Liu) MWF 10

263. T'ang and Sung Lyrics—Selected readings in the songs (tz'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 1981-82
264. Yuan and Ming Songs—Selected readings in the songs (san-ch’u) 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 1981-82

265. Chinese Critical Texts—Readings in traditional Chinese literary criticism. Prerequisite: 223 or consent of instructor.
4 units, Win (Liu) given 1981-82

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 1981-82
272. 4 units, Win (Wang) given 1981-82

273. Chinese Drama—Selected readings in dramatic works of the Yuan, Ming, and Ch’ing periods, with emphasis on literary rather than theatrical qualities. Prerequisite: 113 or consent of instructor.
4 units, Spr (Wang) TTh 11-12:15

276. Chinese Myths, Legends, and Folktales—(Same as 176 with additional work requiring knowledge of the language.)
4 units, Spr (Wang) given 1981-82

299. Dissertation. (Staff) by arrangement

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 MTWThF 9
Section 2 MTWThF 1:15
2. 5 units, Win (Sakamoto, Nebrig)
Section 1 MTWThF 9
Section 2 MTWThF 1:15
3. 5 units, Spr (Sakamoto, Nebrig)
Section 1 MTWThF 9
Section 2 MTWThF 1:15

5. Intensive First-Year Modern Japanese—Equivalent to 1, 2, and 3 combined. (DR:X)
12 units, Sum (Staff) MTWThF 8-12

6, 7, 8. Elementary Modern Japanese (I)—Same as First-Year Modern Japanese, but proceeds at a slower pace. The course is recommended for students whose schedules do not permit them to invest five hours a week, or whose interest in Japanese is still tentative. (DR:X)
6. 3 units, Aut (Sakamoto) MWF 11
7. 3 units, Win (Sakamoto) MWF 11
8. 3 units, Spr (Sakamoto) MWF 11

9, 10, 11. Elementary Modern Japanese (II)—Continuation of Elementary Modern Japanese (I). Students who complete this course are qualified to advance to Second-Year Modern
Japanese or Intermediate Conversation. Prerequisite: 8 or equivalent. (DR:X)

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<th>Term</th>
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<tbody>
<tr>
<td>3</td>
<td>Aut</td>
<td>Sakamoto and Nebrig</td>
<td>1981-82</td>
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<tr>
<td>3</td>
<td>Win</td>
<td>Sakamoto and Nebrig</td>
<td>1981-82</td>
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<tr>
<td>3</td>
<td>Spr</td>
<td>Sakamoto and Nebrig</td>
<td>1981-82</td>
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21, 22, 23. Second-Year Modern Japanese — Further instruction and practice in conversation, grammar, reading, and composition. Prerequisite: 3 or equivalent.

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<th>Days and Time</th>
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<td>Kubota</td>
<td>MTWThF 9</td>
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<tr>
<td>5</td>
<td>Win</td>
<td>Kubota</td>
<td>MTWThF 9</td>
</tr>
<tr>
<td>5</td>
<td>Spr</td>
<td>Kubota</td>
<td>MTWThF 9</td>
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25. Intensive Second-Year Modern Japanese — Equivalent to 21, 22, and 23 combined. Prerequisite: 3 or equivalent.

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<th>Unit</th>
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<th>Days and Time</th>
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<tbody>
<tr>
<td>12</td>
<td>Sum</td>
<td>Staff</td>
<td>MTWThF 8-12</td>
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27, 28, 29. Conversation I — Prerequisite: 3 or consent of instructor. (DR:X)

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<th>Unit</th>
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<tr>
<td>2</td>
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<tr>
<td>2</td>
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<td>TTh 1:15</td>
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<tr>
<td>2</td>
<td>Spr</td>
<td>Sakamoto</td>
<td>TTh 1:15</td>
</tr>
</tbody>
</table>

ADVANCED

101, 102, 103. Modern Written Japanese — Reading texts representative of various modern written styles. Prerequisite: 23 or equivalent.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Aut</td>
<td>Kubota</td>
<td>MWF 11-12:15</td>
</tr>
<tr>
<td>5</td>
<td>Win</td>
<td>Kubota</td>
<td>MWF 11-12:15</td>
</tr>
<tr>
<td>5</td>
<td>Spr</td>
<td>Kubota</td>
<td>MWF 11-12:15</td>
</tr>
</tbody>
</table>

105. Intensive Modern Written Japanese — Equivalent to 101, 102, and 103 combined. Prerequisite: 23 or equivalent.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Sum</td>
<td>Staff</td>
<td>MTWThF 9-12</td>
</tr>
</tbody>
</table>

121, 122, 123. Conversation II — Prerequisite: 23 or consent of instructor. (DR:X)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Aut</td>
<td>Kubota</td>
<td>TTh 1:15</td>
</tr>
<tr>
<td>2</td>
<td>Win</td>
<td>Kubota</td>
<td>TTh 1:15</td>
</tr>
<tr>
<td>2</td>
<td>Spr</td>
<td>Kubota</td>
<td>TTh 1:15</td>
</tr>
</tbody>
</table>

199. Individual Reading in Japanese — (Asian Languages majors only.) Prerequisite: 103 or consent of instructor. (DR:X)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Aut</td>
<td>Win, Spr</td>
<td>by arrangement</td>
</tr>
</tbody>
</table>

GRADUATE

200. Directed Reading in Japanese — Prerequisite: 213 or consent of instructor.

| Units to be arranged, |
| Aut, Win, Spr (Staff) by arrangement |


<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Aut</td>
<td>Matisoff</td>
<td>given 1981-82</td>
</tr>
<tr>
<td>5</td>
<td>Win</td>
<td>Staff</td>
<td>given 1981-82</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Aut</td>
<td>Arahari</td>
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</tr>
<tr>
<td>5</td>
<td>Win</td>
<td>Staff</td>
<td>MW 11-12:15</td>
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<tr>
<td>5</td>
<td>Spr</td>
<td>Staff</td>
<td>MW 11-12:15</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
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<td>Staff</td>
<td>TTh 2:15-4:05</td>
</tr>
<tr>
<td>5</td>
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<td>TTh 2:15-4:05</td>
</tr>
<tr>
<td>5</td>
<td>Spr</td>
<td>Staff</td>
<td>TTh 2:15-4:05</td>
</tr>
</tbody>
</table>

250. Introduction to Kambun — Selected readings from a variety of Japanese works written in Kambun, ranging from Kaifūsō to Yoshida Shōin’s diary. Offered when there is sufficient demand.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Spr</td>
<td>Ueda</td>
<td>given 1981-82</td>
</tr>
</tbody>
</table>

256. Readings in Japanese Culture — Reading and discussion of articles on the identity of Japanese culture. The articles will be chosen from the works of prominent essayists, social critics, anthropologists, sociologists, and scholars in a wide variety of other fields. Prerequisite: one quarter of Advanced Modern Japanese or consent of instructor. Taught in Japanese.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Aut</td>
<td>Ueda</td>
<td>given 1981-82</td>
</tr>
</tbody>
</table>

257. Japanese-Western Literary and Cultural Interaction — (Same as 110 with additional work requiring knowledge of the language.)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Win</td>
<td>Ueda</td>
<td>given 1981-82</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Term</th>
<th>Instructor</th>
<th>Days and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Win</td>
<td>Staff</td>
<td>W 2:15-4:05</td>
</tr>
</tbody>
</table>
278. Japanese Poetry from Manyōshū to Shin-kokinshū (759-1206)—(Same as 178 with additional readings in the original Japanese.) Pre-requisite: 247 or equivalent.
   4 units, Spr (Staff) M 2:15-4:05

279. Classical Japanese Drama—(Same as 179 with additional work requiring knowledge of the language. Prerequisite: 247 or equivalent.)
   4 units, Spr (Matisoff) given 1981-82

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

296. Readings in Modern Japanese Literature—Reading and discussion of works selected from contemporary authors. Prerequisite: 213 or equivalent. May be repeated for credit.
   4 units, Aut (Matisoff) given 1981-82

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

300. 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

Committee in Charge: Arthur B.C. Walker, Jr., Chairman; Ronald N. Bracewell, Von R. Eshleman, Vahe Petrosian, John R. Spreiter, Peter A. Sturrock, Robert V. Wagoner, John M. Wilcox, Clifford M. Will

Professors: Ronald N. Bracewell (Electrical Engineering), Von R. Eshleman (Electrical Engineering), Vahe Petrosian (Applied Physics), John R. Spreiter (Mechanical Engineering and Aeronautics and Astronautics), Peter A. Sturrock (Applied Physics), Robert V. Wagoner (Physics)

Associate Professors: Arthur B.C. Walker, Jr. (Applied Physics)

Adjunct Professor: John M. Wilcox (Applied Physics)

Assistant Professor: Clifford M. Will (Physics)

Lecturers: Philip H. Scherrer (SEL), Gordon Emslie (SEL)

STATEMENT OF PURPOSE

Although Stanford University presently does not have a degree program in Astronomy or Space Science, teaching and research in various branches of these disciplines is an ongoing activity in several departments (Aeronautics and Astronautics, Applied Physics, Electrical Engineering, Physics). For the convenience of students interested in the general areas of astronomy, astrophysics, cosmology and space science, a course program for undergraduate and graduate study is listed below.

The program is especially committed to providing introductory courses for the student who wishes to be informed about the field of astronomy without the need for prerequisites beyond high school algebra and physics; Astronomy 15 and 50 are designed to serve this group of students.

The Astronomy 100 series serves the student interested in an initial scientific study of astronomy.

The courses numbered 200 and above are for graduate students and advanced undergraduates, subject to prior approval by the course instructor.

UNDERGRADUATE PROGRAMS OF STUDY

The University does not offer a separate undergraduate major in astronomy. Students who
GRADUATE PROGRAMS OF 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; 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. Students planning study in astronomy beyond the B.S., are urged to consider an undergraduate thesis (Astronomy 190).

15. Topics in Modern Astronomy—The following two courses 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.

- Cosmic Evolution—(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

16. The Nature of the Universe—(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, Spr (Wagoner) TTh 2:15 discussion T 3:15

50. 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. In addition to the introductory material described above, the lecture series will discuss present models of the solar system, stars and stellar associations, binary stars, the interstellar
Astronomy Program

Medium, diffuse nebulae and extragalactic objects.

3 units, Aut (Staff) lecture T 4:15, laboratory by arrangement (DR:T)

100. Introduction to Observational Astronomy and Astronomy Laboratory—(Enroll in Applied Physics 100.) This course is intended to provide the student of physical science or engineering with a comprehensive introduction to observational techniques in astronomy, including conventional optical and infrared observations, radio astronomy techniques, spacecraft techniques for observations in the ultraviolet, x-ray and gamma-ray bands of the electromagnetic spectrum, and in situ measurements of charged particles. Emphasis will be placed on measurement of fundamental astronomical parameters such as distance, temperature, mass and composition of stars. The lectures will be combined with observations at the Stanford Student Observatory where students will perform a series of fundamental observations using the 16-inch telescope and learn to identify spectra of various classes of stars. Prerequisites: one year of physics or concurrent registration in Physics 29, 57 or 63.

4 units, Spr (Walker) lecture M 3:15, laboratory by arrangement


3 units, Aut (Emslie) MWF 1:15-2:05, alternate years, given 1980-81

102. Astronomy Laboratory and Observational Astronomy—The Astronomy Laboratory course has been split into two sections: Astronomy 50, which has no prerequisites and Astronomy 100, which is intended to appeal especially to students of physical science and engineering.

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 (Sturrock) TTh 2:15-3:30


3 units, Aut (Scherrer) MWF 1:15-2:05 alternate years, given 1981-82


3 units, Spr (Petrosian) MW 1:15-2:30

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)

150A. 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 50. Open to qualified graduates and undergraduates on consent of the instructor. (DR:T)

150A. 3 units, Aut (Staff) lecture M 4:15 laboratory by arrangement, alternate years, given 1980-81
190A, B, C. Independent Study in Astrophysics and Honors Thesis—Students enrolled in this course will undertake a detailed study of a selected problem in astrophysics with an individual faculty member or with several faculty members. Due to limitations of time, students are encouraged to select projects which examine a problem from a theoretical viewpoint, or which make use of existing data to provide a fresh insight into the problem. Projects involving the construction of apparatus or the acquisition of new data will be considered on an individual basis. While not all projects will require 3 quarters, the sequence outlined below is intended to suggest a format which most projects are expected to follow. Projects may commence in any quarter.

(Petrosian, Sturrock, Walker, Wilcox) (DR:T)

190A. Selection of the Problem—During this quarter the student should select the problem to be studied and develop the theoretical apparatus or initial interpretation of observational data required for the study of the selected problem. Students will be asked to prepare a detailed description of the problem and its background and a comprehensive discussion of the work planned in the subsequent two quarters.

3 units, Aut (Staff) by arrangement

190B. Continuation of Project—During this quarter the student should substantially complete the required computations or data analysis for the research project selected.

3 units, Win (Staff) by arrangement

190C. Completion of the Project—During this quarter the student should complete the research project and write a detailed paper presenting the methods used and results of the research program.

3 units, Spr (Staff) 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, Aut (Petrosian) by arrangement, alternate years, given 1981-82


3 units, Spr (Sleep) TTh 10-11:30

222. Classical Gravitation—(Enroll in Physics 222.)

3 units, Spr (Staff) alternate years, given 1980-81

227. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)

3 units, Spr (Spreiter) TTh 2:45-4 alternate years, given 1981-82

279A. Space Mechanics—(Enroll in Aeronautics and Astronautics 279A.)

3 units, Win (Breakwell) TTh 9:30-10:45

279B. Advanced Space Mechanics—(Enroll in Aeronautics and Astronautics 279B.)

3 units, Spr (Breakwell) MWF 10 alternate years, given 1980-81

348. Ionospheric Processes—(Enroll in Electrical Engineering 348.)

3 units, Spr (Waterman) alternate years, given 1981-82

350. Radioscience Seminar—(Enroll in Electrical Engineering 350.)

1 unit, Aut, Win, Spr (Lusignan)

352. Wave Propagation in the Ionosphere and Magnetosphere—(Enroll in Electrical Engineering 352.)

3 units, Spr (Helliwell) alternate years, given 1980-81

354. Introduction to Radio Wave Scattering—(Enroll in Electrical Engineering 354.)

3 units, Spr (Tyler)

alternate years, given 1981-82

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 1980-81


3 units, Win (Petrosian) MWF 11 alternate years, given 1980-81
366. Cosmology and Extragalactic Astrophysics—(Enroll in Applied Physics 366.)
   3 units, Win (Petrosian) MWF 11
   alternate years, given 1981-82

368, 369. Gravitation—(Enroll in Physics 368, 369.)
   368. 3 units, Aut (Will) MF 11-12:30
   alternate years, given 1981-82
   369. 3 units, Spr (Witt) MF 11-12:30
   alternate years, given 1981-82

370E. High-Energy Particles in Astrophysics—(Enroll in Applied Physics 370E.)
   Review of observational data concerning high-energy particles (cosmic rays) in the Galaxy and
   in the heliosphere. Inferences concerning the role of high-energy particles in pulsars, quasars
   and other objects. Theories of acceleration and propagation of high-energy particles. Pre-
   requisite: Consent of instructor.
   3 units, Aut (Sturrock) by arrangement

The following seminars will be offered in future years by members of the Astronomy Program.

370A. Astrophysics Seminar: Supernovae, Supernova Remnants, Neutron Stars and Pul-
sars

370B. Astrophysics Seminar: Galactic and Ex-
tragalactic X-Ray and EUV Astronomy

370C. Astrophysics Seminar: The Interstellar
Medium and Stellar Evolution

370D. Astrophysics Seminar: Peculiar Stars

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**BIOLOGICAL SCIENCES**


Chairman: Robert T. Schimke
Associate Chairman: Marcus W. Feldman
Director of Undergraduate Studies: H. Craig Heller
Director of Graduate Studies: David D. Perkins


Charles Yanofsky. By Courtesy: Olle E. Bjorkman, David C. Fork

Associate Professors: H. Craig Heller, Jonathan Roughgarden, Robert D. Simoni, Frank E. Stockdale, Ward B. Watt

Adjunct Professor: Donald H. Perkel

Assistant Professors: Corey S. Goodman, Patricia P. Jones, Stuart H. Thompson. By Court-
esy: Joseph A. Berry, William F. Thompson

Senior Lecturers: Marcia K. Allen, Charles H. Baxter

*Directors of Systematic Collections:* Paul R. Ehrlich (Entomological Collections), John H. Thomas (Dudley Herbarium)

**OFFERINGS AND FACILITIES**

The department of Biological Sciences comprises facilities and personnel housed in Herrin Laboratories, Herrin Hall, and the Jasper Ridge Preserve on the campus; and at 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 in Biological Sciences at Stanford.

The Jasper Ridge Biological Preserve is a 1,300-acre reserve on the campus for physi-
ological, ecological and population studies.

Special laboratory facilities for marine re-
search are described in the Hopkins Marine Station Bulletin.

The department’s large collections of plants (Dudley Herbarium), fishes, reptiles, and amph-
ibians, as well as smaller collections of birds, mammals, and invertebrates are now housed at the California Academy of Sciences in San Fran-
cisco, 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 gen-
eral 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 Hop-
kins 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>
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<tbody>
<tr>
<td>Biology 40</td>
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</tr>
<tr>
<td>Biology 41</td>
<td>4</td>
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<td>Biology 42</td>
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<tr>
<td>Biology 43</td>
<td>4</td>
</tr>
<tr>
<td>Biology 44xy</td>
<td>6</td>
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</table>

Total 23 units

(2) Elective Courses

<table>
<thead>
<tr>
<th>Electives</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core and Electives</td>
<td></td>
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</tbody>
</table>

Total 41 units

Elective courses may be selected from the offerings in the Department of Biological Sciences and 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 175H, 178, 199, 199H, may be applied toward the total number (41) of required biology units.

(3) Cognate Courses

Required courses in cognate fields include:

(a) Introductory, organic, and physical chemistry, with laboratory.

(b) A half year (two quarters) of General Physics

(c) Mathematics through Calculus

(d) One additional course in Mathematics, Statistics, or Computer Science

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:

(a) Chemistry 31, 33, 35, 36, 131, 130 or 132, 135

(b) Mathematics 19, 20, 21, or 41, 42

(c) Physics 21, 23 or 51, 53, 55

(d) Mathematics 44 or beyond; or

Biology 141, Psychology 60, or Statistics 60 or beyond; or

Computer Science 105 or 106

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 advised to take the yearlong Physics sequence Physics 21, 23, 29 (or Physics 51, 53, 54, 55, 56, 57, 58). It is 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 recommended that students take at least one additional course in statistics and probability.

TYPICAL SCHEDULE FOR A FOUR-YEAR MINIMUM PROGRAM

FIRST YEAR

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31, 33, 35, 36.</td>
<td>4</td>
</tr>
<tr>
<td>Math 19, 20, 21. Calculus and Analytic Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Writing &amp; Distribution Requirements or Electives</td>
<td>8</td>
</tr>
</tbody>
</table>

Totals 15 15 16

SECOND YEAR

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology 40. Principles of Biology</td>
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<tr>
<td>Biology 41. Principles of Biology</td>
<td>—</td>
</tr>
<tr>
<td>Biology 42 and 43. Principles of Biology</td>
<td>—</td>
</tr>
<tr>
<td>Biology 44. Core Experimental Laboratory</td>
<td>—</td>
</tr>
<tr>
<td>Chem. 131, 130 or 132, 135. Organic &amp; Physical Chemistry</td>
<td>8</td>
</tr>
<tr>
<td>Writing &amp; Distribution Requirements or Electives</td>
<td>3</td>
</tr>
</tbody>
</table>

Totals 16 15 16
### 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, with a minimum letter grade equivalent of 3.0 in biology core, electives, and cognate courses, leads to graduation with "Departmental Honors." This designation appears on the student's transcript and in the Commencement Program. An Honors notation is made on the student's diploma. (See Biology 199 under "Courses.")

### PREMEDICAL, PREDENTAL, AND PREPARAMEDICAL REQUIREMENTS

It is recommended that premedical, preprofessional and preparamedical students who are not biology majors take at least the following courses in biology: 40, 41, 42, 43, 44XY, 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 yearlong 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 44X,Y. 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 Administrator, 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 Administrator, 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 9 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. The deadline for receipt of applications with all supporting materials is June 1. 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. Reading knowledge of a foreign language is recommended.

**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 initiative in applying for predoctoral national fellowships in open competition, especially those from the National Science Foundation, and to consult their Financial Aid Officers for information and applications.

Students who have had their undergraduate training in biology at Stanford are ordinarily encouraged to undertake graduate study elsewhere to ensure breadth of experience. Printed information regarding choice of a graduate school can be obtained from the Biology Bridge 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, Medical Microbiology, Pharmacology, Structural Biology, Biochemistry, Neurological Sciences. Students interested in these areas should contact the appropriate department.

An admissions officer is required to conform to the requirements of the University as outlined in the "Degrees" section in this bulletin and to the department requirements stated below.

**Courses Required of all Ph.D. Candidates**—Each student must take at least three units of work as a graduate under each of four or more Stanford faculty members. Course work to be taken will be determined in consultation with an advising committee. All first year graduate students in the Ph.D. program are required to take 1-3 units of 301 each quarter of the first year with the Biology faculty.

**Teaching Experience and Training** are part of the graduate curriculum. Each student assists in teaching eight units, 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 Advising Committee**—At the time of admission, each incoming graduate student is assigned an advising committee, consisting of three faculty members. The advising committee meets with each student directly after arrival to plan an integrated first year program, taking into due consideration the student's needs in the area of specialization, and his or her deficiencies both in the specialty and outside. Preferably at the end of Spring Quarter of the first year, and in any case no later than the beginning of the second year, the advising committee meets with the student to plan academic aspects of the second year, and to select a dissertation committee. The advising
committee continues to function until a dissertation committee (including the prospective major professor) has been chosen. This choice should be completed no later than the beginning of the second year.

The Dissertation Committee and the Departmental Oral Examination—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 automatically leads to departmental certification for admission to 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 reading knowledge of a modern scientific language (ordinarily French or German) is recommended at the time of entry. If an entering student is deficient, the advising committee and the student should carefully weigh the value of language study vs. other needs, and decide whether further study of a foreign language should be undertaken.

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 childbearing 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.
photosynthesis, intermediary metabolism and regulation of metabolism, hormonal control of enzyme activity, genome structure, procaryotic genetics, gene transfer mechanisms, genome replication, DNA repair, genetic fine structure, mutagenesis, protein synthesis, genetic code, regulation of gene expression, recombinant DNA techniques, regulation of gene expression in eucaryotes.

4 units, Win (Simoni, Yanofsky) MTWTh lecture, F discussion 10

42. Cell and Developmental Biology—Intermediate level course covering the cellular, developmental, and molecular biology of eucaryotes. Topics will include the structure and function of organelles, chromosome structure and replication, the cell cycle, regulation of eucaryotic gene expression, and basic concepts in determination, differentiation, and morphogenesis.

4 units, Spr (Jones, Schimke) MTWTh 10

43. Organismal Biology—Intermediate level survey of the structure and function of organs and organ systems of plants and animals. We shall examine the physico-chemical principles underlying the exchanges of mass and energy between organisms and their environments. Then the organ and organ system adaptations which have evolved in response of these principles will be discussed. A major theme will be the mechanisms by which the functions of each system are controlled and regulated.

4 units, Spr (Heller, Ray) MTWTh lecture, F discussion 9

44. Core Experimental Laboratory—The intent of these laboratory exercises is to familiarize the students with an experimental approach to biology and to provide a working familiarity with some 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 weeks, including a discussion section each week. Since it will be conducted as an open laboratory, working times will be determined by individual students. The course is designed to be taken concurrently with or subsequent to Biology 40, 41, 42, 43. Biology 44X and 44Y are required for a major in Biology. Prerequisites: Chemistry 31, 33, 35, 36. Grading is mandatory Pass/No Credit.

44X. 3 units, Win (Woodward) Discussions (Staff)
T 1:15-3:05, T 3:15-5:05, T 7:00-9:00 p.m., W 1:15-3:05, W 3:15-5:05, Th 1:15-3:05, Th 3:15-5:05, Th 7:00-9:00 p.m., F 1:15-3:05

44Y. 3 units, Spr (Woodward)
Discussions (Staff)
T 1:15-3:05, T 3:15-5:05, T 7:00-9:00 p.m., W 1:15-3:05, W 3:15-5:05, Th 1:15-3:05, Th 3:15-5:05, Th 7:00-9:00 p.m., F 1:15-3:05

45. Research Biology—This course is designed to allow students who have taken Biology 44X and 44Y to pursue specific experiments in greater detail. This is also designed as a possible entry into an honors project.

3-5 units, Aut (Woodward) discussion Th 2-4

51. Scientific Philosophy and Bioethics—The philosophy of science is analyzed from various perspectives (e.g., philosophy, science, politics, society). These perspectives are treated from historical as well as contemporary considerations. Much of the emphasis leans toward analyses of bioethical controversies and how these relate to the philosophy and practice of science today. (DR:X)

3 units, Aut (Woodward) MWF 11

94. General Botany—The diversity of plant groups is considered, with a brief introduction to the structure, development, physiology, and ecology of higher plants. Prerequisite: 40.

4 units, Aut (Fultz, Green, Holm, Mooney, Ray, and Thomas) MWF 11, lab T or W 2:15-5:05

UPPER DIVISION COURSES

Prerequisites: The upper-division course descriptions refer to prerequisite courses from the core sequence by their new numbers. For students who took the core courses prior to 1980-81, the following equivalencies pertain: 40 is equivalent to former 1 and 23; 41 is equivalent to the former 21; 42 is a new course; 43 is equivalent to the former 22; and 44 XY is the equivalent of the former 24 YZ.

100H. Marine Algae—See Hopkins Marine Station.

105H. Subtidal Communities—See Hopkins Marine Station.

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, particularly in simple organisms, will also be covered. Prerequisites: 42 or Human Biology 2A and 3A, college math, some physics is involved in the analysis.

3 units, Spr (Green) MWF 10

108. Organismal Development—A study of those processes responsible for development of multicellular organisms. Morphogenesis, cyto-
differentiation, growth control, and regulatory phenomena will be discussed. Prerequisite: Biology core, or Human Biology core.

3 units, Spr (Wessells) MWF 9

109. Neuronal Development—A study of the development of the nervous system at the cellular level, including the proliferation, determination, and differentiation of neurons, the formation of synaptic connections, cell death, and the modification of neurons and synapses during maturation. Some topics in cellular neurobiology will be covered. Prerequisites: Biology core and Psychology 107, or Biology 166H, or Neurobiology 200 (neurobiology component), or consent of instructor.

4 units, Win (Goodman) MWF 9

110. Vertebrate Biology—Structure, function, behavior, and evolution of vertebrates. Prerequisites: Biology core, or Human Biology core.

3 units, Aut (Wessells) MWF 9

110L. Vertebrate Biology Laboratory—Dissection of selected vertebrates. Pass/No Credit only. Prerequisites: same as for 110.

2 units, Aut (Staff and Wessells) labs. TTh 1:15-5:05; W 7-11 p.m.

111H. Marine Invertebrates—See Hopkins Marine Station.

112H. Marine Invertebrates—See Hopkins Marine Station.

113H. Introduction to Oceanic Biology—See Hopkins Marine Station.

124. Plant Adaptations—The physiological ecology of plants of diverse environments. Prerequisites: 40 and 43.

4 units, Win (Mooney) TTh 11; field trips by arrangement, alternate years, given 1981-82

125. Ecosystems of California—Principles of ecosystem function with emphasis on vegetation components and on California systems. Prerequisite: 40, or Human Biology 4A. (DR:X)

4 units, Win (Mooney) TTh 11; field trips by arrangement, alternate years, given 1980-81

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.

3 units, Win (Page) TTh 2:15-4:05
periodism, phototropism, vision, photoinactivation and recovery. Prerequisites: 40, 41, 42, 43.

3 units, Win (Briggs and Hanawalt) TTh 11, alternate years, given 1980–81

141. Biostatistics—An introduction to the statistical analysis of biological data. Lectures, discussion and student exercises.

3 units, Win (Feldman) MWF 3:15-4:05

142. Computational and Mathematical Models of Biological Systems—Mathematical frameworks and computer techniques for constructing dynamic models of biological systems. Deterministic and stochastic models; continuous-time and event-centered simulation techniques; matrix applications; parameter estimation, sensitivity calculations, and validation of models. Examples from population dynamics, enzyme kinetics, physiological regulatory systems, neural systems, and other areas of biology. Individual term projects drawn from student's field of special interest. 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

156. Plant Physiology—Principal functions of green plants, including photosynthesis, gas exchange, water and nutrient transport, mineral metabolism, growth, and environmental responses. Prerequisites: 41, 42, 43, 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: 40, 43.

3 units, Aut (Holm) TTh 11, alternate years, given 1980–81

162. Biogeography—Survey of major principles of ecological and historical geography of plants and animals. Prerequisite: 40.

3 units, Aut (Holm) TTh 11, alternate years, given 1981–82

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, 164, 165, which may be taken in any order. Prerequisites: 43 or Psychology 107, or 108, or 109 is recommended.

4 units, Win (Wine) MWF 10, alternate years, given 1981–82


3 units, Aut (Heller) MWF 8, alternate years, given 1980–81

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: 40 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, Aut (Heller) 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 1980–81

170. Microscopy for Biologists—A broad survey of the methods which use light and other radiation (electrons, X-rays) for the analysis of cells in biological and medical research. Topics range from cell sorters and holography through polarized light and electron microscopy. The lectures cover the physical principles (presented primarily at the graphical level of high school physics). The laboratory involves partial construction and extensive use of pertinent instruments. Campus laboratories, developing advanced optical techniques for biology, will be visited. Prerequisites: 41, 42, 43, 44XY.

3 units, Aut (Green) TTh 1:15; lab T or Th 2:15-5:05

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 labora-
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 1980–81

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: 40, 41, 42, 43, or consent of instructor. 4 units, Spr (Watt) MTh 2:15; lab T 1:15-5:05; alternate years, given 1980–81

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: 40 or Human Biology 3A and consent of instructor. 3 units, Spr (Ehrlich) M 2:15-4:05; alternate years, given 1981–82

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: 40 or Human Biology 3A. 3 units, Spr (Ehrlich, Holm) M 2:15-4:05; alternate years, given 1980–81

187. Topics in Epizootiology—Lectures, discussions, and readings on the effects of particular diseases on infra-human animal populations. Prerequisite: 40 or consent of instructor. 3 units, Spr (Regnery) TTh 10

190. Population Biology of Butterflies—Lectures will focus on field studies of the dynamics and genetics of butterfly populations, life histories, and resource utilization. Also covered will be the evolution and taxonomy of this group of insects which has become a key research tool in population biology. Lab will include field work on *Euphydryas* populations now under study, both on campus and elsewhere in California. Prerequisites: 40 and consent of instructor. 3-5 units, Spr (Ehrlich) W 2:15-4:05 plus lab by arrangement

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

199. Special Problems—Individual study on research or directed reading undertaken by arrangement with biology department instructor. Successful completion of a minimum of 10 units of “Special Problems” may be applied towards graduation with Departmental Honors, if so desired. Entry into the Honors Program requires submission of a petition to the Committee on Undergraduate Studies. Forms are available in the departmental Student Affairs Office. 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. 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 departmental Library and in the University Archives. See unit limitation under “Bachelor of Science Course Requirements.” (DRX)

199H. Special Problems—See Hopkins Marine Station.

199X. Special Problems—(Same as 199.) To be used for out-of-department instructors. For Biology majors only.

**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: 41 and/or consent of instructor. 3 units, Spr (Hanawalt, Friedberg, K.C. Smith) TTh 1:15; alternate years, given 1981–82
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 1980-81 will be eukaryote chromosome rearrangements. Prerequisites: 166, 167 or equivalent, and consent of instructor.

2 units, Aut (Perkins) M 2:15-3:05

211. Advanced Topics in Membrane Biochemistry—Structure, function, and biosynthesis of cellular membranes and organelles. The course will be based on the current literature and will require extensive student participation. Prerequisites: Biochemistry 200-201 or equivalent experience in biochemistry and molecular biology, as well as consent of instructors.

4 units, Spr (Rothman, Simoni) TTh 10-12 alternate years, given 1980-81

213. Viruses—Principles of virus growth, genetics, architecture and assembly. Relation of temperate viruses and other epistomes to the host cell. Prerequisite: 21 (or 41).

3 units, Win (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: 40, 41, 42, 43, or substantial equivalents.

3 units, Win (Watt) MWF 9, alternate years, given 1981-82

221. Advanced Topics in Plant Physiology and Development—Will consider in depth currently important aspects of plant physiology such as growth and its hormonal regulation, transport phenomena, and environmental responses. Topic will vary from year to year and the course may be repeated for credit with consent of instructor. Prerequisites: 156, Biochemistry 200, or equivalents, and consent of instructor.

3 units, Spr (Briggs, Green, Ray) MW 1:15-3:15

223. Advanced 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

228. Advanced Plant Systematics—A study of selected families of flowering plants with particular attention to phylogenetic relationships. Lectures, demonstrations, and field trips. Prerequisite: 128 or consent of instructors.

4 units, Aut (Thomas, Holm) WF 1:15-3:05, alternate years, 1981-82

230. Topics in Immunology—A lecture and student discussion course for graduate and advanced undergraduate students. Introduction to the basic elements of the immune system: structure and functions of antibody molecules; cellular basis for immunity and its regulation; genetics of immune responsiveness; molecular biology of antibody genes. Prerequisites: 41, and Biochemistry 200 (can be taken concurrently) or consent of instructor.

3 units, Aut (Jones) TTh 10 plus one hour by arrangement given 1981-82

231. Field Research Methods in Physiological Plant Ecology—A discussion of the techniques used to quantify the microenvironment and gas exchange of terrestrial plants under natural conditions. In each technique the physical principles involved will be outlined and the theory of measurement given. Primary standard instrumentation will be described as well as the most commonly used instruments or methods; specifically the measurement of water contents, potentials, and fluxes will be discussed. The measurement of radiation, temperature, wind speed and the computation of leaf and soil energy balance will also be covered, as will be the methods for measuring CO2 fluxes. (DR:X)

2 units, Spr (Mooney) by arrangement alternate years, given 1980-81

232. Application of Research Methods in Physiological Plant Ecology—A two week field excursion, starting mid-June, to apply the principles given in 231 to a specific research problem. The work will be carried out at Jasper Ridge, and the Sierran Mather and Timberline Carnegie Stations. Limited enrollment. Students from Stanford will join others from U. C. Irvine, U. C. Davis, and the University of Utah for this class.

3 units, Spr (Mooney) by arrangement alternate years, given 1980-81

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 11 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, Jardetzky, Staff)
TTh 10 and Th 1:15-3:05
alternate years, given 1980-81

252. Gene Action—Lectures and student seminars on various aspects of gene structure and function and regulation of gene expression in prokaryotes. Prerequisite: Biochemistry 201.
3 units, Spr (Yanofsky) TTh 9:00-10:30
alternate years, given 1980-81

263. Regulatory Physiology—Lectures, student presentations, and discussion on organ systems' physiology. The course will be based largely on recent research literature and will stress mechanisms of control and regulation. The specific topics covered will change from year to year. Prerequisite: 43, or an equivalent course in animal physiology.
3 units, Win (Heller) TTh 9

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 1981-82


3 units, Aut (Roughgarden) TTh 11

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.

300X. Research—(Same as 300.) To be used for out-of-department instructors.

301. Current Topics in Biology—Lectures in the areas of current research interests of the faculty. Enrollment is limited to Biology Ph. D. students in their first year of graduate study.
1-3 units, Aut, Win, Spr (Biology Staff) by arrangement

315. Seminar in Biochemical Evolution—Literature review and discussion of current topics in biochemical evolution and molecular evolutionary genetics. Prerequisite: consent of instructor.
1-3 units, Spr (Watt) by arrangement
alternate years, given 1981-82

335. Seminar in Immunobiology and Immunogenetics—Literature review of current topics in immunology. Prerequisite: consent of instructor.
1-3 units, Aut, Win, Spr (Jones) by arrangement

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 selected 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

350. Seminar in Neurobiology—Literature review and current research projects and problems in neurobiology, with particular emphasis on cellular and developmental neurobiology. Prerequisite: consent of instructor.
1 unit, Aut, Win, Spr (Goodman) T 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
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

Director: Colin S. Pittendrigh
Associate Director: Donald P. Abbott
Professors: Donald P. Abbott, Isabella A. Abbott, David Epel, Daniel Mazia, Colin S. Pittendrigh
Associate Professor: Jonathan Roughgarden
Assistant Professor: Stuart H. Thompson
Senior Lecturer: Charles H. Baxter

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, 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

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

166H. Comparative Neurobiology—Principles of nervous system organization are developed from the comparative study of excitability, sensory receptors, sensory and motor systems, and integrative mechanisms with the CNS. Lectures, labs and field trips.
5 units, Aut (Thompson) MWF

175. 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. 175 is subdivided into 175A, 175B, and 175C, each 5 units. Students taking the course must register for all three parts.
5 units, Spr (D. Abbott, I. Abbott, Baxter) MTWThF 8-5

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 175 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

300H. Research—Graduate study involving original work may be undertaken with members of the staff in the fields indicated below.


D. Epel: Developmental Biology—Physiology and regulation of early embryonic development.

C. Pittendrigh: Biological Clocks—The comparative physiology of circadian and other biological clocks.

J. Roughgarden: Theoretical ecology.

S. Thompson: Neurophysiology—Neuronal control of behavior and mechanisms of ion permeation in membranes.

384H. 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.

1-3 units, Win (Roughgarden) by arrangement

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 water marine communities. Emphasis will be on local habitats and the course will introduce physical environmental parameters, community composition, aspects of the biology of constituent species and methods for subtidal studies. Prerequisites: SCUBA certification SCUBA equipment, ocean diving experience, and some back ground 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

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 postdoctoral 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

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

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.)

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—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, Jardetzky, Staff)
TTh 10 and Th 1:15-3:05 p.m., alternate years, given 1980-81

273. Magnetic Resonance in Biology—Principles and applications of High Resolution Nuclear Magnetic Resonance and other magnetic resonance techniques to problems of protein structure and macromolecular dynamics, conformational changes and transducer functions of macromolecules and the organization of membranes. Prerequisites: Chemistry 171 and 173 to consent of instructor.

3 units, Aut (Jardetzky) TTh 10 plus 1 hour by arrangement, alternate years, given 1981-82

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 will be expected to participate.

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

RELATED COURSES

Other courses recommended to Biophysics students:
Chemistry 287, 289, 291; Biological Sciences 205, 211, 252, 255; Structural Biology 211; Radiology 201.

COMMITTEE ON BLACK PERFORMING ARTS

Chairman: Sylvia Wynter (African & Afro-American Studies)

Committee in Charge: Irvin Brown (Psychology), Woodrow Myers (Resident Fellow—Ujamaa), Emey De Pradines Morse (Afro-American Studies—Dance Theatre of the Afro-Americas), Les Williams (Athletics—Black American Dance), Kim Euell, Karen Ransom and Janice O’Neil (Student Representatives)

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 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.
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 (Convener); 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 of Undergraduate Studies' 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.

PROGRAM OF STUDY

Although British Studies students 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 of Undergraduate Studies' Advisory Committee on Individually Designed Majors published in this bulletin.

In addition, the Program 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 British Studies 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*


Chairman: John I. Brauman


Associate Professors: Michael D. Fayer, Keith O. Hodgson

Assistant Professors: Steven G. Boxer, Wray Huestis

Lecturer: James E. LuValle

ENTRANCE PREPARATION

Students who intend to major in chemistry are expected to offer entrance credit in the preparatory subjects of chemistry, physics, and mathematics (including algebra and plane trigonometry). Those who do not have entrance credit or equivalent training in the foregoing subjects, particularly mathematics, may experience some difficulty in meeting the department requirements for graduation in four years, especially if they expect to pursue a program leading to professional certification by the American Chemical Society or to the B.S. degree with Honors. A year or more of secondary school preparation in German is desirable.

Advanced placement in chemistry courses, based on the College Board Advanced Placement Examination, is not available.

PROGRAMS OF STUDY

BACHELOR OF SCIENCE

MINIMUM REQUIREMENTS

University writing and distribution requirements: Mathematics 19, 20, 21, 22, 23, or 41,

* The curriculum leading to the B.S. degree in Chemical Engineering is described elsewhere in this bulletin.
42, 43; Physics 51, 53, 54, 55, 56, 57, 58; Chemistry 31, 33, 35, 36, 131, 132, 133, 134, 151, 153, 171, 173, 174, 175, 176. In addition, a reading knowledge of scientific German is strongly recommended. Premedical students majoring in chemistry may substitute Physics 21, 23, 29 for Physics 51-58 provided they also complete Biology 1, 21, 22, 23. Students interested in attending overseas campuses should consult their advisors as early as possible in order to avoid scheduling problems. Note that it is particularly convenient to attend an overseas campus during spring and summer of the second year, since the courses listed in these quarters may be delayed to subsequent years without disadvantage. No required course may be taken on a pass/no credit basis.

**AMERICAN CHEMICAL SOCIETY CERTIFICATION**

Students who wish to be certified as having met the minimum requirements of the American Chemical Society for professional training must complete, in addition to the above requirements, at least six units from Chemistry 136 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, Geology 278, or other advanced courses approved by the student's advisor and by the supervisor of his or her in work 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

#### FIRST YEAR

<table>
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<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
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<tr>
<td>Chem. 31</td>
<td>Chemical Principles</td>
<td>4</td>
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<tr>
<td>Chem. 33</td>
<td>Structure and Reactivity</td>
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<td>4</td>
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<td>Chem. 35</td>
<td>Monofunctional Compounds</td>
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<tr>
<td>Chem. 36</td>
<td>Chemical Separations</td>
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<tr>
<td>German 1</td>
<td>First-Year German</td>
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<tr>
<td>Math. 19</td>
<td>Calculus</td>
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<td>Math. 20</td>
<td>Calculus</td>
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<td>Math. 21</td>
<td>Calculus</td>
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#### SECOND YEAR

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<tr>
<td>Chem. 131</td>
<td>Polyfunctional Compounds</td>
<td>3</td>
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<tr>
<td>Chem. 132</td>
<td>Qualitative Organic Analysis</td>
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<td>Chem. 133</td>
<td>Special Topics in Organic Chemistry</td>
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<td>3</td>
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<tr>
<td>Chem. 134</td>
<td>Theory and Practice of Quantitative Chemistry</td>
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<td>4</td>
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<tr>
<td>Chem. 136</td>
<td>Synthesis Laboratory</td>
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<td>Math. 22</td>
<td>Analytic Geometry</td>
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<td>Physics 51</td>
<td>Mechanics, Sound, Electricity</td>
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#### THIRD YEAR

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<td>Chem. 171</td>
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<tr>
<td>Chem. 174</td>
<td>Physical Chemistry</td>
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<tr>
<td>Chem. 151</td>
<td>Inorganic Chemistry</td>
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<td>Physics 55</td>
<td>Light, Heat, Atomic Physics</td>
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#### FOURTH YEAR

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<td>Electives (see Note 1)</td>
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**Note 1.**—Elective courses must be used to complete the University Writing and Distribution Requirement. They may also be used to broaden the student's background in science and non-science areas and to provide an opportunity for advanced study in chemistry. Courses offered by other departments that may be of interest to chemistry majors include: Chem. Engr. 20, 120, 130; Econ. 1; English 191; Math 44, 106, 113, 130, 131, 132; Physics 110, 111, 132; Stat. 40, 110, 116; Geol. 1, 278; Engr. 50; Appl. Earth Sci. 105; Mat. Sci. and Engr. 50; Med. Micro. 101; Biol. Sci. 1, 21, 22, 23; Bioch. 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 Administrator of the School of Education.

ADVANCED DEGREES IN CHEMISTRY

GENERAL REQUIREMENTS

Qualifying examinations are given prior to the first week of the Autumn Quarter and in the first week of the Winter Quarter. Each new graduate student must take these examinations on entrance. Satisfactory performance is required for permission to begin thesis research and to continue work for an advanced degree. Students on full time fellowships may complete all requirements for the Ph.D. degree in 9 quarters. Students on research or teaching assistantships may complete their requirements in 3 to 4 calendar years. Students who do not complete the requirements for an advanced degree within six years after entrance as a graduate student must repeat and pass the qualifying examinations and must meet any other requirements established by the faculty before the degree will be granted.

Candidates for advanced degrees must have a minimum grade average of B for all chemistry lecture courses as well as for all courses taken during graduate study. Required courses may not be taken under the pass/no credit option. All students are expected to give full time to their graduate work once they have begun thesis research. All prospective Ph.D. candidates, regardless of the source of their financial support, are required 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 "Degrees" section 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 examinations 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 September 26, 27, 1980 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 or she 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
Students with an exceptionally strong background in physics and mathematics may, upon special arrangements, pursue a program 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); (2) six units of advanced lecture courses in physical chemistry, biophysical chemistry, or inorganic chemistry; (3) Chemistry 221, or 223, or 225; and (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; and (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.

**PhD 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. McBeth Memorial Fellowship, Frederick P. Whitney Fellowship, William H. and Myrtle B. Sloan Scholarship, David L. and Lavinia E. 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 Gard 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. 31. Chemical Principles—Preparation for chemistry, chemical engineering, medicine, biochemistry, biology, and related fields. Atomic and molecular orbital theory, periodicity, bonding properties of matter, stoichiom-
etry. Prerequisite: high school algebra; high school chemistry and physics desirable. Sign up in Chemistry Dept.

4 units, Aut (Ross, Boxer, Andersen)  
lec (1) MWF 9, lec (2) MWF 10;  
lec (3) MWF 1:15;  
one recitation by arrangement


4 units, Win (Collman, Mosher, Eastman)  
lec (1) MWF 8, lec (2) MWF 9;  
lec (3) MWF 10; one recitation by arrangement

35. Organic Monofunctional Compounds—Organic chemistry of oxygen, nitrogen aliphatic and aromatic compounds. Prerequisite: 33. Sign up in Chemistry Dept.

4 units, Spr (Huestis, Mosher, Eastman)  
lec (1) MWF 8; lec (2) MWF 9;  
lec (3) MWF 10; 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 (Bonner)  
lec. T or Th 1:15;  
lab M,T,W,Th or F 1:15-5:05 or  
T,Th 6:30-10:15

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 and concurrent registration in 131. Sign up in Chemistry Dept.

4 units, Aut (Eastman, Staff) lec. (1) TTh 8  
lab M,T,W,Th 1:15-5:05 or  
T,Th 6:30-10:00

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 (Bonner, Staff) 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 (Eastman, Staff)  
lec (1) TTh 9 plus additional dhr;  
lab MW 1:15-5:00 or TTh 1:15-5:00  
or TTh 6:30-10


3 units, Win (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.

5 units, Win (Hodgson)  
lec TTh 10 plus lec F 1:15  
lab. MW 1:15-4:05; TTh 1:15-4:05,  
T,Th 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 (McConnell, Pecora)  
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 (van Tamelen) by arrangement

137A. Biosocial Aspects of Birth Control—(Same as Human Biology 150A.) 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 portion of the quarter will consist predominantly of lectures, of selecting the population groups and task forces and of individual discussions with each task force. The remainder of the 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. For acceptance, application prior to Nov. 6, 1980 is essential, using special questionnaires available from the Human Biology office. Prerequisite: At least junior standing.

6 units, Win (Djerassi) TTh 1:15-4:05

137B. Biosocial Aspects of Birth Control—
(Same as Human Biology 150B.) Selected students from 137A will be encouraged to continue with field work dealing with task force topics completed in 137A. Prerequisite: 137A.

1-6 units, Spr (Djerassi) TTh 1:15-4:05

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 (Staff) MW 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 (Staff)

171. Physical Chemistry—Chemical thermodynamics: fundamental principles, Gibbsonian 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 (Pecora) MWF 11

173. Physical Chemistry—Introduction to quantum chemistry: basic principles of wave mechanics, the harmonic oscillator, infrared and microwave spectroscopy, the hydrogen atom, atomic structure, molecular structure, valence theory.

3 units, Win (Fayer) 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 (Zare) lec. TTh 9, lab. MTW or Th 1:15-4:05 or F 2:15-5:05


3 units, Spr (Andersen) MWF 11

176. Physical Chemistry Laboratory—(Continuation of Chemistry 174.) Prerequisites: 174 and previous or concurrent enrollment in 175.

3 units, Spr (Boxer) lec. TTh 10; lab T 1:15-4:05 or W 1:15-4:05

Chemistry and the Life Sciences in Historical and Philosophical Perspective—(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.

4 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 (Staff) 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 (Djerassi and Smith) TTh 8-9:30

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 (Crosby and Li) by arrangement

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, stereochemistry, structural chemistry of organic and biological molecules. Prerequisite: 225 or consent of instructor.

3 units, Aut (Staff) MWF 9

229. Organic Chemistry Seminar—Attendance is required of all graduate students majoring in organic chemistry. (DR:X)

1 unit, Aut, Win, Spr (van Tamelen, Brauman) 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. (DR:X)

1 unit, Aut, Win, Spr (van Tamelen, Brauman) 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, not given 1980-81

253. Advanced Inorganic Chemistry—Introduction to stereochemical and electronic principles of transition metal compounds; ligand field and molecular orbital theories, electronic spectra and magnetism.

3 units, Win (Staff) TTh 11, alternate years, given 1980-81


3 units, Spr (Collman) TTh 10-12

257. Research Proposals in Inorganic Chemistry—Research progress reports (Fall Quarter) and 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. (DR:X)

1 unit, Aut, Win, Spr (Staff) 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, Aut (Zare) MWF 9

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 (Ross) TTh 11-12:15

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, not given 1980–81

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. (DR:X)
1 unit, Aut, Win, Spr (Staff) 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, not given 1980–81

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 1980–81

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 1980–81

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 (Hodgson) MWF 9, alternate years, given 1980–81

300. Department Seminar—Attendance is required of all graduate students, and all undergraduates registered for 190. (DR:X)
1 unit, Aut, Win, Spr (Staff) Th 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 required of all graduate students who have passed the qualifying examination. (DR:X)
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 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)

Acting Chairman: Mark W. Edwards

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., Michael Wigodsky

Assistant Professors: Wilbur Knorr (History of Science), Jody Maxmin (Art History and Classics), Stella G. Miller, Bruce M. Rosenstock, Susan A. Stephens, John J. Winkler

Lecturers: Robert Hamerton-Kelly (Classics and Religious Studies), Edward W. Spofford

Mellon Fellows: Warren Treadgold, Raymond H. Van Dam

Visiting Bonsall Professors: Desmond J. Conacher (University of Toronto, Spring Quarter 1980–81), G. E. R. Lloyd (Kings College, Cambridge, Spring Quarter 1980–81)
Offerings

The Department of Classics offers work in the Greek and Latin languages and literatures (both in the original languages and in translation), 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.

Normally students who major in Classics go on to careers in business, law, or medicine. Some students may elect to go on to teach Latin and Greek in high school or colleges.

Distribution Requirements

For those students who have matriculated before Autumn 1980, many courses in the department 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:


II. The literature, art and life of ancient Rome: Classics (code 378) 006, 007, 008, 011, 163; Ancient History (code 371) 102, 103, 115; Ancient Art (code 372) 100C.

III. Philosophy and thought of the ancient world: Classics (code 378) 008, 019, 165, 100.

IV. History of the ancient world: Anc. History (code 371) 101, 102, 103, 105, 115; (code 378) 008.

For those matriculating in Autumn 1980, see the "Degrees" section of this bulletin for explanation of new distribution requirements.

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 as early as possible.

Programs of Study

Bachelor of Arts

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.

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 the advisor at regular intervals.

1. Greek and Latin. At least 27 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, offered in successive years, and they should include some work in Greek or Latin Style and Syntax (Greek and Latin 175). In addition, they should do some work in Ancient History or Art or some other aspect of Classical Civilization to make up a minimum of 60 units. 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, and it is normally elected by those students preparing 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 the 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 31 units in Greek courses at the 100 level or higher (one course of which should be Greek Style and Syntax), 2 courses in Ancient History, and a course in Ancient Art or Archaeology.
The introductory sequence (1, 2, 3, or 51, 52) or one 100-level course in Latin is highly recommended. 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 recommended. (See “Note 1” below.)

b) Latin: at least 55 units, including a minimum of 31 units in Latin courses at the 100 level or higher (one course of which should be Latin Style and Syntax), 2 courses in Ancient History, and a course in Ancient Art or Archaeology. The introductory sequence (1, 2, 3, or 51, 52) or one 100-level course in Greek is highly recommended. 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 recommended. (See “Note 1” below.)

3. Classical Studies. This major is recommended for students who wish to study the classical civilizations 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 particularly 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, Psychology, Sociology, Political Science, or a combination of such courses agreed upon with the advisor. A summer at Stanford-in-Greece is strongly recommended.

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.

HONORS PROGRAM IN HUMANITIES

For majors in Classics with appropriate interests, an Honors Program in Humanities is offered, a description of which will be found under "Humanities Special Programs."

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 and 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 prepares and assists qualified students to study in Greece in the summer, both at the American School of Classical Studies and in programs operated by Stanford. Students who are not Classics majors are eligible, and all students should take prepara-
tory courses in the fields of Greek archaeology, art, history, and language (including modern Greek). 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 may 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 "Degrees" section 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) Translation examinations into English from Greek and Latin authors included in an approved list (drawn up by the department and available from the departmental secretary).
   c) Three general written examinations; a supplementary general oral examination; one special author and one special field examination.
   d) An oral examination on the candidate's dissertation subject and on two special topics, such as selected authors or selected aspects of Greek or Latin literature, linguistics, history, archaeology, philosophy, epigraphy, papyrology, or paleography.
3. The examinations in translation from Greek and Latin authors will normally be taken in the Autumn Quarter of the second year of graduate work, the general written and oral examinations in the Autumn Quarter 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 his or her dissertation committee. This committee will normally be appointed (for each candidate) by the Chairman of the department at least one quarter before the student’s dissertation topic is due to be submitted. At the same time or earlier a senior member of the department will be appointed as the candidate’s advisor and will thereafter supervise the candidate’s writing of the dissertation. An acceptable dissertation must be a genuine contribution to classical scholarship and must be written in an acceptable style. All theses are to 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 exams 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 (5 units a quarter); the series 51, 52 begins in Winter Quarter (6 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, Euripides, and Homer. 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 elsewhere in Greek should consult a member of the department to determine what course they are qualified to enter.

Students whose major work is in another department and who wish to fulfill a departmental foreign language requirement by taking Greek 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 Greek—For beginners. 5 units. Aut (Winkler) M WTh F 9

2. First-Year Greek—Continuation of 1. 5 units. Win (Winkler) M WTh F 9
3. First-Year Greek—Continuation of 2.
   5 units, Spr (Staff) MTWThF 9

51. First-Year Greek—Accelerated course.
   6 units, Win (Rosenstock) MTWThF 1:15

52. First-Year Greek—Continuation of 51.
   6 units, Spr (Rosenstock) MTWThF 1:15

The intensive Greek course (Greek 10) offered in Summer Quarter also prepares students to enter Greek 101 in Autumn Quarter.

INTERMEDIATE COURSES

All courses (DR:H)

101. Second-Year Greek—Reading of selections from Plato.
   5 units, Aut (Knorr) MWF
   with review session by arrangement

102. Second-Year Greek—Euripides, one play
   5 units, Win (McCall) MWF
   with review session by arrangement

103. Second-Year Greek—Homer, Odyssey.
   5 units, Spr (Spofford) MWF
   with review session by arrangement

   3 units (Hamerton-Kelly) given 1981-82

111. Sophocles—One Play.
   4 units, Aut (Staff) MWF 9

112. Herodotus.
   4 units, given 1981-82

113. Attic Prose.
   4 units, given 1981-82

ADVANCED COURSES

All courses (DR:H)

151-153 and 161-163 are offered in alternate years and may be taken in succession.

151. Greek Lyric Poetry.
   4 units, given 1981-82.

152. Homer
   4 units, given 1981-82.

153. Aristophanes.
   4 units, given 1981-82.

160. Individual Work.
   By arrangement

161. Plato.
   4 units, Win (Staff)

163. Thucydides.
   4 units (Edwards)

176. Senior Seminar—Senior language majors and Classical Studies majors who wish to examine in depth topics which span several Classical disciplines (e.g. Philosophy, History, Literature) are urged to participate in the Senior Seminar. An extra unit will be given to those students who wish to read part of the course material in the original languages. (DR:X)
   4 to 5 units, Win (Staff) by arrangement

199. Undergraduate Thesis.
   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 Style and Syntax—This course is designed to teach some of the nuances of Greek syntax and style. Classes will be devoted to stylistic analysis of selected prose authors, techniques of sight-translation, and the writing of idiomatic Greek prose. The course is designed for the major, but all students enrolled in Greek language courses are encouraged to take Greek 175 as soon as possible after the completion of 103. (DR:X)
   4 units, Aut (Rosenstock) MWF 1:15

GRADUATE COURSES

All courses (DR:X)

201. Introduction to Classical Scholarship.
   1 unit, Aut, Win, Spr (Wigodsky and Staff)

202. Tutorial in Greek Poetry.
   3 units, Aut, Win (Edwards, Winkler)

205. Greek Language and Style.
   3 units, Win, Spr (Jameson, Raubitschek)

The above courses are offered every year. Other courses alternate or vary from year to year. In 1979-80 there were seminars in the following authors or topics: Homer, Aeschylus, Plato, Greek religion, and Indo-European Linguistics. The following courses and seminars will be offered in 1980-81.

227. Euripides.
   5 units, Spr (Conacher)

232. The Athenian Empire.
   5 units, Win (Jameson)

250. Topics in Greek Philosophy.
   5 units, Spr (Lloyd)

260. Directed Reading.
   By arrangement

270. Greek Prose or Verse Composition.
   By arrangement

See also Philosophy 235, 236.

Note: Some of the courses listed above may be
continued in the following quarter by arrange-
ment with the instructor. This will usually re-
quire the writing of an extended 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 (5 units a quarter), the series 51, 52
begins in Winter Quarter (6 units a quarter) and
is intended to cover the same ground at a more
rapid pace, so that the series 101, 102, 103 forms
a sequel equally to Latin 3 and Latin 52. During
the first year some Caesar or other simple Latin
prose will be read so as to prepare the students
in the following year for Cicero, Virgil, Ovid,
and other authors. 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 de-
partment 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.
   5 units, Aut (Stephens) MWThF 9

2. First-Year Latin—Continuation of 1.
   5 units, Win (Stephens) MWThF 9

3. First-Year Latin—Continuation of 2.
   5 units, Spr (Stephens) MWThF 9

41. First-Year Latin—Accelerated course.
   6 units, Win (Devine) MTWThF

42. First-Year Latin—Accelerated course.
   Continuation of 51.
   6 units, Spr (Devine) MTWThF

The intensive Latin course (Latin 10) offered
in Summer Quarter also prepares students to
enter Latin 101 in the Autumn Quarter.

INTERMEDIATE COURSES

All courses (DR:H)

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.

   4 units, given 1981-82

   4 units, given 1981-82

143. Virgil, Aeneid.
   4 units, given 1981-82

151. Roman Comedy.
   4 units, given 1982-83

52. Petronius
   4 units, given 1982-83

53. Roman Popular Philosophy: Horace and
Seneca.
   4 units, given 1982-83

160. Individual Work.
   By arrangement

students may be admitted in the Winter or
Spring Quarters by consent of the instructor.

101. Second-Year Latin—Poetry and Prose of
   the Republic.
   5 units, Aut (Staff) MWF 1:15
   with review session by arrangement

102. Second-Year Latin—The age of Nero.
   5 units, Win (Davis) MWF,
   with review session by arrangement

103. Second-Year Latin—Selections from Vir-
   gil, the Aeneid.
   5 units, Spr (Raubitschek) MWF,
   with review session by arrangement

111. Horace, Odes.
   4 units, Aut (Spofford) MWF 2:15

112. Virgil, Eclogues and Georgics.
   4 units, given 1981-82

113. Pliny’s Letters.
   4 units, given 1981-82

114. Seneca’s Tragedies.
   4 units, given 1981-82

118. Post-Classical Latin—(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 Renais-
sance. Intended primarily for students not
majoring in Classics. Prerequisite: two years
secondary school Latin or equivalent.
   4 units, Aut (Brown)

ADVANCED COURSES

All courses (DR:H)

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.

   4 units, given 1981-82

   4 units, given 1981-82

143. Virgil, Aeneid.
   4 units, given 1981-82

151. Roman Comedy.
   4 units, given 1982-83

52. Petronius
   4 units, given 1982-83

53. Roman Popular Philosophy: Horace and
Seneca.
   4 units, given 1982-83

160. Individual Work.
   By arrangement
161. Tacitus.  
4 units, Spr (Van Dam)

163. Lucretius.  
4 units, Win (Wigodsky)

176. Senior Seminar—Senior language majors and Classical Studies majors who wish to examine in depth topics which span several Classical disciplines (e.g. Philosophy, History, Literature) are urged to participate in the Senior Seminar. An extra unit will be given to those students who wish to read part of the course material in the original languages. (DR:X)  
4-5 units, Win (Staff) by arrangement

199. Undergraduate Thesis. (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. Latin Style and Syntax—This course is designed to teach some of the nuances of Latin syntax and style. Classes will be devoted to stylistic analysis of selected prose authors, the techniques of sight-translation, and the writing of idiomatic Latin prose. The course is designed for the major, but all students enrolled in Latin language courses are encouraged to take Latin 175 as soon as possible after the completion of 103. (DR:X)  
4 units, Aut (Stephens) MWF 10

GRADUATE COURSES  
All courses (DR:X)

201. Introduction to Classical Scholarship.  
1 unit, Aut, Win, Spr (Wigodsky and Staff)

3 units, Aut, Win (Staff, Wigodsky)

205. Latin Language and Style.  
3 units, Win, Spr (Decine, Wigodsky)

The above courses are offered every year. Other courses alternate or vary from year to year. In 1979–80 there were seminars in the following authors or topics: Virgil, Apuleius, Conversion of the Roman Empire to Christianity, and Indo-European Linguistics. The following courses and seminars will be offered in 1980-81:

214. Horace, Odes  
5 units, Win (Dacis)

260. Directed Reading.  
By arrangement

263. Lucretius  
5 units, Aut (Wigodsky)

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 an extended research paper based on work directly related to the course.

COURSES IN HEBREW  
For courses in Hebrew, see Linguistics.

COURSES IN MODERN GREEK  
Consult Chairman of Classics Department for available courses in Modern Greek.

GENERAL COURSES  
No knowledge of Greek or Latin is required for these courses.

TOPICS IN CLASSICAL CIVILIZATION  
In this program a number of courses are offered specifically intended to acquaint 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 into 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 translated original sources, the development and interrelationships of democracy and imperialism, with the purpose of identifying the universal principles involved. (DR:A)  
3 units, Spr (Edwards)

7. Rome and the Romans in the Age of Augustus—The course will deal with various aspects of public and private life in ancient Rome: the family, religion, the arts, politics, housing, commerce, leisure activities. Attention will be paid to the city plan and architecture of ancient
Rome, in an attempt to relate the everyday life of the Romans to their physical environment.

3 units, given 1981-82

8. Classical Politics—Lectures on the political philosophy of Plato and Aristotle and on their impact on 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)

16. Sex Roles in Ancient Greece—This course studies the social construction of women's and men's roles, and the changes they underwent, in three periods of Greek culture: archaic, classical, and hellenistic. The topics covered include work, marriage, power and authority, health and sexuality. Some of the texts studied are theoretical justifications or criticisms of a social order (Plato, Aristotle); most are imaginative literature dealing with issues of sexual politics (the *Odyssey*, Sappho, Euripides, Aristophanes). (DR:H)

3 to 4 units, given 1981-82
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 (Van Dam) 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, given 1981-82

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, given 1981-82

160. Individual Work in Ancient History.
By arrangement

185. Roman Society in the Early Principate—(Same as History 201.) This course is concerned mainly with understanding the institutions of Roman society through reading what the Romans themselves (especially Pliny the Younger) had to say about the theory and practice of, for example, patronage, status, family, education, religion, and values. Satisfies History Department undergraduate colloquia requirement. (DR:A)
3 to 4 units, given 1981-82

117. Greek Religion and Society—The origins and development of Greek religious phenomena from Mycenae to Byzantium. (DR:A)
3 to 4 units, Spr (Jameson)

18. 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, Win (Rosenstock)

163. Comparative Mythology: Topics from Greek and Roman, Near-Eastern and African Culture—(DR:H)
3 to 4 units, given 1981-82

217. Topics in Greek Religion.
5 units, given 1981-82

ART AND ARCHAEOLOGY

108. Topography and Monuments of Greece.
(DR:H)
3-4 units, Win (Raubitschek)

112. Mycenaean Greece. (DR:A)
3-4 units, given 1981-82

116. Greek Sanctuaries—A survey of the important sanctuaries of Greece and different aspects of their significance in terms of culture, religious and healing cults, and athletics. (DR:H)
3-4 units, given 1981-82

120. Greek Vase-Painting—(Same as Art 102.) A survey of Greek vases and their painters from the Protogeometric period onwards. Special attention will be given to the masters of Athenian black-figure and red-figure painting, and to the problems involved in distinguishing individual hands. (DR:H)
4 units, Aut (Maxmin)

127. Archaeological Practicum—(DR:X)
2 units, Aut, Win, Spr (Raubitschek)
F 2:15-4:05 Art Museum

167. Buildings of Classical Athens—(DR:H)
3-4 units, given 1981-82

185. Eros in Greece: A Survey of the Aspects of Love—(DR:H)
3-4 units, given 1981-82

119. Human Settlement and Landscape in the Aegean—(Same as Geology 119.) Lectures, seminars, and readings on the relations between civilization and landscape from the Old Stone Age to the present day, with emphasis on Greece. No prerequisites; the course is open to all undergraduates. (DR:A)
3 units, Spr (Jameson, van Andel)
Field Research Program—It is expected that undergraduates who complete this course satisfactorily will be candidates for participation in a summer field program involving archaeological and geological research in Greece. The program is part of Stanford in Greece and is made possible by the Stanford on the Aegean fund. Participation is open to majors in all fields. For further information, please consult M. H. Jameson, Classics, or Tj. van Andel, Geology.

160. Individual Work in Human Settlement and Landscape in the Aegean.
By arrangement

260. Individual Work in Human Settlement in Landscape in the Aegean.
By arrangement

(Courses at the 200 level are mainly for graduate students.) All 200 courses (DR:X)

255. Homer and the Monuments.
3 units, given 1981-82
See also Art 100 A, B, C, D, and Art 102.

INDO-EUROPEAN LINGUISTICS

25. Greek and Latin Words in Modern English—Study of the Greek and Latin roots of modern scientific vocabulary and of the origins and development of the English language. No foreign language required; recommended both for science and humanities students. (DR:H)
3 units, Spr (Devine)

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. (DR:H)
4 units, given 1981-82

221. Greek and Latin Phonetics. (DR:X)
5 units, Aut (Devine)

240, 241. Elementary Sanskrit. (DR:X)
3 units, given 1981-82

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. (DR:X)
5 units, given 1981-82

253. Introduction to Indo-European Linguistics—(Same as Linguistics 249.) 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. (DR:X)
5 units, given 1982-83

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
Director, Film and TV Production Center: Julian Blaustein
Associate Professors: William J. Paisley, Donald F. Roberts
Adjunct Professors: Ronald Alexander, Julian Blaustein, Marion Lewenstein
Assistant Professors: Bella Mody, Diana Tillinghast. Acting: Dennis Foote
Lecturers: Richard C. Block, Jules Dundes, Leonard Koppett, Celia Lighthill, Harry Press, Douglas S. Solomon
Consulting Professor: Irv Drasnin
The Department of Communication engages in research in communication and offers curricula leading to the A.B., A.M. and Ph.D. degrees. The Master of Arts degree prepares students for careers in journalism or documentary film 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 anthropology, computer science, economics, English, history, political science, psychology, sociology and statistics 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 preprofessional program and is designed to provide a variety of offerings within the department combined with a flexible program of breadth and depth in courses outside the department. 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, but not in a second or co-equal major.

As part of the 40 to 50 units students take 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. One course from the journalism sequence, preferably 100-102
   c. One course from the broadcast and film sequence
   d. Psychology 60, Statistics 60, or Statistics 70
   e. Any two courses numbered 151 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 101 and 180 (112 and 113 or 216 and 242B are recommended but not required and may be used to fulfill this requirement)
   c. One course from the Communication social science sequence numbered 151 through 170
   d. One course from the journalism sequence, preferably 100-102

3. Students concentrating in the journalism sequence must complete:
   a. Communication 100-102
   b. Communication 107
   c. Communication 175
   d. One course from the Communication social science sequence numbered 151 through 170
   e. One course from the broadcast and film sequence
An alternative degree is a Bachelor of Arts degree in Communication: Social Sciences. 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.

Courses required to fulfill area sequences must be taken for letter grade unless offered only Pass/No Credit.

**MASTER OF ARTS**

The Master of Arts degree is awarded by the department in the fields of Journalism, Film, Broadcasting, and Communication and Development. 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. An independent project (on occasion a thesis) under the direction of a major professor must be undertaken. Three to six hours of credit in independent study may be applied to this requirement. A report of the project must be made to the professor directing the independent study. Completion of the entire program normally takes three to five quarters depending on the nature of the independent project. Students who have completed the courses and residence requirements may register as Terminal Graduate Students.

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, 208 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 responsibility of the student. These costs currently approximate $2,000 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, 275, 277 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 and Development is designed primarily for students from Asia, Africa, and Latin America. It entails a two-year commitment on the part of most students and requires course work in communication and development theory (251, 252), research methods (204, 253) 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 and development, 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.

The Ph.D. program is designed to encompass four years of graduate study (subsequent to completion of the A.B. degree) during which, in addition to fulfilling University residence requirements, Ph.D. candidates are required to:

1. Satisfactorily complete all departmental course requirements.

2. Pass general preliminary examinations by the beginning of the second academic year of study and specialization examinations by the
completion of the third academic year of study.

3. Demonstrate proficiency in tools required in area of specialization. Chosen with the advice of the faculty, such tools may include foreign languages, statistics, computer programming, etc.

4. Complete both a master's research project (first-year project) and a pre-dissertation research project (second-year project).

5. Teach or assist in teaching at least two courses.

6. Have at least one year of work experience in the mass media or in another activity relevant to the area of specialization, prior to writing the dissertation.

7. Complete a dissertation satisfactory to an advisory committee of three or more members and to the University Committee on the Graduate Division.

8. Pass the University oral examination, which may be either a comprehensive 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:

Communication 311A: Theory of Communication I
Communication 311B: Theory of Communication II
Communication 313: Computer Analysis of Communication Research Data
Communication 317: Doctoral Research Methods I
Communication 318: Doctoral Research Methods II
Communication 319: Doctoral Research Methods III

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
   Psychology 151: Statistical Methodology

B. Statistics 160: Introduction to Statistical Methods I

Statistics 161: Introduction to Statistical Methods II

C. Education 250A: Statistical Analysis in Educational Research
   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 320 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. In rare instances, Ph.D. level courses from other departments may be substituted for part of this requirement. 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.

Ph.D. MINOR IN COMMUNICATION

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 or her senior advisor.

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. Research assistantships are usually available to qualified Ph.D. students in Communication. Among the qualifications which will be highly valued in applicants are high scholarship, training in the behavioral sciences (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 18-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

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, Abel) MWF 9 plus sections to be arranged

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, Aut (Paisley) MW 1:15

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 (Lewenstein) TTh 11
   Win (Hulteng)
   Spr (Staff)

101. Film Aesthetics—Graduate students register for 201.) A theoretical, historical examination of the nature of the film medium. Attention is given to the problems of aesthetics and communication from the view point 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 (Lewenstein, Stephens, Staff)
   Win (Hulteng)
   Spr (Staff)

103. Precision Journalism—Undergraduate Section (Graduate students register for 203.) See 203. (DR:S)

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. Primarily for graduate students but open to a limited number of undergraduates with permission of instructor. Prerequisites: 100 and 102. (DR:X)
   2 units, Aut (Staff)
   Win (Staff)
   Spr (Staff)

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) MW 11
112. Writing for Film—Script writing techniques for film and television. Emphasis is placed on conceptualizing and executing film ideas in a series of short exercises, 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 (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. (DR:X)
5 units, Win, Spr (Alexander)
TTh 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. (DR:X)
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, Spr (Koppett)

125. Problems of the Mass Media—Visiting lecturer series. Prerequisite: any other Communication course. May be repeated once for credit. (Graduate students register for 225.) (DR:X)
1 unit, Aut (Nelson) Th 4:15-5:30

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. (DR:X)
4 units, Win (Hulteng)

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)
3 units, Aut (Lewenstein)

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, Aut (Lewenstein)
given 1981-82

141. History of Film—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 (Staff) TTh 3-5
plus evening film showings

142. Broadcast Communication—The development of American broadcasting and its contemporary problems. (Graduate students register for 242.) (DR:S)
4 units, Aut (Dundes)
MW 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, given 1981-82

143. Anthropology of Film—(Same as Anthropology 128.) 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. (DR:A)
5 units, Spr (Gibbs) MF 10-10:50; W 7:30 p.m.

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, Spr (Gibbs) MF 10-10:50; W 7:30 p.m.

150. Magazine Writing—(Graduate students register for 250.) Practice in writing magazine articles, with emphasis on marketing manuscripts. Conferences. Prerequisites: 100 and 102. Primarily for graduate students, but open
to a limited number of undergraduates with permission of instructor. (DR:X)

4 units, Aut (Staff)
Win (Staff)
Spr (Lewenstein)

151. Television and the Exaggerated Image—Examines the nature of stereotypes on television. Considers the processes by which exaggerated images of any sector of the population (e.g. minorities, women, white males) are created, the purposes that those images serve, and their potential effect on the viewing audience. (DR;S)
3 units, Aut (Blosser) MW 4:15-6

152. Broadcasting Systems in Third World Countries—(Graduate students register for 244.) Focuses on ownership, operation and control of radio and TV media within specific historical and economic contexts. Explores objectives for which these media were introduced and their actual subsequent performance. Differences in the nature of the state are explored to help explain differences in the goals, programming and evolution of these media in Asia, Africa, Latin America and the Caribbean. (DR:S)

3 units, Spr (Mody) Th 2:15-4:05

154. Underdevelopment, Media and Culture—(Graduate students register for 254.) Seminar on the "mainstream" and "critical" literature on the causes of underdevelopment and the role of transnational media in the cultural incorporation of third world countries. The course is concerned with finding empirical support to de-mystify the rhetoric that surrounds issues like cultural imperialism. (DR:S)
3 units, Spr (Mody) F 10-12

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. (DR:X)
4 units, Spr

156. Scientific and Technical Communication—How scientific findings and technological innovations are communicated to scientists and technologists, policy makers, 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.) (DR:S)
3 units, Win (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 357.) (DR:S)
3 units, Aut (Paisley)

158. Organizational Communication—Interpersonal and organization factors affecting communication efficiency in organizations. Topics to include information processing, motivation, leadership styles, environmental uncertainty, and communication networks. (Graduate students register for 358.) (DR:S)
3 units, Spr

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.) (DR:S)
4 units, Win

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 context and process of cross-cultural education. 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. (DR:S)
4 units, Win (Clarke, Rogers)
Th 3:15-5:05

164. Special Topics in Communication Theory and Research I: Electoral Politics and the Mass Media—Context of campaign news coverage; campaigns' use of the news media; news media's use of campaigns (leer and frothing on the campaign trail); marketing of political campaigns; effects of campaigns' outputs on the citizenry and the political process. Prerequisite: Communication 1 or consent of the instructor. (Topic and instructor change each year.) (DR:S)
4 units, Aut (Hochheimer) TTh 4:15-6

165. Special Topics in Communication Theory and Research II—Topic and instructor change each year. (DR:S)
3 units, Win (Staff)
166. Special Topics in Communication Theory and Research III—Topic and instructor change each year. (DR:S)
3 units, Spr (Staff)

167. Diffusion of Innovations—(Same as Values, Technology and Society 172.) Course takes multidisciplinary approach to diffusion in business, education, law, government and consumer groups. Emphasis is one role of communication in spread of new technology, new ideas, and new values among individuals, within organizations, and among organizations in the U.S. and abroad. Special emphasis upon energy conservation innovations and on scaling down in a limited-growth future. (Graduate students register for 267.) (DR:S)
3-4 units, Win (Rogers)

168. Formative Research for Message Design—(Graduate students register for 268.) Focuses on low-cost research methods for the systematic design of persuasive messages. Lectures and weekly assignments deal with setting behavioral objectives, identification of audience characteristics, assessment of information needs, selection of instructional strategy, production of draft messages, pre-testing of draft messages, utilization of messages, and feedback systems design. (DR:X)
3 units, Aut (Mody)

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:S)
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. Primarily for graduate students but open to a limited number of undergraduates with permission of instructor. (DR:X)
5 units, Win (Lewenstein) Spr (Staff)

176. International Communication: Structures and Issues—Comparative survey of different national media systems and the policy issues arising from the existing imbalances between developed and developing countries. This seminar examines the new technologies that have transformed the global flows of news, economic data, cultural and technical information. Prerequisites: Comm 1. Seniors and graduate students in communication and international relations have first priority, with permission of instructor. (DR:S)
4 units, Win (Abel)

177A. Specialized Workshops—Analyzing the News—(Graduate students register for 277A.) Thrust of seminar is to learn how the news analyst functions, whether writing editorials, broadcast commentaries or background articles. Students will try their hands at all these forms, designed to clarify public events rather than to exhort. Open to seniors and graduate students, with instructor's permission. (DR:X)
4 units, Spr (Abel)

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, strustructuralist and semiological approaches. Weekly reviews will stress the meaning of the films and a lucid writing style. (Graduate students register for 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, Lewenstein) by arrangement

196. Issues in Public Broadcasting—Examines the major issues facing public broadcasting in the United States today. Emphasis on three major areas: (1) program concept and content, (2) organizational problems at national and local levels, (3) financing, including both sources and allocation. Intended primarily for graduate and undergraduate students in Communication. (DR:S)
3 units, Win (Nelson)

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 I—A reporting and writing course emphasizing various forms of journalism: news, interpretation, features, opinion. Detailed criticism of writing. Com-
201. Film Aesthetics—See 101

202. Editorial Techniques I Laboratory—Practice in journalistic writing. Must be taken concurrently with Communication 200. Open to non-majors. Prerequisite: typing speed of 35 words per minute. For graduate students.

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 and Development A.M. program. Prerequisite: Psychology 60 or equivalent.

207. Editorial Techniques II—(For graduate students.) See 107.

208A. Seminar in Film and Broadcasting I—Limited to Film and Broadcasting A.M. students.

208B. Seminar in Film and Broadcasting II—Limited to Film and Broadcasting A.M. students.

208C. Seminar in Film and Broadcasting III—Limited to Film and Broadcasting A.M. students.

209S. Broadcasting News Workshop—Production and direction of news and documentary television programs. Prerequisite: consent of instructor.

210A,B,C. Topics in Film Study—Each quarter during the academic year a different aspect of film history, criticism, aesthetics, and institutional development will be examined in detail. Admission by consent of the instructor. (DR:H) Given 1981-82

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.

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.

222. Documentary Film—Analysis of the techniques and strategies of films designed to effect attitudinal and behavioral change. Prerequisite: consent of instructor

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.

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.

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.

224A. Film Production I—First quarter of a three quarter sequence leading to professional training in motion picture production. Super 8 exercises and a short 16 mm non-synchronous film with sound track comprising narration, music and sound effects. Prerequisite: Concurrent registration in 223A.

224B. Film Production II—Write, direct and edit a short original dialogue scene in 16 mm. Project to be carried through post-production to answer print. Prerequisites: Successful completion of 223A and concurrent registration in 223B.
224C. Film Production III—Final quarter of professional training in motion picture production. A five minute, 16 mm film utilizing all skills acquired in 224A and 224B. Prerequisites: Successful completion of 224B and concurrent registration in 223C.

   5 units, Spr (Alexander, Blaustein)
   MW 2:15-4:05

225. Problems of the Mass Media—Graduate section. (See 125)

240. History of American Journalism—See 140.
   Given 1979-80

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.

   4 units, Win (Dundes) MW 11

242B. Broadcast News Techniques and Production—Writing, delivery and direction of radio and TV news. Prerequisites: 100, 102, 142, and consent of instructor.

   4 units, Spr (Dundes) MW 2:15-4:05
   plus lab by arrangement, given 1981-82

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.

   4 units, Win (Dundes)
   Sum (Block) by arrangement

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 rural development, social change, and education. Special uses and difficulties of communication research in developing countries. Case studies and planning exercises.

   3-5 units, Win (Rogers) MW 1:15-3:05

252. Communication Theory and Social Change—This course is required for the Communication and Development A.M. program. Surveys theories of communication process and effects and applies them to real-life problems of social change and national transformation in Third World countries. Video tapes show cases of exemplary applications.

   3-5 units, Aut (Mody)

253. Evaluation Research Methods for Development Communication Projects—(Same as Education 214.) Nature of summative and formative evaluation and evaluation designs, problems of field work, construction of instruments, questions of methodology, data analysis, and utilization of results. Prerequisites: basic statistics, Communication 204 (or equivalents).

   3-5 units Spr (Staff)

254. Underdevelopment, Media and Culture—(For graduate students.) See 154.

263. Ideology and Mass Culture—(Same as Spanish and Portuguese 292.) Against stereotypes. The course will deal with the new Latin American cinema in contrast to the Hollywood movie and its stereotypes of the Latin.

   3-5 units, Spr (Franco)

267. (For graduate students.) See 177.

268. (For graduate students.) See 168.

275. 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. For graduate students.

   Prerequisites: 100 and 102.
   5 units, Win (Lewenstein)

276. (For graduate students.) See 176.

277. 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 1979-80. (DR:X)

   3-4 units, Spr (Staff)

277A. (For graduate students.) See 177A.

280. Film Criticism—(For graduate students.) See 180.

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 2:15-4:05
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

317. Doctoral Research Methods I—Application of scientific method to communication research. Logic of inquiry; conceptualization of variables; design of experiments, quasi-experiments, and noneperiments. Previous or concurrent enrollment in statistics required.
4 units, Aut (Staff) MW 2:15-4:05

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

311. Developmental Communication—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—The preparation of audio-visual materials; techniques of public speaking, including: use of audio-visuals, use of voice, non-verbal techniques; the organization of lectures; leading and facilitating discussions; self-paced and self-directed learning; planning a course, including: creation of a syllabus, scheduling and course progression, assessment techniques.
1 unit, Aut (Cardillo, Pierce) TTh 10-11

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.
1 unit, Win (Rivers) T 12-1

343. Marketing and the Public Sector—(Same as Business 343.) Explores how elements of marketing and communications mix can be transferred to activities of government and other nonbusiness organizations. Stresses value of behavioral and communications models in conceptualized problems and suggest solutions. Problem areas selected include the marketing of new ideas and behavior patterns, as well as products and services. Problems in fields such as health care services, art management, social services, transportation management, and educational planning are examined.
3 units, Spr (Staff) by arrangement

347. Management of Advertising Communications—(Same as Business 347.) Deals with the models and measurement procedures useful in devising, testing, and monitoring marketing communication campaigns. Emphasis on logic underlying these models. Topics include analysis of message strategy, pretesting and tracking systems, budget allocation models, and media planning systems.
4 units (Ray)

349. Consumer Research—(Same as Business 449A.) Examines relevant theory, methodology, and findings relevant to understanding consumer behavior. Focus on such behavioral science concepts as learning, perception, personality theories, attitude structure and change, cognitive consistency and novelty seeking, social stratification and life style, diffusion and innovation, subculture theory, and risk taking. Consumer information processing, communication research, comprehensive models of consumer behavior and the relevant literature in marketing and consumer research and psychology receive special attention.
4 units (Ray)

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 (Staff) by arrangement
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: 311A and 319.

3 units, Win (Staff) by arrangement

372. Advanced Communication Theory and Method Seminar III—May be repeated for credit. Topic and instructor change each year. Prerequisites: 311A and 319.

3 units, Spr (Staff) by arrangement

373. Communication and Health—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

375. Communication Theory Review Seminar—Limited to Ph.D. students. Prerequisites: 311A, 311B.

3 units, Spr (Roberts) 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


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.

1-5 units (Staff) by arrangement

400. Dissertation Research.

6-10 units, (Staff) by arrangement

COMPARATIVE LITERATURE

Committee in Charge: Herbert Lindenberger (Chairman), Joaquin F. Coelho, Gerald Gillespie, Donald Howard, William M. Todd III, John Wang, John Winkler

Professors: Joaquin F. Coelho (Portuguese and Comparative Literature), Jean Franco (Spanish and Comparative Literature), Gerald Gillespie (German Studies and Comparative Literature), David G. Halliburton (English, Comparative Literature, and Modern Thought and Literature), Herbert Lindenberger (Comparative Literature and English), James J. Y. Liu (Chinese and Comparative Literature), Charles R. Lyons (Drama and Comparative Literature), N. Scott Momaday (English and Comparative Literature), Makoto Ueda (Japanese and Comparative Literature)

Associate Professors: N. Gregson Davis (Classics and Comparative Literature), William M. Todd III (Slavic and Comparative Literature)

Assistant Professors: Robert Ball (Spanish and Comparative Literature), Sandra E. Drake (English 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 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—not necessarily 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

DOCTOR OF PHILOSOPHY

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 stu-
1. A literary genre, to consist of 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 present a dissertation proposal as part of the University Oral Examination. Successful completion of the examination will constitute approval of the proposal. Members of the dissertation reading committee will ordinarily be drawn from the University Oral examining committee.
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. At least two of the three courses in Comparative Literature should originate in a department other than the one in which the student is completing the degree. 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)

21, 22, 23. Major Texts in Western Culture—Presentation of central issues in Western thinking and culture through the study of closely-related literary and philosophical texts. The course is not structured chronologically; rather each quarter's syllabus is organized around a particular set of problems dominant throughout the history of western culture. Special emphasis is given to literary works. Limited to 20 freshmen per quarter. (DR:H)

21. The Literature of Interaction and Conflict—Conflict and concord between the individual and the world as exemplified in texts by writers such as Aeschylus, Virgil, Thomas More, and Dostoevsky.
   5 units, Aut (Todd)

22. The Literature of Introspection—The discovery, growth and limitations of the self as portrayed in texts by writers such as Augustine, Dante, Rousseau, and Freud.
   5 units, Win (Ball)

22. The Literature of Speculation—The human situation set forth in theories of ethics and knowledge and conceptions of nature and the universe, as illustrated in texts by writers such as Plato, Descartes, Goethe, and Nietzsche.
   5 units, Spr (Wellbery)

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, Spr (Drake)

40. Drama—(Enroll in English 40.) Principal dramatic forms; development of dramatic art, masterpieces of the theater from various periods, countries.
   5 units, Aut (Friedlander)

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, Win (Stone)

61, 62, 63. Western Thought and Literature—An introduction to fundamental ideas of the past; lectures, discussions, reading of selected masterpieces.

61. The World of Classic Antiquity—(Enroll in Humanities Special Programs 61.) Homer, Aeschylus, Sophocles, Euripides, Plato, Aristotle, Cicero, Virgil, Seneca.
   5 units, Aut (A. Rubitschek, Staff)

   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)

132. The Nineteenth-Century Continental Novel—(Enroll in English 132.) The main tendencies, as illustrated in works by Stendhal,
292  SCHOOL OF HUMANITIES AND SCIENCES

Tolstoy, Balzac, Dostoevsky, Flaubert, and Mann.
5 units, Spr (Foster)

136. The Age of Reason and Enlightenment: European Thought in the 18th Century—(Enroll in History 136.) Main currents of European thought: articulation of ideas by representative writers (Montaigne, Diderot, Rousseau, Descartes, Hobbes, Locke, Voltaire, Pascal, Goethe) and their dissemination among the literate public; interplay of ideas and social change; interaction between elite culture and popular mentalités; translation of ideas into political action.
5 units, Spr (Foster)

136A. European Thought in the 19th Century—(Enroll in History 136A.) 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, Aut (Robinson)

5 units, Win (Robinson)

163A. Women's Writing as Critique and Vision: the Nineteenth Century—(Enroll in English 163A.) A feminist reading, primarily thematic and biographical in focus, of works by major nineteenth-century women writers, among them Madame de Stael, George Sand, Charlotte Brontë, Margaret Fuller, Elizabeth Barrett Browning, and Harriet Beecher Stowe.
5 units, Aut (Gelpi)

163B. Women's Writing as Critique and Vision: the Twentieth Century—(Enroll in English 163B.) Works by major twentieth-century writers covering such topics as feminist utopias, the buried tradition of women poets, lesbian critiques and visions, woman-centered realism in fiction, feminist literary criticism.
5 units, Win (Middlebrook)

5 units, Spr (Mellor)

165A. Interpretations of the Modern Experience—(Enroll in English 165A.) The last century has seen the massive industrialization and urbanization first of Europe and North America, and subsequently of much of the rest of the world. This course will consider, in historical context, the literary expression of this experience in different traditions, as social and cultural values and artistic forms have been affected. Works read will be Ambiguous Adventure, Cheikh Hamidou Kane (Senegal); Notes from Underground, Fyodor Dostoievskii (Russia); The White Ship, Chingiz Aitmatov (Kirghiz Soviet Socialist Republic—U.S.S.R.); House Made of Dawn, N. Scott Momaday (U.S.); Invisible Man, Ralph Ellison (U.S.).
5 units, Aut (Mellor)

166. Modern Literature from Africa—(Enroll in English 166.) The readings will be considered in the historical context of events since roughly 1900—colonization of much of Africa by Europe, the gaining of political independence, and continuing conflicts.
5 units, Spr (Drake)

186. Women in Later Medieval Literature—(Enroll in English 186.) Readings in such works as The Romance of the Rose, Tristan and Isolde, and Triolus and Criseyde.
5 units, Win (Bloomfield)

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. Will include works by Simone de Beauvoir, Violette Le duc, Marguerite Duras, Sylvia Plath, Tillie Olsen, and Maxine Hong Kingston.
5 units, Spr (Yalom)

212A. Medieval to Renaissance: The Development of Literary Forms—(Enroll in French and Italian 212A.)
5 units, Win (Bloomfield)

212B. Continuation of 212A—(Enroll in English 212B.)
5 units, Win (Trimpit)

230. Russian Formalism and Structuralism—(Enroll in Slavic Languages and Literatures 230.) 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, Aut (Brown)

240. Dante: Inferno—(Enroll in French and Italian 240.) A reading of Dante within the context of Medieval thought and literature.
4 units, Aut (Frecceo)
241. Deutsche Geistesgeschichte I—(Enroll in German Studies 241.) From Lessing to Romanticism.
3-5 units, Aut (Mueller-Vollmer)

242. Deutsche Geistesgeschichte II—(Enroll in German Studies 242.) From Hegel to Nietzsche.
3-5 units, Spr (Wellbery)

3-5 units, Win (Pütz)

253. Western Culture and the Latin American Experience. The Semiotics of Self and Other—(Enroll in Spanish and Portuguese 253.)
3-5 units (Wynter), given 1981-82

255B. Chinese and Western Theories of Literature—(Enroll in Asian Languages 255B.) Study of traditional Chinese theories of literature in comparison with Western ones. Seminar with limited enrollment.
5 units, Win (Liu)

256. Contemporary Drama from 1918—(Enroll in Drama 256.)
5 units, Spr (Esslin)

260. The Renaissance—(Enroll in French and Italian 260)
4 units, Spr (Ahern)

261. Introduction to Medieval and Renaissance Apocalyptic and Millenarian Literature—(Enroll in English 261.) Texts will be read in English.
5 units, Spr (Bloomfield)

262. The Symbolist Poets—(Enroll in French and Italian 262.) Baudelaire, Mallarmé, Verlaine, Rimbaud, Yeats, George, etc. Lectures and discussions in English, readings in original and/or bilingual editions.
4 units, Win (Cohn)

268. The Storyteller and His Art—(Enroll in English 268.) A concentrated inquiry into the nature and function of the story in the oral tradition of the American Indian, with emphasis upon the identity and role of the storyteller. Limited enrollment. Prerequisite: 68 or 168, or equivalent.
5 units, Aut (Momaday)

296. Interpretive Strategies/Strategic Interpretations: Western Views of the Non-West through the Literature of Travel—(Enroll in Spanish and Portuguese 296.) This course focuses on the Western traveler in the Third World as cross-cultural mediator and interpreter, and on the ideological appropriation of foreign contexts as related to developments in world history and economy. Course materials include travelogues, journals, letters, essays, works of fiction, documentary and ethnographic writings, and film. Open to all students; no prerequisites. Readings will be in English.
3-5 units, Win (Pratt, Benmayor)

296A. Preconditions of Literature. German Literature as an Example—(Enroll in German Studies 296A.)
3 units (Frank), given 1981-82

300. Graduate Seminar: Russian Literature as an Institution—(Enroll in Slavic Languages and Literatures 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)

301. Colloquium: Allegory and Symbolism—(Enroll in English 301.) Emphasis on medieval and Renaissance literature, with some discussion of theoretical matters.
5 units, Win (Bloomfield)

301A. History of Dramatic Criticism—(Enroll in Drama 301.)
5 units, Win (Prosser)

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.
3-5 units, Win (Pratt)

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)

3-5 units, Aut (Benmayor)

3-5 units, Win (Ball)
349B. Language Theories of the Romantic Movement—(Enroll in German Studies 349B.) 3-5 units (Mueller-Vollmer), given 1981-82

349C. Literary Hermeneutics—(Enroll in German Studies 349C.) Its history and principles since the enlightenment. Classical hermeneutics: Schliermacher, Boeckh. Current issues of literary hermeneutics within the spectrum of structuralist, phenomenological and Marxian criticism. 3-5 units, Win (Mueller-Vollmer, Seeba)

352. Seminar: Theatre and Politics—(Enroll in Drama 352.) 5 units, Spr (Esslin)

353. Seminar: Medieval Drama—(Enroll in Drama 353.) 5 units, Aut (Prosser)


354A. Seminar: Expressionism—(Enroll in Drama 354A.) 5 units, Win (Esslin)

361. Seminar: The Modern Tradition—(Enroll in English 361.) Studies in masters of modern thought and literature such as Diderot, Marx, Nietzsche, Freud, Wittgenstein, Heidegger, Kafka, Malraux, and Beckett. Restricted enrollment and priority admission to Modern Thought and Literature graduate students. 5 units, Win (Halliburton)

369. Seminar: Major Modern Critics—(Enroll in English 369.) An introduction to modern European and American literary criticism. Required of first-year graduate students in Comparative Literature. 5 units, Aut (Lindenberger)

373A. European Novel I: Renaissance Heritage—(Enroll in German Studies 373A.) 3-5 units, Aut (Gillespie)

394. Poets of Infinity—(Enroll in German Studies 394.) 3-5 units (Gillespie), given 1981-82


COMPUTER SCIENCE

Chairman: Edward A. Feigenbaum
Associate Chairman: Dennis P. Brown

Associate Professors: Forest Baskett, Joseph E. Oliger, Robert E. Tarjan (on leave 1980-81), Terry Winograd

Adjunct Professors: Bruce G. Buchanan, Arthur Samuel, Emeritus

Assistant Professors: Douglas B. Lenat, Robert S. Schreiber, Gino Wiederhold, Andrew C. Yao

Acting Assistant Professor: Michael R. Genesereth

Senior Research Associates: Thomas O. Binford, Lester D. Earnest

Lecturers: Dennis P. Brown, Ralph Gorin, Nils Nilsson, Robert W. Taylor, John F. Wakerly

Affiliated Associate Professors: John T. Gill III (Electrical Engineering), Susan S. Owicki (Electrical Engineering)

Affiliated Adjunct Professor: David Luckham (Electrical Engineering)

Affiliated Assistant Professors: John Hennessy (Electrical Engineering), Fouad Tobagi (Electrical Engineering), Willem M. van Cleeemput (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 al-
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 at the end of the Computer Science Course listings.

There is no bachelor's degree in Computer Science. Undergraduates who wish to enter the field are advised to major in one of the sciences, in Mathematics or in the Program in Mathematical Sciences and to include Computer Science 107, 109A, 109B, or 111; 137A; 144A, 144B, and 155 in their course of study.

A variety of computer systems is available to Stanford students. There are two large systems available to all students in the University. Most courses, including courses given by the Computer Science Department, use the Low Overhead Time Sharing (LOTS) system. See the section "LOTS" in this bulletin. A few courses and many sponsored research projects use the Stanford Center for Information Technology (CIT). See the section "Stanford Center for Information Technology" in this bulletin.

There are three more large systems available to students of Computer Science: SCORE, SAIL, and SUMEX. SCORE is a DecSystem-2060 running TOPS-20. It is jointly owned by the Departments of Computer Science, Electrical Engineering, and Operations Research. All students in a degree program in Computer Science have access to SCORE.

SAIL is a DecSystem-1080 running the WAITS operating system. SAIL supports 64 display consoles, computer controlled television cameras, computer controlled artificial hands, a computer controlled vehicle, etc. SAIL is operated by the Computer Science Depart-

ment. Users include members of the Electrical Engineering, Mechanical Engineering, Mathematics, and Psychology Departments.

SUMEX is a dual processor Dec-System-1060 running TENEX. It is a national facility owned by the National Institutes of Health and managed by a national governing board. Applications of artificial intelligence to problems in medicine and biology are the prime research foci of this facility. Students whose research involves such applications may be granted access to SUMEX.

The Computer Science Department also operates several Xerox Alto personal computers, linked together by the Ethernet communications network. Xerox has provided these Altos, a Dover printer, and a network file system, as an equipment grant to the Computer Science Department.

In addition to these systems, various other facilities are present in the department. Among these are two VAX-11/780 computer systems, an IBM 4331 system, and a variety of Hewlett-Packard systems.

Close collaboration is maintained between the Electrical Engineering and the Computer Science Departments. Research in hardware and software computer systems is done in the Computer Systems Laboratory (CSL). CSL is a laboratory of the Electrical Engineering Department populated by faculty from both Electrical Engineering and Computer Science. CSL is the home for a variety of small computer systems.

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 three distinct programs. In each of these the candidate must attain at least a 2.50 average in his or her course work and a 3.00 (=B) average in courses taken in the Computer Science Department.

MASTER OF SCIENCE IN COMPUTER SCIENCE

A candidate is expected to complete a course program of 42 units, at least 36 of which will be
in this department or in related areas and 24 of these 36 units must be graded units. A list of suggested courses in other departments appears at the end of the course offerings in Computer Science. These 36 units must include 6 units of course 293 and 15 additional units of courses numbered 200 or above. The course program must be approved by the Computer Science Department’s Committee on Graduate Study.

A candidate is also required to demonstrate a suitable level of competence on the departmental Comprehensive Exam. Completion of the M.S. program in C.S. typically requires six quarters of residence at Stanford. It is possible for students who enter with preparation fully equivalent to Stanford courses Stat-116, Math-113, and 130, and C.S. 107, 111, and 112 to complete the program in one calendar year (4 quarters). The Comprehensive Examination is given twice a year, once in January and once in May.

MASTER OF SCIENCE IN ARTIFICIAL INTELLIGENCE

The degree of “Master of Science in Computer Science: Artificial Intelligence” may be conferred upon students who wish to develop a competence in the design of substantial knowledge based AI applications. The degree will be administered by the Committee for Applied Artificial Intelligence, composed of faculty and research staff of the Computer Science Department. Present members include Bruce Buchanan, Chairman, Doug Lenat, Mike Genesereth, and Tom Binford.

The CS:AI program will begin in Autumn Quarter each year. Normally, a student will spend two years in the program. Each quarter the student will register half-time (9 units) and serve as a research or teaching assistant half-time (20 hours per week). The first year will involve acquiring the fundamental concepts and tools through course work and project involvement. During the second year, the student will implement and document a substantial A.I. system.

A student should indicate preference for this degree at the time of applying for admission. Admission to the CS:AI program will be limited by the amount of financial support available, and by the amount of research supervision available. To be considered for this program, an application should reach us by January 15.

The degree of “Master of Science in Computer Science: Artificial Intelligence” is intended as a terminal professional degree. Students completing this program will have no advantage over other Ph.D. applicants; admission to MS/SC:AI may negatively affect a subsequent Ph.D application. Students planning to obtain the Ph.D. degree are strongly advised to apply directly for admission to the Ph.D. program.

PROGRAM REQUIREMENTS

Programs of at least 54 quarter units that meet the following guidelines will normally be approved:

1. Core AI. At least four AI courses. Required are C.S. 206 or C.S. 222, C.S. 223, and C.S. 224. The fourth course may be chosen from C.S. 275, C.S. 276, C.S. 226, or C.S. 227.


4. Practicum. 9 units of C.S. 225. A substantial A.I. system is implemented and documented.

5. Practicum related electives. 9 units in courses related to the C.S. 225 project. Acceptable courses will be determined by the project supervisor, depending upon the application area of the project. Examples include courses in Physical Science, Social Science, Computer Science, or Mathematics.

6. Electives. Additional courses (usually five) to bring the total to 54 or more quarter units. These courses may be in departments other than Computer Science.

Courses taken to satisfy guidelines 1 through 5 will normally be taken for a letter grade. As in other MS programs in the Computer Science Department, a 3.00 grade point average must be maintained in these courses. Electives taken under guideline 6 may be taken Pass/No credit; if taken for grade a 2.50 grade point average in these courses must be attained.

CS:AI 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 CS:AI 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.

A successful experience in this program is likely to require an undergraduate education in the sciences, with at least a moderate exposure to computing concepts and practice.
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, Joseph Oliger, 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. Choose five courses from the following: E.E. 282, E.E. 381, C.S. 142, C.S. 143, C.S. 145, C.S. 246A.

2. At least one course in mathematical foundations for computer engineering. Acceptable courses: 150, 151, 155, or 156.


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, H, Electrical Engineering 390, 385 A, B, C, D, E, F, H.

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.

This program is normally open to students with a bachelor's degree in Mathematics, Statistics, Physics, or Engineering. A bachelor's degree in another field may be accepted provided the applicant has a knowledge of calculus, linear algebra, and probability.

Upon entrance to the program, students are expected to have proficiency at the level of C.S. 107, 111, and 112. Students lacking in one or more of these areas should enroll in 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 professional 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, databases, 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.

PhD 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 scholarship for up to nine units of study per quarter during the academic year, and in addition receive stipends of at least $5,010 for the nine-month year. Some may work full time in the summer for approximately $1,114 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 sometimes 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. † Identical course offered by Electrical Engineering some quarters. Refer to Time Schedule for department in which to register.

75. Computers and Language—(Same as Linguistics 75.) The goal of this course is to provide a basis for understanding how computers can be used in applications dealing with language and to discuss the implications of putting computer systems into everyday life situations. It introduces the basic principles of computing and linguistics on which the programs are based, through lectures, films, discussions and demonstrations of existing systems. A term paper will be required. Students will not be assumed to have prior computer background. Enrollment limited.

5 units, Spr (Winograd)

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 (Staff) MWF 2:15

103. Programming in FORTRAN—An introduction to FORTRAN for students with experience in programming in another high-level programming language. Prerequisite: 105, 106 or equivalent.

1 unit, Aut (Staff) 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, 105. Prerequisite: Mathematics 3 or equivalent.

*3 or 4 units, Aut (Staff) MWF 10, 1:15
Win (Staff) MWF 10,1:15
Spr (Staff) MWF 10,1:15
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 (Staff) MWF 11, 2:15
Win (Staff) MWF 11, 2:15
Spr (Staff) MWF 11, 2:15
Sum (Staff) MTWTh 9, 11

107. Systematic Programming—Introduction to systematic program design, use of a variety of data structures, recursion manipulation of text. Program correctness, informal verification, and testing. Modularization, scope concepts, and portability. Prerequisite: 104, 105, 106 or equivalent. (E.E. 180)

3 units, Aut (Brown) MWF 2:15
Win (Brown) MWF 2:15
Spr (Owicky) MWF 9
(Enroll in E.E. 180)

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, 111S. Prerequisite: 107 (E.E. 180).

3 units, (Ehrman) by arrangement


3 units, (Gorin) by arrangement

use the LOTS facility and will program and operate a small computer. Enrollment limited to 50. Prerequisite: 105 or 106 or equivalent. Corequisite: 107 (E.E. 180) or equivalent.

3 units, Aut (Staff)
Win (Staff)


3 units, Spr (Staff)
Sum (Staff)


3 units, Aut (Staff)
Win (Staff)

135. Numerical Methods—This survey course is designed to acquaint students in science and engineering with methods and techniques for solving scientific problems of a mathematical type on digital computers. Emphasis is given to practical problems and pragmatics. Program libraries are studied and used. Problems to be discussed include interpolation and approximation of data, solution of differential equations, numerical integration, solution of linear and nonlinear systems of equations, fast Fourier transform. Pitfalls in automatic computation and their remedies are discussed. Not intended for students with further interests in Numerical Analysis. Alternate: 137A,B. Prerequisites: FORTRAN; Mathematics 113 and 130; or equivalents.

3 units, Win (Olicer) MWF 1:15
Sum (Staff) TTh 10-12

136. Numerical Methods for Partial Differential Equations—This survey course is designed to acquaint students of science and engineering with numerical methods for solving partial differential equations. The model equation approach is used. The derivation of model equations relevant to various applications will be discussed. Methods for model equations of elliptic, parabolic, hyperbolic, and certain mixed types commonly occurring in applications will be treated. Finite difference, finite element, collocation and approximate eigenfunction methods will be considered. The efficiencies of these methods for equations of various types will be examined. Implementation of the methods in scientific applications will be stressed. Prerequisites: FORTRAN, advanced calculus, linear algebra, and introductory level ordinary and partial differential equations.

3 units, Aut (Olicer) MWF 1:15

137A,B. Numerical Analysis—This course is designed to acquaint students of computer science and mathematics with the analysis of methods for solving mathematical problems on digital computers. Problems discussed in 137A include solution of nonlinear equations, interpolation and approximation of functions, and solution of linear algebraic systems. Problems discussed in 137B include numerical differentiation and 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 (Staff) MWF 2:15
Spr (Staff) MWF 2:15

137B. 3 units, Win (Schreiber) MWF 2:15


3 units, Aut (Wiederhold) TTh 1:15
Win (Owicki) Enroll in E.E. 285)

143. Compilers—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). (†E.E. 286).

3 units, Win (Hennessy)

144A, B, C. Data Structures—This three-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; database management. Analysis of algorithms to determine which is more efficient in a given situation. Prerequisites: 109 or 111; Mathematics 20 or 41, or equivalents. Prerequisites recommended: 107 (E.E. 180), 155.

144A. 3 units, Aut (Ullman) MWF 3:15
144B. 3 units, Win (Floyd) MWF 3:15
144C. 3 units, Spr (Knuth) MWF 3:15


3 units, Spr (Wiederhold) MWF 1:15

150. Introduction to Combinatorial Theory—Intended as an elementary first course in combinatorics. Topics include permutations, combinations, partitions; the principle of inclusion and exclusion, and more general Mobius inversion; 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 (Yao) 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 (Staff)

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 (Floyd) 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 (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) MWF 10


3 units, Aut (Manna, Waldinger) TTh 11

191. Software Engineering Laboratory—(Enroll in Electrical Engineering 288.) An eclectic apprenticeship program in the folklore and craft of programming system design and implementation. Individual and group problem-solving, design methodology, project planning and management, and communication skills are emphasized. Practical and theoretical issues of computer systems are explored through projects, written reports, oral presentations, and class discussions. The approach is neither comprehensive nor formal. Students should have some knowledge of programming; concurrent enrollment in 142 (E.E. 285) is recommended.

3 units, Win (Allison) MWF 10

Spr (Allison) MWF 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 cir-
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. Prerequisites: 112 (E.E. 182) and E.E. 121 or equivalent.

3 units, Aut (Staff) plus 4 hour lab by arrangement
Spr (Staff) plus 4 hour lab by arrangement

194. Microcomputer Laboratory—(Enroll in Electrical Engineering 281.) Introduction to a specific microprocessor. Lectures covering the programming and structure of a microcomputer system, accompanied by laboratory exercises. A final laboratory project is required. Prerequisites: 111S (E.E. 181S) or 111 (E.E. 181), and 112 (E.E. 182), or equivalents, and some hands-on experience with TTL logic, such as 193 (E.E. 183) or E.E. 121.

3 units, Aut (Staff), plus lab by arrangement
Win (Staff), plus lab by arrangement
Spr (Staff), plus lab by arrangement

199. Independent Work.

Any quarter, (Staff) by arrangement

COURSES PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:T) if taken for three or more units.

† Identical course offered by Electrical Engineering some quarters. Refer to Time Schedule for department in which to register.

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. Recommended for first-year Computer Science graduate students.

1 unit, Aut (Brown) Th 2:45-4

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 11-12:15

206. Recursive Programming and Proving—Recursive programming using the LISP language and techniques for proving the correctness of recursive programs. Computing with symbolic expressions rather than numbers, e.g. algebraic expressions, logical expressions, patterns, graphs, and computer programs. Pattern matching and syntax directed computation. Preparation for work in artificial intelligence is emphasized. Prerequisite: 107 (E.E. 180) or equivalent ability to program.

3 units, Aut (McCarthy) TTh 9:30-10:45

209. Topics in Computer Science—Given only when a suitable faculty member is available.

By arrangement

211. Logic Design—(Enroll in Electrical Engineering 381.) Principles and techniques of digital design. Topics include codes for representing information, integrated-circuit logic families, logic design, MSI design, hazards, sequential circuit analysis and synthesis. Prerequisites: 111 (E.E. 181), 112 (E.E. 182) or equivalent.

3 units, Aut (Staff)
Win (Staff)

212. Processor Design—(Enroll in Electrical Engineering 382.) Computer description languages; relationship of processor architecture to design; arithmetic algorithms; memory system design; issues in processor control including microprogramming, emulation and pipelining; processor performance evaluation. Prerequisites: 111 (E.E. 181), 112 (E.E. 182).

3 units, Win (Staff)
Spr (Staff)

219. Topics in Digital Systems—Given only when a suitable faculty member is available.

By arrangement

222. Artificial Intelligence Programming—Detailed introduction to the LISP programming language. Symbolic computation, recursion, pattern matching, the pragmatics of the LISP programming environment. Examples of how various artificial intelligence programs and techniques are realized in LISP. Brief treatment of embedded languages for artificial intelligence research (such as QA4 and KRL). A moderate (3-week) programming project is undertaken by each student. Prerequisite: 224 or 223 can be taken concurrently.

3 units, Aut (Lenat)

TTh 1:15-2:30

223. Fundamentals of Artificial Intelligence—Introduction to the issues and methods of artificial intelligence. Knowledge representation, search, problem reduction methods, learning, knowledge acquisition, and system validation. Includes an introduction to elementary techniques of vision and natural language processing. Prerequisite: Familiarity with LISP.

3 units, Win (Genesereth)
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: 107 (E.E. 180) or equivalent.

2 units, Spr (Lenat) TTh 1:15-2:30

225. Artificial Intelligence Research—Intermediate-level examination of problems of artificial intelligence research. Emphasis will be on a research project involving computer programming. Not recommended for first-year graduate students. Prerequisites: 206 or 222, 223, 224. Consent of instructor required.

1-6 units, any quarter (Staff) by arrangement.

226. Epistemological Problems of Artificial Intelligence—(Same as Philosophy 326.) Formalisms for representing what a general intelligent program must know about the common sense world including facts about causality, ability, knowledge and action. Modes of rigorous and conjectural reasoning, especially non-monotonic reasoning. Approximate theories and counterfactuals. Connections with philosophy, especially philosophical logic and epistemology. Some familiarity with first order logic will be assumed.

3 units, Win (McCarthy) alternate years, given 1980-81

227. Introduction to Robotics and Computer Vision—A survey of robot systems and their applications, geometric modeling and representation within Very High Level robot language, and force control theory. Use of the AL language for programming robots is emphasized. A survey of vision systems, especially the ACRONYM system, three-dimensional interpretation and geometric representation, edge features and their spatial organization as texture, stereo and motion parallax, and psychophysics.

3 units, Aut (Binford) TTh 2:45-4

229. Topics in Artificial Intelligence—Given when a suitable faculty member is available. Topics have included: automatic programming, intelligent computer aided instruction, knowledge engineering, learning, mathematical discovery, philosophical issues in A.I., and representation theory.

By arrangement (Staff)

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 and pricing optimization techniques in linear programming, combinatorial search procedures, shortest path and other graph and polynomial algorithms, dynamic programming from the software point of view, trade-offs between solution time and storage needs. Students are expected to program algorithms discussed in class. This course is recommended as a complement to courses like Operations Research 340A. Prerequisite: Math 113; and some knowledge of computer programming and data structures (linked lists and binary search trees).

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, Win (Golub) MWF 1:15

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. Prerequisites: 137A and 137B.

3 units, Aut (Staff) Alternate years, given 1981-82

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 1981-82

237C. Advanced 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 1981-82

238A. Advanced Topics in 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 (Schreiber)
Alternate years, given 1980–81

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 1980–81

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 (Schreiber)
Alternate years, given 1980–81

239. Topics in Numerical Analysis—Given only when a suitable faculty member is available.

By arrangement

242. Programming Language Design—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). (E.E. 389).

3 units, Aut (Hennessy) TTh 1:15-2:30

243. Compiler Project—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, optimization methods, and code generation. Significant project will be included. Prerequisite: 143 (E.E. 286). (E.E. 383).

3-6 units, Spr (Ullman)

245. Database System Theory—Overview of database systems; the entity-relationship model of the real world; the network data model and the DBTG proposal; the hierarchical model; the relational model; relational algebra and calculus; query languages based on algebra and calculus, such as ISBL, QUEL, SQL, and Query-by-Example; functional dependencies and their influence on database design; multivalued dependencies; query optimization; concurrent operations on the database. Pre-requisites: A familiarity with file organization, as in 145 (E.E. 287), and with predicate calculus, as in 156, will be assumed. (E.E. 484).

3 units, Win (Ullman)


246A. 3 units, Win (Baskett)
246B. 3-6 units, Spr (Baskett)

247. Computer System Evaluation—Performance criteria in computer systems, queuing 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. Prerequisites: 246A (E.E. 386A), Stat. 116. (E.E. 388)

3 units, Aut (Staff) by arrangement
Alternate years, given 1981–82

249. Topics in Programming Systems—Given only when a suitable faculty member is available.

By arrangement


3 units, (Staff) by arrangement


3 units, Spr (Yao)
Alternate years, given 1981-82

252. Lower Bounds—Techniques for establishing limits on the possible efficiency of algorithms. Optimum searching, sorting, merg-
ing, selection, algebraic computation. Decision trees. Straight-line programs. Logical networks. Recent results. Prerequisite: 150 or equivalent.

3 units, Aut (Yao)
Alternate years, given 1981–82


253A. 3 units, Win (Tarjan)
not given 1980–81
253B. 3 units, Spr (Tarjan)
not given 1980–81

255. Analysis of Algorithms—An advanced course primarily for students who will be doing specialized work in the analysis of algorithms. The intent is to present each of the important paradigms used to analyze algorithms. The course studies combinatorial approaches, generating functions, techniques for exact solution of recurrences, and asymptotic methods in connection with important algorithms for sorting and searching.

3 units, Win (Knuth)
Alternate years, given 1981–82

256. Advanced Theory of Computation—Topics in the theory of programs, including the semantics of programming languages, formalization and proof of properties of programs, modal logics of programs, and the theory of parallel programs. Prerequisite: 156 or equivalent.

3 units, Spr (Manna) TTh 11-12:15


3 units, Aut (Floyd)
Alternate years, given 1981–82

259. Topics in Theory of Computation—Given only when a suitable faculty member is available.

By arrangement

275. Computational Models for the Syntax of Natural Language—(Same as Linguistics 275.) Introduction to formal systems and computer implementation for syntax. Survey of relevant material from linguistics and formal language theory. Review and discussion of past and current parsing systems. Overview of relevant aspects of the syntax of English.

3–4 units, Aut (Winograd) MWF 10
Alternate years, given 1981–82

276. Computational Models for the Semantics of Natural Language—(Same as Linguistics 276.) Conceptual overview of problems of meaning. Formalisms from logic, computation theory, psychology and linguistics, relevant to computer systems for natural language. Survey and critical discussion of current research on computational approaches to natural language.

3–4 units, Win (Winograd)
MWF 10

277. Topics in Computational Linguistics—(Same as Linguistics 277.) Content varies from year to year.

3 units, Aut (Staff)

293. Computer Laboratory—A substantial computer program is designed and implemented. A detailed written report is required. Recommended as preparation for dissertation research. Intended for graduate students of Computer Science; consent of instructor required.

Any quarter (Staff)
by arrangement

300. Computer Science Colloquium—Presentation of current research in computer science.

1 unit, Aut, Win, Spr (Brown) T 4:15

301. Seminar on the Professional Career in Computer Science—This course is designed to ease the trauma of your delivery into the real world. Upon receiving a Ph.D., you will be treated as if you knew many things. Many were never covered in any classroom, and you may suffer for a long time before you induce them from experience. Lecturing and writing effectively; managing your thesis; how the C.S. Department runs; grantsmanship; designing and building a career.

3 units, Spr (Lenat)

310. Seminar on Computer Systems—(Enroll in Electrical Engineering 380.) Discussion of current research in the design, implementation, analysis, and use of computer systems ranging
from integrated circuits to operating systems and programming languages.

1 unit, Aut, Win, Spr (Staff)


3 units, Aut (McCluskey) MWF 11
Spr (Staff) (enroll in E.E. 282)

312. Advanced Computer Organization—
(Enroll in Electrical Engineering 482.) Topics in computer arithmetic; models of memory systems; single stream system concurrent detection and control; multiple stream system design, analysis and algorithms; relationship between processor architecture and organization. Prerequisites: 311 (E.E. 282) and 212 (E.E. 182).

3 units, Spr (Staff)
Alternate years, given 1980-81

316. Advanced Computer Architecture—
(Enroll in Electrical Engineering 486.) Machine mapping issues, design of image machines, including addressing, name space design, operations and formats; emulation, semantics, interpreters and levels of emulation. Image machine analysis and statistical usage. Information theoretic limits and canonic interpretive program forms for high level languages. Directly Executed Language (DEL) synthesis. Prerequisites: 311 (E.E. 282) and 212 (E.E. 182).

3 units, Spr (Flynn)
Alternate years, given 1981-82

317. Digital Signal Processing Architecture and Circuits—(Enroll in Electrical Engineering 487.) The architecture, system design and hardware implementation of real time signal processors and digital filters. Signal processing operations including the Discrete Fourier Transform, Discrete Convolution, Cosine transform, Hadamard transform and the estimation of power spectra. Design of Finite Impulse Response and Infinite Impulse Response implementations of low pass, high pass, bandpass and all-pass filters. Applications in speech processing, image processing, communication, sonar and radar signal processing. Possibilities for LSI implementation of signal processing and digital filter computation structures will be investigated. Prerequisites: 211 (E.E. 381) and 212 (E.E. 382). Recommended: E.E. 263.

3 units, Spr (Staff)
Alternate years, given 1981-82


3 units, (McCluskey)
Alternate years, given 1980-81

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—Student-faculty discussions on measuring, modeling and analyzing the performance of computer systems and computer system components. Prerequisite: consent of the instructor.

(E.E. 385B)

1 to 4 units, Aut, Win, Spr (Baskett)
by arrangement

319C. Computer Architecture and 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 (Staff)
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, Spr (vanCleemput)
by arrangement

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 4 units, Aut, Win, Spr (Owicki)
by arrangement

319F. Computer Communication Network Seminar—(Enroll in Electrical Engineering 385F.) Student-faculty discussions of research problems in the design of computer communication networks. Specific areas include modeling and evaluation of various design alternatives. Particular attention is focused on packet-switching, packet-broadcasting, and integrated networks. Emphasis is placed on student presentations and Ph.D. thesis research.
1-4 units, Aut, Win, Spr (Owicki)
by arrangement

319H. Programming Language Design and Implementation Seminar—(Enroll in Electrical Engineering 385H.) Student-faculty discussions of research problems in the design and implementation of new and existing programming languages.
1-4 units, Aut, Win, Spr (Hennessy)
by arrangement

320. Artificial Intelligence Seminar.
1 to 3 units, any quarter (Staff)
by arrangement

321. Readings in Artificial Intelligence—A series of lectures and discussions on readings in all areas of artificial intelligence research. Primarily intended for students planning to take the A.I. Qualifying exam. Prerequisites: 223, 224 and consent of instructor.
3 units, Win (Staff)

322. Computer-Based Medical Decision Aids—(Same as Medicine 211.) Study representative examples of several major medical computing paradigms as they relate to computer-based clinical decision aids. Topics include: (1) clinical algorithms, (2) clinical databanks, (3) mathematical models of physical processes, (4) pattern recognition, (5) Bayesian statistics, (6) decision analysis, and (7) artificial intelligence. Lectures will be given by the instructors or by occasional guest speakers. Emphasis will be given to the limitations of early work that have made artificial intelligence techniques and knowledge engineering research particularly attractive. Students will be asked to develop a small computer program or to write an analytical paper. Prerequisites: none, although some prior computing experience will be useful.
3 units, Aut (Buchanan, Shortliffe)
MW 4:15-5:30

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

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: 211 (E.E. 381), and some familiarity with basic programming concepts. Corequisite: 212 (E.E. 382).
3 units, Spr (vanCleemput)

342. Program Verification—(Enroll in Electrical Engineering 392C.) This course is intended for those who wish to study recent developments in methods of program verification and corresponding developments in programming language design. Introductory topics include axiomatic semantics of programming languages (e.g., Pascal), inductive assertions and the proof theory of programs. Topics in verification include design of specification languages, design and implementation of verifiers, methods of using an on-line interactive verifier to debug and verify programs, automatic analysis of programs for common runtime errors. Topics in recent developments in programming language design deal with modules and concurrent processes. The verification of programs in Modula, Concurrent Pascal, and Ada will be studied. Design and axiomatic semantics of a concurrent systems language, Pascal Plus, will be presented. Prerequisites: 107 (E.E. 180), 142 (E.E. 285) or equivalents.
3 units, Win (Luckham) TTh 1:15-2:30

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 1980-81

344. Computer Communication Networks—(Enroll in Electrical Engineering 384.) Introduction to computer communication networks and data transmission systems. Introduc-
tion to circuit-switching, packet-switching and packet-broadcasting. Description of existing networks (ARPANET, SATNET, PRNET, ETHERNET, etc.) and their operational protocols. Special emphasis will be placed on design issues, modeling techniques, analysis, and performance evaluation. Prerequisite: O.R. 153 3 units, Spr (Tobagi)

345. Database Research Seminar.
1-3 units, any quarter
(Wiederhold) F 3:15

1 to 3 units, any quarter (Staff)
by arrangement

1-3 units, by arrangement.

370. Artificial Intelligence and Language Seminar.
1-3 units, any quarter (Staff)
by arrangement.

390. Advanced Reading and Research—
Intended for graduate students of Computer Science; consent of instructor required.
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 133, 141, 144, 201, 208.

Data Processing in Business Problems—See Business 366.

Information and Communication Theory—See Electrical Engineering 278, 279, 376A,B, 378A,B, 379, 479.

Mathematical Logic—See Philosophy 160A,B, 161, and Mathematics 290A,B,C.

Mathematical Models in Behavioral Sciences—See Behavioral Sciences courses.

Mathematical Programming—See Operations Research courses.


Statistical Methods of Econometrics—See Economics 272, 273.

Fundamentals of Acting. Drama 120A

Dramatic Literature. Three courses to be chosen from the following: Drama 151-159 Electives in literature, history, design, or acting to total at least 15 units at undergraduate level or at graduate level with the consent of the instructor.

ADVANCED DEGREES

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 of this bulletin.

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.”

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 “Degrees” section 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

The candidate must complete four examinations, three written and one oral, by the end of Winter Quarter of the third year. Examinations
are offered annually in each of the following periods of dramatic literature:

- Classical
- Medieval and Renaissance
- Neoclassical
- Romantic and early realistic
- Modern, 1870–1918
- Contemporary, 1918 to the present

Students in the criticism/directing program will be required to take the examinations in Classical, Medieval and Renaissance, and Modern drama. The fourth examination will be at the student's choice. Students in the theater history/design program will be required to take two examinations in theater history and one in design. The fourth examination will be in one of the periods of dramatic literature, the specific period to be defined in consultation with his or her advisor and approved by the departmental Graduate Study Committee. The core reading list of dramatic texts for each period is available. Each student, however, is to submit a critical bibliography to his or 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—one written and one oral or, in exceptional circumstances, two written—must be completed by the end of the second year of residence. During the first year, the student will select one of the four examination topics on which he or she wishes to be examined orally. If the student's individual program permits, this departmental oral examination should be completed by the end of the second year, before Application for Candidacy (see below).

A University oral examination is 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. At least two 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 restate 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 number 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)
   - 4 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
3. **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)
   - 3 units, Aut, Win, Spr (Staff) MW 2:15-4:05
25. Voice and Speech for the Actor. (DR:X) 3 units, Aut, Spr (Ryan) MWF 9

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, folk, 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; one unit for Graduate Directing Workshop 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, Spr (Eddelman) MWF 11 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) 5 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, Win, Spr (Cleveland, Russell) TTh 1:15-3:05 plus lab dhr

34. Sound for the Theater—An investigation of the use of sound to augment theatrical productions through mechanical and electronic methods. (DR:X) 2 units, Aut (Murgatroyd) M 10-12 plus lab by arrangement.

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 (Staff) by arrangement

59. Shakespeare—(Same as English 73.) An introduction to Shakespeare's dramatic art based on the reading of approximately 12 plays. Emphasis on historical background and focus on staging methods and production values. Designed for the general student. (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 (Ryan, Weber) TTh 10-12, TTh 1:15-3:05, MW 10-12

120B. 4 units, Win (Ryan, Weber) TTh 10-12, TTh 1:15-3:05, MW 10-12

Prerequisite: 120A or consent of instructor

120C. 4 units, Spr (Ryan, Weber) TTh 10-12 and MW 10-12

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. Acting Workshop: Improvisation 4 units, Win (Ryan) MW 2:15-4:05

121B. Advanced Scene Study. 4 units, Spr (Weber) TTh 1:15-3:05

123. Audition Techniques. (DR:X) 4 units, Aut (Ryan) M 2:15-5:05
127. Text and Movement for the Actor—Emphasis on movement, rhythms and sounds, imagery, and form in poetry, culminating in an informal group demonstration. (DR:X)  
4 units, Aut (Valenzuela, Weber)  
WF 2:15-4:05

128 Theatrical Makeup. (DR:X)  
2 units, Aut (Cleveland, Russell) W2:15-4:05

130A. Theatrical Design I—Visual analysis of historical styles as interpreted for the modern theater and developed throughout various presentational media. Specific problems in spatial perceptions and compositions and the relationship between costuming and scenic design. (DR:H)  
4 units, Aut (Eddelman) MWF 1:15 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, Win (Eddelman) MWF 1:15 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. Prerequisite: Drama 31.  
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: 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 presentational 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, Aut, Win (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 (Murgatroyd) MWF 10-12

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 (Murgatroyd) MWF 10-12

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 (Murgatroyd) 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 (Lyons) MWF 9

152. Medieval and Renaissance Drama. (DR:H)  
5 units, Win (Prosser) given alternate years

153. Neoclassic Drama. (DR:H)  
4 units, given alternate years

154. Romantic and Early Realistic Drama. (DR:H)  
5 units, given alternate years.
155. Modern Drama (1880-1918). (DR:H)  
5 units (Esslin) given alternate years

156. Contemporary Drama from 1918. (DR:H)  
5 units, Spr (Esslin) MWF 9

157. American Drama from 1920. (DR:H)  
5 units, Aut (Cole) MWF 11

159. Shakespeare. See Drama 59.

160. History of Theater—Classical Greece to  
the Eighteenth Century. (DR:H)  
4 units, Aut (Eddelman) MWF 10

161. History of the Theater—Nineteenth and  
Twentieth Centuries. (DR:H)  
4 units, Win (Eddelman) MWF 10

162. 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)  
4 units, Win (Russel) MWF 11

170. Introduction to Directing—Preequirit:  
120A,B,C or consent of instructor. (DR:X)  
4 units, Spr (Lyons) TTh 2:15-4:05

190. Special Research—Individual project in the work of a playwright, period, or genre. Pre- 
quisite: consent of instructor. (DR:X)  
1 to 5 units, any quarter (Staff)  
by arrangement

ADVANCED COURSES

All courses (DR:X)  
Courses numbered 200-299 are designed for advanced undergraduates and graduates.

235. Projects in Design and Technical Production.  
1 to 5 units, any quarter (Staff)

251. Greek Tragedy  
5 units, Win (Lyons) MWF 9

252. Medieval and Renaissance Drama.  
5 units (Prosser) given alternate years

253. Neoclassic Drama.  
5 units, given alternate years

254. Romantic and Early Realistic Drama.  
5 units, given alternate years.

255. Modern Drama (1880-1918).  
5 units (Esslin) given alternate years

256. Contemporary Drama from 1918.  
5 units, Spr (Esslin) MWF 9

257. American Drama from 1920.  
5 units, Aut (Cole) MWF 11

4 units, Aut (Eddelman) MWF 10

261. History of Theater—Nineteenth and Twentieth Centuries.  
4 units, Win (Eddelman) MWF 10

262. History of Costume and Fashion.  
4 units, Spr (Russell) MWF 11

270. Independent Project in Directing—Prerequisite: Drama 170 and approval of depart- 
ment of Drama curriculum and academic policy committee.  
2 to 5 units, any quarter (Staff)  
by arrangement

290. Special Research—Individual project in the work of a playwright, period, or genre. Re- 
quirement for department honors.  
1 to 5 units, any quarter (Staff)  
by arrangement

GRADUATE COURSES

Courses numbered 300 and above are primarily for graduates but are open to advanced under- 
graduates with permission. All courses (DR:X)

300. Research Methods.  
5 units, Aut (Prosser) MTW 1:15

301. History of Dramatic Criticism.  
5 units, Win (Prosser) TTh 10-12

302. Contemporary Approaches to Criticism.  
5 units, given alternate years

330A,B,C. Design Workshop—Advanced course in design for the theatre.  
330A. 5 units, Aut (Eddelman, Ramsaur, Russell) by arrangement

330B. 5 units, Win (Eddelman, Ramsaur, Russell) by arrangement

330C. 5 units, Spr (Eddelman, Ramsaur, Russell) by arrangement

331. Design Project—Design of a full-length production in conjunction with directing project (Drama 372).  
5 units, any quarter (Eddelman, Ramsaur, Russell) by arrangement

350. Seminar: Greek Tragedy.  
5 units, Win (Lyons) MW 10-12

351A. Seminar: A Playwright.  
5 units, given alternate years

352. Seminar: Theater and Politics  
5 units, Spr (Esslin) MW 10-12

353. Seminar in Medieval Drama.  
5 units, Aut (Prosser) MW 10-12

354A. Seminar: Expressionism  
5 units, Win (Esslin) MW 2:15-4:05
355. Seminar: American Drama Between the World Wars
5 units, Aut (Cole) TTh 10-12
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. 5 units, Aut (Eddelman Lyons, Ramsaur, Russell) MWF 4:15-6:05
370B. 5 units, Win (Lyons) MWF 4:15-6:05
370C. 5 units, Spr (Lyons) 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 multiformal theater space. Public performances.

371A. 5 units, Aut (Lyons) by arrangement
371B. 5 units, Win (Lyons) by arrangement
371C. 5 units, Spr (Lyons) by arrangement

5 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

110. Independent Study. (DR:X)
1 to 3 units, Aut, Win (Schrader) by arrangement

111. Exposition—Focuses on inter-personal communication in the small group. (DR:X)
3 units, Aut, Win (Schrader) MWF 11

113. Group Communication—Focuses on inter-personal processes of communication as they relate to inter-group experience. Prerequisite: 111 or consent of instructor. (DR:X)
4 units, Spr (Schrader) TTh 2:15-4:05

CENTER FOR EAST ASIAN STUDIES

Director: Peter Duus


Art: John LaPlante (on leave Spring Quarter 1980-81), D. Michael Sullivan (on leave Spring Quarter 1980-81), Melinda Takeuchi


Business: Richard T. Pascale

Economics: John G. Gurley (on leave Autumn and Winter Quarters 1980-81), Lawrence Lau, Toshiaki Tachibanaki

Education: David Grossman, Douglas P. Murray

Food Research Institute: Dennis Chinn, Ramon Myers (Hoover Institution)

History: Peter Duus, Harold L. Kahn, Mark I. Mancall, Jeffrey Mass, Lyman P. Van Slyke

Law: Victor H. Li

Philosophy: David S. Nivison

Political Science: Thomas Fingar, Harry Harding, Jr., Nobutaka Ike, John W. Lewis, Robert C. North, Daniel Okimoto, Robert E. Ward, Franklin B. Weinstein

Religious Studies: Carl Bielefeldt, Diana M. Y. Paul, Lee H. Yearley

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), John K. Emmerson (Hoover Institution), Walter P. Falcon (Food Research), William B. Gould (Law), 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**

**BACHELOR OF ARTS IN EAST ASIAN STUDIES**

The undergraduate major in East Asian Studies enables students who are committed to the study of China and/or Japan to design a major curriculum that combines language training and interdisciplinary coursework. The structure of the major is intended to guide the student in a course of study that provides broad exposure to China or Japan (or East Asia as a whole) through a combination of courses in several departments. The student should integrate his or her studies around a thematic or disciplinary focus.

Before declaring a major in East Asian Studies, students should consider whether it truly meets their interests and long-range academic and career plans. Alternatives include a major in Chinese or Japanese within the Department of Asian Languages, an informal concentration on China or Japan within a regular departmental major, and such other interdisciplinary majors as International Relations. The hallmarks of the East Asian Studies major are concentration on a single area of the non-Western world, interdisciplinary breadth, and flexibility of focus. These alternatives are specified not to discourage East Asian Studies majors but to ensure that their declaration represents a considered and clearheaded decision.

Potential majors must submit a written application (a *Student Proposal for a Major in East Asian Studies*) for approval by the East Asian Studies A.B. Program Committee.

Students interested in working on an honors program should consult the director.

Majors are required to complete a minimum of 75 units of coursework treating China and/or Japan. These units are to be distributed as follows:

1. **Language:** 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 towards the requirements for the major.

2. **History:** 15 units—Completion of at least one of the following course sequences:
   - History 91, 92, 93 (East Asian Civilization)
   - History 192A, 192B, 193C (Chinese History)
   - History 194, 194A, 194B (Japanese History)

3. **Substantive Concentration:** 30 units—These units should be focused around a discipline or theme that may also specify either China or Japan and a particular historical era. The concentration may not include language courses, but literature courses and additional courses in history may be counted. The concentration normally includes coursework in at least two departments. Examples of substantive concentrations include:
   - traditional Japanese civilization
   - social transformation of modern China
   - economic development in East Asia
   - political economy of postwar Japan
   - fine arts and literature in Ming-Qing China
   - culture and society of modern Japan

4. **Senior Paper**—The student must submit a paper treating China, Japan or East Asia as a senior thesis in East Asian Studies. This paper may be written for one of the courses or seminars included in 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 the latter case, some units of directed reading may be credited towards the fulfillment of the substantive concentration.

**COTERMINAL DEGREE**

The Center for East Asian Studies will admit a limited number of undergraduates to work for a coterminal 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

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. Foreign applicants are also required to take the Test of English as a Foreign Language. Applications for admission and financial aid may be obtained by writing to the Office of Graduate Admissions, Old Union, Stanford University, Stanford, California 94305. The deadline for applications for admission and financial aid for 1981–82 is January 15, 1981.

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 or 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.

DUAL DEGREE PROGRAMS
Qualified graduate students may apply for A.M. degrees within the Food Research Institute and the Medical School.

A Master of Arts degree may be awarded by the Food Research Institute to students who complete 25 units of work in the 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 with an average grade of B or better. The Master's program of course work 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. Applications should be made to the Chairman, Graduate Instruction Committee, Food Research Institute.

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, system 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. For more information, address inquiries to the Program Administrator, Division of Health Services Research.

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 (Skinner), given alternate years

121. Japanese Society and Culture. 5 units, Spr (Befu)

122. Ecology, Industrialization and Culture in Japan. 5 units (Befu), given alternate years

125. Japanese Culture Through Novels and Films—(Same as Asian Languages 125.) 5 units (Befu), given alternate years

157(257). Law in Radically Different Cultures—(Same as Law 157.) 3 units, Spr (Barton, Gibbs, Li, Merryman)
ART

2. Ideas and Forms in Asian Art.
4 units (Sullivan), given 1981-82

20. Introduction to the Art of Asia—(to 600 A.D.).
4 units, Aut (La Plante) TTh 11-12:15

4 units, Win (La Plante) TTh 11-12:15

22. Introduction to the Art of Asia (14th Century Onward).
4 units, Spr (La Plante), given 1981-82

125A. Indian Painting.
4 units, Aut (La Plante) M 2:15-4:05

125B. The Art of India.
4 units (La Plante)

125C. The Art and Architecture of Moghul India.
4 units (La Plante)

126A(226A). Introduction to Chinese Art.
4 units, Aut (Sullivan) MWF 10

126B(226B). Introduction to Chinese Painting.
4 units, Win (Sullivan) MWF 10

126E(221E). The Meeting of Eastern and Western Art.
4 units (Sullivan)

128A(228A). Ritual Bronzes of Ancient China.
4 units, Spr (La Plante) given 1981-82

128B(228B). Chinese Ceramics.
4 units, Win (La Plante) M 2:15-4:05

128C(228C). Buddhist Art in Asia.
4 units (La Plante)

4 units (La Plante)

4 units (La Plante)

129A(229A). Arts of Japan I.
4 units, Aut (Takeuchi)

129B(229B). Arts of Japan II.
4 units, Win (Takeuchi)

4 units, Aut (Takeuchi)

4 units, Win (Takeuchi)

4 units, Spr (Takeuchi)

227A,B. Seminar in Chinese Art.
4 units, Aut, Win (Sullivan) W 2:15-4:05

229D. Seminar: Japanese Literati Painting—Prerequisite: Art 129B or 129C.
4 units, Spr (Takeuchi)

ASIAN LANGUAGES

COURSES NOT REQUIRING KNOWLEDGE OF AN ASIAN LANGUAGE

42. Haiku—Seminar for Freshmen.
3 units, Aut (Ueda) given 1982-83

46. Philosophical Chinese—(Same as Philosophy 46.)
4 units, Win (Nivison) MWF 10

47. Philosophical Chinese—(Same as Philosophy 47.)
4 units, Spr (Nivison) MWF 9

91. Traditional East Asian Civilization—(Same as History 91 and Humanities 91.)
5 units, Aut (Van Slyke, Lyell and Staff) MTWTh 10

92. Traditional East Asian Civilization—(Same as History 92 and Humanities 92.)
5 units, Win (Duus, Van Slyke) MTWTh 10

93. Modern East Asian Civilization—(Same as History 93 and Humanities 93.)
5 units, Spr (Duus, Staff) MTWTh 10

110(257). Japanese-Western Literary and Cultural Interaction.
4 units, Win (Ueda) given 1981-82

125. Japanese Culture through Novels and Films—(Same as Anthropology 125.)
5 units, Win (Befu) given 1981-82

131. Chinese Poetry and Drama in Translation.
4 units, Aut (Liu) MWF 11

4 units, Win (Wang) MWF 11

133. Modern Chinese Literature in Translation.
4 units, Spr (Lyell) MWF 11

4 units, Aut (Staff) MWF 1:15

4 units, Win (Matisoff) MWF 1:15-2:30

4 units, Spr (Staff) MWF 1:15

142. Chinese Philosophy from Han through Sung—(Same as Philosophy 122.)
4 units, Spr (Nivison) MWF 10

143(243). The Philosophy of Wang Yang-ming—(Same as Philosophy 123.)
4 units, Spr (Nivison) given 1981-82

144. Confucianism Since Wang Yang-ming—(Same as Philosophy 124 and Religious Studies 154.)
4 units, Spr (Nivison) given 1982-83
151. Chinese History in Translation—(Same as History 196.) 
4 units, Win (Dien) 

152. Nomad Empires of Inner Asia—(Same as History 195.) 
5 units, Spr (Dien) MTWTh 1:15 

154(254). Undergraduate Colloquium: The Middle Period in Chinese History—(Same as History 294/394.) 
5 units, Win (Dien, Kahn) M 2:15-4:05 

4 units, Spr (Wang) given 1981-82 

178 (278). Japanese Poetry from Manyōshū to Shinkokinshū (759-1206) 
4 units, Spr (Staff) M 2:15-4:05 

4 units, Spr (Matoss) given 1981-82 

4 units, Aut (Matoss) given 1981-82 

254. Graduate Colloquium: The Middle Period in Chinese History—(Same as History 394.) 
5 units, Win (Dien, Kahn) M 2:15-4:05 

255A. The Nature of Literature: Japanese and Western Views—(Same as Comparative Literature 255A.) 
5 units, Win (Ueda) given 1982-83 

255B. Chinese and Western Theories of Literature—(Same as Comparative Literature 255B.) 
5 units, Win (Liu) T 2:15-4:05 

COURSES IN CHINESE 

1,2,3. First-Year Modern Chinese. 
1. 5 units, Aut (Kao, Shou) 
   Section 1 MTWThF 9 
   Section 2 MTWThF 10 
   Section 3 MTWThF 1:15 
2. 5 units, Win (Shou, Staff) 
   Section 1 MTWThF 9 
   Section 2 MTWThF 10 
   Section 3 MTWThF 1:15 
3. 5 units, Spr (Shou, Staff) 
   Section 1 MTWThF 9 
   Section 2 MTWThF 10 
   Section 3 MTWThF 1:15 
4. 5 units, Spr (Chuang) MTWThF 9 
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. 
1-2 units, Spr (Chuang) TTh 1:15 

81,82,83. First-Year Cantonese. 
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). 
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) 
111. 5 units, Aut (Kao) by arrangement 
112. 5 units, Win (Nivison) by arrangement 
113. 5 units, Spr (Nivison) by arrangement 

111A. 3 units, Aut (Nivison) by arrangement 
111A. 3 units, Win (Nivison) by arrangement 
111A. 3 units, Spr (Nivison) by arrangement 

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. 
131. 2 units, Aut (Kao) given 1981-82 
132. 2 units, Win (Kao) given 1981-82 
133. 2 units, Spr (Kao) given 1981-82 

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.
   5 units, Aut (Dien) MWF 1:15
222. Philosophical Texts.
   5 units, Win (Nivison) MWF 1:15
223. Literary Essays.
   5 units, Spr (Liu) MWF 1:15

234. Translation of Modern Chinese Literary Texts.
   4 units, Win (Lyell) TTh 1:15

243. The Philosophy of Wang Yang-ming—
   (Same as 143 with additional work requiring knowledge of the language.)
   4 units, Spr (Nivison) given 1981-82

   4 units, Aut (Liu) MWF 10
261. Chinese Poetry (II).
   4 units, Win (Liu) MWF 10
262. Chinese Poetry (III).
   4 units, Spr (Liu) MWF 10

263. T'ang and Sung Lyrics.
   4 units, Aut (Liu) given 1981-82
264. Yüan and Ming Songs.
   4 units, Win (Liu) given 1981-82

   4 units, Win (Liu) given 1981-82

   271. 4 units, Aut (Wang) given 1981-82
   272. 4 units, Win (Wang) given 1981-82

273. Chinese Drama.
   4 units, Spr (Wang) TTh 11-12:15

276. Chinese Myths, Legends, and Folktales—
   (Same as 176 with additional work requiring knowledge of the language.)
   4 units, Spr (Wang) given 1981-82

291. The Structure of Modern Chinese.
   4 units, Spr (Kao) given 1981-82

   4 units, Spr (Kao) given 1982-83

299. Translation.
   5 units (Staff) by arrangement

321. Seminar on Archaic Inscriptions—Bone and bronze inscriptions.
   5 units, Aut (Nivison) M 2:15-4:05

334. Seminar in Modern Chinese Literature.
   5 units, Win (Lyell) TTh 1:15

351. Seminar in Chinese Traditional Historiography.
   5 units, Spr (Dien) W 2:15-4:05

361. Seminar in Chinese Literary Criticism.
   5 units, Spr (Liu) given 1981-82

   5 units, Aut (Wang) T 2:15-4:05

COURSES IN JAPANESE

1, 2, 3. First-Year Modern Japanese.
   1. 5 units, Aut (Sakamoto, Nebrig)
       Section 1 MWTWThF 9
       Section 2 MWTWThF 1:15
   2. 5 units, Win (Sakamoto, Nebrig)
       Section 1 MWTWThF 9
       Section 2 MWTWThF 1:15
   3. 5 units, Spr (Sakamoto, Nebrig)
       Section 1 MWTWThF 9
       Section 2 MWTWThF 1:15

   12 units, Sum (Staff) MTWThF 8-12

6, 7, 8. Elementary Modern Japanese (I).
   6. 3 units, Aut (Sakamoto) MWF 11
   7. 3 units, Win (Sakamoto) MWF 11
   8. 3 units, Spr (Sakamoto) MWF 11

9, 10, 11. Elementary Modern Japanese (II).
   9. 3 units, Aut (Sakamoto) given 1981-82
   10. 3 units, Win (Sakamoto) given 1981-82
   11. 3 units, Spr (Sakamoto) given 1981-82

   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. Conversation I.
   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. Conversation II.
   121. 2 units, Aut (Kubota) TTh 1:15
   122. 2 units, Win (Kubota) TTh 1:15
   123. 2 units, Spr (Kubota) TTh 1:15

GRADUATE

   Number of units to be arranged,
   Aut, Win, Spr (Staff) by arrangement

201, 202. Proseminar.
   201. 5 units, Aut (Matisoff) given 1981-82
   202. 5 units, Win (Staff) given 1981-82
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Time</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>211, 212, 213</td>
<td>Advanced Modern Japanese. Essays and Scholarly Articles.</td>
<td>5</td>
<td></td>
<td>Aut (Arahari)</td>
</tr>
<tr>
<td>211</td>
<td>Newspaper Articles.</td>
<td>5</td>
<td></td>
<td>Win (Arahari)</td>
</tr>
<tr>
<td>213</td>
<td>Fiction.</td>
<td>5</td>
<td></td>
<td>Spr (Arahari)</td>
</tr>
<tr>
<td>246, 247, 248</td>
<td>Introduction to Classical Japanese.</td>
<td>5</td>
<td></td>
<td>Aut (Staff)</td>
</tr>
<tr>
<td>246</td>
<td>Newspaper Articles.</td>
<td>5</td>
<td></td>
<td>Win (Staff)</td>
</tr>
<tr>
<td>248</td>
<td>Fiction.</td>
<td>5</td>
<td></td>
<td>Spr (Staff)</td>
</tr>
<tr>
<td>250</td>
<td>Introduction to Kambun.</td>
<td>4</td>
<td></td>
<td>Spr (Ueda)</td>
</tr>
<tr>
<td>251</td>
<td>Graduate Seminar: Japanese Historical Texts.</td>
<td>5</td>
<td></td>
<td>(Mass) by arrangement</td>
</tr>
<tr>
<td>256</td>
<td>Readings in Japanese Culture.</td>
<td>4</td>
<td></td>
<td>Aut (Ueda)</td>
</tr>
<tr>
<td>257</td>
<td>Japanese-Western Literary and Cultural Interaction.</td>
<td>4</td>
<td></td>
<td>Win (Ueda)</td>
</tr>
<tr>
<td>259</td>
<td>Readings in Japanese Criticism.</td>
<td>4</td>
<td></td>
<td>Win (Staff)</td>
</tr>
<tr>
<td>278</td>
<td>Japanese Poetry from Manyoshu to Shinkokinshu (759—1206).</td>
<td>4</td>
<td></td>
<td>Spr (Staff)</td>
</tr>
<tr>
<td>279</td>
<td>Classical Japanese Drama.</td>
<td>4</td>
<td></td>
<td>Spr (Matisoff)</td>
</tr>
<tr>
<td>282</td>
<td>Japanese Popular Religious Literature.</td>
<td>4</td>
<td></td>
<td>Aut (Matisoff)</td>
</tr>
<tr>
<td>296</td>
<td>Readings in Modern Japanese Literature.</td>
<td>4</td>
<td></td>
<td>Aut (Ueda)</td>
</tr>
<tr>
<td>299</td>
<td>Master's Thesis or Translation.</td>
<td>5</td>
<td></td>
<td>(Staff) by arrangement</td>
</tr>
<tr>
<td>392A</td>
<td>Undergraduate Colloquium: Aspects of Chinese Economic History.</td>
<td>5</td>
<td></td>
<td>Spr (Kahn)</td>
</tr>
<tr>
<td>294/394</td>
<td>Undergraduate/Graduate Colloquium: The Middle Period in Chinese History, A.D. 617-907—(Same as Asian Languages 154/254.)</td>
<td>4-5</td>
<td></td>
<td>Win (Kahn, Dien)</td>
</tr>
<tr>
<td>295</td>
<td>Undergraduate Colloquium: The Imperialist Era in East Asia.</td>
<td>5</td>
<td></td>
<td>Win (Duus, Van Slyke)</td>
</tr>
<tr>
<td>296</td>
<td>The Chinese Communist Movement to 1949.</td>
<td>5</td>
<td></td>
<td>Aut (Van Slyke)</td>
</tr>
<tr>
<td>299</td>
<td>Undergraduate Colloquium: The Institutions of Medieval Japan.</td>
<td>5</td>
<td></td>
<td>Win (Mass)</td>
</tr>
<tr>
<td>291/391</td>
<td>Undergraduate/Graduate Colloquium: Japanese Historiography on Chinese History.</td>
<td>5</td>
<td></td>
<td>Spr (Kahn)</td>
</tr>
</tbody>
</table>

**EAST ASIAN STUDIES**

**ECONOMICS**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Time</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>The Marxist and Radical Tradition.</td>
<td>5</td>
<td></td>
<td>(Gurley)</td>
</tr>
<tr>
<td>121, 221</td>
<td>Economic Development in China.</td>
<td>5</td>
<td></td>
<td>Spr (Lau)</td>
</tr>
<tr>
<td>124</td>
<td>Contemporary Japanese Economic Problems.</td>
<td>5</td>
<td></td>
<td>Spr (Tachibanaki)</td>
</tr>
<tr>
<td>126</td>
<td>Japanese Economic Development.</td>
<td>5</td>
<td></td>
<td>Win (Tachibanaki)</td>
</tr>
</tbody>
</table>

**HISTORY**

91. Traditional East Asian Civilization. 5 units, Aut (Van Slyke, Lyell, Staff)
92. Traditional East Asian Civilization. 5 units, Win (Duus, Van Slyke, Staff)
93. Modern East Asian Civilization. 5 units, Spr (Duus, Staff)
92A. China from Earliest Times to the 9th Century. 5 units, Aut (Kahn)
92B. China from the 9th to the 19th Centuries. 5 units, Win (Kahn)
92C. Modern China: 19th and 20th Centuries. 5 units, Spr (Van Slyke)
194. Early and Medieval Japan to 1336. 4-5 units, Aut (Mass)
194A. Medieval and Early Modern Japan, 1336-1800. 4-5 units, Win (Mass)
194B. The Rise of Modern Japan. 5 units, Spr (Duus)
195. Nomad Empires of Central 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)
292A. Undergraduate Colloquium: Aspects of Chinese Economic History. 5 units, Spr (Kahn)
294/394. Undergraduate/Graduate Colloquium: The Middle Period in Chinese History, A.D. 617-907—(Same as Asian Languages 154/254.) 5 units, Win (Kahn, Dien)

295. Undergraduate Colloquium: The Imperialist Era in East Asia. 5 units, Win (Duus, Van Slyke) given 1981-82
296. The Chinese Communist Movement to 1949. 5 units, Aut (Van Slyke)
299. Undergraduate Colloquium: The Institutions of Medieval Japan. 5 units, Win (Mass)
291/391. Undergraduate/Graduate Colloquium: Japanese Historiography on Chinese History. 5 units, Spr (Kahn)
390A, B. Graduate Colloquium: Topics in Late Traditional and Modern Chinese History. 10 units, Aut, Win (Kahn, Van Slyke)

395A. Graduate Colloquium: Early and Medieval Japan 5 units, Aut (Mass)

395B. Graduate Colloquium: Medieval and Early Modern Japan. 5 units, Win (Duus)

395C. Graduate Colloquium: Early Modern and Modern Japan. 5 units, Win (Duus)

490A, B. Graduate Seminar: Modern China. 10 units, Aut, Spr (Van Slyke)

496. Graduate Seminar: Social Thought in Modern Japan. 5 units, Aut (Duus)

498. Graduate Seminar: Japanese Historical Texts—(Same as Asian Languages 251.) 5 units, Win (Mass)

LAW

157. Law in Radically Different Cultures—(Same as Anthropology 157/257.) 3 units, Spr (Barton, Gibbs, Li, Merryman)

243. Law and Society in the People's Republic of China. 3 semester units, Spr (Li)

PHILOSOPHY

46. Philosophical Chinese—(Same as Asian Languages 46.) 4 units, Win (Nivision) MWF 10

47. Philosophical Chinese—(Same as Asian Languages 47.) 4 units, Spr (Nivison) MWF 9

122. Chinese Philosophy from Han through Sung—(Same as Asian Languages 142.) 4 units, Spr (Nivison) MWF 10

123. The Philosophy of Wang Yang-ming (1472–1529)—(Same as Asian Languages 143.) 4 units, Spr (Nivison) given 1981-82

124. Confucianism Since Wang Yang-ming—(Same as Asian Languages 144 and Religious Studies 154.) 4 units, Spr (Nivison) given 1982-83

194A. Undergraduate Seminar: Topics in Eastern Philosophy. 4 units, Aut (Strasnick) TTh 11-12:15

POLITICAL SCIENCE

112. Contemporary Asian Politics. 5 units, Aut (Ike) MTWTh 10

114. Government and Politics in Japan. 5 units, Win (Ike)

115. Government and Politics of China. 5 units, Win (Harding)

118L. Political Leadership. 5 units, Aut (Lewis) MWF 9

122. Seminar: Modernization and Democracy in Asia. 5 units, Spr (Ike)

137. Seminar: The World of the Superpowers. 5 units, Spr (Ike, North) T 2:15-4:05

138A. Seminar: Arms Control and Disarmament. 5 units, Win (Lewis, Blacker) MTWTh 1:15-2:05

138B. Seminar: Arms Control and Disarmament. 5 units, Spr (Blacker) W 2:15-4:05

138D. The United States and Asian Security: A Multi-perspective Approach. 5 units, Aut (Dallin, Harding, Okimoto, Weinstein) MTWTh 11

139. Chinese Foreign Policy. 5 units, Spr (Harding)

139A. Japanese Foreign Policy. 5 units, Aut (Okimoto)

139B. Japanese Foreign Policy. 5 units, Win (Okimoto)

214. Theories of Fascism in Prewar Japan. 5 units, Spr (Okimoto)

215B. Capitalism and the State in Japan. 5 units, Spr (Okimoto)

222. Colloquium in Comparative Politics: Japan. 5 units, Spr (Ward) T 2:15-4:05

225. Colloquium in Chinese Politics. 5 units, Spr (Harding)

235. Seminar: United States and the Pacific. 5 units, Win (Ward) T 2:15-4:05

239. Colloquium: Chinese Foreign Policy. 5 units, Win (Harding)

243. Seminar: International Relations Theory. 5 units, Win (North) T 4:15-6:05

244. Colloquium: Global Politics and the Future. 5 units, Spr (North) W 2:15-4:05

325. Research Seminar: The Chinese Political System. 5 units, Aut (Lewis, Li, Fingar) Th 2:15-4:05

326. Advanced Seminar: Japanese Politics. 5 units, Aut (Ike)

RELIGIOUS STUDIES

1C. Comparative Religious Thought. 3 units, Aut (Yearley) MWF 10
13(113). Hinduism.  
3-5 units, Win (Paul) MWF 11

14(114). Buddhism.  
4-5 units, Aut (Paul) MWF 1:15

3-5 units, Aut (Bielefeldt) MWF 11

16(116). Japanese Buddhism.  
3-5 units, Win (Bielefeldt) MWF 11

18(118). Ch'an and Zen Buddhism.  
3-5 units, Spr (Bielefeldt) MWF 9

19(119). Taoism.  
3-5 units (Staff) given 1981-82

20(120). Confucianism.  
3-5 units (Staff) given 1981-82

35A. Buddhist Views of Death and the After-life.  
3 units, Win (Paul) MWF 1:15 given 1981-82

40A. Eastern and Western Conceptions of the Self.  
4 units, Win (Yearley) TTh 8:30-9:50

136. Buddhist Meditation.  
5 units, Win (Bielefeldt) TTh 2:15-4:05

140B. Self Deception—(Same as Philosophy 190.)  
5 units, Spr (Bratman, Yearley) TTh 2:45-4:05

151(251). Chinese Buddhist Thought.  
5 units, Spr (Paul) TTh 2:15-4:05

152(252). Chuang Tzu.  
5 units, Win (Yearley) TTh 2:15-4:05

154. Confucianism since Wang Yang-ming—(Same as Asian Languages 144 and Philosophy 124.)  
5 units (Nivison) given 1982-83

319. East Asian Religions.  
(Bielefeldt, Nivison, Paul, Yearley) by arrangement

economics

Emeriti: Moses Abramovitz, Bernard F. Haley, Tibor Scitovsky, Edward S. Shaw (Professors)  
Chairman: Paul A. David  
Vice Chairman: John B. Shoven


Associate Professor: A. Mitchell Polinsky

Assistant Professors: Timothy F. Bresnahan, John T. Cuddington, Paul Evans, Alexander J. Field, Marie-Therese Flaherty, Thomas E. McCurdy, Hajime Miyazaki, William Novshek, William P. Rogerson

Visiting Professors: Robert Aumann, Donald V.T. Bear, PeterBernholz, Roderick Floud, N. Eugene Savin

Visiting Associate Professors: Michael Block, John James, Toshiaki Tachibanaki

Visiting Assistant Professors: John F. Cogan, Lawrence Goulder, Lawrence Summers

Affiliated 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)

Affiliated Associate Professors: Carl Gotsch, Reynaldo Martorell, Scott R. Pearson (Food Research Institute), James L. Sweeney (Engineering-Economic Systems)

Affiliated Assistant Professors: Ben S. Bernanke, Jeremy Bulow (Graduate School of Business), Dennis L. Chinn, Omar Davies, (Food Research Institute), James E. Hodder (Industrial Engineering), Anne E. Peck (Food Research Institute), David J. Teece (Graduate School of Business)

OCCERINGS AND FACILITIES

The department's purposes are to acquaint students with the economic aspects of modern society, to familiarize them with techniques for the analysis of contemporary economic problems, and to develop in them an ability to exercise judgment in evaluating public policy. There is training for the general student as well as for those who plan careers as economists in civil service, private enterprise, teaching, or research. Associated with the department are the Research Center in Economic Growth in Encina Hall, for research and graduate training in problems of economic growth in both industrialized and developing countries, and comparable facilities in Encina Hall for mathematical economics and econometrics.

The University Library is well supplied with literature in all fields of economics. The Hopkins Transportation Library holds invaluable
material on transportation problems, and there are special collections on the institutions and commerce of Latin America, the Orient, and Pacific Coast development. Advanced students have access to the Hoover Institution, with its comprehensive collections of original and secondary materials on many foreign nations. The Food Research Library in Encina Hall is particularly valuable for International Trade and Economic Development.

Qualified graduate students in economics are given the opportunity for training and research in the special fields of the Food Research Institute. A few 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: 102, 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, 102, 170, 171, 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, in economics, 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.

COTERMINAL 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 or she may submit his or her Honors thesis as one of the alternative two term papers. A student admitted to the coterminal A.M. program is expected to initiate the study plan immediately. A student's coterminal 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 Administrator, 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
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 degree:

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 simultane
ously 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 102, 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 or her advisors and the Director of Graduate Studies, to serve his or her 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 lan-

guage 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.

a) 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.

b) 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 the 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.

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 by completing Economics 270 and 271 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 276 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 the 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 adjudged by the department that he or she is qualified for the Ph.D., the student will be recommended by his or her 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 or her 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 student's second year. Based on the student's performance in the program up to that time, the Graduate Studies Committee will make a judgment as to his or her 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 or her, by the Director of Graduate Studies, and by his or her 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 or she 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 or her 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 the student's 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 the 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 on 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 the 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) the student has mastered the existing literature and professional techniques in the dissertation area, and (2) that no major conceptual or empirical problems remain to be overcome in making a significant contribution.

Joint Programs Leading to Dual Degrees—Attention is called to a joint program. The Department of Economics and the Stanford Law School offer a joint program leading to the Doctor of Philosophy in Economics and the J.D. degree in Law.

In the above case, the student’s program objectives must clearly justify such a joint program; decisions by the Departmental Graduate Studies Committee will govern. In this case, a student’s program in Economics must satisfy the same standards as a Ph.D. degree in Economics taken with a minor in Law. See the Law School catalogue for descriptions of its participation in the joint program. In this case, it is expected that dissertation research will cross departmental lines and that members of the dissertation committee will be drawn from both faculties.

Students may matriculate in Economics or Law, initially. After one year of study, they may apply for admission to a joint program by petition to the two appropriate faculty committees.

Similar joint programs involving the Master of Arts degree in Economics may be arranged upon application and following standards set up for that degree.

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 $3210 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 $4360 plus an allowance for tuition. In the case of teaching assistants, students are currently receiving $4260 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 for information about the exact times at which courses will be given in 1980–81.

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, Fuchs, 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, Miyazaki) MTWThF
Win (Miyazaki, Rogerson)
Spr (Novshek) 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 (Goulder)
Win (James, Hickman)
Spr (Goulder, Muth) 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.

5 units, Aut (Fellingham)
Win (Staubus)
Spr (Griffin)

91. Introduction to Cost Accounting—The use of internal financial data for managerial decision-making. Students who have had or are now taking a college-level cost accounting course may not enroll. (May be taken as 191 by graduate students.) Prerequisite: 90 or IE-133.

5 units, Spr (Amershi) 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 (Field) MTWThF

102. Introduction to Econometrics—Review of probability, random variables, distribution theory, theory of estimation, and hypothesis testing. Introduction to simple and multiple regression analysis. Applications to economics. Prerequisites: Statistics 60 or the equivalent. (DR:C)

5 units, Aut (Bresnahan) MTWThF

104. Labor Markets and Income Inequality—Addresses the measurement and sources of inequality of income with specific reference to the distribution of personal earnings. Theoretical and empirical discussions on human capital, labour market, occupational stratification in relation to earnings distribution. Special emphasis on the empirical findings at the developed countries such as U.S., Japan and Western Europe. Prerequisite: 51.

5 units, Aut (Tachibanaki) MTWThF

106. The World's Food Economy—(Same as Food Research Institute 103 and Human Biology 121.) This course will examine the inter-relationships 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, Spr (Johnston) MWF 10

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

109. Macroeconometric Models—Use of computerized econometric models for analyzing economic fluctuations and trends, preparing and evaluating short- and long-term forecasts, and appraising quantitative policies for stabiliza-
tion of growth. Advance knowledge of computers or computer programming not required. Prerequisite: 52.

Given 1981-82

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, Win (Cuddington) MTWThF
Spr (Gurley) MTWThF

112. Introduction to Financial Decisions—(Same as Industrial Engineering 235.) This course focuses on the models and techniques in financial decision-making under uncertainty. Topics covered include risk measurement, expected utility theory, decision trees, portfolio and capital market theories. The effects of taxation and inflation are also discussed. Prerequisites: 51, 181, Statistics 116, Econ 190 recommended, or equivalent.

3 units, Aut (Hodder) MWF
Win (Hodder) MWF

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.

4 units, Spr (Rosenberg)

115. European Economic History—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. (DR:A)

5 units, Aut (Field)

116. American Economic History—This course covers the history of the American economy from the colonial period to the second world war. It emphasizes the application of economic analysis to historical issues. Topics to be dealt with include: Trade and Development in the Colonial Economy, The American Growth Record and its Determinants, Slavery and the Civil War, Transportation and Growth, Economic Opportunities and Discrimination, Postbellum Transformation of the Industrial Structure and Organization of Industry. Institutional Framework for Economic Activity, and the Role of Government in the Economy. (DR:A)

5 units, Spr (James) MTWThF

117. British Economic History—Selected problems in the economic history of Great Britain from 1700 to the present day. The agricultural revolution, the standard of living of the workers in the Industrial Revolution, British-American differences in technology, overseas trade, capital exports and migration in the nineteenth century, and the relative decline of Britain in the twentieth century, are among the problems to be treated. Prerequisites: 51 and 52 for Economics majors.

5 units, Win (Floud) MTWThF

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 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 1:15-3:05

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)
Given 1981-82

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, Spr (Lau) MTWThF

122. The Theory of Capitalist Development—This course is concerned with theoretical 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 deter-
minants 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 Marxian theory and the recent elaborations and extensions of that theory. Reference is made to relevant historical case studies. Prerequisites: 51 and 52.

5 units, Win (Harris)

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 projects. Graduate students and advanced undergraduates. (Graduate students enroll in 223.) Prerequisites: 51, 52 for economics majors.

5 units, Spr (Reynolds) MW 3:15-5:05

124 Contemporary Japanese Economic Problems—An overview of the Japanese economic system and workability of financial market, labour market, social policy, foreign trade and etc. Not only the contemporary economic problems but also the social and political problems which are related to the economic problems are discussed. Special emphasis on the future course of the Japanese social, economic and political trend with relation to the world economy.

5 units, Spr (Tachibanaki) MTWThF

126 Japanese Economic Development—Japanese economic development since the Meiji period to the current age. The role of government and of borrowed technologies from abroad. Can the Japanese experience be a good example of the development programs for contemporary developing countries? Detailed discussions on governmental economic and development policies and their performances.

5 units, Win (Tachibanaki), MTWThF

127. Economic Development in Postwar Western Europe—The course starts with a short description of the economic situation of Western Europe shortly before and after the war. After this the development of the most important real variables and the reasons thereof will be treated. Special emphasis will be given to the organizational reforms taken in West Germany after the war and their consequences.

The importance of GATT and the formation of the European Community for the recovery of Western Europe will be stressed and some aspects of the policies of the Community (especially concerning agriculture) will be discussed. Prerequisites: 51 and 52 for Economics majors.

5 units, Spr (Bernholz)

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.

5 units, Spr (Peck) TTh 3:15-5:05

129. Analytical Techniques for Development Planning—(Same as Food Research 129/229.) This course will treat selected analytical techniques which are of use in development planning, with emphasis on linear programming models and cost-benefit analysis. The lectures will have a strong practical bias and are intended to provide students with basic competence in using the tools and understanding their use by others. Prerequisite: an introductory course in microeconomic theory.

5 units, Win (Chinn) TTh 10-12

130. Economics of the Household’s Life-Cycle—(Same as Human Biology 129.) 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 summary of data 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 observations. Among the models considered in the course are explicit economic models of natality, assortative mating, and differential mortality. Prerequisite: Economics 51.

5 units, Spr (Staff) MTWThF

131. Population in the American Economy and Society—(Same as Economics 131 and Sociology 151.) (Graduate students register for Food Research 235.) Basic demographic concepts applied to evaluation of trends in U.S. popula-
tion, especially as measured by 1980 Census. Socio-economic causes and consequences of changes in age structure; of dramatic reduction of mortality (e.g., longer duration of education, working life, marriage and retirement); of smaller families; of immigration, internal migration and population concentration in metropolises; of slower population growth. U.S. population policy and the politics of population.

5 units, Aut (Kirk) MTWTh 10

132. Application of Mathematical Programming to Agricultural Systems—(Same as Food Research Institute 130.) 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. Prerequisite: 51, 52 for economics majors.

3-5 units, Win (Gotsch) MW 1:15-3:05

140. Introduction to Financial Economics—This course will provide an introduction to modern portfolio theory and corporate finance. Topics will include savings and investment, capital formation, consumer behavior towards risk, financial effects of inflation, properties of various financial instruments, and government policy regarding securities markets. Both theoretical and institutional material will be included. Prerequisites: 51 and one course in calculus.

5 units, Win (Bulow)

141. Public Finance and Fiscal Policy—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, Spr (Shaven, Summers) 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, with 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.

Given 1981-82

144. Economics of American 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.

4 units, Aut (Falcon) MWF 9


5 units, Win (Cogan) MTWThF


5 units, Spr (Block)

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, Aut (Muth) MTWThF

150. Economics and Public Policy—An examination of the reasons for, and the varieties and consequences of government policies in economic affairs. This course will explore the means of policy formation and the means and effects of policies by focussing on specific case materials in three topic areas—market regulation policies (antitrust and commission regulation), tax and income redistribution policies, and macroeconomic stabilization policies. Prerequisites: 51, 52.

5 units, Spr (Rosse)
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.

Given 1980-81

154. Economics of Legal Rules and Institutions—(Graduate students enroll in 254.) Analyzes how legal rules (such as property rights) should be designed and enforced in externality situations. The Coase theorem on social costs; private versus public enforcement of law; the tradeoff between the certainty and severity of punishment; and ex ante versus ex post sanctions (when the external harm is statistically uncertain). Applications to pollution control; automobile accidents; the criminal justice system; consumer products liability, land use regulation; and medical malpractice. Prerequisite: Economics 51.

5 units, Spr (Polinsky) MTWThF

155. Economics of Natural Resources—Application of tools of economic analysis to the allocation of natural resources, including environmental resources, depletable mineral resources and renewable resources population. Particular emphasis on analyzing the ability of market mechanisms 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) MW 2:15-4:05

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, Spr (Fuchs)

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 (Rogerson) 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 (Bresnahan) MTWThF

159. International Economics—Comparative advantage in production and trade among nations; the international monetary mechanism; domestic monetary, fiscal, and exchange rate policies and their relationship to foreign trade. Prerequisites: 1, 51, in addition 52 for economics majors.

5 units, Aut, Spr (Cuddington) MTWThF

160. International Trade and Investment Policy—(Same as Food Research Institute 166.) This course is concerned with the formulation, implementation, and effects of selected government policies affecting international trade and foreign investment. Topics include trade policy and economic welfare, government responses to competition from imports, issues underlying the international negotiation of reductions of barriers to trade, influences of domestic agricultural policies on international trade, multinational commodity agreements and cartels, policies affecting international trade in energy resources, and special trade and investment arrangements for developing countries. 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.

5 units, Spr (Pearson) MW 11:00-1:00
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 production practices. Prerequisites: 165, or consent of instructor.
3 units, Win (Hodder) MW 3:15-4:30

168. Problems in International Political Economy—This course introduces the student to the complexity and controversy of international economic policy problems through the study of a selected number of specific policy-making situations relating to international trade policy, international monetary policy, and international development policy. Approximately one-half of the sessions will be devoted to small group policy conferences in which students will present and discuss "position papers" on the specific policy problems. Considerable independent study is encouraged in the preparation of the position papers. These problems are studied primarily through sets of specially prepared source materials. Lectures will present some international economic principles that can be applied to the problems and will place the problems in their wider context. Prerequisites: 1, 165 for majors. Limited enrollment.

169. Monetary and Financial Institutions and Policy in Western Europe—This course starts with a short description of the breakdown of the Bretton Woods system and of the reasons thereof. Afterwards the European Currency System (Snake), its institutions and its working from 1973-80 will be discussed. In addition the development of flexible exchange rates will be analyzed. Independence and organization of some Central Banks as well as the Eurocurrency Market will be touched on. The emphasis of the course will be on German and Swiss policies. Prerequisites: 51 and 52 for Economics majors.
5 units, Win (Bernholz)

170. Intermediate Econometrics I—(Graduate students enroll in 270.) Review of probability, random variables, distribution theory. Theory of estimation and hypothesis testing. Introduction to regression analysis. Applications to economics. Prerequisites: 51 and 52; Mathematics 43 or equivalent; Statistics 116 or equivalent (DR:C)
5 units, Win (Amemiya)

171. Intermediate Econometrics II—(Graduate students enroll in 271.) Discussion of violations of the classical assumptions of the multiple regression model. Introduction to the estimation of multivariate regression models, simultaneous equation models, and nonlinear models. Applications to economics. Prerequisites: 170, 270. (DR:C)
5 units, Spr (Savin)

176. Applied Econometrics—(Graduate students enroll in 276.) Critical review of the literature in econometric applications. Discusses the estimation of production functions, demand functions, consumption functions, etc. Prerequisite: 171/271 or equivalent.
5 units, Spr (Savin)

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 (Novshek) MTWThF

181. Optimization and Economic Analysis—The development of optimization techniques, including calculus, linear and nonlinear programming, the calculus of variations, and control theory. Emphasis on concepts and results rather than techniques and proofs. Examples will include static and dynamic theories of the household and the firm, and problems in aggregative planning and control. Prerequisites: 151, 180 or Mathematics 43 or equivalent and an introductory statistics course. (DR:C)
5 units, Spr (Bear)

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 with limited enrollment. 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. Topics in Macroeconomic Modelling.
5 units, Spr (Bear)

5 units, Spr (Goulder)

194. Economics of Regulation
5 units, Spr (Rogerson)
195. Law and Economics.  
5 units, Aut (Block)

197. Capital Accumulation and Imperialism.  
5 units, Spr (Harris)

198. Uses of Quantitative Methods in Economic and Social History—(Same as History 204S.) The use of quantitative methods in historical studies, emphasizing the understanding rather than mathematical derivation and formal properties of statistical techniques. The course will be taught through examples drawn from the recent literature of British and American history, and students will have an opportunity to apply appropriate techniques to historical data. Prerequisites: Statistics 60 for economics majors.  
5 units, Spr (Floud), by arrangement

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


A. CORE THEORY CURRICULUM
Course numbered over 200 are (DR:S) if taken for 3 or more units and unless noted otherwise.

5 units, Aut (Pencavel, Lau)

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 (Arrow)

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 (Bernanke, Hall)  
211. 5 units, Win (Bernanke, Hall)  
212. 5 units, Spr (Hickman)

214. Advanced Topics in Macroeconomics—Applications of rational expectations in wage-price determination, investment, consumption, and other areas. Emphasis on empirical implications and applications.

210. 5 units, Aut (Bernanke, Hall)  
211. 5 units, Win (Bernanke, Hall)  
212. 5 units, Spr (Hickman)

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, Aut (Rosenberg)

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 Marxian economic theory are developed and compared with the approaches of Neo-Keynesian and Neoclassical theories.

5 units, Spr (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.

Given 1981-82

395 A,B,C. Seminar in Alternative Approaches to Economic Analysis.

10 units (Staff) by arrangement

C. ECONOMIC DEVELOPMENT

To receive comprehensive credit in the field of Economic Development students must: (1) Complete 215 and 266; (2) choose one of the following courses: 216, 225, 230, Food Research Institute 225.

225. See Economy, Technology and Society.

230. See Monetary Theory and Institutions.

266. See International Economics.


5 units, Aut (Scitovsky)

216. International Development Management—(Same as Graduate School of Business 302.) (Only PhD students in Economics may enroll.) For developing countries of Latin America, Asia, and Africa it is often said that “Development needs the manager.” But the manager also needs to understand the development process if he or she wants a globally oriented general management perspective, or plans to associate with private or public enterprises that are lending to, trading with, or operating in developing nations. This course will therefore combine analytical models with decision-oriented policy studies to illuminate the following four key problems of economic development: (a) investment criteria and project appraisal; (b) private and public transfers of capital and technology; (c) export promotion; and (d) country credit-worthiness. Prerequisite: 215.

5 units, Spr (Meier)

221. Economic Development in East Asia 1—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

225. Technology, Economy and Society—Determinants and consequences of the diffusion of technological innovations in the economic history of the West from the ninth to the nineteenth centuries. Selected “clusters” of technical innovations will be examined for the light they throw upon the determinants of the rate and bias of innovative activity, economic and cultural conditions governing diffusion, and the problems of identifying and measuring the primary and second-order economic consequences of new modes of production and warfare. Innovation-clusters considered will include, e.g., the stirrup, horseshoe and horsecollar, the watermill, crank and gearing, the lateen rigged ship and nautical compass, gunpowder and the cannon, convertible husbandry and enclosures, the steam engine, Watt Rotary motion and steam railways.

5 units, Aut (David)

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 (James)

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)
E. MONETARY THEORY AND INSTITUTIONS


230. Monetary Theory—Advanced topics in monetary theory with special reference to policy criteria and control techniques in open economies. Financial intermediation and the banking system in advanced and less developed countries. Prerequisites: 211 and 265.
5 units, Spr (McKinnon)

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

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, Spr (Boskin)

341A,B,C. Workshop on the Economics of the Public Sector—Issues in measuring and evaluating the economic performance of government tax, expenditure, debt, and other policies; their effects on private economic activity such as saving, investment, labor supply, etc.; alternative policies and methods of evaluation. A workshop format combining student research, faculty presentations and guest speakers. Prerequisite: 241 or consent of instructor.
10 units (Boskin, Shoven, Summers), by arrangement

354A,B. Seminar in Law and Economics.
6 units, Aut, Win, Spr (Polinsky)
by arrangement

G. ECONOMICS OF LABOR

5 units, Aut (Pencavel)

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 (MaCurdy)

345A,B,C. Seminar in Labor Economics.
10 units, (Staff) by arrangement

H. URBAN ECONOMICS

To prepare for the comprehensive examination in Urban Economics, students are advised to take 249 and at least one 200-level Economics course in Public Finance or in Economics of Labor. Students planning to write this comprehensive examination should consult with Prof. Muth prior to taking these courses.

249. Urban Economic Analysis—Topics in the economic theory of urban areas, including: Cities as open regions in a larger economy; urban spatial structure, urban transportation, segregation, slums and local land-use controls; governmental housing policy toward urban areas. Prerequisite: 202 or Engineering-Economic Systems 212.
5 units, Spr (Muth)

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 (Bresnahan)

10 units, (Staff) by arrangement

360A,B,C. Energy Modeling Seminar—Seminar topics cover the economics of the supply and demand of energy in the U.S. and in the world, energy-economy interactions, bene-
fit-cost and welfare analysis of economic and energy policies.
10 units (Lau and Sweeney) 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 (Cuddington)

266. International Trade Theory and Economic Development—Causes of trade and its effects on the allocation of resources, income distribution, growth and development, commercial policies in advanced and poor countries. Prerequisite: 265 for students, or 215 for students in Development.
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.
3 units, Spr (McKinnon)

365A,B,C. Seminar in International Economics.
10 units, (Staff) by arrangement

K. ECONOMETRICS

Among the courses listed, an examination in 272, 273, 274 will satisfy the comprehensive requirement.


272. Econometrics I—Includes a review of classical least squares theory, problems pertaining to serial correlation of the residual, autoregressive models, distributed-lag models, and other single-equation methods and problems. Selected applications in economics. Prerequisites: Mathematics 113, Statistics 219 and 220, or the equivalent.
5 units, Aut (Amemiya)

5 units, Win (Anderson)

274. Econometrics III—Continuation of 273. Discusses nonlinear models; probit, logit, and Tobit models; disequilibrium models; frontiers in econometrics. Prerequisite: 273.
5 units, Spr (Amemiya)

275. Selected Topics in Advanced Econometrics—Covers the current topics not discussed in the sequence 272-273-274. Topics may include spectral analysis, Bayesian analysis, prediction and control, factor analysis, aggregation, etc. Given in alternate years. Prerequisite: 274.
Given 1981-82

5 units

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, Win (Hammond)

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.
5 units, Spr (Starrett)

282. Theory of Information and Organization—(Same as Operations Research 363.) 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 (Arrow)

Field II: General Theory

283. Game Theory and Economic Applications—A systematic treatment of game theory and some of its applications in economic analysis. Non-cooperative games and cooperative games (including both market games and voting

*Under Field I and Field II, among the courses listed any two courses plus a term paper satisfy the comprehensive requirement. This does not apply to 299 and 290 which require special approval.
games). Alternative-solution concepts. Prerequisite: Mathematics 115 and basic probability concepts.

5 units, Win (Kurz)

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 (Staff)


5 units, Win (Novshek)

288. Special Topics in Mathematical Economics—Repeated games and application to economics. This course will review the theory of repeated games under alternative conditions of the state of information and its applications in economics. Repeated games with full information. The “folk” theorem and applications to economics. Altruism, oligopoly theory and other topics. The concepts of perfect and epsilon equilibria. Zero sum repeated games with incomplete information on one or two sides. Non-zero sum repeated games and its application to the theory of entry. Introduction to Stochastic Games.

5 units, Aut (Aumann)

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.

5 units, Spr (Aumann)

290. Incentives—(Same as Business 468.) A workshop on the theory of incentives and decentralization. Topics include: implementation of welfare criteria, revelation of preferences and information, decentralization of organizational control. Includes game-theoretic analysis of the effects of differences in information, limitation on observability and contracting, and the particular problems of adverse selection and moral hazard. Prerequisites: Two courses from 280-283, 289, Business 363, or consent of instructor.

Given 1981-82

385A,B,C. Seminar in Mathematical Economics.

10 units, (Staff) by arrangement

386A,B,C. Interdisciplinary Seminar in Decision Analysis—(Same as Graduate School of Business 494A, B, C; Operations Research 366A, B, C; Psychology 283A, B, C.) This seminar aims to study a normative and descriptive decision making particularly in the face of uncertainty. It will examine general studies on the way decisions are made and the problems arising in making decision analyses in applied policy contexts. This seminar will meet once every two or three weeks throughout the academic year. Prerequisite: consent of instructor.

3-6 units, Aut, Win, Spr (Arrow, Tversky, Wilson) by arrangement
Fliegelman (on leave Winter), John B. Foster
(English and Comparative Literature)
Acting Assistant Professor: Norris F. Pope, Jr.
Lecturers: Phyllis Rugg Brown, Nora Cain, Brigitte Carnochan, Ernest Gaines, Barbara Charlesworth Gelpi, Ronald Hansen, Michael Koch, Stephanie Vaughn, David Weissmann
Sloss Visiting Professor: Morton Bloomfield
Visiting Professor: Max Byrd
Visiting Associate Professor: Joel B. Altman
Visiting Assistant Professor: Alan Shapiro

OFFERINGS

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

The English major is designed to provide students with both an understanding of the historical development of English literature and an appreciation of the variety and richness of literary texts.

PREPARATION FOR THE MAJOR

Before declaring an English major, students should have satisfied the University writing requirement. 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 requisite courses may be taken on a pass/no fail 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.

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.

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 students selecting this major are courses with broad historical perspectives on literature and language and courses which concentrate on such major writers as Chaucer, Shakespeare, Milton, Pope, Wordsworth, Dickens, Joyce and Melville. Students are required to choose one course from each of the following eight historical areas (a course from Area A will prove more useful if taken sooner rather than later; and insofar as it is possible, students should take courses in chronological sequence):

A) Language: English 100A, 101, 102, 205, Linguistics 10, 35.
F) Romantic and Victorian: English 100F, 131B, 163C, 219*, 254D.

*This course may satisfy one Area Requirement only.

In addition, students must elect two additional courses in English or American literature from
those offered by the English Department (excluding only English 1-2-3 or advanced composition courses). In place of one of these courses, students may choose one course in a foreign literature read in the original language.

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. Students must choose one course from each of the eight areas A-H listed above. In addition, students with this major are required to take the following: for fiction writers, "Fiction Writing" (English 90), "Development of the Short Story" (English 137), plus two quarters of "Advanced Fiction Writing" (English 190) or of a more advanced writing 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 "Advanced Poetry Writing" (English 192) or of a more advanced writing 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 the study of the literature of one historical period with an interdisciplinary program of courses relevant to that literature. Students are required to take the following courses:

a) During their freshman or sophomore years, all students planning to major in this program must elect two courses in the history of thought of Europe. One of these should be concerned primarily with the period before the Enlightenment (e.g., Humanities 61, 109A, History 1, History 65, Western Culture 1); the other, primarily with the period since the Enlightenment (e.g., Humanities 63, History 2 or 3, Western Culture 3, Political Science 168A or 168B).

b) Six English Department courses numbered 100 and above in Medieval and Renaissance literature (Areas A, B, C, D); or Renaissance and Enlightenment literature (Areas C, D, E); or English and American literature since the Enlightenment (Areas F, G, H).

c) In addition, students must take the following English courses:

1) those electing a Medieval/Renaissance emphasis must take English 35; or 115 and 117 and 119.

2) those electing a Renaissance/Enlightenment emphasis must take English 35; or 117 and 119.

3) those electing an emphasis in English and American literature since the Enlightenment must take English 25; or English 113 and a course on Chaucer; or a course on Chaucer and a course on Shakespeare and a course on Milton (English 171, 173, 276).

d) 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. 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, one from each of the Areas A-H listed under the major in English and American Literature. 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, one from each of Areas A-H, 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, one from each of Areas A-H, 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 eight areas A-H, and a coherent program of four courses in Spanish or Spanish-American literature, totaling at least twenty units and read in the original. The program of each student must be approved by the departments involved as specified above.
5. HONORS PROGRAM IN ENGLISH

Students who wish to undertake a more intensive and extensive program of study in English literature, including seminars and independent research, are invited to become candidates for Honors.

Candidates for Honors will register for the Junior Honors Seminar on critical approaches to literature in the Spring Quarter of their junior year. In exceptional cases, English 100A-H may meet this requirement.

At the same time they will register for English 196, "Honors Essay Proposal" (one unit). Successful completion of the essay proposal under the guidance of a faculty advisor, submission of a research bibliography and completion of a guided tour of the research facilities in Green Library will constitute admission to the Honors Program. Students should consult with the Director of the Honors Program before registering for the Junior Honors Seminar.

In the Autumn and Winter Quarters of their senior year (or their two penultimate quarters), candidates for Honors will write a Senior Honors Essay under the guidance of a faculty advisor. They should register for English 197, for a total of ten units. Honors candidates are urged to take no more than 15 units of work during these two quarters. The deadline for submission of the Honors Essay is the first day of Dead Week of Winter Quarter.

Candidates for Honors will also register for a Senior Honors Seminar in the Autumn Quarter of their senior year, which will focus on a close reading of literary texts.

Students in the Honors Program will complete the following program:

Area requirements (A through H)—eight courses
Junior and Senior Honors Seminars—two courses
Senior Honors Essay—10 units

The Director of the Honors Program may, in special cases, modify these requirements.

Students electing the major in English with an 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 d) and will write the Senior Honors Essay.

On the basis of their performance in the program as a whole, successful 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 who 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.

6. 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 in English 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 Credentials Administrator, Room 110, 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 subsequently 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 Candidates. 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 two graduate seminars. 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. In addition to the two required graduate seminars, the Master's student may schedule 5 or 10 units of directed reading and research as English 398, which would result in a substantial piece of scholarly or critical writing of appropriate length.

2. Demonstration of a reading knowledge of one foreign language.

Candidates for a coterminal 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 the "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 and one foreign language.

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 and by passing one foreign language.

**DOCTOR OF PHILOSOPHY**

University regulations regarding this degree are discussed in the "Degrees" section 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 98 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.

Towards the 98 course units currently required for the Ph.D., a student may count no more than 20 units of English 398 without the Graduate Director's written permission. A student must take at least 70 units (normally 14 courses) of the 98 in classroom courses (that is, courses other than 396, 397, 398, and 399), of which no more than 15 units (normally 3 courses) may come from courses numbered 100-199.

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 six courses for a letter grade from the graduate colloquia and graduate seminars, of which at least three must be graduate seminars. These colloquia and seminars should be from different genres and periods as approved by the advisor.

3. A three-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 97 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 the doctoral program who has done graduate work at another university must petition in the first week of the first quarter at Stanford for transfer credit for course work completed elsewhere and for exemption from the Stanford Qualifying Examination. The petition should list the courses and grades and describe the nature, scope, and result of the qualifying examination taken elsewhere. The Graduate Studies Committee will meet the first week of Winter Quarter to consider these petitions in conjunction with the students' grades for the first quarter here. If the Committee cannot make a decision at that time, it will meet the first week of Spring Quarter to make a decision after two quarters of Stanford grades. If a student's petition is not granted, he or she will have the option of taking the Stanford Qualifying Examination either in the Spring Quarter of the first Stanford year or at the regular time in September of the second Stanford year.

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 the field of concentration (as defined by the student and the student's 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. Among these, a minimum of six courses for a letter grade from the graduate colloquia and graduate seminars, of which three must be in
American literature, and of which at least three must be graduate seminars. The colloquia and seminars should be in different genres and periods as approved by the advisor.

3. A three-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 97 units.

6. Qualification: (See paragraph 7 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 field of concentration (as defined by the student and the student's 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 7 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 three-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 six courses for a letter grade from graduate colloquia and graduate seminars, of which three must be graduate seminars and of which at least four must be in the English Department. Among these courses, students should take one in literary theory or criticism. These colloquia and seminars should be in different genres and periods as approved by the advisor.

7. A University oral examination covering the field of concentration (as defined by the student and the student's advisor). 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 Graduate Studies Committee will not accept courses taken as an undergraduate in satisfaction of the language requirement for doctoral candidates. For students coming to doctoral work at Stanford from graduate work done elsewhere, satisfaction of a foreign language requirement accepted at the other institution will normally be accepted here.

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 reinstate their candidacy by application to the graduate director.

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.

Requirements of the Ph.D. program in English and Linguistics are as follows:

1. A five-unit course in Old English, a five-unit course in Middle English, and English 102 (History of the English Language) for five units.

2. A minimum of three seminars in different genres and periods as approved by the advisor. The student will normally take a total of six courses from the graduate colloquia and graduate seminars.

3. A three-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 30 additional units of graduate courses and seminars (excluding 396, 397A, B, and C, and 399) in English or American literature. Courses outside the department to be taken only with consent of advisor. The student may not count more than 10 units of English 398 towards the required number for the Ph.D.

6. A minor in Human Language (30 units, administered by the Department of Linguistics), to be worked out with the graduate advisor in Linguistics in conjunction with the graduate advisor in English. This minor will include Linguistics 210 and English 101.

7. Qualification: (See paragraph 7 under requirements of the Ph.D. program in English literature.)

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 the field of concentration (as defined by the student and the student's advisor). Topics for the colloquy will include at least one on applications of linguistics to literary studies. Half of the question period will be devoted to literature, and half to linguistics and its application to literature.

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
Genre Courses:
- Drama: 40-49, 140-149, 240-249, 340-349
- Poetry: 50-59, 150-159, 250-259, 350-359
Topic Courses: 60-69, 160-169, 186-189, 260-269, 360-369
Author Courses: 70-79, 170-179, 270-279, 370-379
Overseas Campus Courses: 80-89, 180-185
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 through the Freshman English Office. (DR:X)

- 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. Directed Writing**—For students who have been exempted from or have completed the Writing Requirement and wish further work in writing. Taught partly by the tutorial method, tailored to the individual student's needs. (DR:X)

- 3 units, Aut, Spr (Staff)

**Freshman Seminars**—Designated Freshman Seminars fulfill the University Writing Requirement.

**21, 22, 23. Major Texts in Western Culture**—Presentation of central issues in Western thinking and culture through the study of closely-related literary and philosophical texts. The course is not structured chronologically; rather each quarter's syllabus is organized around a particular set of problems dominant throughout the history of Western culture. See Comparative Literature 21, 22, and 23 for more information about these courses.

**25, 35, 45. Masterpieces of English and American Literature**—Courses offering an in-depth study of selected works by major English and American writers from the medieval to modern periods.

**25. Masterpieces of English Literature I: Chaucer, Shakespeare, Milton, and Their Contemporaries**—This course is designed as an introduction to the works of three of the greatest English writers: Chaucer, Shakespeare, and Milton.

- 5 units, Aut (Howard)

**35. Masterpieces of English Literature II: From the Enlightenment to the Modern...**
Period—This course is designed as an introduction to literary masterpieces written in English between 1700 and the present. Works by such authors as Swift, Keats, Dickens, and Joyce will be read.

5 units, Win (Chace)

45. Masterpieces of American Literature—This course is designed as an introduction to major literary works by American writers. Works by such authors as Hawthorne, Melville, James, and T.S. Eliot will be read.

5 units, Spr (Islas)

30. The Novel—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, Spr (Drake)

40. Drama—Principal dramatic forms; development of dramatic art, masterpieces of the theater from various periods, countries.

5 units, Aut (Friedlander)

50. Poetry—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, Win (Stone)

63A. Women's Writing as Critique and Vision: the Nineteenth Century—A feminist reading, primarily thematic and biographical in focus, of works by major nineteenth-century women writers, among them Madame de Staël, George Sand, Charlotte Brontë, Margaret Fuller, Elizabeth Barrett Browning, and Harriet Beecher Stowe. Strongly recommended as a complement to English 63B/163B. (May be taken as 163A by English majors.)

5 units, Aut (B. Gelpi)

63B. Women's Writing as Critique and Vision: The Twentieth Century—Works by major twentieth-century writers covering such topics as feminist utopias, the buried tradition of women poets, lesbian critiques and visions, woman-centered realism in fiction, feminist literary criticism. Strongly recommended as a complement to English 63A/163A. (May be taken as 163B by English majors.)

5 units, Win (Middlebrook)

63C. English Women Writers—A feminist approach to the works of Jane Austen, Mary Wollstonecraft, Mary and Percy Shelley, Emily and Charlotte Brontë, George Eliot, Virginia Woolf, and Margaret Drabble. (May be taken as 163C by English majors.)

5 units, Spr (Mellor)

73. Shakespeare—(Same as Drama 59.) An introduction to Shakespeare's dramatic art based on the reading of approximately twelve plays. Emphasis on historical background and focus on staging methods and production values. Designed for the general student as well as the prospective English major.

5 units, Spr (Prosser)

79B. Faulkner—(May be taken as 179B by English majors.)

5 units, Aut (Moser)

90. Fiction Writing—Basic problems of narrative and imaginative writing. Prerequisite: completion of the writing requirement. (DR:X)

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. (DR:X)

5 units, Aut, Win, Spr (Staff)

101. The Structure of the English Language—(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, Win (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 (Howard)


113. The Renaissance.
5 units, Aut (Ryan)

115. The Neoclassic Period.
5 units, Win (Fifer)

119. Modern British Literature.
5 units, Aut (Stone)

120. American Historical Novel—An introduction to the American historical novel, beginning with Great Britain's Scott, and progressing chronologically through Cooper, Hawthorne, Melville, Twain, Wharton, Cather, Faulkner, and Janet Lewis.
5 units, Spr (Dekker)

121. American Literature and Culture to 1855—(Same as American Studies 50.)
5 units, Aut (Fliegelman)

122. American Literature, 1855-1917.
5 units, Win (Rampersad)

125. American Literature, 1917 to the Present.
5 units, Spr (Momaday)

131A. The English Novel through the Eighteenth Century.
5 units, Aut (Fifer)

131B. The English Novel in the Nineteenth Century.
5 units, Win (Stone)

132. The Nineteenth-Century Continental Novel—The main tendencies, as illustrated in works by Stendhal, Tolstoy, Balzac, Dostoevsky, Flaubert, and Mann.
5 units, Spr (Foster)

138. The Autobiographical Narrative.
5 units, Win (Momaday)

152. Varieties of Eighteenth-Century Poetry—Examination of the characteristics and meaning of a number of different kinds of poetry (satires, odes, lyrics, pastorals, epitaphs, hymns, and ballads) in the context of eighteenth-century aesthetic and cultural backgrounds in order to understand the unique poetic achievement of the century.
5 units, Win (Brigitte Carnochan)

161A. The Afro-American Novel—The focus of this course will be on the literary expression of the Afro-American experience in historical context, and on the implications of choice of literary form in interpreting the historical experience. Readings: Black Thunder, Arna Bontemps; Confessions of Nat Turner, William Styron; Ten Black Writers Respond; The Autobiography of Malcolm X; Song of Solomon, Toni Morrison.
5 units, Aut (Drake)

161D. Afro-American Autobiography—An examination of the major extended statements of their personal history and its general significance by a number of black Americans over a period of more than a century. The range of the autobiography as a literary genre will be discussed, including its tendencies toward fiction and its value as social and historical commentary. The reading list will include Nat Turner's Confessions, Douglass' Life, Washington's Up From Slavery, Du Bois' Dust Tracks on a Road, Wright's Black Boy, Malcolm's Autobiography, Maya Angelou's I Know Why The Caged Bird Sings, and Langston Hughes' The Big Sea.
5 units, Win (Rampersad)

162A. Contemporary Chicano Literature—(Same as Spanish and Portuguese 162A.) An intensive examination of Chicano and Mexican-American prose writers from 1959 to the present.
5 units, Aut (Islas)

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)
3-5 units, Win (Alegria)

163A. Women's Writing as Critique and Vision: the Nineteenth Century—See 63A.

163B. Women's Writing as Critique and Vision: the Twentieth Century—See 63B.

163C. English Women Writers—See 63C.

165A. Interpretations of the Modern Experience—The last century has seen the massive industrialization and urbanization first of Europe and North America, and subsequently of much of the rest of the world. This course will consider, in historical context, the literary expression of this experience in different traditions, as social and cultural values and artistic forms have been affected. Works read will be Ambiguous Adventure, Cheikh Hamidou Kane
166. Modern Literature from Africa—The readings will be considered in the historical context of events since roughly 1900: colonization of much of Africa by Europe, the gaining of political independence, and continuing conflicts.

5 units, Aut (Drake)

169A. The Existential Hero in Modern Literature—This course explores the qualities that distinguish a uniquely modern species of literary protagonist. Kierkegaard, Heidegger, Sartre, and Tillich form the perspective through which the course evaluates works such as Lawrence's *The Man Who Died*, Woolf's *Mrs. Dalloway*, Ellison's *Invisible Man*, and Beckett's *Waiting for Godot*.

5 units, Spr (Drake)

171A. Chaucer: *Canterbury Tales*.

5 units, Aut (G. Brown)

171B. Chaucer: Minor Poems and *Troilus*.

5 units, Spr (Howard)


5 units, Aut (Rebholz)


5 units, Win (Riggs)


5 units, Spr (Ryan)

175. Defoe, Swift, and Pope.

5 units, Spr (Bender)


5 units, Win (Trimpi)

177. Virginia Woolf.

5 units, Spr (Ruotolo)

179B. Faulkner—See 79B.

186. Women in Later Medieval Literature—Readings in such works as *The Romance of the Rose*, *Tristan and Isolde*, and *Troilus and Criseyde*.

5 units, Win (Bloomfield)

187. English History and Literature of the Restoration and Eighteenth Century—A study of the inter-relation between history and imaginative, biographical, and historical literature in the era during which social and political events had the most profound impact on the work of writers of high talent.

5 units, Spr (Loftis)

190. Advanced Fiction Writing—Intermediate course. May be taken twice. Prerequisite: 90. (DR:X)

5 units, Aut, Win, Spr (Staff)

191. Expository Writing—This is an advanced course in composition taught partly by the tutorial method, and tailored to the individual student's needs. Open to undergraduate and graduate students who wish further work in writing. This course does not fulfill the Writing Requirement. (DR:X)

3 units, Win, Spr (Staff)

192. Advanced Poetry Writing—Intermediate course. May be taken twice. Prerequisite: 92. (DR:X)

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. (DR:X)

Any quarter, by arrangement


1 unit, any quarter, by arrangement

196A. Junior Honors Seminar—Required of all juniors in the English Honors Program. (DR:X)

5 units, Spr (Halliburton)

196B. Senior Honors Seminar—Required of all seniors in the English Honors Program. (DR:X)

5 units, Aut (Moser)

197. Senior Honors Essay. (DR:X)

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 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. (DR:X)

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:H) unless marked otherwise. Note—Graduate students in other departments who wish to broaden their programs will find many of these courses useful.

201. Old Saxon—(Same as German 207.)
3-5 units, Aut (Robinson)

205. Old English—Elements of Old English grammar; critical reading of short poems and selected prose in Old English.
5 units, Win (G. Brown)

208. Post-Classical Latin—(Same as Classics 118.) (DR:X)
5 units, Aut (G. Brown)

211. Readings in Middle English.
5 units, Aut (Howard)

212A. Medieval to Renaissance: The Development of Literary Forms.
5 units, Aut (Trimpi)

212B. Continuation of 212A.
5 units, Win (Trimpi)

214. English Culture from Elizabeth I to the Civil Wars—(Same as History 242.) Enrollment limited to 20.
5 units, Spr (Riggs and Seaver)

215. Later Eighteenth-Century Literature—A survey of late Enlightenment and pre-Romantic writing, with major emphasis on the moral and critical thought of Samuel Johnson. Additional readings from Boswell, Blake, Diderot, Burke, and Gibbon.
5 units, Spr (Byrd)

219. Authorial "Voice" in Verse and Prose, 1800-present—The relationship of authorial voice to inherited styles, verse forms and narrative structures, and to temperament and assumed personae or roles. Selected works by Wordsworth, Coleridge, Dickens, Hardy, Conrad, Faulkner, and one or two contemporary writers.
5 units, Spr (Guerard)

5 units, Win (Moser)

239. American Short Fiction.
5 units, Aut (Fields)

242. Elizabetian and Jacobean Drama.
5 units, Spr (Riggs)

5 units, Spr (Loftis)

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 (Shapiro)

251. The Renaissance Lyric—Historical development of the lyric form in Renaissance England, from Wyatt to the middle of the seventeenth century.
5 units, Spr (Altman)

254D. Romantic Poetry as Myth-making—Confronted with the historical disintegration of Christianity and the Great Chain of Being, Romantic 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, and Byron.
5 units, Aut (Mellor)


256B. American Poetry, 1900-1945.
5 units, Win (A. Gelpi)

256C. American Poetry, 1945 to the Present.
5 units, Spr (Fields)

259A. Symbolist Poetry, French and American—The Symbolist imagination and its consequences in the nineteenth and twentieth cen-
turies: Baudelaire, Mallarmé, Rimbaud, Valéry; Huysmans, Proust, Robbe-Grillet; Stevens, Crane, Williams, Winters, Frost. Reading knowledge of French useful but not necessary. Novels to be read in English; poems in bi-lingual translations.

261. Introduction to Medieval and Renaissance Apocalyptic and Millenarian Literature—Texts will be read in English.

5 units, Win (Fields)

265. Literature of the American West, 1850 to the Present.

5 units, Aut (Momaday)

267. Irrationality in the Age of Reason—Counter-currents in the Enlightenment. Ideas of madness, alienation, metamorphosis, sexuality in such writers as Swift, Diderot, Johnson, Blake, Mary Shelley (Frankenstein). Emphasis on case studies like those of the "wild boys" of the late eighteenth century and on the emergence of central modern themes.

5 units, Spr (Byrd)

268. The Storyteller and His Art—A concentrated inquiry into the nature and function of the story in the oral tradition of the American Indian, with emphasis upon the identity and role of the storyteller. Limited enrollment. Prerequisite: 68 or 168, or equivalent.

5 units, Aut (Momaday)

270A. Beowulf—Reading and critical analysis of Beowulf. Prerequisite: 210, or 205 with instructor's permission.

5 units, Spr (Harris)

273. Knowing in Shakespeare—Problems of inquiry and judgment in such plays as 1 and 2 Henry IV, Henry V, Julius Caesar, Troilus, Othello, and Measure for Measure, in the light of philosophical, legal, and political developments in the later sixteenth and early seventeenth centuries. Emphasis on the skeptical revival, concepts of equity and legal fiction, and the trend toward political absolutism.

5 units, Spr (Altman)

278. Johnson and His Circle.

5 units, Spr (Fifer)


5 units, Aut (Halliburton)

285C. Emily Dickinson and F. G. Tuckerman.

5 units, Win (Momaday)

288. Authors of the Nineteenth and Twentieth Centuries.

288A. Joyce.

5 units, Aut (Chace)

288B. Dickens and His Society—An examination of some of the ways in which Dickens's novels shed light on his society; also, an attempt to use historical materials to help assess Dickens's achievements as a novelist. Readings will include several of Dickens's novels, a sampling of his journalism and letters, and various historical sources (some primary, some secondary).

5 units, Aut (Pope)

288E. Yeats and T. S. Eliot.

5 units, Aut (Lindenberger)

290. Reading for Fiction Writers—A practical workshop in the slow, meticulous analysis of fictional texts in an attempt to discover different authors' strategies of style, structure, technique. Not a writing course, but a fiction course for writers. Prerequisites: 90, 190, a course in short fiction, and submission of a manuscript ten days before registration. (DRX)

5 units, Win (L'Heureux)

COURSES NUMBERED 300 THROUGH 309 ARE GRADUATE COLLOQUIA; COURSES NUMBERED 310 THROUGH 399 ARE GRADUATE SEMINARS AND WORKSHOPS

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. All courses (DRX)

301. Colloquium: Allegory and Symbolism—Emphasis on medieval and Renaissance literature, with some discussion of theoretical matters.

5 units, Win (Bloomfield)


5 units, Aut (Rebholz)

303. Colloquium: Eighteenth-Century Literature of Travel—A study of the theme of travel as it is employed in works, fiction as well as non-fiction, by such writers as Swift, Smollett, Sterne, Johnson, and Boswell.

5 units, Aut (Fifer)

304A. Colloquium: English Romanticism.

5 units, Spr (Mellor)
5 units, Spr (Stone)

5 units, Spr (A. Gelpi)

5 units, Win (Howard)

330. Seminar: Theory of Narrative—(Same as Slavic Languages and Literatures 300.)
5 units, Win (Todd)

340. Seminar in Medieval Drama—(Same as Drama 353.)
5 units, Aut (Prosser)

361. Seminar: The Modern Tradition—(Same as Modern Thought and Literature 361.)
Studies in masters of modern thought and literature such as Diderot, Marx, Nietzsche, Freud, Wittgenstein, Heidegger, Kafka, Malraux, and Beckett. Restricted enrollment and priority admission to Modern Thought and Literature graduate students.
5 units, Win (Halliburton)

365. Topics in American Literature.
365C. Seminar: American Culture and Society in the 1840s—An attempt to recover the major intellectual and cultural issues reflected in the literature of the American Renaissance. Much attention will be given to the periodicals of the period.
5 units, Spr (Fliegelman)

369. Seminar: Major Modern Critics—An introduction to modern European and American literary criticism.
5 units, Aut (Lindenberger)

373. Seminar: Shakespeare.
5 units, Win (Bender)

376. Seminar: Milton.
5 units, Spr (Evans)

385. American Authors of the Nineteenth and Twentieth Centuries.
385F. Seminar: Faulkner.
5 units, Win (Moser)

388. British Authors of the Nineteenth and Twentieth Centuries.
388F. Seminar: Joseph Conrad.
5 units, Win (Guerard)

390. Graduate Fiction Writing—A workshop designed primarily for graduate students enrolled in the Writing Program. May be repeated for credit. Prerequisite: consent of instructor.
3-5 units, Aut (L'Heureux)
Win (Shapiro)
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 (Dekker, 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 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 (Packer)

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 (Packer)

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.

See Overseas Studies section for English courses given at overseas centers.

RELATED COURSES
Sense of Identity in Modern Women Writers—See Modern Thought and Literature 207.

Spanish American Literature in Translation—See Spanish and Portuguese 123A.

Russian Formalism and Structuralism—See Slavic Languages and Literatures 230.

COURSES REGULARLY OFFERED, BUT NOT DURING 1980-81

60A. American Jewish Writing.
60B. Literature of the Holocaust.
60D. The English Bible as Literature.
67C. Introduction to Folklore.
67D. Introduction to Myth.
68. American Indian Mythology, Legend, and Lore.
79A. Fitzgerald and Hemingway.
110. The Earliest English Literature.
111. Middle English Literature.
117. Romantic and Victorian.
128. Reflections on the American Condition.
131C. The Twentieth-Century English Novel.
136. Forms of the Modern Novel.
137. Development of the Short Story.
139. The Detective Novel.
160A. American Jewish Writing.
160B. Literature of the Holocaust.
160D. The English Bible as Literature.
161B. Afro-American Poetry.
161E. Recent Writings of Afro-American Women.
162C. Contemporary Mexican Writers (In Translation)
162E. Introduction to Caribbean Poetry: English, French, Spanish.
162F. Contemporary Caribbean Writing.
162G. Chicano Culture: Interdisciplinary Approach to the Study of Chicano Life and Culture.
164. Critics of America.
165B. Colloquium on National and International Identity.
167A. The Literature of Fantasy.
167B. Modern British Comic Writers.
167C. Introduction to Folklore.
167D. Introduction to Myth.
169B. Post-Modernism: The Literature of the Last Decade.
179. Hawthorne and Melville.
179A. Fitzgerald and Hemingway.
200A. Old Norse—(Same as German 205A.)
200B. Advanced Old Norse—(Same as German 205B.)
206. Linguistics and Literature: Linguistic Approaches to Point of View and Tone.
209. Introduction to Paleography and Codicology.
213. Literature of the Sixteenth Century.
217A. The Bloomsbury Group.
226. American Literature of the 1930s.
227. Modern Southern Writers.
234. American Fiction and Prose.
234A. Colonial American Prose.
234B. American Romanticism.
234C. American Fiction: Romance to Realism.
234F. History as Literary Art.
234G. American Literary Critics.
235. The Impressionist and Experimental Novel.
237A. Eighteenth-Century Prose.
237B. Romantic Prose.
238. Culture and Society from Coleridge to T. S. Eliot.
240. Medieval Drama.
243. Jacobean and Caroline Drama.
248. Modern British Drama.
253A. Some Eighteenth-Century Poets.
253B. Poetry and Ideas: Johnson to Blake.
254C. Victorian and Early Modern Poetry.
256A. American Poetry before 1900.
258. Twentieth-Century Neo-Romantic British and American Poetry.
260. The History of Literary Theory.
262. Nietzsche and the Literary Imagination.
263B. Feminist Literary Criticism: Theory and Practice.
263C. The Female Experience: Victorian Heritage—Part I—(Same as Modern Thought and Literature 263C and History 163.)
264A. The Reciprocal Vision.
266A. Medieval Romance in Text and Image.
266B. Chaucer's England.
269A. Toward an Understanding of Romanticism.
269B. Toward an Understanding of Modernism.
270B. German Heroic Poetry.
274. Donne and the Metaphysicals.
276. Milton.
279. Blake.
280A. Wordsworth and Coleridge.
280B. Byron, Shelley, and Keats.
280C. Tennyson and Browning.
281A. Dickens and Trollope.
281D. The Brontës and Elizabeth Gaskell.
283. From Aestheticism to Modernism.
284B. Whitman and Dickinson.
285B. Twain and James.
287. Conrad and Faulkner.
288C. Joyce's Ulysses.
288F. Joseph Conrad.
289A. Ezra Pound's Cantos.
289B. Eliot and Neruda.
291. Workshop in Creation and Criticism.
293. Workshop in Verse Translation.
312. Seminar: Piers Plowman.
313. Methods and Materials for the Study of Renaissance 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.
314E. Seminar: Drama and Society in Renaissance England.
314F. Seminar: Renaissance Romance.
314G. Seminar: Two Myths of Modern Individualism: Faust and Don Juan.
315. Literary Problems of the Restoration and Eighteenth Century—Prerequisite: 115 or equivalent.
315A. Seminar: Eighteenth-Century Fiction.
315B. Seminar: Eighteenth-Century Satire.
315C. Seminar: Johnson and His Circle.
315E. Seminar: Lyric Poetry of the Eighteenth Century.
315F. Seminar: The Enlightenment and Its Literary Traditions.

316. Literary Problems of the Romantic Period—Prerequisite: 117 or 216, or equivalent treatment of Romantic Period.
316A. Seminar: Studies in Romanticism.
316C. Seminar: Romantic Irony.
326. Seminar: American Literature of the 1930's.
355B. Seminar: British Poetry Since Hardy.
358A. Seminar: American Poets of the Twenties and Thirties.

360A. 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.
368A. Seminar: American Critics.
370A. Beowulf
371. Seminar: Chaucer’s Troilus.
374. Seminar: Ben Jonson
380. Interdisciplinary Research Seminar—(Same as Spanish and Portuguese 390.)
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.
388. British Authors of the Nineteenth and Twentieth Centuries.
388A. Seminar: James, Conrad, and Ford.
388B. Seminar: Virginia Woolf.
388C. Seminar: Joyce’s Ulysses.
388E. Seminar: The Bloomsbury Group.
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, Anne E. Peck
Assistant Professors: Dennis L. Chinn, Todd E. Petzel
Librarian: Charles C. Milford
Affiliated 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 consump-
tion 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 75,000 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.

PROGRAMS OF STUDY

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 primarily 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.

COTERMINAL A. B./MASTER OF ARTS PROGRAM

The Food Research Institute offers a limited number of coterminous degrees for undergraduate students in Economics (and occasionally other departments). For admission a student must have a minimum letter-grade equivalent 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 below.

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.

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 201 (Applied Econometrics) is 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 one 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 IN FOOD RESEARCH

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 $3200 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

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. Prerequisite: Human Biology core or consent of instructor. (DR:S)
3 units, Spr (Johnston) MWF 10

105. Commodity Futures Markets and Prices—(Same as Economics 107A.) (Graduate Students register for 205.) 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.) 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. 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. Limited to 60 students. (DR:S)
5 units, Aut (Yotopoulos) MW 1:15-3:05

119. Human Nutrition—(Same as Human Biology 120.) An introduction to human nutrition including the function, digestion, absorption and metabolism of nutrients, dietary recommendations and standards, and a general overview of national and international nutrition problems. Prerequisite: Human Biology core or consent of instructor.
5 units, Win (Martorell, Taylor) MWF 8

120. Marketing, Consumption, and Price Analysis—(Same as Economics 128.) (Graduate students register for 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.
5 units, Spr (Peck) TTh 3:15-5:05

129. Analytical Techniques for Development Planning—(Same as Economics 129.) (Graduate Students register for 229.) This course will treat selected analytical techniques which are of use in development planning, with emphasis on linear programming models and cost-benefit analysis. The lectures will have a strong practical bias and are intended to provide students with basic competence in using the tools and understanding their use by others. Prerequisite: an introductory course in micro-economic theory.
5 units, Win (Chinn) TTh 10-12.

130. Application of Linear Programming to Agricultural Systems—(Same as Economics
132.) (Graduate Students register for 230.) After a brief review of programming theory, the course concentrates on a series of case studies in which linear programming techniques are used to analyze issues in such areas as land reform, water resource development, rural credit, mechanization, agricultural prices, transportation, and employment. Extensive use of the computer by students for case preparation is anticipated. Manipulation of models for policy purposes and agricultural data problems will be stressed throughout. Prerequisite: one course in micro-economic theory.

3-5 units, Win (Gotsch)  
MW 1:15-3:05

135. Population in the American Economy and Society—(Same as Economics 131 and Sociology 151.) (Graduate students register for Food Research 235.) Basic demographic concepts applied to evaluation of trends in U.S. population, especially as measured by 1980 Census. Socio-economic causes and consequences of changes in age structure; of dramatic reduction of mortality (e.g., longer duration of education, working life, marriage and retirement); of smaller families; of immigration, internal migration and population concentration in metropolises; of slower population growth. U.S. population policy and the politics of population. (DB:S)

5 units, Aut (Kirk) MTWTh 10

144. Economics of American Agriculture—(Same as Economics 144.) (Graduate Students register for 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.

4 units, Aut (Falcon) MWF 9

146. European Agricultural Policy—Same as Economics 142.) (Graduate Students register for 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.

4 units, Spr (Josling) Given in 1981-82

166. International Trade and Investment Policy—(Same as Economics 166.) (Graduate students register for 266.) This course is concerned with the formulation, implementation, and effects of selected government policies affecting international trade and foreign investment. Topics include trade policy and economic welfare, government responses to competition from imports, issues underlying the international negotiation of reductions of barriers to trade, influences of domestic agricultural policies on international commodity trade, multinational commodity agreements and cartels, policies affecting international trade in energy resources, and special trade and investment arrangements for developing countries. 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.

5 units, Spr (Pearson) MW 11:00-1:00

COURSES PRIMARILY FOR GRADUATE STUDENTS

201. Seminar: Applications of Research Methods—Focuses on the uses of economic methods in the analysis of agricultural problems. Lectures and student presentations will be used to develop skills in both model building and estimation. Emphasis is placed on the empirical implications of a model's structure and the choice of estimation technique. Prerequisite: Economics 171 or Business 403 and consent of the instructor.

5 units, Win (Petzel) TTh 8-10

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, Spr (Reynolds) MW 3:15-5:05

220. Marketing Consumption and Price Analysis—See 120.

221. Economics of Production—An examination of production theory with emphasis on agriculture. Topics examined will include: production, profit, and supply functions; technological change; risk and uncertainty in
production decisions. Scholarly research materials will be complemented by a series of case studies prepared by the instructors. These will be assigned regularly and, along with a final exam, will constitute the requirements for the course. Prerequisites: one course in microeconomic theory and one in statistics.

5 units, Aut (Gotsch, Petzel, and Yotopoulos) 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

225. Agricultural Development and Economic Growth—This course will cover selected problems of rural/agricultural development using economic modeling and quantitative techniques to analyze aspects of historical and current experiences of particular countries. Specific topics will include sources of agricultural growth, agricultural price policies, technical change in agriculture, mechanization, and the impact of land tenure and institutional structure on rural development. Both socialist and nonsocialist cases will be considered, with most examples drawn from Japan, Taiwan, Mexico, the Soviet Union, and the People’s Republic of China. Prerequisites: one course in microeconomic theory and one in statistics.

5 units, Win (Chinn, Reynolds) MW 10:00-12:00

229. Analytical Techniques for Development Planning—See 129.

230. Applications of Linear Programming to Agricultural Systems—See 130.


244. Economics of American Agriculture—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 (Martorell) TTh 8:30-10

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, Spr (Johnston) TTh 10:00-12:00

266. International Trade and Investment Policy—See 166.

267. International Agricultural Policy—This course will discuss the major continuing and contemporary problems in world agricultural trade, 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 1:15-3:05

285. Research Problems on Demography of the Third World—(Same as Sociology 252.) Review of demographic problems in major regions and countries, and what is being done about them. Techniques of measuring and modelling interrelations of population and development. Each student will be required to write a research paper and to lead a seminar on his/her subject.

5 units, Spr (Kirk) MWF 1:15-3:05
286. Demographic Methods—(Same as Sociology 284.) Methodology of population analysis, stressing demographic research methods which are widely applicable in economics, sociology and anthropology.
3-5 units, Win (Staff) MW 3:15-5:05

305. Seminar: Commodity Price Analysis—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) 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 (Yotopoulos, Chinn, Reynolds) 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: Ralph M. Hester

FRENCH DIVISION

Professors: Robert C. Cohn (on leave Spring Quarter), Raymond D. Giraud, Ralph M. Hester, Alphonse Juillard, Pauline Newman-Gordon, Leo Weinstein

Associate Professor: Marc Bertrand
Adjunct Professor: John G. Barson
Assistant Professors: Jean-Marie Apostolides, Brigitte Cazelhes (on leave Autumn and Winter Quarters)
Senior Lecturers: Marguerite Bauer, Clio P. Dorr, Jacqueline Ollivier
Lecturers: Nélée Langmuir, Michelle Morran

ITALIAN DIVISION

Professor: John Freccero
Assistant Professor: John Ahern
Senior Lecturer: Annamaria Napolitano
Lecturers: Maria Devine, Leda S. Mussio, Emily Omlsted, 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.

FRENCH UNDERGRADUATE PROGRAMS OF STUDY

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 six of the following courses:

Séminaire sur des problèmes contemporains
Prononciation et Phonétique
Civilisation I: 17ème-18ème siècles
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 or her advisor's recommendation. Honors program students also fulfill all regular requirements for the A.B. in French.

HONORS PROGRAM IN HUMANITIES

For majors who wish to supplement their departmental major by a related program of studies. See the “Humanities Special Program” section.

EXTENDED MAJORS

French and English Literatures—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.

French and Italian Literatures—In addition to reading proficiency in Italian, candidates should satisfy requirements similar to those stated in the previous paragraph.

English and French, and Italian and French—English majors and Italian majors interested in a combined degree with French literature should refer to “Extended Majors” in the English and Italian sections.

LA MAISON FRANÇAISE

The “Maison Française” 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.

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.
TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the "School of Education" section of this bulletin and the Credential Administrator, School of Education.

FRENCH GRADUATE PROGRAMS OF STUDY

Applicants should read carefully the general regulations governing advanced degrees (see the "Degrees" section 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.

VISITING STUDENTS

Students who are not candidates for a graduate degree but meet the standards of admission to a Master's or Ph.D. program may apply to the Graduate Admissions Office for admission as non-matriculated students for a period of not more than three consecutive quarters. Each quarter they may take up to three courses numbered 200-299 or two such courses and (with the permission of the instructor) one course numbered 300.

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 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 require-

ments 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:

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<th>Units</th>
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<tr>
<td>French 200. Stylistics</td>
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<td>4</td>
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<tr>
<td>French 201. Prononciation et Phonétique</td>
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<td>French 202. French Historical Phonology</td>
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<td>French 203. Histoire de la langue française depuis le moyen age</td>
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<td>or</td>
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<td>French 210. Old French</td>
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<td>4</td>
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<tr>
<td>French 290. Civilisation I: 17ème-18ème siècles</td>
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<td>4</td>
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<tr>
<td>French 293. Methods of Teaching French</td>
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<td>4</td>
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<tr>
<td>Four literature courses numbered 200</td>
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<td>16</td>
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<td>Total .................................. 36</td>
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Candidates are advised to develop teaching skills by participating in supervised teaching of language courses. Some 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, preferably to be completed by the end of the second year. Additional units of graduate courses, seminars, or individual work in the candidate's major or minor field are strongly recommended and will be determined according to the advisor's (or advisory committee's) judgment and the candidate's needs. French 200, Stylistics, 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).

2. **Examinations.** The Ph.D. qualifying examination will be given in the Spring Quarter at the beginning of the second year. The candidate will be asked to give a commentary in French of a text by a previously chosen author. The text will be indicated two days before the examination. A brief question and answer period will follow the commentary. The second part of the examination will include a discussion in French or English of the period of the work selected, as well as of the periods immediately preceding and following that of the work. The examination is intended to provide an opportunity for the candidate to use his knowledge of the literary, cultural, and social history of the period. For works of the Middle Ages or twentieth century, three successive centuries must be represented including that of the candidate's specialization.

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.

**PHD 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.

**EXCHANGE WITH THE ECOLE NORMALE SUPERIEURE**

The department has an annual exchange with the Ecole Normale Supérieure. Every year one of the French doctoral candidates spends the academic year at the Ecole in Paris.

**ITALIAN PROGRAMS OF STUDY**

**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 first-year language courses, Italian 1, 2, 3, and two second-year language courses, Italian 51, 52, or 53 (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 60 additional units of courses are required, including:

1. 45 units of Italian courses beyond five quarters of Italian language courses. Students are required to take the sequence of Italian 127, 128, and 129 (or in Florence 110A, B, C), one course on Dante, as well as at least one course in each of the following areas: Middle Ages, Renaissance, Eighteenth or Nineteenth Century, and Twentieth Century.

2. 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 taught in Italian that are 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 may count, with the approval of the Italian Division, toward the fulfillment of the requirements for combined majors.

Students are encouraged to structure their program individually in consultation with a departmental advisor.

EXTENDED MAJORS

Italian and English Literatures—In addition to the 45 units (beyond five quarters of Italian language courses) 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.

Italian and French Literatures—In addition to the 45 units (beyond five quarters of Italian language courses) 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 the "Humanities Special Program" section.

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.

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.

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 literature and language examination, which will be administered two weeks before the end of the Spring Quarter.
An oral examination will follow within a week of the written exam.
All candidates are required to teach at least one Italian language course under departmental supervision in order to gain teaching experience. The program director reserves the right to waive this requirement for those candidates who have prior teaching experience in Italian.
Limited financial aid is available in the form of teaching assistantships.
Applications for admission with financial aid must be received by January 15, without financial aid by May 15.

**FRENCH DIVISION COURSES**

**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.

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, Aut (Giraud TTh 11-12:30)

4 units, Win (Giraud)

114A. *The 19th Century Novel*—The major novelists of the century, including Stendhal, Balzac, Hugo, Flaubert, Huysmans, and Zola.
4 units, Win (Giraud)

114B. *The Modern French Novel*—Significant modern French authors: Proust, Gide, Malraux, Sartre, Camus, etc. Lectures, readings in English.
4 units, Aut (Cohn) TTh 12:50-2:05

115. *Introduction to Existentialism*—Existentialism as a philosophical system (theory of knowledge, theory of being, theory of value) with reference to other philosophical systems; French existentialism as reflected in the writings of Sartre, Camus, Céline, and Malraux. Readings in French, discussion in English.
4 units, Win (Juilland)

204. *Introduction to Romanian*—4 units, Spr (Juilland) 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**

John G. Barson
Coordinator

*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 26 and 29, October 1 and 6 (for Autumn Quarter); January 5 and 6 (for Winter Quarter); March 30 and 31 (for Spring Quarter). The placement test is not given in the Summer.

All courses (DR:H) unless noted otherwise.

**1. First-Year French (Part 1)**—Basic French through a rationalist direct method. Systematic acquisition of vocabulary and grammar in the immediate reality of the classroom. Only French is used by both 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 (Part 1 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 (Staff)

5 units, Aut, Win, Spr (Staff) MTWThF

**25. First-Year Conversation (French 2 level)**—(Supplément du Francais 2.) Cours de conversation au niveau linguistique du Francais 2. Prerequisite: 1 or equivalent. Course offered on a Pass/No Credit basis only. (DR:X)
2 units, Aut, Win, Spr (Staff)

**3. First-Year French (Part 3)**—Continuation du Francais 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

**38. First-Year Conversation (French 3 level)**—(Supplément du Francais 3.) Cours de conversation. Les étudiants utilisent leurs connaissances en les appliquant à l'étude de la cul-
ture et de la vie française: actualités, théâtre, cinéma, voyages, agences, etc. Renseignements utiles pour les étudiants qui partent pour le Campus de Tours ou qui projettent un voyage en France. Prerequisite: 2 or equivalent. Course offered on a Pass/No Credit basis only. (DR:X)

2 units, Aut, Win, Spr (Staff)

5. Intensive French for Beginners—An accelerated first-year French course in which either 2 or 3 quarters of French may be covered. Course offers preparation in speaking, writing, and reading the language. An all in French method is used; the course is conducted entirely in French with oral presentation immediately reinforced in small group conversation sections. Written exercises, compositions, as well as daily work in the language laboratory are also an integral part of the course. (No auditors permitted.) (DR:X)

9-12 units, Sum (Staff)

10. Reading French—An accelerated course designed specifically for the acquisition of reading ability. Primarily intended for graduate students seeking to meet the University reading requirement for advanced degrees. Also open to seniors. No auditors permitted. (DR:X)

4 units, Aut (Juilland) MTWTh 9

20. The Art of Conversation (French 22 level)—Le français dans les situations de la vie de tous les jours. Prerequisite: French 3 or equivalent. Course offered on a Pass/No Credit basis only. (DR:X)

2 units, Aut, Win, Spr, Sum (Staff)

21R. 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.

3 units, Aut (Staff) MWF


4 units, Aut, Win, Spr (Staff) MTWTh


4 units, Aut, Win, Spr (Staff) MTWTh


4-5 units, Aut, Win, Spr (Staff) MTWTh

26. Intensive Second-Year French—Equivalent to both French 22 and 23.) A complete grammar review will be offered in conjunction with reading of selected French texts. Classroom discussions, entirely in French, will focus both on the reading material and on topics of current interest. Written exercises, oral reports, written compositions, and work in the language laboratory are also included. Prerequisite: one year of college French or equivalent preparation. (No auditors permitted.)

6 units, Sum (Staff) MTWTh

30. Conversation and Culture (French 24 level)—La France vue par des écrivains français et étrangers. Présentation et discussion des opinions. Prerequisite: French 23 or equivalent. May be repeated once for credit after an interval of two quarters. Course offered on a Pass/No Credit basis only. (DR:X)

2 units, Aut, Win, Spr (Staff)

UNDERGRADUATE SEMINARS

61. French Culture—Grandes tendances de l'histoire sociale et culturelle de la France du Moyen Age à nos jours.

3-4 units, Aut (Staff) T 7:00-8:00


3-4 units, Win (Staff)

63. French Theater Workshop—Réalisation d'une pièce; interprétation, techniques, mise-en-scène, décor.

3-4 units, Spr (Staff)

STANFORD PROGRAM IN TOURS

70-80-90. Intensive and Accelerated French—Given only at Stanford in France. (See Overseas Studies for DR information.)

5 or more units, Aut, Win, Spr (Staff)

THIRD- AND FOURTH-YEAR LANGUAGE COURSES

All courses (DR:H) unless noted otherwise. Auditing is not permitted in participation language courses except in special cases.

120. Séminaire sur des problèmes contemporains—Conversation et discussion sur des problèmes actuels à partir de journaux, revues
ou films français. Prerequisite: 24 or 82 through 86 or equivalent. May be repeated once for credit after an interval of two quarters.

3 units, Aut, Win, Spr (Staff)

121. Prononciation et Phonétique—(Same as French 201.)

123. Composition, grammaire et étude de textes—Langue orale et écrite, grammaire descriptive, analyse grammaticale, composition, explication de textes. Prerequisite: 24 or equivalent.

4 units, Aut (Weinstein) TTh 11-12:15

124. Langue, style et écriture—Continuation du Français 123. Le commentaire littéraire, les styles de la critique, composition.

4 units, Win (Staff)

125. Cours avancé de français—Exercise de style, traduction et explication de texte: enrichissement du vocabulaire. Prerequisites: 123 and 124 or equivalent.

4 units, Spr (Cazelles)

LITERATURE COURSES

For literature courses in English, see also General Courses section.

130. French Literature I—Middle Ages & Renaissance—Etude générale de la littérature française de l'époque médiévale jusqu'à l'essai philosophique du 16ème siècle (Chanson de Roland, Chrétien de Troyes, poètes du 16ème siècle, Rabelais, Montaigne). Prerequisite: 24 or equivalent.

4 units, Aut (Newman-Gordon) TTh 12:50-2:05


4 units, Win (Apostolidés)

132. French Literature III—Nineteenth & Twentieth Centuries—Etude générale de la littérature française de la Révolution romantique du 19ème siècle à l'époque contemporaine (Baudelaire, Verlaine, Rimbaud, Mallarmé, Giraudoux, Flaubert, Malraux, Ionesco, Beckett, Camus.) Prerequisite: 24 or equivalent.

4 units, Spr (Weinstein)

Note: prerequisites for the following courses are normally 130, 131, or 132, or 85 and 86, or equivalent.

153. La Tragédie—La Tragédie classique en France. Sa théorie, les principaux auteurs (Corneille, Racine, Boyer, Quinault).

4 units, Aut (Apostolidés) TTh 11-12:15
280. Individu et société dans le roman français contemporain—De La Peste de Camus au "roman de contestation" actuel.
4 units, Spr (Bertrand)

293. 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 1:15 plus DHR

CIVILISATION FRANÇAISE
Approches: civilisation matérielle et modes de vie; Etat et classes sociales; culture savante et traditions populaires; idéologies et mentalités.

291. Civilisation II: 19ème et 20ème siècles.
4 units, Spr (Bertrand)

GRADUATE COURSES
All courses (DR:H) except when noted otherwise.

322. Rabelais—Graduate Seminar.
4 units, Spr (Hester)

334. Racine—Graduate Seminar. Analyse des principales œuvres de Racine à travers des critiques contemporaines.
4 units, Aut (Apostolides) T 2:15-4:05

351. Le Romantisme—Poètes et romanciers romantiques; Chateaubriand, Lamartine, Hugo, Vigny, Musset, Sand, et autres.
4 units, Aut (Weinstein) W 2:15-4:05

353. Stendhal—Graduate Seminar.
4 units, Win (Weinstein)

354. Flaubert—Graduate Seminar.
4 units, Aut (Giraud) Th 2:15-4:05

363. Mallarmé—Graduate Seminar.
4 units, Aut (Cohn) M 2:15-4:05

371. La Grande Génération—Proust, Gide, Péguy, Claudel, Romain Rolland, Valéry.
4 units, Spr (Newman-Gordon)

372. Proust
4 units, Win (Newman-Gordon)

4 units, Win (Apostolidès)

398. Tutorials—Initiated by a professor. Tutorials are intended for at least three (but preferably more) graduate students who wish to study on an informal basis a subject or an area not covered by regular courses.
4 units, Aut, Win, Spr, by arrangement

399. Individual Work—Exclusively for graduate students in French working on thesis or engaged in special work. See instructor for section number. (DR:X)
1-12 units, any quarter (Staff) by arrangement

FRENCH COURSES REGULARLY OFFERED BUT NOT DURING 1980/81

102. Writings of Simone de Beauvoir
105. The Writings of Albert Camus
110. Contemporary French Literature and Thought—(Same as French 281.)
114C. The Contemporary French Novel
129. Littérature feminine en France
135. Le Roman arthurien
139. Special Topics on Medieval Literature
141. Renaissance II
150. Romanciers et Prosateurs du 17ème siècle
151. 17th Century Literature
171. Le Roman au 19ème siècle
173. Symbolism
180. La Poésie française
181. Le Théâtre en France (1900-1960)
191. The Idea of Revolution in Modern French Literature
203. Histoire de la langue française depuis le moyen âge
210. Old French
211. Old Provencal
213. Littérature médiévale II: 14ème-15ème siècles
214. L'Epopeé
215. Le Roman arthurien
218. Medieval Romance in Text and Image
219. Special Topics on Medieval Literature
230. Introduction au 17ème siècle
241. Le Roman au 18ème siècle
244. Rousseau
270. Le Roman 1898-1950
275. Le Surréalisme
281. Contemporary French Literature and Thought
290. Civilisation I: 17ème et 18ème siècles
295. Etude de genre: Le Théâtre
310. Old French Literature Survey
ITALIAN DIVISION COURSES

All courses (DR:H) unless noted otherwise. Department code: 472 (except General Courses: 471).

311. Saints' Lives
312. Fabliaux
313. Courtly Love
314. French Epics
315. French Medieval Romances
316. French Lyric Poetry
317. French Medieval Drama
318. Chronicles
319. Special Topics on Medieval Literature
320. Poésie de la Renaissance I
321. Poésie de la Renaissance II
323. Montaigne
330. Le 17ème siècle
331. Le Théâtre classique
332. Poésie de Malherbe à la Fontaine
333. Corneille
335. Molière
336. Pascal
352. Balzac
355. Zola
360. Baudelaire
361. Rimbaud
362. La Doctrine de l'Art pour l'Art et la littérature sociale
365. Théories critiques au 19ème siècle
370. Théories du roman: du Naturalisme à 1945
373. Apollinaire—Alcools et Calligrammes
374. Valéry
380. Théories du roman: le "Nouveau roman" et après
382. Le Théâtre contemporain
385. Points de vue critiques au 20ème siècle, de Valéry à Nouvelle Critique
393. Théorie de la Poésie
394. Théorie du Roman

GENERAL COURSES

The courses in this section are open to all students and have no prerequisites. All readings and discussions are in English.

140. Dante: Inferno
4 units, Aut (Freccero)

141. Dante: Purgatorio
4 units, Win (Freccero)
(In Florence)

142. Dante: Paradiso
4 units, Spr (Freccero)
(In Florence)

144. Petrarch and Petrarchism
4 units, Win (Freccero)
(In Florence)

160. The Renaissance
4 units, Spr (Ahern)

161. Machiavelli: The Prince
4 units, Spr (Freccero)
(In Florence)

FIRST- AND SECOND-YEAR

LANGUAGE COURSES

Annamaria Napolitiano
Coordinator

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

2. First-Year Italian (Second quarter)—(Continuation of 1.) (DR:X)
5 units, Aut, Win, Spr (Staff) MTWThF

2A. L'Italia d'Oggi—Introduction to Italian life. Conversation and lectures on various aspects of contemporary Italy (politics, art, cinema, press, customs). Especially designed for students who plan to go to Italy. May be taken concurrently with Italian 2. Prerequisite: Italian 1. (DR:X)
3 units, 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

4. 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

10. Reading Italian—An accelerated course designed specifically for acquisition of reading
ability. Primarily intended for graduate students seeking to meet University reading requirement for advanced degrees. Also open to seniors. No auditors. (DR:X)

4 units, Spr (Ahern)

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 (Napolitano) MWF 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 (Staff) MWF 11

53. Second-Year Italian—Sequential progression of 51 and 52. Prerequisite: 52 or consent of instructor.

3 units, Spr (Staff) MWF 1:15

70-80-90. Intensive and Accelerated Italian—Given only at Stanford in Italy. (See Overseas Studies for DR information.)

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 (Napolitano) MWF 11

115. Advanced Grammar and Translation—(Continuation of 114.)

4 units, Spr (Staff) MWF 11

CULTURE AND CIVILIZATION

120. Culture and Society: 1920-40—Reading of selected works by Moravia, Montale, Svevo, Vittorini, Silone.

4 units, Aut (Ahern) TTh 11-12:30

121. Culture and Society: 1940-70—Reading of selected works by Levi, Pavese, Gramsci, Calvino.

4 units, Win (Ahern) TTh 11-12:30


4 units, Spr (Staff)

LITERATURE COURSES

127. Introduction to the Survey of Italian Literature—The historical and cultural background through the study of specific events, movements, figures, and artifacts.

4 units, Spr (Napolitano)

128. Survey of Italian Literature I: 13th to 16th Century—Reading of major works from Dante to Machiavelli, Ariosto, Tasso, and other significant representatives of Italian "Civiltà comunale" and Renaissance.

4 units, Aut (Ahern) MW 11-12:30

129. Survey of Italian Literature II: 17th to 19th Century—Close study of selected works by Goldoni, Parini, Alfieri, Foscolo, Leopardi, Manzoni, and Verga against their historical and cultural background. (In Italian)

4 units, Win (Ahern) MW 11-12:30

140. Dante: Inferno

4 units, Aut (Freccero)

141. Dante: Purgatorio

4 units, Win (Freccero)

(In Florence)

142. Dante: Paradiso

4 units, Spr (Freccero)

(In Florence)

144. Petrarch and Petrarchism

4 units, Win (Freccero)

(In Florence)

160. The Renaissance

4 units, Spr (Ahern)

161. Machiavelli: The Prince

4 units, Spr (Freccero)

(In Florence)

199. Individual Work—Open to all students with special permission of the department. See instructor for section number. May be repeated for credit. (DR:X)

1-3 units, any quarter (Staff)

by arrangement

GRADUATE COURSES

240. Dante: Inferno

4 units, Aut (Freccero)
GERMAN STUDIES

Emeriti: Helmut R. Boeninger, Kurt F. Reinhardt, Gertrude L. Schuelke, F. W. Strothmann (Professors)
Chairman: Gerald Gillespie
Associate Professor: Orrin W. Robinson III
Adjunct Professor: Gertrude Mahrholz (Autumn Quarter)
Assistant Professors: Russell A. Berman, David Wellbery (Bonn Exchange, Autumn, Winter)
Acting Assistant Professor: William E. Petig
Senior Lecturer: Kathryn Strachota
Lecturers: Peter Frank, Ulrike Lieder

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 coterminal 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 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), the Austrian 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, on the occasion of the U.S. Bicentennial, the Republic of Austria endowed a Distinguished Visiting Professorship in Austrian Studies. A Distinguished Visiting Professorship in Comparative Western European Studies is funded by the Volkswagen Foundation in the Federal Republic of Germany. Both these professorships 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 (J. Alan Pfeffer, Founding Director). The Institute is currently engaged, jointly with the Stanford Computer Archive of Language Materials, in a Project in Contrastive Analysis, supported by a major grant from the National Endowment for the Humanities. 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 118/218 or 119). 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.); or (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; and (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 the English section of this bulletin.

COTERMINAL PROGRAMS
   Students may elect to combine programs for the A.B. and A.M. degrees in German Studies. For details, see the Degrees section of 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 GRADUATE EXCHANGE
   Annually one or two selected Stanford graduate students in German Studies are accepted as exchange students by the University of Bonn, and their counterparts from Bonn participate in academic programs at Stanford.

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 Administrator, 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.

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 contrastive 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
208A. Introductory Middle High German
311. Syntax of Modern German
or
312. Linguistics and the Analysis of German
313. The Transformational Grammar of German
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:
Two courses in German Literature, preferably in the 350-series
One seminar in German Literature
300. Proseminar
201 and 202. Language and Style
208A. Introductory Middle High German
311. Syntax of Modern German
Two courses in German Thought, preferably Geistesgeschichte I and II
One course in German Language and Linguistics

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.

19A. Introduction to the Germanic Languages—(Same as 119, Linguistics 81.) Survey of the oldest attested stages of the Germanic language family, including Gothic, Old Norse, Old Saxon, Old English, Old High German, Old Dutch, Old Frisian. Presentation both of external history and internal relationships. (DR:H)
3 units, Spr (Robinson)

31A-33A. German Culture and Civilization I-III—(See also 131-133.) These courses provide a survey of different aspects of modern society and culture in the countries of German-speaking Europe: social processes and institutions, modernism in literature and the fine arts, central concerns of philosophical and social thought. There are no prerequisites, and students may elect to enroll in any part of the series without participating in the full series.

31A. Culture and Civilization I—This course surveys geography, people, and institutions of the German-speaking areas of Central Europe focusing on the contemporary situation and historical origins. Topics include governmental structure of the BRD, the DDR, Austria and Switzerland; population; stability and migration; social structure of East and West Germany; the educational system; communications systems; urbanization and its consequences since World War II. (DR:H)
3 units, Aut (Lohnes)

32A. Culture and Civilization II—The birth of modernism in Vienna at the turn-of-the-century and in the Weimar Republic with emphasis on literature, music, painting and architecture. The connections to broad intellectual and historical developments. Examinations of the works of Hofmannsthal, Mahler, Freud, Schönberg, Kandinsky, Groppius, Brecht and Mann. (DR:H)
3 units, Win (Berman)

33A. Culture and Civilization III—An introduction to central issues in German thought since 1945 with reference to the political context. "Overcoming the past" and the confrontation with the Holocaust. Democracy as an issue for political philosophy. The Frankfurt School from the critique of enlightenment to the consensus theory of rationality. The New Left, feminism and ecology. Marxism in the German Democratic Republic and dissident thought. The new sensibility and the new irrationalism. (DR:H)
3 units, Spr (Berman)

83A. Faust and the Western Tradition—The Faust figure from the 16th century chapbook and Marlowe's tragedy to Goethe's masterwork. Romantic interpretations in literature, art, and music. Modern views of the Faust "myth" and "archetype," including Mann's Dr. Faustus as the story of Western man culminating in catastrophe. (DR:H)
3 units, Win (Gillespie)

196A. Preconditions of Literature. German Literature as an Example.—(Same as 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 topics as literacy and analfabetism, literary socialization (education and literary canon), book publishing and trade, the common reader, the impact of libraries, and so on. (DR:X)
3 units (Frank) given 1981-82

273A. European Novel I: Renaissance Heritage.—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, picaresque, quester, and adventure modes in British, French, German, Spanish, and Italian literature.
3-5 units, Aut (Gillespie)

274A. European Novel II: Sentiment, Education, and the Crisis of Development—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. (DR:H)

3-5 units, Win (Gillespie)

275A. European Novel III: The Romantics—Readings from American, English, French, German, and Russian 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 (antithero, artist problem, ego, “double,” oversoul, romantic irony, etc.)

3-5 units, Spr (Gillespie)

291A. Literature of Decadence—Symbolist, fin de siècle, and modernist understandings of the evolution of civilization; the theme 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.)

3 units, (Gillespie) given 1981-82

296A. Preconditions of Literature. German Literature as an Example—(Same as 196A.)

3 units (Frank) given 1981-82

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.

(DR:X)

2 units, Aut (Frank)

INTRODUCTORY COURSES

First- and second-year language courses are under the direction of Gertrude Mahrholz (Aut) and William E. Petig (Win, Spr).

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 introduc-
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 (Staff) 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.

2-3 units, Aut, Win, Spr (Staff)

70, 80, 90. Intensive German—Given only in Vienna and Berlin. (See Overseas Studies for DR information.)

Aut, Win, Spr, Sum

INTERMEDIATE COURSES

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)

2-3 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, Spr (Staff)

118. Introduction to German Dialects—(Same as 218, Linguistics 182.) Introduction to the major dialects of German-speaking Europe through texts, tapes, lectures and presentations by native speakers; also a general introduction to the field of dialect geography. (DR:H)

3 units, Win (Robinson)

119. Introduction to the Germanic Languages—(Same as 19A, Linguistics 81.)

3 units, Spr (Robinson)

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: 101 and 102 (or equivalent) and consent of instructor.

121T. Translation of Texts in the Social Sciences—Translation practice of modern non-literary materials. Texts in this course concentrate on the fields of sociology, psychology, and general technology. (DR:X)

3 units, Aut (Lieder)

122T. Translation of Texts in the Social Sciences—Continuation of 121T. Practice texts will primarily be taken from the fields of business, political science, and medicine. (DR:X)

3 units, Win (Lieder)

123T. Translation of Texts in the Social Sciences—Continuation of 122T. Texts will be selected predominantly from the fields of anthropology, law, and economics. (DR:X)

3 units, Spr (Lieder)

130. German Newspapers—Articles of current interest in German newspapers are read and discussed in German. This course may be taken twice for credit. Prerequisite: 51 or equivalent. (DR:X)

3 units, Aut, Spr (Staff)

131-133. German Culture and Civilization I-III—(See also 31A-33A.) In addition to attending the lectures in 31A-33A, students with an adequate knowledge of German may register for German Studies 131, 132 or 133 and participate in a supplementary section in which further material will be read and discussed in German. Students who have received credit for 31A-33A may not repeat courses in this sequence for credit.

131. Culture and Civilization I—Prerequisites: 51 or consent of instructor. (DR:S)

4 units, Aut (Lohnes)

132. Culture and Civilization II—Prerequisites: 51 or consent of the instructor. (DR:H)

4 units, Win (Berman)
133. Culture and Civilization III—Prerequisites: 51 or consent of the instructor. (DR:H)
4 units, Spr (Berman)

134. Reading on Contemporary Germany—Students read and discuss articles dealing with present-day Germany in order to improve their mastery of the language and acquire up-to-date information about Germany and its problems. Prerequisite: 51. (DR:A)
3 units, Win (Strachota)

150. Introduction to German Literature—Literary terms and major themes in representative contexts; symbol, metaphor, parody, etc. Discussion of genres; lyric, poetry, novel, drama. Introduction to key concepts of major literary periods such as aesthetic man, romantic irony, the absurd. Consideration of various critical approaches to literature. Prerequisite: 51 or equivalent. (DR:H)
4 units, Win (Staff)

154. Modern Short Prose—Aphorisms, anecdotes, sketches, fables, parables, short stories, articles, and short novels by contemporary authors writing in German. Practice in reading, talking about, and writing about literature. Discussion in German. (DR:H)
4 units, Aut (Strachota)

4 units, Aut (Staff) given 1981-82

157. Orpheus in Germany: Lyric Poetry from the Middle Ages to the Present—Poetry provides the reader with the fullest linguistic challenge, incorporating emotional and intellectual apprehensions of the world. German poetry will be analyzed and discussed from its origins in magic to the present. The great poets will be viewed in relation to one another as well as to their cultural contexts. The nature of poetic language, the varieties of poetic forms, the changing function of poetry, techniques of interpretation and other topics will be discussed. Guest lectures by specialists will be combined with discussion sessions. Exercises in reading poetry aloud, translation, and interpretation will be included. (DR:H)
4 units, Spr (Mommsen)

161. The Classical Period—Introduction to major authors, works, and literary movements of the 18th century in historical context. Emphasis on the rise of Weimar classicism against the background of Winckelmann's aesthetics of Greek art ("noble simplicity and quiet grandeur"), Lessing and the enlightenment and Storm and Stress. Examples of drama, narrative, lyric poetry, essays from Goethe, Schiller, Hölderlin and other authors from the richest period of German literature. (DR:H)
4 units, Aut (Mommsen)

4 units, Win (Berman)

163. Naturalism to the Present—Introduction to major literary trends since the end of the 19th century with particular emphasis on the changing status of the author. Aesthetics and expressionism; literature in the Weimar Republic; the impact of fascism and exile culture; the writer in East and West Germany and current developments. Readings by Heinrich and Thomas Mann, Tucholsky, Brecht, Horvath, Böll, Becker and Enzensberger. (DR:H)
4 units, Spr (Berman)

171-174. These courses introduce the student to specific developments and topics of German literature and culture with some emphasis on methods of literary interpretation. Prerequisites: 51 plus 2 additional courses or consent of instructor.

173. Modern Fiction—Study of novels and short stories characteristic of the development of 20th century fiction; the historical, philosophical and political context; modernism; the concerns of fiction in the post-war period in East and West Germany; contemporary trends and the new sensibility. Readings by such authors as Musil, Kafka, Thomas Mann, Böll, Bobrowski, Plenzdorff and Schneider. (DR:H)
4 units, Aut (Berman)
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 1981-82

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

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 (Staff)

202. Language and Style II—Continuation of 201.
2 units, Spr (Staff)

203. History of the German Language—Introductory course on the phonological and syntactic development of Modern German from the Germanic parent language. Involves the analysis of selected texts and the consultation of linguistic works on the subject.
3-5 units, Aut (Robinson) given 1981-82

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 (Robinson) given 1982-83

205A. Old Norse—(Same as 305A.) 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 1981-82

205B. Advanced Old Norse—(Same as 305B.) Study of Eddic Poems on Helge and Sigurd.
5 units (Andersson, Harris) given 1981-82

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 1981-82

207. Old Saxon—(Same as 307.) Introduction to the grammar and documents of the earliest attested stage of Low German.
3-5 units, Aut (Robinson)

208A. Introductory Middle High German—Presentation of grammar and selected readings from the epic, lyric, and didactic writers represented in Eels Okkaar’s Mittelhoechdeutsch.
3-5 units (Andersson) given 1981-82

208B. Advanced Middle High German—A continuation of 208A, with readings on Minnesang.
3-5 units (Andersson) given 1981-82

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 181.) An introduction to linguistic theory and analysis with special emphasis on the analysis of modern German.
3-5 units (Robinson) given 1981-82

213. The Transformational Grammar of German—(Same as 313, Linguistics 282.) Study of the syntactic mechanisms of German within the framework of transformational grammar.
3-5 units (Robinson) given 1981-82

214. The Phonology of German—(Same as 314, Linguistics 281.) Systematic treatment of the German sound system, especially within the framework of generative phonology.
3-5 units, Win (Robinson)

218. Introduction to German Dialects—(Same as 118, Linguistics 182.)
3 units, Win (Robinson)

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 ex-
pected 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)

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. Note: Beginning 1980-81, this series will be given in German in alternate years.

241. Deutsche Geistesgeschichte I—From Lessing to Romanticism. The course will delineate the conceptual field within which from the middle to the end of the eighteenth century the problems of human knowledge, of history, of the nature of man and of art were revolutionized and given a new basis. In the center of the course are readings and detailed interpretations of selected texts by Lessing, Kant, Herder, Schiller and Fichte.

3-5 units, Aut (Mueller-Vollmer)

242. Deutsche Geistesgeschichte II—From Hegel to Nietzsche. The outlines of Hegel's phenomenology and his model of historical development as the becoming-conscious of freedom. The transformations of this model in the cultural criticism of Heine, the anthropology of Feuerbach and the dialectical materialism of Marx and Engels. Nietzsche's radical critique of the idea of the nature of man and of his historical self-actualization.

3-5 units, Spr (Wellberg)

243. Deutsche Geistesgeschichte III—From Nietzsche to the Present. Texts by Nietzsche, Freud, Husserl, Heidegger, Wittgenstein, and others. With a special emphasis on aesthetic problems, this introductory course attends to such philosophical movements as phenomenology, existential philosophy, critical theory and analytic logic. Shorter essays on aesthetics will be discussed in order to indicate possible applications to literary theory. The discussion of the positions and counterpositions of Benjamin and Marcuse will provide social-theoretical perspectives.

3-5 units, Win (Pütz)

244A. Nineteenth Century German Religious Thought—(Same as Religious Studies 144/244.)

5 units, Spr (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.

251A. Pidreks saga.—(Same as 351A.) Readings in Pidricks saga.

3-5 units, Aut (Andersson)

251B. Dietrich epic.—(Same as 351B.) Survey of the Middle High German Dietrich epic.

3-5 units, Win (Andersson)

251C. Heimskringla.—Same as 351C.) Colloquium on Snorri Sturluson's Heimskringla.

3-5 units, Spr (Andersson/Harris)

254. German Literature and Culture IV—(Same as 354.) From Baroque through enlightenment (circa 1600-1750).

3-5 units, (Gilkspie) given 1981-82

255. German Literature and Culture V—(Same as 355.) Eighteenth Century (1750-1800.)

3-5 units, (Monmsen) given 1981-82

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.

3-5 units (Staff) given 1981-82

270-279. Genres—These courses treat the development, contents, and formal characteristics of such kinds of writing as lyric poetry, epic drama, novel, Nouelle, 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.

277. Moderne Lyrik—(Same as 377.)

3-5 units, (Mueller-Vollmer) given 1981-82

290-299. Special Subjects and Problems—Variable topics.
292. Heine und das Junge Deutschland—
(Same as 392.)
3-5 units, (Mueller-Vollmer)
given 1981-82

293. Realismusprobleme in der Erzählkunst
von Stifter, Keller, Fontane and Keyserling—
(Same as 393.) Theorie und Praxis im “deutschen Realismus”.
3-5 units, Win (Mommsen)

294. Poets of Infinity: Hölderlin, Novalis,
Keats, Baudelaire, Leopardi, and Bécquer—
(Same as 394.)
3-5 units, (Gillespie) given 1981-82

295. Lessing und die Aufklärung—
(Same as 395.)
3-5 units, Aut (Pütz)

297. Literatur der 70-er Jahre—
(Same as 397.)
3-5 units, Win (Pütz)

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)

by arrangement

GRADUATE COURSES
All courses (DR:X)

300. Proseminar—Einführung in das Studium
der Germanistik. Die Germanistik im Gefüge
der Humanwissenschaften gestern und heute.
Bestimmung der Arbeitsbereiche. Probleme
des wissenschaftlichen Arbeiten. Für alle neu
eintretenden Studenten.
3-5 units, Win (Mommsen)

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 Ger-
man 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 Education 291.)
2 units, Aut (Lohnes) given 1981-82

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 (Robinson) given 1982-83

305A. Old Norse—
(Same as 205A.) 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 1981-82

305B. Advanced Old Norse—
(Same as 205B.)
5 units (Andersson, Harris) given 1981-82

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 1981-82

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, Aut (Robinson)

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 Ger-
man—(Same as 212; Linguistics 181.) An intro-
duction to linguistic theory and analysis with
special emphasis on the analysis of modern
German.
3-5 units (Robinson) given 1981-82

313. The Transformational Grammar of Ger-
man—(Same as 213; Linguistics 282.) Study of the syntactic mechanisms of German within the framework of transformational grammar.
3-5 units (Robinson) given 1981-82

314. The Phonology of German—
(Same as 214; Linguistics 281.) Systematic treatment of the German sound system, especially within the framework of generative phonology.
3-5 units, Win (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.
3-5 units, Win (Robinson)

321T. Advanced Translation—Translation
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.

324T. Interpretation—Interpretation of conversations and negotiations; introduction to consecutive and simultaneous interpretation; conference terminology; writing of reports and précis.  
3 units, Aut (Lieder) by arrangement

325T. Interpretation—Continuation of 324T.  
3 units, Win (Lieder) by arrangement

326T. Interpretation—Continuation of 325T. Upon completion of this course, the Certificate in Interpretation is awarded.  
3 units, Spr (Lieder) by arrangement

349. Seminars

349A. Humboldt and Structuralism—(Same as 449A.)  
3-5 units, (Mueller-Vollmer) given 1982–83

349B. Language Theories of the Romantic Movement—(Same as 449B.) 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

349C. Literary Hermeneutics—(Same as 449C.) Its history and principles since the enlightenment. Classical hermeneutics: Schliermacher, Boeckh. The impact of historical and philosophical hermeneutics: Droysen, Dilthey, Heidegger, Gadamer. Current issues of literary hermeneutics within the spectrum of structuralist, phenomenological and Marxian criticism.  
3-5 units, Win (Mueller-Vollmer/Seeba)

349K. Das Problem der Mimesis bei und nach Aristoteles—(Same as 449K.)  
3-5 units, Aut (Pütz)

349M. Goethe in neuer Sicht—(Same as 449M.) Französische Revolution und Weimarer Klassik, Ästhetische Erziehung, Rolle der Frau.  
3-5 units, Spr (Mommsen)

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.

351A. Pidreks saga—(Same as 251A.) Readings in Pidreks saga.  
3-5 units, Aut (Andersson)

351B. Dietrich epic—(Same as 251B.) Survey of the Middle High German Dietrich epic.  
3-5 units, Win (Andersson)

351C. Heimskringla—(Same as 251C.) Colloquium on Snorri Sturluson's Heimskringla.  
3-5 units, Spr (Andersson/Harris)

354. German Literature and Culture IV—(Same as 254.) 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 works

3-5 units, (Mommsen) given 1981–82

356. German Literature and Culture VI—German and European Romanticism—(Same as 456.) Origins and formation. The principal theoretical statements of early German romanticism in their historical and ideological setting (Fichte, A. W. and F. Schlegel, Schelling, and Novalis). Types of romantic literature by Tieck, Wackenroder, Bonaventura, Arnim, and E. T.A. Hoffman. Salient features of the European movement: Wordsworth, Blake, Coleridge, and Carlyle in England; Mme. de Stael and her group, Hugo, Nerval, and Baudelaire in France. Close attention paid to the problem of periodization and the establishing of valid criteria for the study of cross-cultural and cross-national phenomena.

3-5 units, Spr (Mueller-Vollmer)

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. Grimmelshausen, Wieland, Lessing, Goethe, Novalis, Tieck, Kleist, Fontane, Nietzsche, Hofmannsthal, Thomas Mann, Kafka, Brecht.

3-5 units (Staff) given 1981–82

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.

377. Moderne Lyrik—(Same as 277.)

3-5 units (Mueller-Vollmer) given 1981–82

390-399. Special Subjects and Problems.

391. Goethe, Schiller und das Problem der Weimarer Klassik.

3-5 units (Mueller-Vollmer) given 1982–83

392. Heine und das Junge Deutschland—(Same as 292.)

3-5 units (Mueller-Vollmer) given 1981–82

393. Realismusprobleme in der Erzählkunst von Stifter, Keller, Fontane and Keyserling—(Same as 293.) Theorie und Praxis im „deutschen Realismus“.

3-5 units, Win (Mommsen)

394. Poets of Infinity—(Same as 294.) 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. Lessing und die Aufklärung—(Same as 295.)

3-5 units, Aut (Pütz)

397. Literatur der 70-er Jahre—(Same as 297.)

3-5 units, Win (Pütz)

ADVANCED GRADUATE COURSES

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.)

3-5 units, (Mueller-Vollmer) given 1982–83

449C. Literary Hermeneutics—(Same as 349C.)

3-5 units, Win (Mueller-Vollmer/Seeba)

449K. Das Problem der Mimesis bei und nach Aristoteles—(Same as 349K.)

3-5 units, Aut (Pütz)

449M. Goethe in neuer Sicht—(Same as 349M.) Französische Revolution und Weimarer Klassik, Ästhetische Erziehung, Rolle der Frau.

3-5 units, Spr (Mommsen)

456. German Literature and Culture VI—German and European Romanticism—(Same as 356.)

3-5 units, Spr (Mueller-Vollmer)

HISTORY

S. Vucinich, Gordon Wright (Professors), Rixford K. Snyder (Associate Professor), Wilhelm Pauck (Visiting Professor Emeritus)

Chairman: Peter Stansky (Professor)


Associate Professors: Barton J. Bernstein, Frederick P. Bowser (on leave 1980-81), Harold Kahn, Kennell A. Jackson, Jr., Carolyn C. Lougee, Mark I. Mancall, Jeffrey Mass, Paul Robinson, Paul S. Seaver

Assistant Professor: Dorothy Atkinson (on leave Spring), Albert M. Camarillo, Clayborne Carson, Stephen C. Ferruolo, Estelle B. Freedman, Jack N. Rakove

Acting Assistant Professor: Richard Roberts

Courtesy Professors: Paul David, Michael Jameson

Lecturers: Harold P. Anderson (Winter), Warren T. Treadgold (Mellon Fellow)

Visiting Professors: Lucy S. Dawidowicz (Winter), Roderick Floud (Spring), Felix Gilbert (Winter), Carl Solberg, John E. Talbott

Modern Europe Program: Stephen Bondos-Greene, Rebecca Gates, Nancy Green, Geoffrey Koziol, James Roberts, Kirk Willis

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) or undergraduate seminar (research and writing on an explicit historical topic); 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; and (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 complete four consecutive quarters of a foreign language or equivalent. (In lieu of a language, the History major may take four quarters of 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 Administrator, School of Education.

COTERMINAL A.B. AND A.M. PROGRAM IN HISTORY

The department admits each year a limited number of undergraduate History majors to work for a coterminal 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 study 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, contact the 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 "Degrees" section 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.

Admission to the History Department in the Graduate Division does not establish any rights respecting candidacy for an advanced degree, and application must be made separately for admission to candidacy for the A.M. (not later than the end of the first four weeks of the quarter preceding the one at the end of which the degree is to be awarded) and also for the Ph.D. Applicants for the doctoral program must proceed by two steps: First, students must apply for admission to (not candidacy in) the Ph.D. program. Those seeking admission to the program should file application during their 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 or she terminate his or 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)

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 member 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 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. Europe from the Middle Ages 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 "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. Europe from the Ancien Régime 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. Europe: 1850 to the Present—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

65. Medieval Culture: An Interdisciplinary Introduction—(Same as Medieval Studies 65.) The development of medieval culture through study of some salient religious, philosophical, literary, artistic, social and political sources with emphasis on their interrelationships. (DR:A)

5 units, Win (Ferruolo, Cazelles Lewis, and Staff)

80. Culture and Society in Latin America—(Same as Latin American Studies 80 and Political Science 123D.) An interdisciplinary course which surveys the interaction of Amerindian, African, and European cultures in the creation of the New World societies from 1500 to the present. The course is organized into four major topic areas: migration and culture contact, agrarian systems and agrarian changes, urban dominance and innovation, and relations between states and society. This is a basic introduction to Latin American courses within several departments. (DR:A)

5 units, Spr (Wirth and Durham)

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 (Van Slyke, Lyell and Staff)

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, Van Slyke and Staff)

93. Modern East Asian Civilization—(Same as Asian Languages 93, and Humanities 93.) A continuation of 92 covering the period from initial Western contacts to the present. (DR:A)

5 units, Spr (Duus and Staff)

ADVANCED COURSES

Courses numbered 100 through 199 are primarily lecture courses designed for advanced undergraduates.

THE ANCIENT WORLD

See Classics, Ancient History section, for description of the following courses, all of which are accepted for credit toward a major in History.

5 units, Aut (Jameson)

Classics 102. Early Rome and the Hellenistic World.
4 units, Win (Treadgold)

Classics 105. History and Culture of Egypt.
3 to 4 units, Spr (Stephens)

Classics 117. Greek Religion and Society.
4 units, Win (Jameson)

Classics 220. Graduate Seminar: The Athenian Empire.
5 units, Spr (Jameson)

Classics 286. Graduate Seminar: Byzantine History.
5 units, Aut (Treadgold)

MEDIEVAL AND RENAISSANCE EUROPE

All courses (DR:S) unless noted otherwise.

104. Byzantine History.
4 to 5 units, Spr (Treadgold)
107. The 12th-Century Renaissance: European Society and Culture, 1050-1220—Demographic and economic expansion, social and political change, law, the cities, the crusades, church reform, heresy and religious dissent; learning and the universities; chivalry, courtly love and romance; aesthetics; Gothic architecture. (DR:A)
5 units, Spr (Ferruolo)

109A. Renaissance Society and Culture—
(Same as Humanities 109A, Art History 109A.)
5 units (Spitz, Ryan, Forster) given 1981-82

110. The Christian Humanist, Lutheran, Calvinist, Catholic, and Radical Reformations—
(Same as Religious Studies 140.) 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. (DR:A)
5 units, Win (Spitz)

See Economics for descriptions of the following courses, both of which are accepted for credit toward a major in History.

Economics 115. European Economic History.
5 units, Aut (Field)

5 units, Win (James)

5 units, Spr (Floud)

ECONOMIC HISTORY

All courses (DR:S) unless noted otherwise.

117. Slavic Civilization—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)
4 to 5 units (Vucinich) given alternate years

118. Modern Russian Thought—A survey of society, politics and history, focusing on original and influential views about Russia's historical evolution and future possibilities vis-à-vis the "Western model;" Slavophilism, Populism, and Leninism with readings from literature, criticism, political and social theory, history and philosophy.
5 units, Spr (Emmons)

120A. Russia to 1689—Beginning with 9th-century Kievan Russia; the Mongol conquest, emergence of a centralized state under Moscow, the role of the Church, the "time of troubles," and the enslavement of the Russian peasantry. (DR:A)
5 units, Aut (Atkinson)

120B. 18th and 19th Century Russia—Reforms of Peter and of Catherine the Great; the Pugachev Rebellion, the partitions of Poland, war with Napoleon, emancipation of the serfs; economic and political development and social change, cultural westernization and intellectual history. (DR:A)
5 units, Win (Emmons)

120C. Russia in Revolution, 1851-1930—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. (DR:A)
5 units, Spr (Emmons)

122B. Soviet Foreign Policy—(Same as Political Science 136.) 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)

123A. The Soviet Union: Politics and Society Since 1917—(Same as Political Science 119A.)
5 units (Dallin) given 1981-82

123B. International Communism—(Same as Political Science 132.)
5 units (Dallin) given 1981-82

126. Eastern Europe Since 1914.
5 units (Vucinich) given 1981-82

126B. The Balkan States Since 1800—The decline of the Ottoman Empire; emergence of the nation-states of Albania, Bulgaria, Greece, Montenegro, Rumania and Serbia; domestic policies and foreign relations; state consolidation, governmental instability; economic crises; peasantism; political rivalries; fascism and communism; nationalism and revisionism.
5 units, Win (Vucinich)

WESTERN EUROPE

All courses (DR:S) unless noted otherwise.

128B. Europe in the Age of the French Revolution and Napoleon
5 units, Spr (Paret)

129A. 19th-Century Germany from 1770 to 1914.—The emphasis is on the political and cultural developments which attended Germany's emergence as a modern state and society.
5 units, Win (Sheehan)
129B. 20th-Century Germany—From 1914 to the present, with particular emphasis on the problems of German democracy, the origins and nature of National Socialism, and the historical roots of the post-1945 era.
5 units, Spr (Sheehan)

132A. Origins of Contemporary France, 1815-1918—Transformation of a tradition-bound rural society into a leading industrial power (DRA)
4 to 5 units, Aut (Talbott)

132B. Origins of Contemporary France, 1918-Present—Stress will be laid on the traumatic consequences of the two world wars, the transformation of French Society and the economy, and the search for political stability. (DRA)
4 to 5 units, Win (Talbott)

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: Political Science 35.
5 units, Win (Craig, George)

136. The Age of Reason and Enlightenment: European Thought in the 18th Century—Articulation of ideas by representative writers and their dissemination among the literate public; interplay of ideas and social change; interaction between elite culture and popular mentalities; translation of ideas into political action. (DRA)
5 units, Spr (Lougee)

136A. European Thought 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 Neitzsche. (DRA)
5 units, Aut (Robinson)

136B. European Thought 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. (DRA)
5 units, Win (Robinson)

AFRICA

146A. The United States and Africa—Slave contribution to the early colonial economies; African influences on American English; American images of Africa in 19th and 20th century novels, ”Back-to-Africa” movements; African students in the U.S.; American foreign policies toward Africa.
5 units, Spr (Jackson)

147B. Women in African History—Their roles in trade, politics, the organization of the family, the history of agriculture; the impact of colonialism on women in the cities, the new labor markets, nationalist politics; the image of women in literature.
5 units, Win (Jackson)

148A. History and Society in West Africa—State-building, effects of the trans-Atlantic slave trade, European imperial domination, tendencies toward one-party and military regimes. 4 to 5 units, Aut (Roberts)

148C. From Colonialism to Independence: Sub-Saharan Africa in the 20th Century—Political, social and economic change; decline of old elites and the rise of new ones; reformulation of belief systems; development of nationalism and decolonization. 4 to 5 units, Spr (Roberts)

THE UNITED STATES

150. Emergence of American Society—Settlement and maturation in the markedly different English colonies in the Chesapeake, Middle Atlantic and New England areas, 1600-1760; colonial isolation, community and family; youth, aging, and death; blacks leading to the new conservatism of the Elizabethan regime. (DRA)
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 socioeconomic and ideological framework in which these political changes took place. (DRA)
4 to 5 units, Win (Seaver)

144. Britain, 1688-1851.
5 units (Stansky) given 1981-82

145. Britain, 1851-Present—Literary and historical sources of British culture, politics and society and Britain’s response to the experience of war, economic depression and social conflict. (DRA)
5 units, Spr (Stansky)

141. Yorkist and Tudor England—An analysis of late medieval English society and the changes leading to the new conservatism of the Elizabethan regime. (DRA)
4 to 5 units, Aut (Seaver)
and slavery; the role of women. (Preliminary to 165A,B,C)
5 units, Win (Rakove)

152B. United States 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 (Camaritto)

153. Interpretive Overview of the United States—The roots of modern America examined topically: land and class; economic growth; development of political parties; relations among blacks, whites and Indians; the role of women; American expansion into the world arena.
5 units, Spr (Degler)

154. Canadian History—From the settlement by the French to the present; racial, economic, political, and cultural problems influencing its history.
4 to 5 units, Win (Solberg)

157. Introduction to Afro-American History—From the beginning of the slave trade to the present. Emphasis will be placed on political and social history and on events of the 20th century.
5 units, Aut (Degler)

158. History of Education in the United States—(Same as Education 201.)
3 units, Spr (Tyack)

159. History of American Judaism.
4 to 5 units, Win (Dawidowicz)

160. The American South, 1815-1890—As a separate region of the United States during the 19th century, how and why did Southern distinctiveness or self-consciousness rise and fall? Emphasis is upon social, cultural and economic, rather than political developments.
5 units, Aut (Degler)

163. The Female Experience: The Victorian Heritage. (DRA)
5 units (Freedman) given 1981-82

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. (DRA)

165A. The American Revolution and Early National Period from 1740. (DRA)
5 units, Aut (Rakove)

165B. 19th-Century America. (DRA)
5 units, Win (Fehrenbacher)

165C. The United States in the 20th Century—1890 to the Present. (DRA)
5 units, Spr (Kennedy)

170. America in the 1960s: The Tumultuous Decade—An analysis emphasizing the cultural, intellectual and social history, foreign policy and the politics; civil rights and black power, the anti-war movement, the counter-cultures, the women’s movement, the New Left, the arms race, Vietnam, the missile crisis, the Great Society, the crises of liberalism.
4 to 5 units, Spr (Bernstein, Carson)

172A. America Since 1945—An analysis of America that emphasizes foreign policy and politics, intellectual history, social themes and the political economy.
4-5 units, Win (Bernstein)

172A.B. History of Women in America—The roles and activities of American women from 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.”
10 units, Aut, Win, (Freedman)

LATIN AMERICA
All courses (DR:S) unless noted otherwise.

176. Latin America to 1870.
4-5 units (Bowser) given 1981-82

177. Latin America Since 1870—From the wars of independence to the present: “development from without” (1870-1910); discovery of nationhood (1910-1950), and claims of tradition in arenas of change since 1950.
5 units, Aut (Morse)

180. 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, Win (Wirth)

MIDDLE EAST

186. The Ottoman Empire. (DR:S)
4-5 units, Aut (Vucinich)
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. (DR:A)
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. (DR:A)
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. (DR:A)
4-5 units, Spr (Van Slyke)

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. (DR:A)
4-5 units, Aut (Mass)

194A. Medieval and Early Modern Japan, 1336-1800—From the end of the Kamakura era through mid-Tokugawa: descent into localism and feudalism; cultural flowering of the Muromachi era, re-welding of the country in the 16th century; the Tokugawa peace of early modern times; moves away from "medievalism." (DR:A)
5 units, Win (Mass)

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." (DR:A)
5 units, Spr (Duus)

195. Nomad Empires of Inner Asia—(Same as Asian Languages 152.) (DR:A)
4-5 units, Spr (Dien)

196. Chinese History in Translation—(Same as Asian Languages 151.)
4 units, Win (Dien)

**UNDERGRADUATE SEMINARS AND COLLOQUIA**

During 1980-81, 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 1980-81. A seminar differs from a colloquium principally by its concentration on materials and methods of historical research rather than on reading and discussion of a given body of historical literature. The student, in writing a research paper based 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 investigation, analysis, and writing. "How do you know?" becomes more important than "What do you know?"

Courses numbered 200 through 299 (undergraduate 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.

**200A,B,C. Senior Honors—(DR:X)**
Units by arrangement (Staff)

**200W. Undergraduate Directed Reading.**
Units by arrangement (Staff)

**200X. Undergraduate Directed Research.**
Units by arrangement (Staff)

**202. Undergraduate Colloquium: History and the Social Sciences.**
5 units, Spr (Emmons)

**203. Undergraduate Colloquium: The Uses of History—The public, private and governmental uses of history and historical resources, focusing on the development and management of archives, museums, historical preservation projects, and research and publications programs.**
5 units, Win (Anderson)

**204S. Undergraduate Seminar: Quantitative Methods for Historians—(Same as Economics 198.)**
5 units, Spr (Floud)

**205. Undergraduate Colloquium: The History of Historical Writing.**
5 units, Spr (Robinson)

**206. Undergraduate Colloquium: Politics and Law in Medieval Europe.**
5 units, Aut (Ferruolo)

**208. Undergraduate Colloquium: The Christianization of Europe.**
5 units, Spr (Langmuir)
213. Undergraduate Colloquium: Humanists and Reformers.
   5 units, Spr (Spitz)

   5 units, Win (Gilbert)

217. Undergraduate Colloquium: Russia and the West—Western Influences on Russian Culture and Society. (DRA)
   5 units, Win (Atkinson)

220. Undergraduate Colloquium: The Soviet Union and the United States—The 20th Century—Soviet-American relations, focusing on both continuities and changes over time, historical roots, alliance systems, the role of ideology, and the “national interest.” Assignments will include different interpretations of the relationship, with attention to the strategic balance, mutual perceptions, conflicts over third areas, the role of domestic factors in shaping foreign policy, and conflict management.
   5 units, Win (Dallin)

222A. Undergraduate Colloquium: Soviet Nationalities.
   5 units (Vucinich) given 1981-82

224. Undergraduate Colloquium: Nationalism and Communism in Eastern Europe.
   5 units, Win (Vucinich)

225B. Undergraduate Colloquium: Culture and Society in Modern Europe.
   5 units, Aut (Sheehan)

232A. Undergraduate Colloquium: France Since 1945—The New French Revolution?
   5 units, Spr (Talbott)

234. Undergraduate Colloquium: The World of the Enlightenment.
   5 units, Win (Lougee)

235. Undergraduate Colloquium: Selected Topics on the Holocaust—Documents, Methodology, Historiography.
   5 units, Win (Dawidowicz)

237. Undergraduate Colloquium: Opera and History—(DRA)
   5 units, Aut (Robinson)

242B. Undergraduate Colloquium: Topics in Early Modern English History. (DRA)
   5 units, Spr (Seaver)

244C. Undergraduate Colloquium: Humanities and International Relations in 20th-Century Europe. (DRA)
   5 units, Aut (Stansky)

   5 units, Aut (Jackson)

248B. Undergraduate Colloquium: Slavery in Africa and the Americas.
   5 units, Win (Roberts)

255. Undergraduate Colloquium: American Urban History—(Same as Urban Studies 188.)
   5 units, Win (Carson)

257A. Undergraduate Colloquium: Black Politics and Social Movements in the 1960’s and 1970’s.
   5 units, Spr (Carson)

259. Undergraduate Colloquium: The Presidency from Washington to Lincoln.
   5 units, Aut (Fehrenbacher)

262. Undergraduate Colloquium: Chicano History—(Same as Spanish and Portuguese 258.)
   5 units, Aut (Camarillo)

   5 units (Freedman) given 1981-82

269. Undergraduate Colloquium: Crises in Modern American Foreign Policy—Imperialism and war in the 1890’s; entry into World War I and the making of the peace; entry into World War II; origins of the Cold War; entry into the Korean War; the Cuban missile crisis; involvement in the Indo-China War.
   5 units, Aut (Bernstein)

270. Undergraduate Colloquium: Technology in American Society—The impact of industrialization on work and living patterns; the role of professionals in directing technology; problems in bio-medicine; technology in weaponry and foreign policy; limits on the development and uses of technology; the society and political economy in which technologies have developed.
   5 units, Win (Bernstein)

273S. Undergraduate Seminar: U.S. Social History.
   5 units, Spr (Freedman)

275. Undergraduate Colloquium: Comparative History of the Canadian Prairie and the Argentine Pampa.
   5 units, Win (Solberg)

   5 units, Win (Needell)

278. Undergraduate Colloquium: Latin American Cultural and Intellectual History in the 20th Century.
   5 units, Aut (Morse)

278S. Undergraduate Seminar: Latin American Cultural and Intellectual History in the 20th Century.
   5 units, Spr (Morse)
283. Undergraduate Colloquium: Topics in Brazilian History.
5 units, Spr (Wirth)

284. Undergraduate Colloquium: Latin American Migration in Historical Perspective.
5 units, Win (Wirth)

287. Undergraduate Colloquium: Topics in Islamic Civilization.
5 units (Vucinich) given alternate years

292A. Undergraduate Colloquium: Aspects of Chinese Economic History.
5 units, Spr (Kahn)

294. Undergraduate Colloquium: The Middle Period in Chinese History, A.D. 617-907—
(Same as Asian Languages 154.)
5 units, Win (Kahn, Dien)

5 units, Aug (Van Slyke)

299. Undergraduate Colloquium: The Institutions of Medieval Japan.
5 units, Spr (Mass)

GRADUATE COURSES

All courses (DR:X)

300W. Graduate Directed Reading.
Units by arrangement (Staff)

301. Graduate Colloquium on the Historiography of American Education—(Same as Education 301.)
4-5 units, Aut (Tyack)

303. Graduate Colloquium: The Uses of History—Public, private and governmental uses of history and historical resources, focusing on the development and management of archives, museums, historical preservation projects, and research and publications programs.
5 units, Win (Anderson)

304A,B. Graduate Colloquium: Historiography of Colonial Latin America.
10 units (Bouwer) given 1981-82

305. Graduate Colloquium: The History of Historical Writing.
5 units, Win (Robinson)

307. Graduate Core Colloquium in Medieval History.
5 units, Aut (Ferruolo)

308. Graduate Colloquium: Topics in Medieval History.
5 units, Spr (Langmuir)

316. Graduate Colloquium: Ranke, Tocqueville and Burekhardt.
5 units, Win (Gilbert)

319. Graduate Colloquium: Humanism and the Reformation.
5 units, Win (Spitz)

319A. Graduate Colloquium: Interpretations of the Reformation.
5 units, Spr (Spitz)

322A. Graduate Colloquium: Soviet Nationalities.
5 units (Vucinich) given 1981-82

323A. Graduate Colloquium: Topics in Russian History.
5 units, Aut (Emmons)

324. Graduate Colloquium: Nationalism and Communism in Eastern Europe.
5 units, Win (Vucinich)

325. Graduate Colloquium: Problems in Soviet History and Politics—(Same as Political Science 126B.)
5 units (Dallin) given 1981-82

331A,B,C,D,E. Graduate Core Colloquium in Modern European History.
25 units, Aut, Win, Spr (Craig, Lougee, Paret, Robinson, Sheehan)

333. Graduate Colloquium: Problems in Modern European History.
5 units, Aut (Talbott)

331A. Graduate Colloquium: Selected Topics on the Holocaust—Documents, Methodology, Historiography.
5 units, Win. (Dawidowicz)

341A. Graduate Colloquium: English Society and Culture, 1500-1700
5 units, Aut (Seaver)

347A. Graduate Colloquium: Social History in Africa.
5 units, Aut (Jackson)

348B. Graduate Colloquium: Slavery in Africa and the Americas.
5 units, Win (Roberts)

348C. Graduate Colloquium: Problems in the Economic History of West Africa.
5 units, Win (Roberts)

351A,B,C,D,E,F. Joint Graduate Colloquium in American History.
30 units, Aut, Win, Spr (Bernstein, Camarillo, Carson, Degler, Fehrenbacher, Kennedy, Rakove, Tyack)

369. Graduate Colloquium: American Social History
5 units, Win (Bernstein)

378. Graduate Colloquium: Latin American Cultural and Intellectual History in the 20th Century.
5 units, Aut (Morse)

383. Graduate Colloquium: Topics in Brazilian History.
5 units, Spr (Wirth)
398 SCHOOL OF HUMANITIES AND SCIENCES

387. Graduate Colloquium: Topics in Islamic Civilization.
   5 units (Vucinich) given alternate years

390A, B. Graduate Colloquium: Topics in Late Traditional and Modern Chinese History.
   10 units, Aut, Win (Kahn, Van Slyke)

394. Graduate Colloquium: The Middle Period in Chinese History, A.D. 617-907—
   (Same as Asian Languages 254.)
   5 units, Win (Kahn, Dien)

395A. Graduate Colloquium: Early and Medieval Japan.
   5 units, Aut (Mass)

395B. Graduate Colloquium: Medieval and Early Modern Japan, 1600-1800.
   5 units (Duus) given 1981-82

395C. Graduate Colloquium: Early Modern and Modern Japan.
   5 units, Win (Duus)

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)

401B. Graduate Seminar: History of American Education
   4 units, Aut (Tyack)

   5 units, Spr (Floud)

408. Graduate Seminar: Medieval History.
   5 units, Win (Langmuir)

410A, B. Graduate Seminar: Early Modern Europe.
   10 units (Spitz) given 1981-82

419. Graduate Seminar: Research on Soviet Politics and Society—(Same as Political Science 126B.)
   5 units, Win (Dallin)

420A. Graduate Seminar: Russian History.
   5 units, Win (Atkinson, Emmons)

421A. Graduate Seminar: Topics in Russian History.
   5 units, Spr (Emmons)

428. Graduate Seminar: Culture and Society in Germany, 1815-1918.
   5 units, Spr (Paret)

434. Graduate Seminar: Modern French History.
   5 units, Spr (Talbott)

   5 units, Spr (Lougee)

444A. Graduate Seminar: Problems in Modern British History.
   5 units, Aut (Stansky)

   5 units, Spr (Jackson)

448. Graduate Seminar: The State and Economy in Africa.
   5 units, Spr (Roberts)

452. Graduate Seminar: The Emergence of Modern America, 1830-1850.
   5 units (Fehrenbacher) given 1981-82

   10 units, Aut, Win (Carson)

   5 units, Spr (Degler)

473. Graduate Seminar: Women's, Family, and Sexual History.
   5 units, Win (Freedman)

   5 units, Spr (Morse)

490A, B. Graduate Seminar: Modern China.
   10 units, Win, Spr (Van Slyke)

496. Graduate Seminar: Social Thought in Modern Japan.
   5 units, Aut (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, Win (Mass)

PROGRAM IN THE HISTORY OF SCIENCE

Faculty: Wilbur Knorr, Assistant Professor
Committee in Charge: Francis Everitt (Hansen Labs); Alexander Fetter (Physics); Ian Hacking (Philosophy); Wilbur Knorr (Classics, Philosophy); Peter Paret (History); Halsey Royden (Mathematics); Patrick Suppes (Philosophy); Walter Vincenti (Aeronautics and Astronautics).
The Program in the History of Science, beginning in 1980-81, 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 insofar as they can be examined through the history of science. The chronological period is extensive, reaching from antiquity through the twentieth century.

The structure of the program will require students to define and pursue their own areas of investigation according to the rubrics of an individually designed major under the administration of the Dean of Undergraduate Studies’ Advisory Committee on Individually Designed Majors.

Members of the History of Science Committee are available to serve as a faculty advisory group for any student wishing to design a History of Science major. A list of appropriate courses is available from the History of Science office, Room 200-27.

**COURSES**

138A, B. Introduction to Exact Sciences: Cosmology—(Same as Classics 138A, B; Same as Philosophy 138A, B.) A two-quarter sequence on the history of the exact sciences, with special emphasis on the field of cosmology. Primary interest will be in the technical aspects of the classical theories (Ptolemaic and Copernican), including mathematics, astronomy, physics and chemical theory. But major attention must also be given to the more speculative aspects in natural philosophy and theology.

138A.
4 units, Aut (Knorr) MWF 11 plus section

138B.
4 units, Win (Knorr)

238. Seminar in the History of Science.
338. Advanced Seminar in the History of Science.

**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 examines 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 involves faculty predominantly from the School of Humanities and Sciences and the Medical School, with representatives from other Schools as well.

There is no graduate program in Human Biology, but students will be prepared for advanced training and coterminal programs in either biology, the behavioral and social sciences, medicine, law, education, or economics-engineering systems, 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 two parts: (1) the fundamental program which is composed of nine one-quarter required courses and (2) the upper division. The sequence of study begins with the core, a block of six required courses (24 units). The first four courses satisfy University distribution requirements in areas 4, 5, and 7. The core provides the necessary academic background for more specialized and advanced courses in the program. The primary objective of the core is to present a broad but rigorous overview of the biology and behavior of man in society.

In addition, all majors must select and successfully complete a Human Biology policy course (4 units); the Workshop in Human Biology, an independent field-experience project (4 units); and an approved course in statistics (3-5 units).

Majors are required to develop an area of concentration which focuses on a specific topic or theme. This is a 20-unit, individually designed, integrated program of in-depth study in one aspect of the social/behavior sciences, the natural sciences, or public policy. These courses may be selected from any department with approval from a Human Biology faculty advisor. Three upper division Human Biology courses are also required.

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 earned in the honors candidate's senior year. These units (see Human Biology 198 under "Courses") will be in addition to the approximately 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.

THE FUNDAMENTAL PROGRAM

The Human Biology Core Courses (2A and 2B, 3A and 3B, and 4A and 4B) are a sequence of courses which introduce the biological sciences, the social sciences, and most importantly, the relationships between the two. The courses meet MWF from 9-10:50 throughout the academic year. Students must register concurrently for the A and B series and take the core courses in sequence. Students are advised to initiate the core in the Autumn Quarter of their sophomore year. Freshman are not permitted to enroll in the core.

All of the fundamental program courses, the core, a public policy course, and a statistics course, are to be taken for a grade by majors with the exception of the workshop (HB 06) which is taken pass/no credit exclusively.

2A,B. Human Evolution: Genetics and Culture—2A is devoted to the basic principles of Mendelian and population genetics, and population biology and ecology. 2B studies human
evolution, the acquisition of language, and the rise of culture. The theme of the courses is the evolution of human populations, with discussion of biological and cultural aspects of such topics as sociobiology, racial differences, and the incest taboo.

2A. Human Evolution: Genetics and Culture. (DR:T)  
4 units, Aut (Durham, Staff) MWF 9

2B. Human Evolution: Genetics and Culture. (DR:S)  
4 units, Aut (Fox, Staff) MWF 10

3A,B. Properties of the Individual and Society—3A concentrates on the basic principles of biochemistry, cell biology and developmental biology. 3B studies the interaction of human populations and their environments. Demographic and economic processes are related to the development of social order. The interaction between 3A and 3B is illustrated by exploring such topics as fertility control and agriculture. Prerequisite: Human Biology 2A,B.

3A. Properties of the Individual. (DR:T)  
4 units, Win (Thompson, Staff) MWF 9

3B. Properties of Society. (DR:S)  
4 units, Win (Staff) MWF 10

4A,B. The Human Organism and the Social Process—4A concentrates on integrative system physiology, neurophysiology, and the biological basis of behavior. 4B stresses the development of social bonds and social influences on the individual's perception of the world. The relation between 4A and 4B will be explored in a series of special topics, such as perception, puberty and abnormal behavior.

4A. The Human Organism. (DR:T)  
4 units, Spr (Thompson, Staff) MWF 9

4B. The Social Process. (DR:S)  
4 units, Spr (Feldman, Staff) MWF 10

6. Workshop in Human Biology—Required of all program majors. Offers the student the opportunity to augment the formal course work with a supervised field, community, or laboratory project of his or her 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 (Morgan)

40. Public Decisionmaking Regarding Human Health—The purpose of HB 40 is to introduce and sensitize the class to the overall complexion of American public decision making in the "environmental" arena, to demonstrate how scientific and technical factors are accommodated in policy-making and how technically-trained people contribute to the policy process, and to introduce systematic decisionmaking skills. This course provides an overview of the process of health policy formulation from multiple perspectives. These include health care financing and organization, health maintenance, clinical decision-making, the evaluation of medical and surgical innovation, the consumer movement in health care, and the determinants of health. Consideration will be given to social, ethical, political, legal, and economic implications. Class time will be divided equally between lectures and small group workshops. Prerequisite: Human Biology Core, or comparable knowledge of the biological and social sciences. Throughout the course, section exercises and policy research projects will be required. (DR:C)  
4 units, (Bunker, Brown, Dutton, Eddy, Enthoven, Fries, Gibson, Holman, Scott, Sox) to be arranged.

41. Public Decisionmaking Regarding the Human Environment—As the required-course alternative to Human Biology 40, 41 has the purpose of introducing and sensitizing the class to the overall complexion of American public decision making in the “environmental” arena, to demonstrate how scientific and technical factors are accommodated in policy-making and how technically-trained people contribute to the policy process, and to introduce systematic decision making skills. Throughout the course, section exercises and policy research projects will be required. Prerequisite: Human Biology Core. (DR:C)  
4 units, Win (Race) MWF 11

ADDITIONAL 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 relationship 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. (DR:C)  
3 units, Win (Katchadourian) MWF 1:15
19. Scientific Thinking—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. Limited to 25 students. (DR:T)

3 units, Win (Dornbusch, Heller) W 7:30-9:30 p.m.

ADVANCED COURSES

Of the minimum 30 units of upper division credit each Human Biology student is expected to earn, 20 units must be selected from course offerings within departments other than Human Biology. This 20 unit concentration of credit should be designed to enable the student to focus on his/her post-baccalaureate goal. 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 upper division Human Biology course 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 when 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. A one-hour lecture plus one field trip per week to be arranged. Limited to 12 students. Prerequisite: Human Biology Core. (DR:C)

3 units, Aut, Win (Dengler) T 9, Th 8-12 plus hours to be arranged

111. Human Physiology—Purpose is to present information on the functioning of organ systems with emphasis on mechanisms of control and regulation. Topics will include structure and function of the endocrine and central nervous systems, cardiovascular physiology, respiration, salt and water balance, and gastrointestinal physiology. Lectures and discussion. Prerequisite: Human Biology or Biology core. (DR:T)

4 units, Win (Heller) MWF 9

120. Human Nutrition—(Same as Food Research 119.) An introduction to human nutrition including the function, digestion, absorption and metabolism of nutrients, dietary recommendations and standards, and a general overview of national and international nutrition problems. Prerequisite: Human Biology core or consent of instructor. (DR:C)

4 units, Win (Martorell, Taylor) MWF 8

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. Prerequisite: Human Biology Core or consent of instructor. (DR:C)

3 units, Spr (Johnston) 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. Prerequisite: Human Biology Core or consent of instructor. (DR:T)

4 units, Spr (Weinshenker) to be arranged

134. Ecological Anthropology—(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...
135. Biology and Culture in Human Evolution—(Same as Anthropology 182.) This lecture course surveys the major stages of human evolution from Australopithecines to the present. The interaction of biological and cultural processes is emphasized as a key to understanding human origins and contemporary diversity. The course is divided into four major sections: Biological Evolution, Sociobiology, Cultural Evolution, and Models of Interaction. Topics covered include the hominid fossil record, genetic selfishness and altruism, sickle cell anemia, hunting and headhunting, incest avoidance, aggression and fertility regulation. Prerequisite: Human Biology Core or consent of instructor. (DR:C)

5 units, Spr (Durham) MW 3:15-4:50

136. Gene Action and Mutation in Man—(Same as Genetics 141.) DNA, proteins and the analysis of their variation between individuals; hemoglobin; enzymes, their defects and their polymorphisms; metabolic diseases; immunogenetics, antibody formation, blood groups (ABO, Rh, HLA); various types of mutation; mutagenesis and carcinogenesis; cancer genetics; sensitivity to drugs and to environmental agents; chromosome aberrations; genetics of behavioral disorders; and social aspects. Prerequisite: Human Biology Core or consent of instructor. Limited to 24 students. (DR:T)

3 units, Win (VanAndel)

140. Human Population Genetics—(Same as Genetics 142.) Genes and populations; analysis of segregations and linkage; natural selection and demography; balanced polymorphisms; incompatibility selection; inbreeding; genetic load; genetic drift; gene flow; quantitative genetics; molecular evolution; human evolution, races, and racial differences; genetic counseling, quantitative aspects; genetic screening, genetic engineering; social problems; eugenics; extrapolations to biologic future of mankind. Prerequisites: Human Biology Core or equivalent, statistics. (DR:T)

3 units, Aut (Cavalli-Sforza) TTh 11-12:30 alternate years, given 1981-82

143. Early Experience—(Same as Psychology 190A.) Focus on experimental literature related to the effects of pre- and postnatal environmental factors on development and adult function. Material covers both animal and human research and deals with behavioral and physiological function. Prerequisite: Human Biology Core or consent of instructor. (DR:T)

3-5 units, Win (Levine) T 4:15-6

146. Demography of Human Populations—A study of the size, structural components, changes, distribution, and characteristics of human populations, including fertility, mortality, migration, epidemiology and morbidity, and social indicators with emphasis on analysis of data. The purpose of demography is both to offer descriptions of populations and their characteristics and to enable the testing of hypotheses from the biomedical and social sciences. Course structure includes lecture discussion, and seminar. Papers will consist of research proposals applying materials and techniques of demography to problems of students' interests. Prerequisite: Algebra, Human Biology Core or equivalent. (DR:C)

3 units, Aut (Johnson) TTh 1:15-3:05

147. Law in Radically Different Cultures—(Same as Anthropology 157 and Law 157.) Comparison of legal systems in Western capitalist, secular, industrialized democracies with legal systems in radically different cultures. Using American law as a benchmark, this course examines comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt (religious law), and the Republic of Botswana (traditional law) in order to identify the historical, philosophical, social, and cultural factors which contributed to the development of different attitudes and practices regarding law. Issues considered are the passing on of status and property rights (especially at death), the handling of anti-social or "criminal" behavior, the handling of promises and contracts, and the use of law as an instrument of social change in the introduction of family planning. Prerequisite: junior or senior standing. (DR:S)

5 units, Win, Spr (Barton, Gibbs, Li, Merryman) MTTh 2:15

148. Environmental Policy—Discussion of important environmental issues of today and the future, how to deal with them technically and politically, and how to resolve conflicts between environmental concerns and other social needs.
Focus will be on the U.S. but an international perspective will be used when appropriate. Main points include definition and description of environmental and environmental impact, history of human impact on environment, causes of increased human impact, history of environmental protection, decisionmaking and resolution of issues, future environmental issues. Two lecture/discussion hours per week plus student research. Enrollment limited to 20. Prerequisites: Human Biology Core and Human Biology 40 or 41. (DR:S)

3 units, Spr (Ehrlich, Anne) TTh 2:15

149. Language and Psychology of Behavior—
Topics include definition of language, universals and design features of human language, language and the brain, perceptual functions underlying language, cognitive development and language acquisition, speech and personality, similarities and contrasts between human and animal languages, language in dissolution. Enrollment limited to 20. Prerequisite: Human Biology Core or consent of instructor. (DR:C)

3 units, Spr (Ehrlich, Anne) TTh 3:15-6:05

150A. Biosocial Aspects of Birth Control—
(Same as Chemistry 137A.) 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 portion of the quarter will consist predominantly of lectures, of selecting the population groups and task forces and of individual discussions with each task force. The remainder of the 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. For acceptance, application prior to Nov. 6, 1980, is essential, using special questionnaires available from the Human Biology office. Prerequisite: At least junior standing. (DR:C)

6 units, Win (Djerassi) TTh 1:15-4:05;

150B. Biosocial Aspects of Birth Control—
(Same as Chemistry 137B.) Selected students from 150A will be encouraged to continue with field work dealing with task force topics completed in 150A. Prerequisite: 150A. (DR:C)

1-6 units, Spr (Djerassi) TTh 1:15-4:05

152. Pest Control—Technical and Policy Aspects—
(Same as Chemistry 130.) 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 the 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. Pre-registration prior to the Winter Quarter is essential, using special preregistration forms available from the Human Biology or Chemistry Department offices. (DR:C)

5 units (Djerassi) given alternate years 1981-82

154. The Biosocial Aspects of Cancer—
(See 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
159. The Social Impact of the New Biology—Focus will be on the biological principles underlying genetic engineering (recombinant DNA, monoclonal antibodies, etc.) and exploration of social issues raised by this new technology. Recent discoveries about gene organization, revealed by recombinant DNA analysis; potential applications and biohazards associated with the expression of cloned foreign DNA in bacterial and mammalian cells; social role of the scientific community and the relationship between industry, academia, and public regulatory agencies; relationship between science and morality, with particular emphasis on genetic engineering. Enrollment limited to 30. Prerequisite: Human Biology Core or consent of instructor. (DR:C)

3 units, Aut (Erlrich, Henry) M 7:30-9:30 p.m.

162. Ecological Issues in Mental Health Care—The course will examine environmental influences on 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 community mental health interventions. Prerequisite: Human Biology Core or consent of instructor. (Limited to 30 students.) (DR:C)

3 units, Win (Spiegel) W 7-9 p.m.; third hour to be arranged

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. Topics in Human Violence and Aggression—A series of 10 lectures and discussions by specialists in important areas of human aggression. Topics will include: history and philosophy of violence; neural mechanisms of aggression; biological aspects of aggression; violence, the media, and the child; patterns of adolescent violence; mental illness and violence; correlates of murder; social and ideological aspects of violence; social stress and violence in the family setting; sex and aggression. Limited enrollment. Prerequisite: Completion of Human Biology Core or consent of instructor. (DR:C)

3 units, Winl (Clayton and Psychiatry Department faculty), Th 7-9 p.m.

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, alcoholic beverages; and cannabis, sedatives, stimulants, opiates, and hallucinogens. Prerequisite: Human Biology Core or consent of instructor. (DR:T)

3 units, Win (Hollister, Staff) F 2:15

166. Biosocial Aspects of Cardiovascular Disease—Examines epidemiological, biological and behavioral perspectives of cardiovascular disease. The assessment and modification of risk factors relating to cardiovascular disease will be reviewed. There will be a detailed consideration of the potential for disease prevention, and an examination of the major preventive trials. Public policy ramifications will be discussed. Although the course will be primarily didactic in nature, students will be asked to monitor one of their own health risk behaviors and prepare reports of their experiences. Enrollment limited to 35. Prerequisites: Human Biology Core or consent of instructor. (DR:C)

4 units, Aut (Rogers, Stanford Heart Disease Prevention Program Staff) MWF 2:15-3:30

167. Neurochemical Aspects of Behavioral Disorders in Children—This course consists of a series of lectures which cover principles of neurotransmitter dynamics as they relate to our understanding of behavioral disorders in children. Current hypotheses concerning the neurochemical and neurobiologic basis of behavior disorders in children will be discussed. Clinical syndromes including infantile autism, childhood schizophrenia, and hyperkinetic syndrome and childhood depression will be discussed in terms of disturbed neurochemical or neurophysiologic functioning. The course is limited to junior and/or senior students. Prerequisites: Human Biology or Biology Core or permission of the instructor. In addition, Human Biology 111, Human Biology 163 and organic chemistry are strongly recommended. (DR:T)

4 units, Win (Ciaranello) TTh 9-10:30

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 de-
174. The Analysis of Medical Policies—(Same as Engineering-Economic Systems 271 and Family, Community and Preventive Medicine 253.) Project course in the quantitative analysis of medical policy problems. Each year, the course will focus on a new problem that is current, important, and difficult. Whenever possible, the analyses will be performed for sponsors and decision makers who actually face the problem. Each analysis will involve (1) problem formulation; (2) a critical analysis of medical research literature, focusing on quality of research design and interpretation of research results; (3) construction of mathematical and economic models of clinical problems; (4) the application of decision theory, and (5) the presentation and writing of reports. Pairs or teams of students will pool quantitative and biological/medical skills to analyze policies. Prerequisites: permission of instructor; Human Biology Core and policy course, or EES 231 or equivalent; preregistration prior to Fall Quarter is essential using preregistration questionnaires available from the Human Biology Office or from EES Department. (Limited to 30 students.) (DR:T) 4 units, Aut (S. Feldman) MW 3:15-5:05; alternate years, given 1980–81

175. The Nature and Origins of Sexual Differentiation—This course will examine the nature and development of both physiological and psychological correlates of gender. General areas to be covered include the development of anatomical sexual differentiation from embryonic state through adulthood; gender identity and its possible origins; sex differences in behavior and the influences of biological and social factors on such differences; and the implications of sex roles as institutions. Special subareas of interest will be covered extensively; these include such topics as gonadal and hormonal disorders, the menstrual cycle, puberty, aggression and nurturance, and sex roles and mental health. Prerequisite: Human Biology Core or consent of instructor. (DR:C) 4 units, Spr (Rosenfeld)

177. Social Psychology of Physical Deviance and Disability—(Same as Psychology 177.) This course will consider 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, Spr (Hastorf, Staff) TTh 11-12:15 (plus 1 mandatory section to be arranged) alternate years, given 1981–82

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; (e) political, economic, housing problems of retirement and other sociological aspects of aging constituting about a third of the lectures; (f) required field experience to representative health care systems for the elderly of two hours per week and a written report.

There will be field trips to representative health care systems for the elderly and a discussion of drug use by the elderly. Prerequisite: Human Biology Core or consent of instructor. (DR:C) 5 units, Spr (Ebough, Staff) MWF 1:15-2:45

183. Hunter-Gatherers in Archeological Perspective—(Same as Anthropology 187.) Encompasses problems of the organization and subsistence of band-level hunter-gatherers, especially as approached through archeological investigations. Included will be a survey of modern hunter-gatherers, providing background for prehistoric groups. The archeological record of Africa, Europe and the New World will provide examples of how archeological data is used to reconstruct the cultural systems of extinct hunter-gatherers. Artifact typology, settlement pattern analysis, modeling approaches, ethnoarcheological methods, and other techniques will be used to determine the similarity of early groups to their modern counterparts. Prerequisite: Human Biology Core or consent of instructor. (DR:C) 5 units, Win (Rick) alternate years, given 1980–81

188. The Evolution of Prehistoric Civilizations—(Same as Anthropology 188.) Study of 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. Prerequisite: Human Biology Core or consent of instructor. (DR:C)
3-5 units, Win (Rick)
alternate years, given 1981-82
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 and Lorraine Morgan for explicit requirements for the Honors Program. Graded pass/no credit exclusively. (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)
(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) (on leave 1980-81), 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 (see information under American Studies)
6. Medieval Studies

HUMANITIES SPECIAL PROGRAMS

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 (Lyell, Van Slyke, Staff)
MTWTh 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, Van Slyke, Staff)
MTWTh 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, Staff)
MTWTh 10

HONORS PROGRAM IN HUMANITIES

Committee in Charge: Mark W. Edwards, Edwin M. Good, Herbert Lindenberger, Lawrence V. Ryan (Director), Paul A. 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 (consult information under Comparative Literature).
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 consult information under Comparative Literature.)

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.

(These requirements apply to students who enrolled in the Program before June, 1980; they may be altered slightly for students who enrolled after that date. Students who think it possible they may wish to enroll in the Program are urged to choose Humanities 61, 62, 63 for fulfillment of the Western Culture Requirement.)

**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, reading of selected masterpieces.

   5 units, Aut (A. Raubitschek, Staff) MWF 11; two hours by arrangement

   5 units, Win (Ryan, Staff) MWF 11; two hours by arrangement

63. From the Enlightenment to the Present—Voltaire, Flaubert, Dostoevsky, Marx, Freud, Kafka, Malraux.
   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 (Mueller-Vollmer) TTh 2:15-4:05

192. The Arts and the Humanities: Literature and Visual Arts.
   5 units, Aut (Mellor) TTh 11:00-12:30

193. Philosophy and the Humanities.
   5 units, Aut (Taurek) TTh 2:15-4:05
   Win (Taurek) MW 4:15-6:05

194. Literature and the Humanities—The critical study of major texts; theory and practice of criticism.
   5 units, Win (Lindenberger) MW 2:15-4:05
   Spr (Pratt) MW 2:15-4:05

196. Religious Studies and the Humanities
   5 units, Spr (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: George H. Brown, Lorne Buchman, Kurt Mueller-Vollmer, David S. Nivison, Lawrence V. Ryan (Director), Debra Skriba, 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 (Raubitschek) TTh 4:15-6:05

302. The Roman and Early Christian Periods.
4 units, Win (Spofford) MW 4:15-6:05

303. The Middle Ages.
4 units, Spr (Brown) TTh 4:15-6:05

304. The Renaissance.
4 units, Aut (Ryan) MW 4:15-6:05

305. The Early Modern Period.
4 units, Win (Sheehan) TTh 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 colloiium of limited enrollment, required of students in the Graduate Program in Humanities. Prerequisite: Enrollment in or completion of one or more seminars of the series Humanities 301-306. (DR:X)
1 or 2 units (will be offered 1981-82)

MEDIEVAL STUDIES

Committee in Charge: Suzanne Lewis, Chairman, Theodore M. Andersson, Steven Ferruolo, Donald R. Howard

Affiliated Faculty: John Ahern (French and Italian), Theodore M. Andersson (German Studies), Robert Ball (Spanish and Portuguese), Rina Bennemayor (Spanish and Portuguese), Lawrence V. Berman (Religious Studies), George H. Brown (English), Brigitte Cazelles (French and Italian), Steven Ferruolo (History), John Freccero (French and Italian), Joseph C. Harris (English), Donald R. Howard (English), Gavin I. Langmuir (History), Suzanne Lewis (Art), William Mahrt (Music), Eleanor Prosser (Drama), William M. Todd III (Slavic Languages and Literatures), W. Wesley Trimpi (English), Wayne Vucinich (History)

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 under the section "Program for Individually Designed Majors." 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 and Society: An Interdisciplinary Introduction—(Same as Art 65, French 65, and History 65.) This course will offer an introduction to the culture and society of the Middle Ages in Western Europe from 1100 to 1500. Major events, works of art and literature will be explored within the broad context of medieval life. The approach to medieval history, literature and art will be interdisciplinary and integrated throughout the course, with a consistent structured emphasis on the mutual interdependence of all aspects of culture and society from the 12th through the 14th century. The course will thus explore such questions as how medieval people defined themselves and their world, their conceptions of reality, their relationships to God and nature, and the individual's role in society. (DR:A)

   5 units, Win (Lewis, Ferruolo, Staff)

RELATED COURSES

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 with (DR) notations.

ART

104. Early Medieval Art.
   Will be offered 1981-82
FRENCH AND ITALIAN

FRENCH

130. French Literature I: Middle Ages and Renaissance.
135. Le Roman authurien.
   Offered 1982-83
139. Special Topics on Medieval Literature.
   Offered 1982-83
210. Old French.
   Offered 1982-83
211. Old Provençal.
   Offered 1982-83
212. Literature Médiévale I: 11ème-13ème siècles
   Offered 1982-83
214. L'épopée.
   Offered 1982-83
215. Le Roman arthurien.
   Offered 1982-83
219. Special Topics on Medieval Literature.
   Offered 1982-83
315. French Medieval Romances.
   Offered 1982-83

ITALIAN

128. Survey of Italian Literature I: 13th to 16th Century.
140. 1240 Dante: Inferno.
141. Dante: Purgatorio.
142. Dante: Paradiso.
143. Boccaccio.
   Offered 1982-83
144. Petrarch and Petrarchism.

GERMAN STUDIES

203. History of the German Language.
205B. Advanced Old Norse.
   Offered 1982-83
208A. Introduction to Middle High German.
   Offered 1982-83
208B. Advanced Middle High German.
   Offered 1982-83
251A. Fidreks Saga.
251B. Dietrich Epic.
251C. Heimskringla.
251. German Literature and Culture I: Topics in Germanic Philology.
   Offered 1982-83
252. German Literature and Culture II: Topics in Germanic Philology.
   Offered 1982-83

HISTORY

104. Byzantine History.
107. The 12th Century Renaissance: European Society and Culture, 1050-1220.
   Offered 1982-83
206. Undergraduate Colloquium: Politics and Law in Medieval Europe.
208. Undergraduate Colloquium: The Christianization of Europe.

HUMANITIES SPECIAL PROGRAMS


MUSIC

3C. Medieval Music.
   Offered 1982-83
100. Music History: Medieval and Renaissance.
   Offered 1982-83
140B. Gregorian Chant.
140D. The Music of Guillaume Dufay.

PHILOSOPHY


RELIGIOUS STUDIES

23. Judaism.
24. Christianity.
27. Islam.
   Offered 1982-83
31. Prophets and Prophecy.
61. Jewish Religious Thought.
   Offered 1982-83
64. Muhammad and the Koran.
72. Maimonides.
   Offered 1982-83
125. The Medieval Church.
171. Augustine.
   Offered 1982-83

SLAVIC LANGUAGES AND LITERATURES

189. Russian Literature of the Middle Ages.
211. Introduction to Old Church Slavic.
   Will be offered 1981-82
212. Reading of Old Church Slavic and Old Russian Texts.  
Will be offered 1981-82

SPANISH AND PORTUGUESE
SPANISH

Offered 1982-83

HUMAN LANGUAGE

See the Linguistics section in this bulletin for course listings.

Chairman: Elizabeth C. Traugott  
Professors: Clara N. Bush (on leave Winter, Spring), Charles A. Ferguson, Joseph H. Greenberg (on leave Autumn), Elizabeth C. Traugott  
Associate Professors: Eve V. Clark, William R. Leben, Thomas Wason (on leave 1980-81), Terry Winograd (on leave Autumn)  
Assistant Professors: Ivan A. Sag  
Affiliated Professors: Alphonse Juilland, Robert L. Politzer  
Affiliated Associate Professors: Andrew M. Devine, Dorothy H. Huntington, Orrin W. Robinson III, Michelle Rosaldo  
Affiliated Assistant Professor: James A. Fox  
Senior Lecturers: Beverley J. McChesney, Frieda N. Politzer  
Visiting Professor Emeritus: Dwight Bolinger  
Visiting Associate Professor: Geoffrey Pullum  
Visiting Assistant Professors: Geoffrey Nunberg, John Rickford

INTERNATIONAL RELATIONS

Committee in Charge: Alexander Dallin (History and Political Science) (Chairman), David Abernethy (Political Science), (Vice-Chairman), Elie Abel (Communication), John Cuddington (Economics), Alexander Dallin (Political Science), Peter Duus (History), Alexander L. George (Political Science), Herbert Lindenerberger (Comparative Literature), Mark Mancall (History), Scott Pearson (Food Research Institute), Mary Pratt (Spanish and Portuguese), 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 internationalists who will be sensitive to the complexities of relations among different cultures, sophisticated in their ability to think about world affairs, and capable of creative work in the international field.

The program seeks to enrich undergraduate course offerings in international relations for non-majors as well as for majors. All students considering either a major or extensive work in international relations are strongly encouraged first to take Political Science 35, "How Nations Deal with Each Other," offered in the Fall Quarter of each year. After that, prospective majors will develop their own programs, in conjunction with advisors, as outlined below.

The degree of Bachelor of Arts in International Relations will require at least 50 units in the major. In addition, each student will be expected to demonstrate the proficiency in a foreign language to be expected after two years of university-level language training. Precise course requirements, after completion of History/Political Science 35, will depend on which cluster of courses the student chooses as a focus for his or her program. Cluster A encompasses courses that emphasize political and historical aspects of international relations. Cluster B focuses on humanistic aspects of relations among national cultures, and Cluster C constitutes a set of problem-oriented courses, largely on political-economic issues. All students must take at least two courses in the humanities-cultural area (Cluster B), at least five courses in one of the two remaining areas and three courses in the other.

In each individual case, the student will develop his or her program in conjunction with an advisor, who will be a member of the Committee on International Relations or a faculty member approved by it.

Students who have already been accepted as majors in the program may petition for credit towards the International Relations major courses not listed in this section of the catalogue or in the updated course lists in the International Relations office. It is important to note that petitions from non-majors or prospective majors will not be reviewed by the committee. Petitions should contain as much information as possible about the course in question: syllabi, reading lists, examinations, papers, etc. No course should be proposed for inclusion in the major unless it meets two conditions:
1) More than half the course work must deal with international materials

2) "International" here means "transactional," that is, dealing with real-life relationships among national or cultural units, as distinguished from relationships that exist only in the mind of the observer, such as comparisons. Extracurricular courses (undergraduate specials, Swopsi, Scire, and others) will not be counted towards the major.

Students are encouraged to shape their own programs, 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 or former 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 no 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 to make periodic presentations 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: definition of topic and relevant background reading in the third quarter of the junior year (2-5 units); conduct the bulk of the research in the first quarter of the senior year (3-5 units); write the honors essay itself in the second quarter of the senior year (3-5 units).

AWARDS

The International Relations Committee invites undergraduate Stanford students, particularly juniors, to apply for funds to finance research or intensive study on forces that transcend national borders. These grants, provided by the United California Bank, the National Endowment for the Humanities, the Committee on International Relations, and the Center for Research in International Studies, are intended primarily for use during the summer of 1981 by students writing honors theses in international relations. Application forms are available in the Winter Quarter in the International Relations office. Preference is given to students whose research proposals are thoughtful and thorough and show promise of leading to truly distinguished honors theses. Funds may be used to finance travel to places where field work or library research is to be conducted, or may be used to support intensive work during the summer at Stanford. The imaginativeness and intellectual promise of the project and the preparation of the student are major considerations in awarding these funds.

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 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 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 prescription for policy.

4-5 units, Aut (Keohane) MTWThF 11

_CLUSTER A: POLITICAL HISTORICAL EMPHASIS_

The Politics of Development in Latin America—(Enroll in Political Science 113A.) Survey course on the principal political systems of Latin America. Deals with the three largest countries (Brazil, Mexico, Argentina) and the major socialist country (Cuba).

5 units, Win (Packenham) TTh 10-12

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) TTh 10-12

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 cases of cooperation and conflict among African states.

5 units, Aut (Abernethy) MTThF 9

Southern Africa: Race, Class, and Political Change—(Enroll in Political Science 118B.) Examines the political history of the region’s ten countries, with special attention to relations among racial and ethnic groups. Analyzes diplomatic, military and economic interactions among these states. Studies the impact of southern Africa’s politics and economic development of movements, corporations, states, and international organizations based outside the region.

5 units, Win (Abernethy) MWF 9

Socialism in Latin America—(Enroll in Political Science 119.) An examination of 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) TTh 2:15

Soviet Foreign Policy—(Enroll in History 122B or Political Science 136.) Foreign and domestic determinants of policy; intentions and capabilities; continuity and change since 1717; institutions and personnel; war and peace; perceptions, priorities and attitudes; alternative futures.

5 units, Aut (Dallin) MTWTh 10

International Communism—(Enroll in History 123B or Political Science 132.) Strategies and questions of effectiveness; the success or failure of some key parties; cleavages among communist parties (including the Sino-Soviet split); sources and variations of appeals of communism; and various patterns of adaptation or evolution to different national settings.

5 units, Aut (Dallin) given 1981-82

The Balkan States Since 1800—(Enroll in History 126B.) The decline of the Ottoman Empire; emergence of the nation-states of Albania, Bulgaria, Greece, Montenegro, Rumania and Serbia; domestic policies and foreign relations; state consolidation, governmental instability; economic crises; peasants; political rivalries; fascism and communism; nationalism and revisionism.

5 units, Win (Vucinich) MTWTh 11
The United States and Asian Security: A Multiperspective Approach—(Enroll in Political Science 138D.) Survey of U.S. and Asian approaches to the maintenance of security in East Asia, focusing on how diverse national perspectives may lead to dramatically different interpretations of events and ideas. Explores the meaning of security in the contemporary age. Coverage includes the U.S., U.S.S.R., China, Japan, and other Asian nations which have been the scene of armed conflict since World War II. Taught by an interdisciplinary faculty.

5 units (Weinstein, Harding, Dallin, Okimoto) given 1981-82

Seminar: Strategic Doctrines and Security in East Asia—(Enroll in Political Science 138W.) Critical examination of the Asian application of U.S. strategic doctrines in selected cases, with particular emphasis on implications for current U.S. policy options in East Asia. Prerequisite: Political Science 138D.

5 units, Aut (Weinstein)

Chinese Foreign Policy I and II—(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.

5 units, Win, Spr (Harding) MTWTh 1:15

Japanese Foreign Policy—(Enroll in Political Science 139 A and 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. For graduates and undergraduates.

5 units each quarter, Aut, Win (Okimoto)

Seminar: Soviet Foreign Policy—(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.

5 units, Spr (Triska) given 1981-82

The Soviet Union and the Role of Force in International Politics: Soviet Security Policy, 1953 to the Present—(Enroll in Political Science 146C.) Provides a comprehensive overview of Soviet security and military policies from the death of Stalin in 1953 to the present. The course begins by examining Soviet attitudes toward a range of relevant issues, including: the utility and limitations of the use of force in the international environment; the character, likelihood and feasibility of general and limited nuclear war in the contemporary period; the notion of war as an instrument of national policy; the role of military power in influencing and/or determining the outcome of international political conflicts; the relationship between political and military power; the nature of the struggle between the capitalist and socialist world systems; and the importance of perception in the formulation and conduct of Soviet security and military policies. The second half of the course focuses on Soviet security policies in four specific geographic contexts: the Soviet-American strategic relationship; Soviet security policy in Europe and Asia; and the projection of Soviet military/political power in the Third World.

5 units, Spr (Blacker)

Seminar on China in the International System—(Enroll in Political Science 147.) Readings and research in China's relations with the United States, the USSR, Japan, the Third World, and various other countries.

5 units, Aut (North) Th 4:15-6:05

Social Structure of World Society—(Enroll in Sociology 152 or Education 147.) This course pursues a sociological analysis of human 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 and its dynamics will be viewed and compared. Special attention will be given to the question of whether once distinctive societies and cultures are converging on a common standard. Among the topics to be covered will be worldwide population dynamics, the nature of the world economy, communication and exchange of persons on a global scale, socio-economic stratification of the world population, and education, science and technology as global systems. The course will utilize a mixed lecture-discussion format.

5 units, Spr (Inkeles) TTh 1:15-3:00

Rebellions in Colonial and Post-Colonial Africa—(Enroll in History 147A.) The ideas, conditions, and "social materials" leading to rebellions; their structure, who led them, the rank and file, the phases through which they went; struggles in southern Africa.

5 units, Spr (Jackson) MTWTh 10

The Soviet Union and the United States: The 20th Century—(Enroll in History 220 or Political Science 148.) Soviet-American Relations, focusing on both continuities and changes over
time, historical roots, alliance systems, the role of ideology, and the "national interest." Assignments will include different interpretations of the relationship, with attention to the strategic balance, mutual perceptions, conflicts over third areas, the role of domestic factors in shaping foreign policy, and conflict management.

5 units, Win (Dallin) W 2:15

History and Society of West Africa—(Enroll in History 148A.) State-building, effects of transatlantic slave trade, European imperial domination.

5 units, Aut (Roberts)

Slavery in Africa and the Americas—(Enroll in History 148B.)

5 units, Win (Roberts)

From Colonialism to Independence: Sub-Saharan Africa in the Twentieth Century—(Enroll in History 148C.)

5 units Spr (Roberts)

America Since 1945—(Enroll in History 172A.) An analysis of America that emphasizes foreign policy and politics, intellectual history, social themes, and the political economy.

5 units, Win (Bernstein) MTWThF 1:15

Latin America to 1870—(Enroll in History 176.) From the Spanish conquest to political independence early in the 19th century; the breakup of empire (1830-1870); the relationships between colonial developments and modern conditions and problems.

4 to 5 units, Win (Bowser) MTWTh 11

International Communication: Structures and Issues—(Enroll in Communication 176.) Survey of different national media systems and the policy issues arising from the existing imbalances between developed and developing countries. This seminar examines the new technologies that have transformed the global flows of news, economic data, cultural, and technical information. Prerequisite: Communication 1. Seniors and graduate students in communication and international relations have first priority with permission of instructor.

4 units, Win (Abel)

Modern Latin America—(Enroll in History 177.) From the Latin American wars of independence to the present: the breakup of empire (1830-70); "development from without" (1870-1910); discovery of nationhood (1910-1950), and claims of tradition in arenas of change since 1950.

4-5 units, Win (Morse)

Modern Brazil, 1750-1977—(Enroll in History 180.) 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)

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, Spr (Okimoto)

Undergraduate Colloquium: Nationalism and Communism in Eastern Europe—(Enroll in History 224.)

5 units, Win (Vacminch) T 2:15

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, Aut (Triska)
given 1980-81

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

Research on Force and Diplomacy—(Enroll in Political Science 236.) Permission of instructor required.

5 units, Win (George)

Colloquium: Chinese Foreign Policy—(Enroll in Political Science 239.) A critical survey of the political literature on China's international behavior and foreign policy making process. Particular emphasis will be placed on the basic sources of China's foreign policy and China's relations with the United States, the Soviet Union, and Asia. Prerequisite: consent of instructor.

5 units, Win (Harding)
Seminar: International Relations Theory—
(Enroll in Political Science 243.) 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.
5 units, Spr (North) T 4:15

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 dependencia school, the environmentalists and other major theorists. A critical comparison through reading and discussion.
5 units (North) given 1981-82

Mau-Mau—The 1950's Anti-Colonial Rebellion in Kenya—
(Enroll in History 247S.)
5 units, Aut (Jackson) M 2:15

Undergraduate Seminar: U.S. Foreign Relations in the 20th Century—
(Enroll in History 266S.) This research seminar covers the two world wars, the cold war, and Vietnam.
5 units, Spr (Kennedy) Th 2:15

Undergraduate Colloquium: Crisis in Modern American Foreign Policy—
(Enroll in History 269.) The colloquium will focus upon some of the major events and problems: imperialism and war in the 1890's, entry into World War I and the making of the peace; entry into World War II; the origins of the Cold War; entry into the Korean War; the Cuban missile crisis; involvement in the Indo-China war; and American-Soviet differences in the Middle East.
5 units, Aut (Bernstein)

Undergraduate Colloquium: Latin American Migration in Historical Perspective—
(Enroll in History 284.)
5 units, Win (Wirth) M 2:15

Undergraduate Colloquium: Topics in Islamic Civilization—
(Enroll in History 287.)
5 units, Aut (Vucinich) T 2:15

The Imperialist Era in East Asia—
(Enroll in History 295.) An undergraduate colloquium on the impact of European imperialism on China and Japan, and the resulting transformation of international relations in East Asia.
5 units, Win (Duus and Van Slyke)

CLUSTER B: HUMANITIES EMPHASIS

77. Ethics, Justice, and the International Community—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. The second half will be devoted to an examination of the issue of world justice and the allocation of scarce natural resources. In particular, we will focus on the problem of development and the responsibility of developed nations to developing ones.
5 units (Strasnick) given 1981-82

Culture and Society in Latin America—
(Enroll in History or Latin American Studies 80 or Political Science 123D.) An interdisciplinary course which surveys the interaction of Amerindian, African, and European cultures in the creation of the New World societies from 1500 to the present. The course is organized into four major topic areas: migration and culture contact, agrarian systems and agrarian changes, urban dominance and innovation, and the relations between states and societies. This is a basic introduction to Latin American courses within several departments.
5 units, Spr (Wirth and Durham)

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, Matisoff, Van Slyke) 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

Western Culture and the Black Diaspora—
(Enroll in African and Afro-American Studies 103.)
5 units (Wynter) given 1981-82

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
Japanese-Western Literary and Cultural Interactions—(Enroll in 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.

4 units (Ueda) given 1981-82

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, Spr (M. Rosaldo)

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)

Christianity—(Enroll in Religious Studies 24 for 3 units.) Ten historic types of Christian religions: martyr and monk, philosopher and prelate, mystic and theologian, pietist and moralist, apologist and activist. The main cultural eras and intercultural transactions in Europe that elicited these life-styles. Christianity as transmitter and transformer of Palestinian, Hellenistic, Germanic, Holy Roman, territorial, and modern national culture.

3 units, Win (Fredriksen) MWF 9

The Meeting of Eastern and Western Art—(Enroll in 126E.) The interaction between the art of the Far East, Europe, and America from the 16th Century to the present day.

4 units, Aut (Sullivan) given 1981-82

Ch'an and Zen Buddhism—(Enroll in Religious Studies 18 for 3 units or 118 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, Spr (Staff) MWF 9

The United States and Africa—(Enroll in History 146A.) Slave contribution to the early colonial economies, African influences on American English; American images of Africa in 19th and 20th century novels; "Back to Africa" movements; African students in the U.S.; trading history; American foreign policies towards Africa.

5 units, Spr, (Jackson) MTWTh 10

Colloquium on National and International Identity—(Enroll in Comparative Literature 194A, Modern Thought and Literature 194A, or English 165B.) 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, Spr (Halliburton)

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) T 2:15

Russia and the West: Western Influences on Russian Culture and Society—(Enroll in History 217.)

5 units, Win (Atkinson) W 2:15

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...
Western Views of the Non-West Through the Literature of Travel—(Enroll in Spanish and Portuguese or Comparative Literature 296.) This course focuses on the Western traveler in the Third World as cross-cultural mediator and interpreter, and on the ideological appropriation of foreign contexts as related to developments in world history and economy. Course materials include travelogues, journals, letters, essays, works of fiction, documentary and ethnographic writings, and film. Open to all students; no prerequisites. Readings will be in English.

3-5 units, Win (Pratt, Benmayor)
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.

Seminar: The International Politics of Modern Capitalism—(Enroll in Political Science 148.) Foreign economic policies of major capitalist states, and their interactions. Trade, international financial relations, energy. Problems of international policy coordination and conflict, responses of foreign economic policy to internal tensions or contradictions, accumulation and divestment of economic power resources, development and disintegration of international economic regimes. Prerequisites: Political Science 35 and the equivalent of Economics 51-52.

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; appropriate to both foreign and American students. 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. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures analyzed in terms of appropriateness 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, life-styles. Development examined in terms of relative satisfaction of human needs. Winter: Alternative development strategies including country case studies. Spring: The individual and social change: the engineer, political scientist,
International Economics I—(Enroll in Economics 165.) Comparative advantage in production and trade among nations, the international monetary mechanism; domestic monetary, fiscal and exchange rate policies and their relationship to foreign trade. Economics 1, 51 and 52 recommended.

5 units, Aut, Win, Spring (Cuddington)

International Trade and Investment Policy—(Enroll in Economics 166 or Food Research 166.) This course is concerned with the formulation, implementation and effects of selected government policies affecting international trade and foreign investment. Topics include trade policy and economic welfare, government responses to competition from imports, issues underlying the international negotiation of reductions of barriers to trade, influences of domestic agricultural policies on international commodity trade, multination commodity agreements and cartels, policies affecting international trade in energy resources, and special trade and investment arrangements for developing countries. 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, Spring (Pearson) MW 11:00-1:00

International Economic Policy Analysis—(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, (Meier) given 1980-81

Monetary and Financial Institutions and Policy in Western Europe—(Enroll in Economics 169.) The course starts with a short description of the breakdown of the Bretton Woods System and of the reasons thereof. Afterwards the European Currency System (Snake), its institutions and its working from 1973-80 will be discussed. Besides this the development of flexible exchange rates as a consequence especially of differing monetary policies will be analyzed. Independence and organization of some central banks as well as the Eurocurrency Market will be touched on. The emphasis of the course will be on German and Swiss policies.

5 units, Win (Bernholz)

International Political Economy—(Enroll in Political Science 241.) An analysis of how the world economy and the international political system are related to one another. Emphasis on theoretical approaches and historical analysis of the period between the mid-19th century and 1971. A basic working knowledge of economics (at least the equivalent of Economics 51-52) is necessary, as well as some background in the study of world politics.

5 units, Aut (R. Keohane) T 2:15-4:05

International Agricultural Policy—(Enroll in Food Research Institute 267.) This course will discuss the major continuing and contemporary problems in world agricultural trade 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 11-12:30

Development and the International System—(Enroll in Political Science 313.) An undergraduate research seminar. Focus is on external constraints on development in the Third World, and the interaction between national and international factors. No formal prerequisites, although previous work in International Relations, Economics, and/or Political Science is highly recommended.

5 units, Win (Fagen) W 10-12

Directed Study in International Relations—(Enroll in International Relations 197.)

2-5 units, any quarter (Staff)

Honors Thesis—(Enroll in International Relations 198A, B, or C.)

2-10 units, any quarter (Staff)
Committee in charge: Clara N. Bush (Linguistics) (Chairman); John Barson (French and Italian), Albert Dien (Asian Languages), Gertrude Mahnholz (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.

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. Portuguese 109, "Portuguese for Students of Spanish" is strongly recommended for those students demonstrating competency in Spanish.

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 main
tained 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 a Latin American area of concentration may apply to the Committee on Latin American Studies for summer grants for pre-dissertational research.

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, 1981.

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 basic-

ally 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. Students with advanced competency in Spanish, but with no knowledge of Portuguese, must take Portuguese 109 "Portuguese for Students of Spanish" during the Fall Quarter; 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.

COURSES

All courses (DR:X) unless noted otherwise.

80. Culture and Society in Latin America—(Same as History 80 and Political Science 80.) An interdisciplinary course which surveys the interaction of Amerindian, African, and European cultures in the creation of New World societies from 1500 to the present. The course is organized into four major areas: migration and culture contact, agrarian systems and agrarian change, urban dominance and innovation, and relations between state and society. This is a basic introduction to the Latin American courses within several departments. (DR:A)

5 units, Spr (Wirth, Durham)

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 (Breedlove) Th 12:00-1:15

LINGUISTICS

Chairman: Elizabeth C. Traugott

Professors: Clara N. Bush, (on leave Winter, Spring), Charles A. Ferguson, Joseph H. Greenberg, (on leave Autumn), Elizabeth C. Traugott

Associate Professors: Eve V. Clark, William R. Leben (on leave Winter), Thomas Wasow (on leave 1980-81), Terry Winograd (on leave Autumn)

Assistant Professor: Ivan Sag

Affiliated Professors: Alphonse Juillard, Robert L. Politzer

Affiliated Associate Professors: Andrew M. Devine, Dorothy A. Huntington, Orrin W. Robinson III, Michelle Rosaldo

Affiliated Assistant Professor: James A. Fox

Visiting Emeritus Professor: Dwight Bolinger

Visiting Associate Professor: Geoffrey Pullum

Visiting Assistant Professors: Geoffrey Nuttberg, John Rickford

Senior Lecturer: Beverley McChesney, Frieda N. Politzer

Special Language Program Coordinator: (Staff)

ENGLISH FOR FOREIGN STUDENTS:

Director: Clara N. Bush

Senior Lecturers: Beverley McChesney, Frieda N. Politzer

UNDERGRADUATE PROGRAMS OF STUDY

Linguistics offers degrees on both the undergraduate and graduate levels. For University regulations governing both undergraduate and graduate degrees, see the "Degrees" section 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 principal 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. **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.

   B. **Psychological and Biological Aspects of Language**: language and meaning; language as a component of thought processes; language disorders; physiology of speech perception and production; language acquisition; biological correlates of language.

   C. **Social Aspects of Language**: language, culture and society; bilingualism; language and social stratification; language policy; change in contemporary languages; language adaptivity.

   D. **Languages and Literature**: structure and history of a particular language or language group; discourse analysis; stylistics, poetics.

3. **Honors Program**—Students majoring in Human Language who plan to apply for graduate studies in Linguistics should seek departmental honors; students who plan to apply for graduate studies in fields related to Human Language are also 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 97, Research in Human Language (4 units), in the Autumn quarter of the senior year, and Linguistics 98, 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 PROGRAMS OF STUDY**

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 seven core graduate courses (Linguistics 200, 201, 220, 221, 230, 240 and 245), which total 31 units, and the option of up to 5 units for a research project or A.M. thesis; see 4 below. Courses to be counted toward the A.M. which are not in general linguistics are to be approved by the advisor. 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.

4. **Thesis**—Terminal A.M. candidates are ex-
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.

PhD MINOR IN LINGUISTICS

1. Courses.—Candidates must complete at least the seven graduate core courses in linguistics, Linguistics 200, 201, 220, 221, 230, 240 and 245 (31 units).

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. Examinations—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.

MINOR IN HUMAN LANGUAGE

1. Courses.—Candidates must complete a minimum of 30 units of graduate work in linguistics maintaining a grade average of B or better. Course work must include Linguistics 210 or equivalent and at least ten additional units in Linguistics courses numbered 200 or above. Candidates are expected to develop an integrated program of courses in consultation with a faculty advisor in Linguistics. All Human Language minor programs are subject to the approval of the Linguistic Department's Graduate Studies Committee.

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. Examinations—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 language with sufficient facility to understand and to interpret 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 or, beyond the 40 units exclusive of dissertation units. This includes the seven core courses in linguistics, Linguistics 200, 201, 220, 221, 230, 240, 245 (31 units), and also Linguistics 219 Modern Linguistics (normally to be taken in the second year.) Candidates must achieve a grade of B or better in each of these courses.

3. Examinations—Successful completion of a qualifying examination on the principles of general linguistics and the theory, methods, and techniques of the main linguistic disciplines. The examination is based on the kinds of materials covered in Linguistics 200, 201, 220, 221, 230, 240 and 245. It will normally be taken at the end of the Spring Quarter of the first year.

4. Teaching—A minimum equivalent to one-half of one quarter during the second or third year in residence. May be fulfilled by Linguistics 396.

5. Colloquia—Two oral presentations exclusive of the oral presentation of thesis proposal (see 6a below). One of these two colloquia may be given in a Topics class or seminar; both should be given during the first three years of study.

6. Dissertation—
   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).

FOREIGN LANGUAGES

The Department of Linguistics administers a number of different foreign language programs, including African Languages, Mideastern Languages, the Special Language Program and the Program in English as a Foreign Language. Course offerings for each of these language programs are presented immediately following the linguistics courses in this section of the bulletin.
LINGUISTICS COURSES

Courses with two-digit numbers are primarily designed for undergraduates. As indicated, certain of these courses may be taken for graduate credit under a corresponding three-digit number. Courses with 100-level numbers are designed for advanced undergraduate enrollments; those with numbers 200 and above are designed primarily for graduate students. With consent of instructor, certain of these 200-level courses may be taken for credit by qualified undergraduates.

At all levels, the course numbering indicates a special area, as follows:

00-19 General
20-29 Phonetics, Phonology & Morphology
20-44 Syntax, Semantics & Pragmatics
45-54 Language Change
55-64 Sociolinguistics
65-74 Psycholinguistics
75-79 Computational Linguistics
80-89 Linguistic Analysis of a Language
90-94 Methods and Applied Linguistics
95-99 UG Honors; Graduate Directed Work, Theses, Dissertations


4 units, Spr (Ferguson)

8. Languages of the World—A survey of the world's languages with special emphasis on the question of language universals and problems of genetic and typological classification. Prerequisite: Linguistics 1, 10 or permission of the instructor. (DR:A)

5 units, Spr (Pullum)

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 (Sag)

15. Language and Speech Disorders—Introductory survey of disorders of human communication. The course focuses on the major congenital and acquired pathologies (e.g. deafness, aphasia, articulatory deficits, vocal malfunctions), their physiological bases and remediation. (DR:X)

3 units, Win (Huntington)

20. Introduction to Phonetics—Practice in the production, preception and transcription of sounds typical of a variety of the world's languages, with an introduction to how man produces and perceives them and what can be learned by analyzing them acoustically and synthesizing them electronically.

Given alternate years

30. Introduction to Syntax—General introduction to transformational grammar, the theory of syntax developed by Noam Chomsky and others. The course deals with analyses of various grammatical constructions, primarily in English, and their consequences for a general theory of language. Such notions as deep structure and universal grammar are examined. (DR:A)

4 units, Spr (Sag)

35. The Analysis of Discourse—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. (DR:A)

4 units, Aut (Nunberg)

40. Language and Meaning—Survey of theories about meaning in language from the perspective of the speaker, analysis of the sentence, and analysis of the word. (DR:H)

4 units, Win (Clark)

45. Language and Culture—(Same as Anthropology 04.) Lecture course on evolutionary, diffusional, functional, and structural theories of language and culture. Functions of language in the speech community. Role of linguistic data in the analysis of society and culture. Language repertoires and rules of use. Linguistic evidence for culture history. (DR:A)

5 units, Spr (Fox)

75. Computers and Language—(Same as Computer Science 75.) The goal of this course is to provide a basis for understanding how computers can be used in applications dealing with language and to discuss the implications dealing with language and to discuss the implications of putting computer systems into everyday life situations. It introduces the basic principles of computing and linguistics on which the programs are based, through lectures, films, discussions and demonstrations of existing systems. A term paper will be required. No prerequisites. Computer background not required. Enrollment limited.

5 units, Spr (Winograd)

81. Introduction to the Germanic Languages—(Same as German Studies 19A, 119) Survey of the oldest attested stages of the Ger-
manic language family, including Gothic, Old Norse, Old Saxon, Old English, Old High German, Old Dutch, Old Frisian. Presentation both of external history and internal relationships.

3 units, Spr (Robinson)

90. Critical Thinking—(Same as Philosophy 56.) Students learn to interpret difficult material, analyze and criticize arguments, and develop intellectual skills needed for academic work. (DR:H)
4 units, Win (Staff)

97. 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 evidence 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 instructor. (DR:S)
4 units, Aut (Sag)

98. 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 97 or consent of instructor. (DR:X)
5 units, Win (Sag)

99. Independent Study—(DR:X)
1 or more units, any quarter (Staff) by arrangement

155. Introduction to Sociolinguistics—The study of language in 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. Prerequisites: Linguistics 10 or its equivalent. (DR:A)
5 units, Win (Rickford)

160. 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 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 prerequisites. (DR:S)

Given alternate years

162. Pidgins and Creoles—(Same as Anthropology 177.) Lecture course on the formation of simplified contact languages (pidgins) and their subsequent elaboration. Emphasis on the relationship between language structure and function, language universals, and the relevance of political power, ethnic identity, and social structure in the contact speech community. Attention is given to other simplified languages and registers. Prerequisite: an introductory course in linguistics or anthropology or consent of instructor. (DR:S)
3 or 5 units, Aut (Fox, Frake)

165. Child Language Acquisition 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 consent of instructor. (DR:A)
4 units, Aut (Clark)

170. Language and Thought—(Same as Psychology 146.) Surveys current topics of interest in language and thought, including language acquisition 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: Psychology 1 or equivalent. (DR:S)
4 units, Win (H. Clark)

180. The Structure of the English Language—(Same as English 101.) 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. (DR:A)
5 units, Win (Traugott)

181. Linguistics and the Analysis of German—(Same as German Studies 212/312.) An introduction to linguistic theory and analysis with special emphasis on the analysis of modern German. (DR:X) given 1981-82

182. Introduction to German Dialects—(Same as German Studies 118/218) Introduction to the major dialects of German-speaking Europe through texts, tapes, lectures and presentations by native speakers, also a general introduction to the field of dialect geography.
3 units, Win (Robinson)
185. Black English—Survey of the features of the English vernacular spoken by Black Americans, especially in big city settings, and its relation to the creole English dialects spoken on the south Carolina Sea Islands ("Gullah"), in the Caribbean, and West Africa. The expressive uses of Black English (e.g. in soundin', and rappin' and the like) will also be considered, and its educational implications will be explored.

4 units, Aut, (Rickford)

192A. Introduction to Methods of Teaching English as a Foreign Language—A practical approach to problems of teaching English to speakers of other languages, including a survey of those features of English phonology, morphology, and syntax which present particular difficulties, presentation of problems, construction of exercises and lesson planning. For the duration of the course, each student is required to serve as a tutor to an individual who is learning to speak English. (DR:S)

3 units, Win (McChesney or Politzer)

192B. Practicum in TEFL—Workshop for volunteer teachers currently active in area TEFL programs or planning to teach English abroad. Course includes demonstration teaching, discussion of teaching problems, and evaluation of classes observed. Prerequisite: Linguistics 192A or equivalent. (DR:X)

1 unit, Spr (Politzer)

200A,B,C. Proseminar—The diversity of languages, types of language, types of structure, types of social settings. Designed for graduate students taking degrees in Linguistics. (DR:X)

2 units, Aut, Win, Spr (Traugott)

201. Mathematical Models of Natural Language—Introduction to mathematical methods and results relevant to the analysis of natural language syntax and semantics. Topics will include elementary logic, model theory, automata theory, and the Chomsky hierarchy of grammars. No prerequisite. (DR:T)

4 units, Aut (Sag)

202. Mathematical Linguistics—(Same as Philosophy 202.) Investigation of mathematical results relevant to empirical issues of 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. Prerequisite: consent of instructor. (DR:T)

4 units, Spr (Leben)

203. Seminar in Theories of Language—(Same as Philosophy 303.) (DR:X)

3 units, Win, Spr (Bower, Moravcsik)

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 1981-82

210. Introduction to Linguistics—Content same as Linguistics 10. (DR:A)

3 units, Aut (Sag)

214. History of Linguistics—(Same as Anthropology 179.) The historical development of linguistic theory and method with major emphasis on the Western tradition up to the present. (DR:S)

5 units, Win (Greenberg)

215. Language and Speech 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 15 or consent of instructor. (DR:X)

1-3 units (Huntington) by arrangement

219. Modern Linguistics—A survey of approaches to linguistic structure that have had significant impact in the twentieth century. (DR:A)

given 1981-82

220. 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 language as well as problems in phonological analysis. (DR:A)

5 units, Aut (Bush, Ferguson)

221. 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. (DR:A)

4 units, Spr (Leben)

222. Phonological Theory—Survey of contemporary theoretical issues in phonology, with detailed treatment of topics that have recently led to significant results. Prerequisite: Linguistics 221, (DR:A)

4 units, Aut (Leben)
223. Practicum in Phonology and Morphology—Practice in problem solving, using data from a lesser known language. The course is designed to increase proficiency in dealing with linguistic evidence and to contribute to scholarship in lesser known languages. (DR:X) given alternate years

224. Topics in Phonetics and Phonology—Selected topics in phonetics and phonology. May be repeated for credit. Prerequisite: Linguistics 220 or consent of instructor. (DR:A) given 1981-82

225. Morphology—Survey of types of word formation processes found in the world's languages. Morphology in relation to phonology, syntax, and semantics. Prerequisite: consent of instructor. 4 units, Spr (Leben)

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:X) 2-4 units, (Huntington) by arrangement

230. Introduction to Syntactic Theory—(Same as Philosophy 230.) Introduction to the transformational theory of syntax. Practical experience in forming and testing linguistic hypotheses, reading and constructing rules, etc. (DR:A) 4 units, Win (Sag)

231. Intermediate Syntax—Constraints on the form and functioning of generative grammars. Topics include anaphora, island constraints and the roles of transformations, lexicon, and grammatical relations in syntactic theory. Prerequisite: Linguistics 230 or consent of instructor.

233. Topics in Syntactic Theory—In-depth study of particular topics in natural language syntax which are of particular theoretical interest. Topic: The Interaction of Phonology and Syntax. May be repeated for credit.

238. Topics in Discourse Analysis. 4 units, Spr (Pullum) given 1981-82

240. Semantics and Pragmatics—A survey of fundamental issues in the analysis of meaning in natural language. Includes an introduction to model-theoretic semantics, and selected readings in the philosophy of language. Other topics addressed include the role of semantics in generative grammar, conversational implicature, and speech acts. Prerequisites: either Linguistics 201 or Philosophy 56, and either Linguistics 30 or 230 or consent of instructor. 4 units, Spr (Staff)

243. Topics in Semantics/Pragmatics—Detailed study of selected topics in natural language semantics or pragmatics. May be repeated for credit. 4 units, Win (Sag)

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. Prerequisite: one course in elementary logic. (DR:H) 4 units, Aut (Moravcsik)

245. Principles and Methods of Historical Linguistics—(Same as Anthropology 180). The nature of linguistic change in phonology, grammar and semantics, problems of internal and comparative reconstruction, and basic issues in the explanation of diachronic processes in language. (DR:X) 4 units, Win (Greenberg)

246. Topics in Language Change—Processes of syntacticization and grammaticalization. Focus on changes between ergative and transitive systems. May be repeated for credit. Prerequisites: 230 and consent of instructor. 4 units, Aut (Traugott)

249. Introduction to Indo-European Linguistics—(Same as Classics 253.)

255. Variation Theory and Implicational Scaling. 4 units, Spr (Rickford)

256. Topics in Sociolinguistics—May be repeated for credit.

Language Norms—Prerequisite: Linguistics 155. The social development of popular and prescriptive doctrines of language evaluation and their consequences for linguistic theory and linguistic description. 4 units, Aut (Nunberg)

Language Stratification—Prerequisite: Linguistics 155 and one other course in Sociolinguistics. Why are some languages or language varieties regarded as higher or better than others in human societies? How and why do patterns of language stratification change? What effect does the language situation have on linguistic change? Sociolinguistic universals and theories of language. 4 units, Spr (Ferguson)

260. Topics in Multilingualism. 4 units, Spr (Rickford)

265. Child Language Acquisition II—(Same as Psychology 241.) Theoretical issues in first language acquisition, with detailed examination of
the evidence available. Interaction of linguistic
and psychological factors.
given 1981-82

266. Acquisition of Phonology—Current state
of knowledge on children’s phonological de-
velopment. Relation of perception to produc-
tion, babbling to early speech, child phonology
to adult phonology. Relevance of phonological
theory to child development and vice versa.
Prerequisite: Linguistics 221 or equivalent.
4 units, Win (Ferguson)

267. Topics in Language Acquisition—
Variable topics selected from semantics, syntax,
morphology, discourse structure or phonology.
May be repeated for credit.
4 units, Spr (Clark)

270. Psycholinguistics—(Same as Psychology
214.) Prerequisite: graduate standing in
psychology or consent of instructor.
3 units, Win (H. Clark)

275. Computational Models for Syntax of
Natural Language—(Same as Computer Sci-
ence 275.) Introduction to formal systems and
computer implementations for syntax. Survey of
relevant material from linguistics and formal
language theory. Review and discussion of past
and current parsing systems. Overview of rele-
vant aspects of the syntax of English. (DR:T)
given alternate years

276. Computational Models for Semantics of
Natural Language—(Same as Computer Sci-
ence 276.) Conceptual overview of problems of
meaning. Formalisms from logic, computation
theory, psychology and linguistics, relevant to
computer systems for natural language. Survey and
critical discussion of current research on
computational approaches to natural language.
(DR:T)
3-4 units, Win (Winograd)

277. Topics in Computational Linguistics—
(Same as Computer Science 277.) May be re-
peated for credit.
3 units, Aut. (Staff)

281. The Phonology of German—(Same as
German Studies 314.) Systematic treatment of
the German sound system, especially within the
framework of generative phonology.
3-5 units, Win (Robinson)

282. The Transformational Grammar of
German—(Same as German Studies 213/313.)
Study of the syntactic mechanisms of German
within the framework of transformational
grammar.
Given 1981-82

285. The Structure of Hausa—A sketch of
Hausa syntax, morphology, and phonology,
with emphasis on points of current theoretical
interest. Prerequisite: 220 and 230 or consent of
instructor.
given 1981-82

289. Chinese Language and Current Linguis-
tic Theories—(Same as Asian Languages 293.)
Prerequisite: Asian Languages 102 or equiva-
 lent. Recommended: a general introductory
course in Linguistics.
given 1981-82

290. Research Methodology: 1980-81 De-
velopmental Psycholinguistics—Introduces the
student to social science research methods
within the context of a given area of linguistic
research.
4 units, Win (Clark)

291. Linguistic Field Methods
4 units, Win (Rickford)

292. Linguistics and the Teaching of English as
a Foreign/Second Language—(Same as Educa-
tion 282.) Linguistic aspects of the problems of
teaching English to speakers of other languages
and standard English to speakers of other
dialects. For the duration of the course, each
student is required to serve as a tutor to an
individual who is learning to speak English.
Prerequisite: introductory course in linguistics
or consent of instructor. (DR:S)
3 units, Aut (Politzer)

294. Topics in Applied Linguistics—Selected
topics in the application of linguistic research
findings to practical language problems. De-
pending on interests of those enrolled, selection
will be made from such topics as the language of
public documents, interethnic communication,
literacy, language planning, language in profes-
sional contexts.
given alternate years

395. Thesis Project (A.M.)
1-5 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
FOREIGN LANGUAGES
All courses (DR:X)

AFRICAN LANGUAGES
(600-619)

602A,B,C. Beginning Hausa.
5 units, Aut, Win, Spr (Staff)

603A,B,C Intermediate Hausa.
5 units, Aut, Win, Spr (Staff)

606A,B,C Beginning Swahili.
5 units, Aut, Win, Spr (Staff)

607A,B,C Intermediate Swahili.
5 units, Aut, Win, Spr (Staff)

610A,B,C Beginning Yoruba.
5 units, Aut, Win, Spr (Staff)

611A,B,C Intermediate Yoruba.
3-5 units Aut, Win, Spr (Staff)

SPECIAL LANGUAGE PROGRAM
(620-679)

Students interested in studying a modern foreign language not regularly taught at Stanford may propose a special language course. Over the past three years, the following languages, among others, have been taught: American Sign Language, Arabic, Armenian, Czech, Danish, Modern Greek, Hebrew, Hindi, Icelandic, Indonesian, Modern Irish, Norwegian, Swedish.

Courses already planned for 1980-81 include:

620A,B,C Beginning Arabic.
3 units, Aut, Win, Spr (Staff)

621A,B,C Intermediate Arabic.
3 units, Aut, Win, Spr (Staff)

625A,B,C Beginning Hebrew.
3 units, Aut, Win, Spr (Staff)

626A,B,C Intermediate Hebrew.
3 units, Aut, Win, Spr (Staff)

Other languages will be offered on request.

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 for three units credit each quarter. Normally grading will be done on a pass/no credit basis. Students must register for the course number assigned to the specific language. Consult Coordinator, Special Language Program.

Special Language courses are usually set up for a year of study, beginning with Autumn Quarter, for groups of three to ten students at the elementary level. 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 supersede ad hoc language courses set up under SWOPSI, SCIRE, and Undergraduate Specials.

Address all inquiries to Coordinator, Special Language Program, Linguistics, 101B.

RELATED 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.

ENGLISH AS A FOREIGN LANGUAGE
(685-699)

The courses below represent the basic offerings in English as a Foreign Language. Each quarter, additional sections of these courses are scheduled as needed. Those students who are
required to take 697 should normally expect to
follow the subsequent course in the sequence
during a succeeding quarter.

During the regular 8-week summer session,
courses in spoken and written English up to a
maximum of 11 units will be offered.

An 8-week program in Intensive English and
Academic Orientation for International En-
ingineering Graduates is also offered in the sum-
er. This program is open to qualified graduate
engineering students who have been admitted
to degree programs at other United States in-
itutions as well as those who have been ad-
mitted to Stanford for the following Autumn
Quarter.

In addition, a late-summer 4-week intensive
program is offered.

690. Spoken Usage—Structured practice in
spoken English with emphasis on current usage
in a variety of natural situations. Review and
practice of grammatical patterns as needed.
3 units, Aut, Win, Spr (Staff) by arrangement

691. Discussion and Speech—For students
with some facility in spoken English. Oppor-
tunity to make oral presentations and partici-
pate in seminar discussions. Emphasis on
fluency and intelligibility.
3 units, Aut, Win, Spr (Staff) by arrangement

693. Aural Comprehension—Graded exercises
in listening to lectures, dialogs, and discussions
with evaluation of comprehension. Prerequi-
tsite: consent of instructor.
3 units, Aut, Win, Spr (Staff) by arrangement

695. Special Topics in English—Topics such as
academic orientation, general vocabulary,
reading comprehension, or pronunciation, to be
determined each quarter according to enroll-
ment.
3 units, Aut, Win, Spr (Staff) by arrangement

697. Written English I—Intermediate work in
expository writing with special attention to cor-
rect grammatical usage. Prerequisite: consent of instructor.
4 units, Aut, Win (Staff)
by arrangement

698. Written English II—For students with
some facility in written English. Emphasis on
fluency, idiomatic usage, and style. Special at-
tention given to mechanics and form appro-
priate to academic papers. May be repeated for
credit. Prerequisite: consent of instructor.
3 units Aut, Win, Spr (Staff) by arrangement

699. Independent Study in English as a
Foreign Language—Consent of instructor.
1-4 units, Aut, Win, Spr (Staff)

LITERATURE IN
TRANSLATION

At Stanford courses in literature are taught in
a number of departments and programs, and the
courses work with texts in many languages. How-
ever, departments and programs do offer
specific courses which use texts translated into
English in order to make these works available
to students who do not read the original lan-
guage. The Advisory Committee on Literature
(Humanities and Sciences) has prepared the
following list of courses to assist students in
selecting courses which feature foreign works in
English translation. Please consult depart-
mental listings for further information.

ASIAN LANGUAGES

42. Haiku—Seminar for Freshmen.

110 (257). Japanese-Western Literary and
Cultural Interaction.

125. Japanese Culture Through Novels and
Films.

131. Chinese Poetry and Drama in Transla-
tion.


133. Modern Chinese Literature in Transla-
tion.

136. Early Japanese Literature in Transla-
tion.


138. Modern Japanese Literature in Transla-
tion.

178. Japanese Poetry from Manyoshu to Shin-
kokinshu.


154 (254). Undergraduate Colloquium: The
Middle Period in Chinese History.

255A. The Nature of Literature: Japanese
and Western Views.

255B. Chinese and Western Theories of Liter-
arture.

CLASSICS

6. Imitations and Translations of Latin Litera-
ture.

172. Classical Influences in Modern Litera-
ture.

174. Stage Comedy from Aristophanes to
Shakespeare.

11. The Classical Epic.

12. Greek Tragedy: Aeschylus, Sophocles,
Euripides.

135. Classical Conventions in European Lyric.
**DRAMA**

1. Introduction to Drama.
152. Medieval and Renaissance Drama.
155. Modern Drama (1880-1918).
181. Drama of Brecht.
350. Seminar: Greek Tragedy.
354A. Seminar: Expressionism.
352. Seminar: Theater and Politics.

**ENGLISH**

165A. Interpretations of the Modern Experience.
166. Modern Literature from Africa.
259A. Symbolist Poetry, French and American.

**FRENCH AND ITALIAN**

107. Sartre: Literature and Politics (Giraud).
114B. The Modern French Novel (Cohn).
114A. The 19th Century French Novel (Giraud).

**GERMAN STUDIES**

275A. European Novel II: The Romantics.
284A. Joyce, Proust, Mann I.
285A. Joyce, Proust, Mann II.
291A. Literature of Decadence.
295A. Literature of Anarchism and Nihilism.
296A. Preconditions of Literature, German Literature as an Example.

**HUMANITIES SPECIAL PROGRAMS**

61. The World of Pagan Antiquity.
301. The Classical Period.
302. The Roman and Early Christian Periods.
303. The Middle Ages.
304. The Renaissance.

**SLAVIC LANGUAGES AND LITERATURES**

150. Romanticism Among the Slavs.
151. Fyodor Dostoevsky.
153. Leo Tolstoy.
154. The Russian Drama.

**SPANISH AND PORTUGUESE**

123A. Spanish American Literature in Translation.

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**MATHEMATICAL SCIENCES**

Committee in Charge: John G. Herriot (Computer Science), Chairman; Paul W. Berg (Mathematics), Donald L. Iglehart (Operations Research), J. Michael Steele (Statistics).

**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 73 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) or Modern Algebra and Its Applications (120S); 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.

HONORS PROGRAM IN MATHEMATICAL SCIENCES

The Honors Program in Mathematical Sciences is designed to encourage a more intensive study of mathematical sciences than the program provided by the Bachelor of Science. In addition to meeting all requirements for the Bachelor of Science in Mathematical Sciences, the student must meet the following:

1. An average letter grade equivalent in Mathematical Sciences courses of at least 3.4.
2. Completion of at least 15 units in Mathematical Sciences in addition to the requirements for the Mathematical Sciences major listed above. These courses should form a sustained effort in one area and constitute a program which is approved by the committee in charge of the Mathematical Sciences Program.
3. Included in the above 15 units must be at least one of the following: (a) an approved higher level graduate course, (b) participation in a small group seminar, or (c) at least three units of directed reading.

MATHMATICS

Emeriti: Harold M. Bacon, Ralph Phillips, George Polya, Menahem Schiffer, Gabor Szego (Professors)
Chairman: Hans Samelson
Vice Chairman: Gregory Brumfiel
Assistant Professors: Russel Caflisch, Ralph Cohen, Paul Garrett, Steven Kalikow, Peter Li, Daniel Rudolph
Visiting Professor: J. P. Bourguignon
Visiting Associate Professor: Robert Gulliver, Josef Rinott
Visiting Assistant Professor: Eric Bedford
Acting Assistant Professor: John Nev

OFFERINGS AND FACILITIES

The Department of Mathematics offers programs leading to the degrees Bachelor of Science, Master of Science, and Doctor of Philosophy in Mathematics, and participates in the program leading to the degree B.S. in Mathematical Sciences.

INTRODUCTORY COURSES

The Department of Mathematics offers two 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.
Precalculus Mathematics (3) is offered for those who need or desire a better preparation in these subjects before entering one of the calculus sequences.

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.
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. For referral to an advisor on advanced placement, communicate with the Academic Secretary of the department.

PROGRAMS OF STUDY

BACHELOR OF SCIENCE

The following departmental requirements are in addition to the University's basic requirements for the Bachelor's degree:

1. Calculus and Analytic Geometry (Courses 19, 20, 21, 22, 23, 44 or 41, 42, 43, 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 (or 120S), 121, 152; analysis—101, 106, 115, 116, 117, 130, 131, 132; geometry—142, 143, 159. 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 Sci-
ence in Mathematical Sciences. See the Mathematical Sciences 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 “Degrees” section 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 and pass a reading examination in two foreign languages, chosen from French, German, and Russian. 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.”

COURSES

All courses (DR:T) unless otherwise noted.

PASS/NO CREDIT

In those undergraduate mathematics courses where a Pass/No Credit grade option is offered, the department deadline for the student to request such Pass/No Credit grading is before the end of the third week of the quarter.

INTRODUCTORY AND UNDERGRADUATE COURSES

Introductory courses will be offered only if twenty or more students enroll.

3. Precalculus Mathematics—Establishes the background needed to begin calculus: Functions and graphs; linear and quadratic equations; inequalities; logarithms; binomial theorem; trigonometric functions, identities, and equations; solutions to triangles. (DR:X)

4 units, Aut (Staff) MTWThF 8 and 12
Spr (Staff) MTWThF 8

19. Calculus and Analytic Geometry—Math 19 presents a rather complete introduction to the concept, techniques and applications of differentiation and a brief introduction to the concept, techniques and applications of integration. The sequence (19, 20, 21, 22, 23) covers the same subjects as the sequence (41, 42, 43) de-
scribed below. Prerequisites are the same as for 41.

3 units, Aut (Staff) MWF 8, 9, 10, 11, and 1:15
Win (Staff) MWF 8, 9, 10, 11, and 1:15

3 units, Win (Staff) MWF 8, 9, 10, 11, and 1:15
Spr (Staff) MWF 8, 9, 10, and 1:15

3 units, Aut (Staff) MWF 8, 9, 10, 11, and 2:15
Spr (Staff) MWF 8, 9, 10, and 1:15

3 units, Aut (Staff) MWF 8 and 2:15
Win (Staff) MWF 8

3 units, Win (Staff) MWF 8
Spr (Staff) MWF 8

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 (Staff) MTWThF 8 and 10

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 (Brumfiel) MTWThF 1:15
Win (Staff) MTWThF 8 and 10

43. Calculus and Analytic Geometry—Courses 43 and 44 present an introduction to multivariable 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 (Staff) MTWThF 1:15
Win (Siu) MTWThF 1:15
Spr (Sunseri) MTWThF 8

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 9, 10, 11 and 2:15
Spr (Staff) MWF 9 and 1:15

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 (Li) MWF 3:15-4:20

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 113S) or equivalent recommended.
3 units, Win (Li) MWF 1:15
Spr (Rinott) MWF 10

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 (Royden) MWF 9
Spr (Levine) MWF 2:15
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 11 and 1:15
Win (Samuelson) MWF 11
Spr (R. Cohen) MWF 1:15

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 10, 1:15, and 2:15
Win (Staff) MWF 10 and 1:15
Spr (Kalikow) MWF 11
Sum (Staff)

114. Linear Algebra and Matrix Theory—Continuation of 113. A deeper study of certain of the topics indicated as well as additional topics chosen among the following: invariant subspaces, canonical forms of matrices; minimal polynomials and elementary divisors; vector spaces over arbitrary fields; inner products; Hermitian and unitary matrices; multilinear algebra.

3 units, Win (Stein) MWF 11
Spr (Orristein) MWF 11

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 (Brumfiel) MWF 1:15
Spr (Neu) MWF 10

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 (Kalikow) 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 (Gilbarg) MWF 11

120. Modern Algebra—Group theory: normal subgroups, permutation groups, Sylow's theorems, finite abelian groups. Introduction to rings. Prerequisite: 113 or 113S.

3 units, Win (Garrett) MWF 10

120S. Modern Algebra and Its Applications—A course with the same principal content as Mathematics 120, but with emphasis on applications of modern algebra. Applications will include symmetry groups—in particular, crystallographic groups—and error-correcting codes. Prerequisite: 113 or 113S.

3 units, Spr (Kalikow) MWF 10

121. Modern Algebra—Continuation of 120. Rings, ideals, polynomials, fields, Galois theory.

3 units, Spr (Garrett) MWF 10


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, Spr (Karlin)
TTh 11-12:15

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 11
Spr (McGregor) MWF 11
132. Partial Differential Equations II—Initial and initial-boundary value problems in infinite domains. Fourier transforms. Boundary value problems for Laplace equation. Bessel functions and Legendre polynomials. 3 units, Spr (Levine) MWF 10

134A, B. 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 1981-82

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 1981-82

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 (Brumfiel) MWF 2:15

143. Topics in Differential Geometry—Geometry of curves in the plane and in the space. Surfaces in $\mathbb{R}^3$. Definition of Gaussian curvature. Lines of curvature and geodesics on the surface. Parallel transportation. Surfaces with constant curvature. Minimal surfaces. 3 units, Aut (Siu) 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 (Garrett) 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, Spr (Samelson) MWF 1:15

160A. First-order Logic—(Enroll in Philosophy 160A.) The syntax and semantics of first-order logic. Gödel's Completeness Theorem which relates formal rules of proof to Leibniz' notion of truth in all logically possible worlds. Consequences like the Löwenheim-Skolem Theorem and the Compactness Theorem will be discussed and applied. Prerequisite: Philosophy 57 recommended for students with no mathematics or computer science background. 4 units, Win (Barwise) TTh 9-10:15

160B. Computability and Logic—(Enroll in Philosophy 160B.) A precise definition of "effective procedure" is given through Turing machines, register machines and recursive functions. Church's Thesis is explained. These are used to develop Gödel's work on the undecidability of arithmetic, culminating in his famous Incompleteness Theorem. Other undecidable problems are also discussed. Prerequisite: 160A. 4 units, Spr (Barwise) TTh 9-10:15

161. Introduction to Set Theory—(Enroll in Philosophy 161.) 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. 4 units, Aut (Staff) MWF 2:15

190. Pro Seminar—The basis of this seminar will be a collection of problems in mathematics, to be solved by the students during the course. Solutions will require techniques from analysis, geometry, and algebra. The goal of the course is to generate understanding and working ability with the central ideas of mathematics from advanced calculus, differential equations, probability, linear algebra and abstract algebra, geometry, and topology. Credit for the course may be used toward the fulfillment of the elec-
tive requirement for the degree in mathematics. There are no prerequisites.
3 units, Aut (McGregor) MWF 2:15

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 (Hawley) 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

199. Independent Work—This course provides an opportunity for any undergraduate to pursue a reading program on a topic of the student's 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. (DR:X)
(Staff) by arrangement

COURSES INTENDED PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:T) if taken for three or more units unless noted otherwise.

200A, B. Research in Mathematics at Stanford—Two or three faculty members each quarter will give a few lectures surveying historical and recent developments in various branches of mathematics. Potential directions of research will be emphasized. Registration is required of all first and second year graduate students in mathematics.
200A. 0 units, Win (Staff) T 3:15-4:30
200B. 0 units, Spr (Staff) T 3:15-4:30

205A. 3 units, Aut (Ornstein) MWF 10
205B. 3 units, Win (Phillips) MWF 10
205C. 3 units, Spr (Rudolph) 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 (Ornstein) MWF 11
206B. 3 units, Win (Hawley) MWF 11
206C. 3 units, Spr (Hawley) 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. 3 units, Win (Osserman) MWF 1:15
217B. 3 units, Spr (Osserman) MWF 1:15

220A, B, C. Methods of Mathematical Physics—Calculus of variations, integral equations, vibrating membranes, expansions in series of eigenfunctions, and methods for solving differential equations arising in science and engineering. In the second and third quarters, emphasis will be on the methods of regular and singular perturbation theory, on bifurcation theory and on asymptotic expansions. Examples from various fields of application. Prerequisite:
some familiarity with ordinary and partial differential equations.

220A. 3 units, Aut (Osserman) TTh 11-12:15
220B. 3 units, Win (Keller) TTh 9:35-10:50
220C. 3 units, Spr (Keller) TTh 9:35-10:50

221A,B. Calculus of Variations—Euler-Lagrange equations, sufficient conditions; applications to eigenvalue and scattering problems; direct methods, Dirichlet's principle. Alternate years, given 1981-82

224. Integral Equations—Singular types and methods for their solution; alternative integral equation reformulation of boundary value problems, dual equations and affiliated variational principles. 3 units, Autumn (Levine) MWF 2:15

226. Mathematical Models in Population Biology—(Same as Mathematics 126.) 3 units, Spring (Karlin) TTh 11-12:15

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. 3 units, Autumn (Steele) MWF 11
230B. 3 units, Winter (Steele) MWF 11
230C. 3 units, Spring (Steele) MWF 11

232A,B,C. Topics in Stochastic Processes—An introduction to the modern theory of stochastic-processes with emphasis on concrete cases such as Brownian motion and Levy increasing processes. General discussion of aspects of Markov processes and potential theory. Prerequisite: 205A. 3 units, Autumn (Chung) MWF 11
232B. 3 units, Winter (Chung) MWF 11
232C. 3 units, Spring (Chung) MWF 11

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. 3 units, Winter (Rudolph) TTh 1:15-2:30
235B. 3 units, Spring (Ornstein) TTh 1:15-2:30

237A,B,C. Advanced Numerical Analysis—(Enroll in Computer Science 237A,B,C.)
237A. 3 units, Win (Rudolph) TTh 1:15-2:30
237B. 3 units, Spr (Ornstein) TTh 1:15-2:30

244A,B. Riemann Surfaces—This course treats, primarily, compact Riemann surfaces: topological classification, Hurwitz' formula, Riemann-Roch formula, uniformization theorem, Abel's theorem, Jacobian varieties. Also, some elements of harmonic analysis will be developed with applications. Methods generally applicable to algebraic curves will be highlighted. 3 units, Autumn (Gilbarg) TTh 11-12:15
244B. 3 units, Spring (Gilbarg) TTh 11-12:15

245B. 3 units, Winter (Siu) MWF 11

252A,B. Inequalities, Convexity, and Applications in Analysis, Probability, and Statistics—A wide range of inequalities in analysis will be dealt with in a unified framework. Concepts of generalized convexity, total positivity, ordering relationships, majorization, univariate and multivariate versions, applications to matrix inequality, correlation inequalities, eigenvalue problems, combinatorics. Also included will be probability and statistical examples. 3 units, Autumn (Karlin) TTh 11-12:15
252B. 3 units, Winter (Karlin) TTh 11-12:15

254A,B. Ordinary Differential Equations—Fundamental existence theorems, stability and asymptotic behavior of nonlinear systems, Poincaré-Bendixon theorem, linear systems and Sturm-Liouville eigenvalue problems; selected topics from equations in the complex domain; Fuchian theory, Hamiltonian systems, existence of periodic solutions and orbital stability. Alternate years, given 1981-82

256A,B,C. Partial Differential Equations—Elliptic equations: Linear boundary value problems — potential theoretic methods (Schauder theory) and weak solutions (L² theory, Sobolev space techniques). Second order nonlinear equations in two and n variables — a priori estimates and fixed point methods. Hyperbolic equations: The case of constant coefficients by methods of Fourier analysis. Mixed boundary value problems for hyperbolic systems in two independent variables by the method of characteristics. Initial value problems for strictly hyperbolic systems using energy inequalities and geometrical optics. 3 units, Autumn (Gilbarg) TTh 11-12:15
256B. 3 units, Winter (Gilbarg) TTh 11-12:15
256C. 3 units, Spr (Phillips) TTh 11-12:15

255A,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 solutions; partial extension of results to variable coefficients; nonexistence. Prerequisites: 205A,B,C. 3 units, Win (P. Cohen) to be arranged 258B. 3 units, Spr (P. Cohen) to be arranged

259. Scattering Theory—Abstract theory: Incoming and outgoing subspaces and the associated translation and spectral representations; the scattering operator. Applications to the wave equation in an exterior domain and to automorphic functions. 3 units, Aut (Phillips) to be arranged


261A. 3 units, Aut (P. Cohen) MWF 10
261B. 3 units, Win (P. Cohen) MWF 10
261C. 3 units, Spr (P. Cohen) MWF 10


Alternate years, given 1981-82

270. Perturbation and Asymptotic Methods with Applications—An exposition of perturbation and asymptotic methods. Topics include regular perturbation theory, singular perturbation theory, initial and boundary layers, the method of multiple scales, ray theory, two-time methods, etc. Applications will include problems from fluid and solid mechanics, wave propagation, etc. Prerequisites: Some familiarity with ordinary and partial differential equations. 3 units, Aut (Keller, Hagan) TTh 9:35-10:50

272B. Hydrodynamics—The mathematical theory of nonlinear dispersive waves and its applications. The main application will be water waves, but also magnetohydrodynamics, optics, and quantum mechanics. The general mathematical methods are dispersion laws, variational principles, and perturbation theory. Solitons and inverse scattering theory, and some of its applications, will be discussed for a variety of equations. 3 units, Spr (Caflisch) TTh 9:35-10:50

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.

Alternate years, given 1981-82


281A. 3 units, Aut (Brunflel) MWF 9
281B. 3 units, Win (R. Cohen) MWF 9
281C. 3 units, Spr (R. Cohen) MWF 9


Alternate years, given 1981-82

284A, B. Differentiable Manifolds—Embeddings of manifolds in Euclidean space, tubular neighborhood theorem, Morse theory, transversality, differential forms, integration on manifolds, deRham cohomology.

Alternate years, given 1981-82

286A, B, C. Topics in Differential Geometry—The purpose of this course is to present some parts of differential geometry which will lead students to do research in the field. Possible topics include: the relation between the curvature of a manifold and its topology; the use of the methods of partial differential equations in the construction of metrics, and the isometric embedding problem; the problem of isometric deformation of submanifold; the application of geometry to general relativity. The choice of the problems constitute a very rich field of application for non-linear perturbation methods. In particular, development of techniques for treating problems with several spatial and temporal scales of motion—the so-called multiscale methods. Apply the multiscale methods to derive Landau equations for the growth of flow instabilities and envelope equations for nonlinear waves.

3 units, Win (Neu) TTh 9:35-10:50
topics will depend to some extent on the interest of the students. Prerequisite: 217B.

286A. 3 units, Aut (Bourguignon)
  Time to be announced
286B. 3 units, Win (Staff)
  Time to be announced
286C. 3 units, Spr (Staff)
  Time to be announced

297. Topics in Algebra and Number Theory—
  Topics from group representations, quadratic
  forms, algebraic number theory, modular
  forms, ring theory, algebraic K-Theory, alge-
  braic geometry.
  3 units, Aut (Garrett) MWF 1:15

290A,B,C. Mathematical Logic—Model
  theory: formal languages and their models; va-
  lidity and definability; complete and decidable
  theories. Theory of recursive functions and for-
  mal systems; recursively enumerable sets; re-
  cursively 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 (Feferman)
     TTh 12:30-2:05
  290B. 3 units, Win (Barwise)
     TTh 12:30-2:05
  290C. 3 units, Spr (Feferman)
     TTh 12:30-2:05

291A,B. Topics in Logic and the Foundations
  of Mathematics—Topics selected from the fol-
  lowing areas (with typical examples): (a) model
  theory (applications to algebra, logics with
  strong quantifiers, infinitary languages), (b) re-
  cursion theory (hierarchies, degree theory,
  generalizations to arbitrary structures), (c) set
  theory (forcing and generic sets, Boolean valued
  models, large cardinals), and (d) proof theory
  (cut-elimination, normalization, functional in-
  terpretations, constructive ordinals).
  291A. 3 units, Win (Feferman) MWF 2:15
  291B. 3 units, Spr (Staff)
     Hours to be arranged

338. Seminar in History of Mathematics—
  (Enroll in History of Science 338.)
  3 units, Win (Knorr)
  hours to be arranged

350. Directed Reading. (DR:X)
  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. (DR:X)
  Any quarter, (Staff) by arrangement

MODERN THOUGHT AND LITERATURE

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

388. Seminar in Probability and Stochastic
  Processes.
  by arrangement

389. Seminar in Mathematical Biology.
  by arrangement

391. Seminar in Foundations of Mathematics.
  by arrangement

MEDICAL MICROBIOLOGY

For information describing requirements for
undergraduate major, see listing under School
of Medicine section of this bulletin.

MODERN THOUGHT AND LITERATURE

Committee in Charge: Albert Guerard (Eng-
lish); Arnold Rampersad (English); Peter
Stansky (History); Steven Strasnick (French
and Italian); Ann Swidler (Sociology)

Chairman: David Halliburton (English)

Faculty: Charles Drekmeier (Political Science);
Albert Guerard (English); David Halliburton
(English, Comparative Literature, and Mod-
erm Thought and Literature); Estelle Freed-
man (History); Diane Middlebrook (English);
Thomas C. Moser (English); Kurt Mueller-
Vollmer (German Studies); Paul A. Robinson
(History); Ann Swidler (Sociology); Ian Watt
(English)

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).

Two 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; the second will emphasize American literature, but include English writers.

**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 the 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 advisor) 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 counted among these 30 units. 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 the student’s 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 advisor 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 addi-
tional 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 Chairperson and may be given permission to undertake an interdisciplinary plan of study under the Humanities Honors Program.

In special cases involving a few very qualified honors undergraduates, the Committee offers a coterminal A.M. Interested students should petition the chairperson not earlier than their ninth quarter (or upon completion of 105 units) and not later than one quarter before they have completed 180 units of work at Stanford.

COURSES

See departmental listings for course descriptions and for (DR) notations.

Courses are open to qualified students from any department.

105. American Philosophy, Its Sources, Its Influences—(Enroll in Philosophy 105.)
4-5 units, Spr (Hacking)

105A. History of Socialisms and Marxisms to 1917—(Enroll in History 105A.)
5 units, Aut (Mancall)

105B. The History of Socialist and Marxist Thought and Politics From 1917 to the Present—(Enroll in History 105B.)
5 units, Win (Mancall)

118. Modern Russian Thought—(Enroll in History 118.)
5 units, Spr (Emmons)

119. Modern British Literature—(Enroll in English 119.)
5 units, Aut (Stone)

120. American Historical Novel—(Enroll in English 120.)
5 units, Spr (Dekker)

120D. Modern Art IV—(Enroll in Art 120D.)
4 units, Win (Elsen)
121. American Literature and Culture to 1855—(Enroll in English 121.) 5 units, Aut (Fliegelman)
122. American Literature, 1855–1917—(Enroll in English 122.) 5 units, Win (Rampersad)
125. American Literature, 1917 to the Present—(Enroll in English 125.) 5 units, Spr (Momaday)
131A. The English Novel Through the Eighteenth Century—(Enroll in English 131A.) 5 units, Aut (Fifer)
131B. The English Novel in the Nineteenth Century—(Enroll in English 131B.) 5 units, Win (Stone)
132. The Nineteenth-Century Continental Novel—(Enroll in English 132.) 5 units, Spr (Foster)
136. The Age of Reason and Enlightenment: European Thought in the 18th Century—(Enroll in History 136.) 5 units, Spr (Lougee)
136A. European Thought in the 19th Century—(Enroll in History 136A.) 5 units, Aut (Robinson)
136B. European Thought in the 20th Century—(Enroll in History 136B.) 5 units, Win (Robinson)
152. Heidegger and Sartre—(Enroll in Philosophy 152.) 4 units, Spr (Follesdal)
153. Political Thought—The Modern Period—(Enroll in Political Science 153.)
157. Feminist Theory—(Enroll in Political Science 157.) 5 units, Aut (Keohane)
161A. The Afro-American Novel—(Enroll in English 161A.) 5 units, Aut (Drake)
161D. Afro-American Autobiography—(Enroll in English 161D.) 5 units, Win (Rampersad)
162. Contemporary Chicano Literature—(Enroll in English 162A.) 5 units, Aut (Islas)
162A,B. Seminar: Symbol, Myth and Metaphor—(Same as Political Science 162A,B) 5 units, Win (Rogat)
162B. 5 units, Spr (Rogat)
162C. Seminar: Thought and Action—(Enroll in Political Science 162.) 5 units, Win (Drekmeier)
163A. Women’s Writing as Critique and Vision: The Nineteenth Century—(Enroll in English 163A.) 5 units, Aut (B. Gelpi)
163B. Women’s Writing as Critique and Vision: The Twentieth Century—(Enroll in English 163B.) 5 units, Win (Middlebrook)
163C. English Women Writers—(Enroll in English 163C.) 5 units, Spr (Mellor)
165A. Interpretation of the Modern Experience—(Enroll in English 165A.) 5 units, Aut (Drake)
166. Modern Literature From Africa—(Enroll in English 166.) 5 units, Spr (Drake)
169A. The Existential Hero in Modern Literature—(Enroll in English 169A.) 5 units, Win (Ruotolo)
173. Modern Fiction—(Enroll in German 173.) 4 units, Aut (Berman)
174A. Sigmund Freud—(Enroll in Religious Studies 174A.) 5 units, Aut (Yearley)
174B. William James—(Enroll in Religious Studies 174B.) 5 units, Aut (Levinson)
174C. Aesthetics—(Enroll in Philosophy 174.) 4 units, Aut (Hepworth)
175. Defoe, Swift and Pope—(Enroll in English 175.) 5 units, Spr (Bender)
177. Virginia Woolf—(Enroll in English 177.) 5 units, Spr (Ruotolo)
176A. American Architecture and Urbanism—(Enroll in Art 176.) 4 units, Spr (Turner)
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. Will include works by Simone de Beauvoir, Violette Le duc, Marguerite Duras, Sylvia Plath, Tillie Olsen, and Maxine Hong Kingston.
5 units, Spr (M. Yalom)
210A,B,C. Topics in Film Study—(Enroll in Communication 210A,B,C.)
214. Russian Formalism and Structuralism—(Enroll in Slavic Languages 230.) 4 units, Aut (Brown)
215. Later Eighteenth-Century Literature—(Enroll in English 215.) 5 units, Spr (Byrd)
219. Authorial "Voice" in Verse and Prose, 1800-Present—(Enroll in English 219.)
      5 units, Spr (Guerard)

220. Film Aesthetics—(Enroll in Communication 101.)
      4 units, Aut (Breitrose)
      evening screenings by arrangement

221. History of Film—(Enroll in Communication 141.)
      4 units, Win (Clarke, Rogers)

222. Early Soviet Prose—Isaak Babel and Mikhail Zoshchenko—(Enroll in Slavic Languages 222.)
      4 units, Spr (Freidin)

234D. American Fiction, 1917-40—(Enroll in English 234D.)
      5 units, Win (Moser)

239. American Short Fiction—(Enroll in English 239.)
      5 units, Aut (Fields)

240. Ritual and Mind—(Enroll in Anthropology 151.)
      3-5 units, Aut (Herdt)

245A. Survey of Russian Literature in English Translation I: Russian Literature of the First Half of the Nineteenth Century—(Enroll in Slavic Languages 145.)
      4 units, Aut (Stahlberger)

245B. Survey of Russian Literature in English Translation II: From Realism to Symbolism—(Enroll in Slavic Languages 146.)
      4 units, Win (Anschuetz)

245C. Survey of Russian Literature in English Translation III: The Modern Period—(Enroll in Slavic Languages 147.)
      4 units, Spr (Freidin)

247. Anthropological Perspectives on American Culture—(Enroll in Anthropology 215)
      3-5 units, Win (G. and L. Spindler)

248. Sex Roles in Society—(Enroll in Anthropology 259.)
      3-5 units, Win (J. Collier and M. Rosaldo)

250. Seminar: Essentials of Political Theory—(Enroll in Political Science 254.)
      5 units, Aut (Drekmeier)

253. Leo Tolstoy—(Enroll in Slavic Languages 153.)
      4 units, Win (Stahlberger)

254D. Romantic Poetry as Myth-Making—(Enroll in English 254D.)
      5 units, Aut (Mellor)

256. Contemporary Drama—(Enroll in Drama 256.)
      5 units, Spr (Esslin)

256A. American Drama since 1920—(Enroll in Drama 257.)
      5 units, Aut (Cole)

256B. American Poetry, 1900-1945—(Enroll in English 256B.)
      5 units, Win (A. Gelpi)

256C. American Poetry, 1945 to the Present—(Enroll in English 256C.)
      5 units, Spr (Fields)

257. Women, Power, and Transcendence—(Enroll in Political Science 257.)
      5 units, Aut (Keohane)

259A. Symbolist Poetry, French and American—(Enroll in English 259A.)
      5 units, Win (Fields)

262. The Symbolist Poets—(Enroll in French 262.)
      5 units, Win (Cohn)

265. Literature of the American West, 1850 to Present—(Enroll in English 265.)
      5 units, Aut (Momaday)

267. Irrationality in the Age of Reason-Counter-Currents in the Enlightenment—(Enroll in English 267.)
      5 units, Spr (Byrd)

268. The Storyteller and His Art—(Enroll in English 268.)
      5 units, Aut (Momaday)

278. Johnson and His Circle—(Enroll in English 278.)
      5 units, Spr (Fifer)

280. Broadcasting and Film Criticism—(Enroll in Communication 280.)
      4 units, Spr (Staff)

288A. Joyce—(Enroll in English 288A.)
      5 units, Aut (Chace)

288B. Dickens and His Society—(Enroll in English 288B.)
      5 units, Aut (Pope)

288E. Yeats and T. S. Eliot—(Enroll in English 288E.)
      5 units, Aut (Lindenberger)

300. Graduate Seminar—Theory of Narrative—(Enroll in Slavic Languages 300.)
      4 units, Win (Todd)

303. Colloquium: Eighteenth-Century Literature of Travel—(Enroll in English 303.)
      5 units, Aut (Fifer)

304A. Colloquium: English Romanticism—(Enroll in English 304A.)
      5 units, Spr (Mellor)

304B. Colloquium: Fiction and the Market Society—(Enroll in English 304B.)
      5 units, Spr (Stone)

305. Colloquium: American Romanticism—(Enroll in English 305.)
      5 units, Spr (A. Gelpi)
SCHOOL OF HUMANITIES
AND SCIENCES

310. Linguistics and Literature—(Enroll in Spanish 310.)
   5 units, Spr (Pratt)

   3-5 units, Spr (Ball)

323. Don Quixote and the Theory of the Novel—(Enroll in Spanish 324.)
   3-5 units, Win (Ball)

324. Graduate Colloquium: Nationalism and Communism in Eastern Europe—(Enroll in History 324.)
   5 units, Win (Vucinich)

330. Seminar: Theory of Narrative—(Enroll in English 330, or Slavic Languages 300.)
   5 units, Win (Todd)

349C. Seminar: Literary Hermeneutics—(Enroll in German 349C.)
   3-5 units, Win (Mueller-Vollmer and Seeba)

354. Theory of the Avant-Garde—(Enroll in Spanish 354.)
   3-5 units, Win (Alegria)

355. Seminar: American Drama Between the World Wars—(Enroll in Drama 355.)
   5 units, Aut (Cole)

361. Seminar: The Modern Tradition—(Same as English 361.) Studies in masters of modern thought (such as Heidegger, Nietzsche, and Freud) from 1750 to the present.
   5 units, Aut (Halliburton)

365C. Seminar: American Culture and Society in the 1840's—(Enroll in English 365C.)
   5 units, Spr (Fliegelman)

369. Seminar: Major Modern Critics—(Enroll in English 369.)
   5 units, Aut (Lindenberger)

378. Graduate Colloquium: Latin American Cultural and Intellectual History in the 20th Century—(Enroll in History 378.)
   5 units, Aut (Morse)

378A. Graduate Seminar: Latin American Cultural and Intellectual History in the 20th Century—(Enroll in History 478.)
   5 units, Spr (Morse)

385F. Seminar: Faulkner—(Enroll in English 385F.)
   5 units, Win (Moser)

388F. Seminar: Joseph Conrad—(Enroll in English 388F.)
   5 units, Win (Guerard)

395. Ad Hoc Graduate Seminars—In a given quarter, a group of graduate students (at least three but preferably more) who wish the following quarter to study a subject or an area not covered by regular courses and seminars may plan an informal seminar and approach a suitable member of the faculty to supervise it, either on a graded or pass/no credit basis.
   Any quarter, by arrangement

398. Research 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

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 Baller, Earle Blew, Edward C. Colby (Lecturers)

Chairman: Albert Cohen

Professors: Albert Cohen, John Chowning, Imogene Horsley, George Houle, Wolfgang E. Kuhn, Herbert B. Nanney (on leave Winter Quarter), Leonard G. Ratner, Leland C. Smith

Associate Professor: William P. Mahrt, William H. Ramsey

Adjunct Professors: Arthur P. Barnes (Director of Bands), Marie Gibson (Voice), Andor Toth (Director of Orchestras and Opera)

Senior Lecturers: Margaret Fabrizio, Naomi Sparrow

Lecturers: Hsueh-Yung Shen (Theory), Gregory A. Wait (Voice), Nathan Schwartz, Christopher S. Salocks (Piano), David Abel, Gennady Kleyman (Violin, Viola), Rolf Persinger (Viola), Bonnie Hampton, Margaret Rowell (Violoncello), Larry Epstein (Contrabass), Frances Blaisdell, Alexandra W. Hawley (Flute), Raymond H. Duste (Oboe), Susan Willoughby (Bassoon), Joyce A.
**OFFERINGS AND FACILITIES**

The department's aims are to promote understanding and enjoyment of music in the University at large and to provide specialized training for those who plan careers in music as composers, performers, teachers, or research scholars.

Practice facilities are available in the Knoll, the Music Annex, and the Dinkelspiel Auditorium Building, which also includes a theater for concert and operatic productions. In addition to pianos, organs, harpsichords, and a variety of early stringed and wind instruments, students may use rare instruments from the Harry R. Lange Historical Collection.

The departmental library contains a comprehensive collection of complete editions, scores, books, and records. Supplementing this is the Stanford Memorial Library of Music, which is an invaluable collection of musical manuscripts and first editions.

The Music Department has access to large digital computers on which work is being done in sound synthesis, acoustical analysis, and composition. Advanced composition students interested in electronic music and use of the computer in composition, and students with a particular interest in acoustics are encouraged to make use of this facility.

**PROGRAMS OF STUDY**

**BACHELOR OF ARTS**

*Undergraduate major—May be planned in one of three ways depending on whether the student wishes:*

1) A concentration in composition, performance, or music history.
2) Preparation for secondary school teaching.
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 24 (Elementary Tonal Counterpoint)
   4. Music 100, 101, 102, 103, and 104 (Music History and Theory)
   5. Individual studies in performance: six quarters
   6. 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.

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 music majors and especially for those expecting to continue into graduate work.

**RECOMMENDED SCHEDULE FOR COMPLETING THE MUSIC MAJOR PROGRAM**

**FIRST YEAR**

<table>
<thead>
<tr>
<th>Courses</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>English* (2 quarters writing)</td>
<td>3</td>
<td>3</td>
<td>—</td>
</tr>
<tr>
<td>Music 21,*22,23</td>
<td>4</td>
<td>4</td>
<td>—</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>

*Members of the Francesco Chamber Trio.*
SECOND YEAR

Courses
Music 24 4
Music 100, 101, 102 4 4 6
Individual Instruction and/or Ensemble 1-4 1-4 1-4
University Distribution Requirement in Science or Social Science 3-5 3-5 3-5
Elective (or Music 23 in autumn if not taken previously) 3-5 (3)† (3)†

THIRD YEAR

Courses
Music 103, 104 6 6

* (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

HONORS PROGRAM IN MUSIC

The Department offers a special program for undergraduate majors leading to honors in music. Eligibility for this program consists of a marked ability in composition, performance, or music history, as indicated by grade average and recommendations from members of the faculty. The program, in addition to the regular requirements for the major, consists of a special honors project undertaken for the duration of one or two quarters of the senior year. Application for the program must be made well before the end of the Spring of the junior year.

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, 240 and 299 plus three quarters of ensemble performance. Depending on the concentration, the Master of Arts Project will be an investigative essay, a composition, or a demonstration of performance supported by a written commentary on the performance practices that are involved.

DOCTOR OF MUSICAL ARTS

The purpose of the Doctor of Musical Arts program is to offer advanced training in the practice and pedagogy of music. Students may concentrate in composition, music education, or performance (including conducting)—the latter concentration to be centered on the investigation of performance practices from medieval to modern times. Each concentration will be given breadth through collateral studies in other branches of music and in relevant fields outside music as seems desirable.

Admission—In addition to completing entrance tests, an applicant will be asked to submit evidence of accomplishment in the 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 concentra-
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 “Degrees” section in this bulletin.

**Admission**—In addition to completing entrance tests, an applicant is asked to submit some evidence of his or her work in the field of music history such as a term paper or a Master’s thesis.

**Basic requirements**—Each candidate must complete a minimum of three years of full-time work. The student may proceed directly to the Ph.D. without taking the A.M. en route. The program will normally include: (1) seminars in musical notation, analysis and performance practice; (2) readings in music theory; (3) independent research culminating in a dissertation; (4) dissertation research to be taken in the third year of residence.

**Foreign language requirements**—A reading knowledge of French or Italian, and German, plus any other language necessary to research in the candidate’s field of specialization. The examination will consist of the translation into idiomatic English of excerpts in prose and poetry. The examination in one language must be taken prior to the student’s first registration. The second language must be certified before the beginning of the second year of residence.

**Departmental examinations**—(1) a qualifying examination consisting of written and oral tests in the general field of music history, no later than the fifth quarter of full-time residence; (2) a written 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, Win (Kuhn)

2B. The Concerto.
3 units, (Barnes) given 1981-82

2C. Opera.
3 units (Kuhn)

3C. Medieval Music.
3 units (Mahrt)

3E. Music in the Baroque Era.
3 units (Horsley)

4A. The Music of J. S. Bach.
3 units (Nanney)

4B. The Music of Mozart.
3 units, Win (Nanney)

4C. The Music of Beethoven.
3 units (Ratner)

5A. Music in America.
3 units, Spr (Cohen)

6C. Music in the History of Ideas
3 units, Win (Houle)

19. Introduction to Music Theory—A preparatory course in the fundamentals of music notation, basic sight reading, sight singing, ear training, keyboard harmony, and melodic, rhythmic, harmonic dictation. This is a skill oriented course, using piano and voice as basic tools to develop listening and reading skills. Enrollment: for non-music majors and music majors who are unable to pass the proficiency test for entry to Music 21.
3 units, Aut (Kuhn)
Win (Shen)

FOUNDATION COURSES FOR A.B. MAJOR

All courses (DR:H) unless noted otherwise.

21. Elements of Music—Fundamentals of music theory; basic tonal, diatonic harmony (major and minor) including primary and secondary triads and seventh chords, use of non-harmonic tones, cadential formulas, and rudimentary four-part writing. Use of keyboard, ear training and sight singing 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 examinations given on first day of class.
4 units, Aut (Mahrt, Shen)
Win (Barnes)

22. Elements of Music—A continuation of Music 21, with emphasis on contrapuntal writing: modal and species counterpoint. Use of keyboard, ear training and sight singing will underlie all written work. Lecture and laboratory sections. Prerequisite: Music 21.
4 units, Win (Shen)
Spr (Barnes)

23. Functional Harmony—Advanced tonal harmonic analysis, four-part writing, bass and harmonic harmonizations, including modulation, secondary dominants, augmented sixth chords, and Neapolitan sixth chords. Prerequisite: Music 22; pass minimum proficiency test in piano, or two quarters prior and concurrent enrollment in Music 12; or consent of instructor.
4 units, Aut (Nanney)
Spr (Shen)

24. Elementary Tonal Counterpoint—Two- and three-part imitative counterpoint, two- and three-voice inventions, analysis of more complex contrapuntal forms, canon and fugue. Use of keyboard, ear training and sight singing will underlie all written work. Prerequisite: Music 23.
4 units, Aut (Ratner)
Win (Mahrt)

100. Music History: Medieval and Renaissance—Prerequisites: 21, 22.
4 units, Aut (Mahrt)

101. Music History: Baroque—Prerequisites: 21, 22, 100.
4 units, Win (Cohen)

102. Music History and Theory: Classic—Prerequisites: 24.
6 units, Spr (Ratner)

103. Music History and Theory: Romantic—Prerequisite: 102.
6 units, Aut (Ratner)

104. Music History and Theory: Modern—Prerequisite: 103.
6 units, Win (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, Spr (Horsley)

126. Tonal Counterpoint—Prerequisite: 103.
3 units (Ratner)

127. Orchestration—Prerequisite: 23.
3 units, Aut (Barnes)

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, Win (Barnes)
225. 4 units, Spr (Barnes)

227. Seminar in Shenkerian Analysis
4 units, Aut (Schwartz)

228A. 4 units (Horsley) given 1981-82
228B. 4 units (Horsley) given 1981-82

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)
140E. The Music of Guillaume Dufay
4 units, Spr (Mahrt)

4 units (Houle)

142A. String Quartets of Beethoven.
4 units, Spr (Ratner)

142F. The Operas of Mozart.
4 units (Ratner)

143B. The Music of Brahms.
4 units (Mahrt)
143D. The Music of Schubert.
4 units (Schwartz)
143E. The Nineteenth-Century Symphony and Tone Poem.
4 units (Schwartz)
143H. The Early Romantics—Emphasis on Schubert, Schumann, Mendelssohn and Chopin.
4 units, Spr (Schwartz)

144. Studies in Modern Music—Prerequisite: 104.
144A. Twelve-Tone and Serial Music.
4 units, Aut (Smith)
144B. Innovations in Contemporary Music.
4 units (Smith)
144C. The Music of Stravinsky.
4 units, Aut (Barnes)

150A. History of Musical Instruments.
4 units (Houle)
150B. History of Fugue.
4 units, Win (Horsley)
150C. History of Musical Esthetics.
4 units (Houle)

151. Studies in Opera.
151A. Survey of Opera—History, reading, listening, and exercises in performance of standard operative repertory. Prerequisite: Music 22.
3 units (Gibson) given 1981–82

153. Organ Literature.
153A. Organ Music (Cabezón to Bach).
4 units, Spr (Nanney)
153B. Organ Music (Bach to Ligeti).
4 units (Nanney) given 1981-82

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 1981-82
252. Choral Repertory (1750 to Present).
4 units (Ramsey) given 1981-82
PERFORMANCE

All courses (DR:X)

12. 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 (Wait)

65D. Percussion Class—For Credential candidates.
   1 unit, Spr (Montoro)

72, 73, 74, 75, 76, 77. Small Group Instruction—A special fee of $45 per quarter is charged for enrollment in any of these groups.
   1 unit, Aut', Win, Spr (Staff)

72. Piano Class—For intermediate students. (Salocks)

73. Voice Class.
   (Gibson, Staff)

74A. Stringed Instruments Classes.
   (Kleiman, 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 $80 per quarter for majors and $160 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 or her instrument. Minimum repertory lists for each instrument are available at the Music Department office.
   3 units, Aut, Win, Spr

172A, 272A. Piano.
   (Baller, Schwartz, Salocks, Sparrow)

172B, 272B. Organ.
   (Nanney)

172C, 272C. Harpsichord.
   (Fabrizio)

172E, 272E. Early Piano.
   (Fabrizio)

   (Gibson, Wait)

174, 274. Stringed Instruments.
174A, 274A. Violin.
   (Abel, Kleyman)

174B, 274B. Viola.
   (Kleyman, Persinger)

174C, 274C. Violoncello.
   (Hampton, Rowell)

174D, 274D. Contrabass.
   (Epstein)

174E, 274E. Viola da Gamba.
   (Staff)

174F, 274F. Classical Guitar.
   (Ferguson)

   (Chauvel)

175, 275. Woodwind Instruments.
175A, 275A. Flute.
   (Blaisdell, Hawley)

175B, 275B. Oboe.
   (Duste)

175C, 275C. Clarinet.
   (Staff)

175D, 275D. Bassoon.
   (Willoughby)

175E, 275E. Renaissance Wind Instruments.
   (Myers)

175F, 275F. Saxophone.
   (Staff)

176, 276. Brass Instruments.
176A, 276A. French Horn.
   (Saxton)

176B, 276B. Trumpet.
   (Johnson)

176C, 276C. Trombone.
   (Williams)

176D, 276D. Tuba.
   (Cooley)

177, 277. Percussion.
   (Montoro)
130. Orchestral Conducting—Prerequisite: 127.

130A. 3 units (Toth) given 1981-82
130B. 3 units (Toth) given 1981-82

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 (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, Aut (Houle)

269B. Renaissance.
4 units, Win (Houle)

269C. Baroque.
4 units, Spr (Houle)

269D. Classic.
4 units (Ratner)


1-4 units, Aut, Win, Spr (Toth)

ENSEMBLE

All courses (DR: X)

MUSIC 457

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.

1 unit, Aut, Win, Spr (Montoro)

158. Contemporary Performance Ensemble.
1 unit, Aut, Win, Spr (Harvey) T 4:15-6:05

159. Early Music Ensembles.

159A. Early Music Singers.
1 unit, Aut, Win, Spr (Mahrt)

159B. Renaissance Wind Band.
1 unit, Aut, Win, Spr (Houle, Myers)

159C. Baroque Orchestra.
1 unit, Aut, Win, Spr (Houle, Myers)

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, Win, Spr (Barnes) by arrangement

162. University Chorus.
1 unit, Aut, Win, Spr (Ramsey)
M 7:30-9:30 p.m. and W 4:00-5:30

163. University Choir—Official choir of Memorial Church, which furnishes music for Sunday services and special occasions in the Church calendar. Eight members chosen by audition may receive an honorarium for performing duties other than those required of the regular Choir.

2 units, any quarter (Ramsey) T4:15-5:30 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) MWFTh 12

166. Chamber Orchestra—Open to advanced players who have had orchestral experience.
1 unit, Aut, Win, Spr (Toth) TTh 12-1:50

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) MWF 12
170. Piano Accompanying.
170A. Piano Accompanying.
  2 units, Aut, Win, Spr (Schwartz)
170B. The Literature and Practice of Accompanying.
  2-3 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. 3 units, Sum (Staff) by arrangement
  265B. 2 units, Aut (Staff) by arrangement
  265C. 2 units, Win (Staff) by arrangement
  265D. 2 units, Spr (Staff) by arrangement
260. 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 (Persons)
201. Graduate Review in Musical Analysis.
  4 units, Aut (Shen)
221. History of Music Theory.
  221A. Ancient Through Renaissance.
    4 units (Cohen) given 1981-82
  221B. Baroque Through Modern.
    4 units (Cohen) given 1981-82
240. Seminar in Music History.
  4 units, Win (Mahrt)
241. Seminar in Analysis for Performance.
  4 units, Spr (Houle and Mahrt)
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 (Staff) by arrangement
303. Research in Music Education.
  Any quarter (Kuhn) by arrangement
321. Readings in Music Theory.
  3 units, any quarter (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)
  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)
  369C. D.M.A. Recital.
    1 unit, 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, James O. Urmson (Professors)
Chairman: John R. Perry (on leave)
Acting Chairman: Ian Hacking
Director of Graduate Study: Jon Barwise
Director of Undergraduate Study: Michael Bratman
Professors: Jon Barwise, Solomon Feferman, Dagfinn Føllesdal (Spring, Summer), Ian Hacking, K. Jaakko Hintikka (Winter), Georg Kreisel (Winter, Spring), Julius Moravcsik, David Nivison, John Perry (on leave), Patrick Suppes
Associate Professors: Michael Bratman, Nancy Cartwright (Autumn), Thomas Wasow (on leave)
Assistant Professors: Wilbur Knorr, Steven Strasnick, John Taurek
Courtesy Associate Professor: Denis Phillips
Visiting Professor: Gerasimos Santas
Visiting Assistant Professor: Michael Hepworth

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 judgments 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 specialties. 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—artistic, 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 undergraduate majors in philosophy have associations for discussion of philosophical issues and reading of papers by students, faculty, and visitors. These associations nominate the Directors of Graduate and Undergraduate Study and elect student representatives to department meetings.

PROGRAM OF STUDY

BACHELOR OF ARTS

There are two programs for majoring in philosophy. One is the "General Program," and the other is the "Special Program in the Philosophy and Logic of Formal Systems." To declare a major, students must consult with the Director of Undergraduate Study. The student will be assigned an advisor with whom she should work out a coherent plan for the major. The department strongly urges that students have proficiency in at least one foreign language.

GENERAL PROGRAM

1. Course requirements
   a) Preparation for the major: An introductory course and 80, for a total of ten units.
   b) The core: 24 additional units as follows:
      1) Logic: 57 or 160A
      2) Philosophy of Science: 6, or one from 163-166
      3) Ethics: 170A or 170B or 171
      4) Metaphysics and Epistemology: 181, 184, or 186
      5) History: two of 100, 101, 102
   c) 20 additional units from courses numbered above 99. Total: 54 units.

2. At least six courses in the major must be completed with a grade of "B" or better. Units for Tutorial or Directed Reading (Philosophy 196, 197) may not be counted in the 54 unit requirement. No more than ten units completed with grades of "Pass" may be counted in the 54 unit requirement.

3. Transfer units must be approved by the Director of Undergraduate Studies at the time of declaring a major. In general, transfer courses cannot be used to satisfy the five area requirements.

SPECIAL PROGRAM IN THE PHILOSOPHY AND LOGIC OF FORMAL SYSTEMS

This special major in philosophy allows students to learn the technical side of computer science along with the logical principles and philosophical tradition that underlie it. Within the major there is room for specialization in one of several disciplines: philosophy, logic, computer science, or formal linguistics.

1. Course requirements
   a) Preparation for the major. These three courses must each be passed with at least a "B-" by the end of Winter Quarter of the junior year (hopefully much sooner) to be admitted to the program.
      1) Philosophy 80 (normally a student will have taken an introductory philosophy course first)
      2) Computer Science 105 or 106, Introduction to Programming
3) Philosophy 160A. (This course presumes some background in logic or mathematics. Either Philosophy 57, a computer-based course, or Mathematics 120 or 120S would be good preparation.)

b) Major requirements
1) Philosophy courses
   (a) Two of the following: 163, 184, 186
   (b) 164 or 165
   (c) 181
2) Logic courses
   (a) Philosophy 160B
   (b) One additional from among: Philosophy 161, 167, 269, 390A, 390B, 390C, 391A, 391B
3) Computer Science and Linguistics Courses
   (a) Computer Science 107
   (b) Computer Science 111
   (c) Linguistics 30
   (d) One of the following: Computer Science 154, Linguistics 202, Computer Science 265
4) Other courses. One of the following:
   Statistics 40, Statistics 116, Mathematics 113 or 113S

c) Specialization requirements. Prior to her or his senior year, the student must have a specialized course of study of at least five additional advanced courses approved by the advisor for the program. Any changes in this program must be approved.

2. At least six courses in the major must be completed with a grade of "B" or better. Units for Tutorial or Directed Reading (Philosophy 196, 197) may not be counted in the requirement. No more than 10 units completed with grades of "Pass" may be counted in the requirement.

3. Transfer units must be approved by the Director of Undergraduate Study at the time of declaring a major. Use of transfer courses to satisfy major requirements will be strictly limited.

A fuller description of this program including examples is available from the Philosophy Department.

HONORS PROGRAM IN PHILOSOPHY

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 Winter Quarter of their junior year. Admission will be selective on the basis of grade point average, demonstrated ability in philosophy, and progress towards satisfying the requirements 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 the undergraduate philosophy seminar (194B) in the Spring Quarter of their Junior year. This seminar will introduce the student to advanced work in philosophy and will require five units of work. For the senior year it should include either (a) the Autumn Quarter undergraduate philosophy seminar (194A) and five units of senior tutorial in the winter; or (b) five units of senior tutorial for each of the Autumn and Winter Quarters. In the quarter preceding their senior tutorial, students should submit an essay proposal to the honors committee. A tutor is assigned on the basis of this proposal.

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 considerably 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 Quarter. 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 applications for honors, assign tutors and second readers, and make the final determination whether students receive honors.

The Honors Seminars may be counted toward the 54 units required for the major. The Honors Tutorials represent units in addition to the 54 unit requirement.

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. No fellowships are available for Master's students.

Unit Requirements—Though the requirements for the Master of Arts are designed so that a student with the equivalent of a strong undergraduate philosophy major at Stanford might complete them in one year, most students will need longer. Students should also keep in mind that 36 units is the minimum required by the University; quite often more units are necessary for a given student to complete the departmental requirement. 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.

Students are reminded of the University requirements for advanced degrees, and particularly of the fact that for a Master of Arts, students must complete three full quarters as measured by tuition payment.

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

The student must have a minimum of 36 units in philosophy, of which 32 must be in courses numbered above 99. The requirement has three parts:

1. Undergraduate core—Students must have when they enter, or complete early in their program, the core undergraduate courses listed above under "General Program." (1b). Students entering from other institutions should establish equivalent requirements with the Director of Graduate Studies upon arrival or earlier.

2. Graduate core—The student must take at least one graduate course (numbered over 199) from three of the five areas listed under proficiency requirements for the Ph.D.

3. Specialization—The student must take two other courses, at least one of which is numbered above 199, in one of these three areas.

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, 163, 164, 165, 166, 242A,B,C.

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 either 183 or 203.

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.

PhD MINOR IN 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 "Degrees" section 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 restate 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 (First-order Logic), 160B (Computability and Logic), 161 (Introduction to Set Theory), 163, 164, 165, 166 or 210 (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

A limited amount of fellowship support is available for Ph.D. students in philosophy. Students request aid by checking the appropriate box on the application form. The University requires all applicants, whether requesting aid or not to submit a CAPS-FAS application. The Department of Philosophy does not offer 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 25% 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.

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. Courses 1 and 2 are designed to constitute a coherent survey of the main problems of philosophy. Each is self-contained, however, and has no prerequisite. Courses 5A, B, C form a Western Culture Sequence, sponsored by the Departments of Philosophy and Religious Studies as part of the Western Culture Pilot Program.

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)
   5 units, Aut (Hepworth) MWF 11 plus section

2. Value, Obligation and Society—An introduction to some of the major issues in moral and political philosophy, including an examination of the works of classical and contemporary philosophers. General questions to be discussed include: What makes acts morally right or obligatory? What makes some consequences of some actions better than others? What makes a social institution just or fair? To what extent can disagreements on such matters be rationally settled? More specific moral perplexities to be discussed include: Are there moral constraints on the conduct of war? Are programs of compensatory discrimination just? Is there a general duty to obey the law? (DR:A)
   5 units, Win (Bratman) MWF 11 plus section

4. Philosophies of the Good Life: East and West—This course will serve as an introduction to some of the main paths humanity has traversed in its pursuit of the illusive ideal of the good life. Through an examination of selected works in philosophy, religion, psychology, and literature, contrast basic Western philosophies of hedonism, duty (moral, religious, and social), self-realization, and naturalism with Eastern philosophies such as Taoism, Zen Buddhism, Confucianism, and Chinese Communism. Following is a sampling of some of the "philosophers" discussed: Aristotle, Buddha, Chuang Tzu, Confucius, Epicurus, Freud, Fromm, Hesse, Jesus, Jung, Kant, Lao Tse, Mao Tse-Tung, Maslow, Mill, Nietzsche, Pirsig, Plato, Skinner, Thoreau, and Watts. (DR:H)
   5 units, Spr (Strasnick) MWTThF 9

5A, B, C. Ideas In Western Culture—This sequence introduces the students to important works in western culture, and attempts to set them in their historical contexts.
464 SCHOOL OF HUMANITIES AND SCIENCES

5A. Ideas in Western Culture: 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 entering students. (DR:H)

3 units, Aut (Moravcsik) MWF 10 plus 2 hour section

5B. Ideas in Western Culture: Faith and Reason—Great philosophical, religious, scientific and literary works of the Middle Ages and Renaissance will be studied. Authors studied include Boethius, Augustine, Dante, St. Thomas, Locke, Galileo, and Shakespeare. (DR:H)

5 units, Win (Santas) MWF 10 plus 2 hour section

5C. Ideas in Western Culture: The World Demystified—(Enroll in Religious Studies 5C.) The breakdown of traditional Western Culture and society under the impact of revolutions in science, industry, politics, literature, and philosophy; the emergence of "modern" thought and institutions; works by Voltaire, Rousseau, Hume, Goethe, Marx, Darwin, Nietzsche, and Freud. (DR:H)

5 units, Spr (Levinson) MWF 10 plus 2 hour section

6. The Growth of Scientific Knowledge—Issues in the philosophy of science (e.g., operationalism, the structure of theories, observation and hypothesis testing) in an historical contact; namely, the development of the modern relativistic concepts of space, time and motion from their Newtonian to Aristotelian ancestors. (DR:B)

4 units, Spr (Hacking) MWF 9

17. From Philosophy to Mathematics—Discuss philosophical origins and quantitative mathematical concepts of 3 or 4 selected topics in mathematics that have arisen out of philosophical concerns. Calculus background not required. Possible topics include non-Euclidean geometry, probability theory, set theory, and game theory. (DR:B)

4 units, Spr (Barwise) TTh 11-12:15

40. Eastern and Western Conceptions of the Self—(Enroll in Religious Studies 40.) Comparison of models of the self in Confucianism, Taoism, Christianity and contemporary Western thought; especially psychoanalysis and Anglo-American philosophy; and theoretic issues arising from them.

4 units, Win (Yearley) TTh 8:30-9:50

42. Philosophy of Religion—Contemporary and Traditional Issues—(Enroll in Religious Studies 42.)

3 units, Win (Harvey) MWF 9

46. Philosophical Chinese—(Same as Asian Languages 46.) Introduction to Classical Chinese and to Chinese philosophical concepts, through study of short philosophical texts and translations; for students who have had no previous work in a Far Eastern language. Philosophers treated will include Confucius, Mencius, Hsün Tzu, and Lao Tzu. This course is self-contained and does not assume that the student will do further work in the subject. (DR:H)

4 units, Win (Nivison) MWF 10

47. Philosophical Chinese—(Same as Asian Languages 47.) Continuation of 46. Reading in Mencius and Han Fei Tzu. (DR:H)

4 units, Spr (Nivison) MWF 9

56. Critical Thinking—(Same as Linguistics 90.) Students learn to interpret difficult material, analyze and criticize arguments, and develop intellectual skills needed for academic work. (DR:X)

4 units, Spr (Follesdal) TTh 11:00-12:15

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 or her 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)

5 units, Aut, Win, Spr (Suppes)

77. Ethics, Justice, and the International Community—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. The second half will be devoted to an examination of the issue of world justice and the allocation of scarce natural resources. In particular, we will focus on the problem of development and the responsibility of developed nations to developing ones. (DR:A)

5 units (Strasnick) given 1981-82

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). Pre-requisite: 1 course in Philosophy or junior standing. (DR:H)

5 units, Aut (Bratman) MWF 1:15

plus section

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 1-17.

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 Sceptics). (DR:H)

4 units, Aut (Santas) 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 (Taurek) 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, given 1981-82

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. (DR:H)

4-5 units, Spr (Hacking) MWF 11

117. 20th Century Philosophies in Mathematics—An examination of recent approaches to fundamental questions in the philosophy of mathematics. Readings in Russell, Hilbert and others. (DR:B)

3 units, Win (Kreisel) TTh 10-11:15

122. Chinese Philosophy From Han through Sung—(Same as Asian Languages 142.) Buddhism in China will be reviewed in this course but not treated in depth. Special attention will be given to the "Neo-Confucians" Ch'eng I, Ch'eng Hao, and Chu Hsi. (DR:H)

4 units, Spr (Nivison) MWF 10

123. The Philosophy of Wang Yang-ming (1472–1529)—(Same as Asian Languages 143.) (DR:H)

4 units, Spr (Nivison) given 1981-82

124. Confucianism Since Wang Yang-ming—(Same as Asian Languages 144.) History of Confucian moral philosophy in China and Japan since the death of Wang Yang-ming in 1529. (DR:H)

4 units (Nivison) given 1982-83

137. Philosophy of Aristotle. (DR:H)

4 units, Win (Moravcsik) MWF 1:15

138A,B. Introduction to Exact Sciences: Cosmology—(Same as History of Science 138A,B and Classics 138A,B.) A two-quarter sequence on the history of the exact sciences, with special emphasis on the field of cosmology. Primary interest will be in the technical aspects of the classical theories (Ptolemaic and Copernican), including mathematics, astronomy, physics and chemical theory. But major attention must also be given to the more speculative aspects in natural philosophy and theology. (DR:A)

138A.

4 units, Aut (Knorr) MWF 11

plus section

138B.

4 units, Win (Knorr)

148. The Philosophy of Nietzsche—A study of the major themes of Nietzsche's philosophy,
focusing especially on his critique of knowledge and morality. Topics to be considered include Nietzsche's conception of truth and value, the doctrine of the overman and the eternal recurrence, and Nietzsche's account of self-realization. (DR:H)

3 units, Win (Strasnick) TTh 2:15-3:30

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:H)

4 units, Spr (Follesdal) TTh 9-10:15

153. Phenomenology and Its Background—A survey of the development of phenomenology and its contemporary philosophical significance. An analysis of the writings of Husserl and others. (DR:H)

4 units (Follesdal) given 1981-82

See also Classics 019, 164, 165.

LOGIC AND PHILOSOPHY OF SCIENCE

157. Introduction to Logic—For graduate students. Same as Philosophy 57.

160A. First-order Logic—The syntax and semantics of first-order logic. Gödel's Completeness Theorem which relates formal rules of proof to Leibniz' notion of truth in all logically possible worlds. Consequences like the Lowenheim-Skolem Theorem and the Compactness Theorem will be discussed and applied. Prerequisite: Philosophy 57 recommended for students with no mathematics or computer science background. (DR:T)

4 units, Win (Barwise) TTh 9-10:15

160B. Computability and Logic—A precise definition of "effective procedure" is given through Turing machines, register machines and recursive functions. Church's Thesis is explained. These are used to develop Gödel's work on the undecidability of arithmetic, culminating in his famous Incompleteness Theorem. Other undecidable problems are also discussed. Prerequisite: Philosophy 57 recommended for students with no mathematics or computer science background. (DR:T)

4 units, Spr (Barwise) TTh 9-10:15

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, Spr (Suppes)

163. Probability and Induction—Philosophical theories about probability and their application to the problem of induction. (DR:T)

4 units (Hacking) given 1981-82

165. Seminar in the Philosophy of Natural Science—This is a seminar in the history of the philosophy of science during the period 1870-1900. This period in philosophy of science is interesting because of the widely accepted phenomenalist. Readings will include selections from Helmholtz, Stallo, Mach, Boltzmann and others. (DR:A)

3 units, Spr (Staff) TTh 1:15

167. Introduction to Philosophy of Social Science—(Same as Education 211.) The course will begin by focusing upon the differences various writers have noted between the natural and social sciences, and will move to several topics of importance in the social sciences: explaining human action, the functional explanation of social phenomena, holistic versus reductionist orientations. Examples will be used from contemporary social science research literature to illustrate the relevant issues. For majors in the social sciences and beginning graduate students in related areas such as education. (DR:A)

4 units, Win (Phillips) TTh 12-2

ETHICS, AESTHETICS AND SOCIAL AND POLITICAL PHILOSOPHY

170A. Ethical Theories—This is a course in normative ethics. We will examine alternative ways of determining what ought or ought not to be done in concrete situations of choice. Primarily we will compare and contrast consequentialist (mainly utilitarian) theories with non-consequentialist theories that rely chiefly on conceptions of individual rights. Readings will be drawn from the works of twentieth century philosophers. (DR:A)

4 units, Win (Stasnick) TTh 11-12:15

170B. Fact and Value—A systematic treatment of major issues about the nature of moral belief. Topics to be covered include: the possibility of moral knowledge; the possibility of deriving an "ought" from an "is"; the role of observation in ethics; moral nihilism, naturalism, intuitionism
and non-cognitivism; moral relativism; the relation between morality and rationality; moral conflict. (DR:A)

4 units, Spr (Taurek) MWF 1:15

171. Political Argument: Justice—This course will develop and examine a series of different frameworks for analyzing the justice of political institutions. The first part will consider the anarchist and libertarian viewpoint, the second the progressive liberal viewpoint, and the third the Marxist and socialist viewpoints. (DR:A)

4 units, Spr (Taurek) MWF 1:15

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:A)

4 units (Strasnick) given 1981-82

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, avant-garde art. (DR:H)

4 units, Aut (Hepworth) MWF 2:15

179. 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 be examined with special reference to modern problems and cases in the areas of punishment and responsibility, legal regulation, and civil disobedience. No prerequisites, but some background in philosophy, political science, social science or the history of ideas is recommended. (DR:A)

4 units, Aut (Rhinelander) MWF 2:15

EPISTEMOLOGY, METAPHYSICS AND PHILOSOPHY OF LANGUAGE

Philosophy 80 or permission of the instructor is a prerequisite for the 180 series.

181. Philosophy of Language—(Same as Linguistics 244.) 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 and Cooper) MWF 1:15

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:H)

4 units (Follesdal) given 1981-82

184. Theory of Knowledge—Some main problems of epistemology, including the analysis of knowledge; the quest of certainty; the objects of knowledge, belief, and perception; different kinds of knowledge and information; information-seeking procedures and their logic. (DR:H)

4 units, Win (Hintikka) MWF 10

186. Topics in Mind and Action—Various topics in the philosophy of mind and the philosophy of action will be considered. Topics will include languages of thought and personal identity. (DR:H)

4 units, Spr (Hepworth) MWF 11

190. Undergraduate Seminar on Self Deception—(Same as Religious Studies 1406.) Readings will be drawn from philosophical, religious, and psychological thinkers from Anglo-American, European, and Chinese traditions. (DR:H)

5 units, Spr (Bratman, Yearley) TTh 2:15-4:05

191. Undergraduate Seminar: Causes, Correlations and Statistical Reasoning—Does saccharin cause bladder cancer? Does “the pill” cause fatal blood clots? In this introductory class we will study the notion of cause that is involved in these questions and the “logic” of the statistical modes of argumentation that are used to establish such causal claims. (DR:H)

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

192. Theories of Love: Plato and Freud—(DR:H)

4 units, Spr (Santas) MWF 10

193. Topics in Wittgenstein’s Later Philosophy—Seminar focusing on questions related to the subject of realism in the later works of Wittgenstein. Among the questions to be considered: What is the exact form of the private language argument? Is Wittgenstein a verificationist? How does Wittgenstein use the notion of a criterion to counter skepticism? Does
Wittgenstein have any new answers to traditional questions such as the question of the existence of our minds? Discussion will center on the Philosophical Investigations. (DR:H)

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

194A. B. Undergraduate Seminar—This is an advanced undergraduate seminar. Enrollment is limited to 12 students and to philosophy majors who have made substantial progress towards satisfying the requirements of the major. Preference will be given to students in the Philosophy Honors Program. Emphasis is placed on philosophical reasoning and writing. For those in the Honors Program this will be a preparation for the writing of an honors thesis. The topics and authors to be studied will be announced by the instructor. Students intending to take this seminar should sign up in advance with the Director of Undergraduate Study. (DR:H)

194A. Topics in Eastern Philosophy.
4 units, Aut (Strasnick) TTh 11-12:15

194B. Topic to be announced.
5 units, Spr (Follesdal) T 4:15-6:05

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

COURSES INTENDED PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:X)

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. (Prerequisite: consent of instructor.)
4 units (Wasow) given 1981-82

3 units, Win, Spr (Staff)

3 units, Aut (Cartwright) MWF 9

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 (Pacheco) given 1981-82

216A. Philosophical and Educational Thought of the Pragmatist—(Same as Education 304A.) Introduction to the influential philosophical and educational writings of C.S. Peirce, William James, and John Dewey. Topics discussed: (1) the philosophy of pragmatism—Peirce on meaning and chance, James on truth and the "biological view of mind," Dewey on truth, knowledge, body and mind; (2) criticism of pragmatism, especially those of G.E. Moore and Bertrand Russell; (3) the educational writings of James and Dewey; (4) the contemporary scene: Peirce, Dewey, and Popper; Dewey and the open classroom. (SSE)
4 units, Win (Staff) TTh 2:15-4:05

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 atomistic psychology).
4 units, Spr (Phillips) TTh 12-2

230. Introduction to Syntactic Theory—(Same as Linguistics 230.) Introduction to the transformational theory of syntax. Practical experience in forming and testing linguistic hypotheses, reading and constructing rules, etc.
4 units, Win (Staff)

235. Graduate Seminar on Plato's Early Dialogues.
3 units, Aut (Santas) T 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, Spr (Moravcsik) T 2:15-4:05

238. Seminar in the History of Science—(Same as History of Science 238; same as Classics 238.)
3 units (Knorr)

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) T 2:15-4:05

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) M 4:15-6:05

269. Formal Semantics—A selection illustrating the principle uses of logic in philosophy and in the understanding of natural language. The topics include: intensional, modal and tense logics; the logic of perception; an introduction into various model-theoretic approaches to the semantics of natural language. (Prerequisite: Philosophy 160A or equivalent.)  
4 units, Win (Hintikka) MW 2:15-4:05

270. Systematic Ethics—This is a graduate level course on major theoretical issues in both normative ethics and moral epistemology ("meta-ethics"). Topics to be discussed will include: utilitarianism - its various forms and problems; consequentialism; rights; naturalism and non-cognitivist conceptions of moral belief; forms of moral conflict. Prerequisite: graduate student status or Philosophy 170A and 170B.  
4 units, Win (Bratman, Taurek) TTh 2:15-4:05

280. Metaphysics and Epistemology—Graduate course in metaphysics and epistemology.  
4 units, Spr (Hepworth) MW 2:15-4:05

281. Graduate Discussion of Philosophy 181.  
2 units, Aut (Moravcsik) Th 2:15-4:05

287. Seminar on Kant.  
3 units, Spr (Staff) Th 4:15-6:05

326. Epistemological Problems of Artificial Intelligence—(Same as Computer Science 226.) Formalisms for representing what a general intelligent program must know about the common sense world including facts about causality, ability, knowledge and action. Modes of rigorous and conjectural reasoning, especially non-monotonic reasoning, Approximate theories and counterfactuals. Connections with philosophy, especially philosophical logic and epistemology. Some familiarity with first order logic will be assumed. Offered alternate years.  
3 units, Win (McCarthy)

338. Advanced Seminar in the History of Science—(Same as History of Science 338; same as Classics 338.)  
3 units (Knorr)

345. Seminar on Scientific Realism.  
3 units, Aut (Hacking) Th 4:15-6:05

PHYSICAL SCIENCES 469

3 units, Spr (Bratman) M 4:15-6:05

353. Seminar on Husserl's Phenomenology.  
3 units, Sum (Follesdal) given 1981-82

360. Seminar on Chance and Determinism—An historical study of the development of 19th century ideas of chance and determinism, with particular emphasis on the origins of social science.  
3 units, Win (Hacking) T 4:15-6:05

371. Seminar in Political Philosophy—A detailed study of John Rawls' A Theory of Justice and some of the critical literature that has appeared in response to it.  
3 units, Spr (Strasnick) W 2:15-4:05

390A,B,C. Mathematical Logic—(Enroll in Mathematics 290A,B,C.)

391A,B. Topics in Logic and the Foundations of Mathematics—(Enroll in Mathematics 291A,B.)

392A,B. Seminar in Foundations of Mathematics.  
392A. Units by arrangement, Win (Kreisel) T 4:15-6:05
392B. Units by arrangement, Spr (Kreisel) T 4:15-6:05

450. Thesis.  
Any quarter (Staff) by arrangement

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:

Physics 19
Applied Science

Additional courses of interest are listed below.
PHYSICS

19. An Introduction to Physics—("Physics for Poets").
15. Special Topics in Physics—(Astronomy Course).
29. Modern Physics—(This course has a prerequisite of Physics 23 but students may be admitted without this prerequisite.)

The following two Physics courses belong in the Physical Sciences category but are not regular course offerings:

APPLIED PHYSICS

15A. The Nature of the Universe.
15C. Modern Astronomy ($\text{S}$).

ASTRONOMY

The aforementioned courses numbered with 15 and Astronomy 50 and 100 represent courses offered in Astronomy that are elementary courses in the Physical Sciences.

50A,B,C. Astronomy Laboratory and Observational Astronomy.

100. Introduction to Observational Astronomy and Astronomy Laboratory.

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


For additional courses, see individual departmental listings.

PHYSICS

Emeriti: Felix Bloch, Paul H. Kirkpatrick (Professors)
Chairman: J. Dirk Walecka

Professors: William M. Fairbank, Alexander L. Fetter, Stanley S. Hanna, Theodor W. Hänsch, Robert Hofstadter, William A. Little, Walter E. Meyerhof (on leave Spring Quarter), David M. Ritson (on leave Spring Quarter), Arthur L. Schawlow (on leave Spring Quarter), Melvin Schwartz, H. Alan Schwettman (on leave), Leonard Susskind, Robert V. Wagoner, J. Dirk Walecka, Stanley G. Wojciecki (on leave), Mason R. Yearian

Assistant Professors: Savas Dimopoulos (on leave Winter and Spring Quarters), Stuart J. Freedman (on leave Fall Quarter), Harriss T. King, Alan M. Litke (on leave Spring Quarter), Brian D. Serot, Karl A. Van Bibber, Clifford M. Will

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 E. L. Ginzton Laboratory) form a closely related complex which houses 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 operates 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 tools a two-mile-long, 20-GeV electron accelerator and a 6-GeV electron-position 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, Hanna, Hofstadter, and Schwettman 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 the reading and study of physics at all levels.

Course work is designed to provide students with a sound foundation in both classical and modern physics. The department also offers courses in gravitation, and 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.

Undergraduates are also 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.

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, 1981 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, 55, 56, 57, 100, 101, 105, 110, 111, 120, 121, 122, 130, 131, 132, 161, 170, 171, 200, 201 and Mathematics 41, 42, 43. The requirements of Physics 55, 56, and 57 may be waived upon approval of the Physics Undergraduate Study Committee.

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.

SEQUENCE I

FIRST YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 51, 53</td>
<td>Mechanics, Electricity</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Physics 54</td>
<td>Electricity Laboratory</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>Math. 41, 42, 43</td>
<td>Analytic Geometry and Calculus</td>
<td>5</td>
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SECOND YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
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</thead>
<tbody>
<tr>
<td>Physics 55, 57</td>
<td>Light and Heat, Modern Physics</td>
<td>4</td>
<td>3</td>
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<tr>
<td>Physics 56</td>
<td>Light and Heat Laboratory</td>
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<td></td>
<td></td>
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<tr>
<td>Physics 100</td>
<td>Intermediate Physics Laboratory</td>
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<td></td>
<td></td>
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<tr>
<td>Physics 110, 111</td>
<td>Int. Mechanics</td>
<td>3</td>
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<td></td>
</tr>
<tr>
<td>Math. 44, 101</td>
<td>Advanced Calculus</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math. 130, 131, 132</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
<td>3</td>
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</table>
**THIRD YEAR**

<table>
<thead>
<tr>
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<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 105, 101.</td>
<td>Int. Physics Laboratory</td>
<td>2</td>
<td>2</td>
<td></td>
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<tr>
<td>Physics 120, 121, 122.</td>
<td>Electricity and Magnetism</td>
<td>3</td>
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</table>

**FOURTH YEAR**

<table>
<thead>
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<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 200, 201. Advanced Physics Laboratory</td>
<td>Physics 210, 211. Introductory Theoretical Physics</td>
<td>(3)†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math. 113, 114, or 120. Linear Algebra and Matrix Theory or Modern Algebra</td>
<td>Math. 113, 114, or 120. Linear Algebra and Matrix Theory or Modern Algebra</td>
<td>(3)†</td>
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**SEQUENCE II**

**FIRST YEAR**

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<tr>
<td>Physics 100. Intermediate Physics Laboratory</td>
<td>Math. 130, 131, 132. Ordinary and Partial Differential Equations</td>
<td>5</td>
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**SECOND YEAR**

<table>
<thead>
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<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 120, 121, 122. Int. Electricity and Magnetism</td>
<td>Math. 106. Complex Variables</td>
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**THIRD YEAR**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 130, 131, 132. Atomic and Nuclear Structure</td>
<td>Physics 161, Optics</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Physics 170, 171, 172. Thermodynamics, Kinetic Theory and Introduction to Statistical Mechanics, Physics of Solids</td>
<td>Physics 210, 211. Introductory Theoretical Physics</td>
<td>3</td>
<td>3</td>
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**Fifth Year**

<table>
<thead>
<tr>
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<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 200, 201. Advanced Physics Laboratory</td>
<td>Physics 220, 221. Classical Electrodynamics, Mechanics</td>
<td>(3)†</td>
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<td></td>
</tr>
<tr>
<td>Physics 230, 231, 232. Quantum Mechanics</td>
<td>Math. 113, 114, or 120. Linear Algebra and Matrix Theory or Modern Algebra</td>
<td>(3)†</td>
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</tr>
</tbody>
</table>

* Additional elective units must be added to bring the total number of units to 180 as required by the University. Students should consult their 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.

**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 205.

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 will be open to the general audience. The expectation is that the student's advisor along with all the other Honors candidates 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 both the Honors work and 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 re-
quirements 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).

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 student is required to pass a written comprehensive examination on undergraduate and first year graduate physics. This exam is given annually on the Thursday and Friday preceding the start of the Autumn Quarter. The examination should be taken at the end of 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 Administrator, 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 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. 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. These quarters are independent of one another. 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 dem-
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 p.m. to 9 p.m. except Fridays when it closes at 3 p.m.

All courses (DR:T) if taken for three or more units unless noted otherwise.

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 nuclei and 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 (Hofstadter) M 2:15-4:05; W 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 (Hofstadter) M 2:15-4:05; W 2:15; discussion W 3:15

13. Modern Physics Through Science Fiction—A seminar 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, quantum mechanics, parallel universes, extraterrestrial life, teleportation, neutron stars, black holes, and general relativity. Prerequisite: current or prior enrollment in Physics 29.

2 units, Spr (Little)
one hour by arrangement


3 units, Aut (Staff) MWF 1:15

15. Cosmic Evolution—(Enroll in Applied Physics 15.) This course develops in a general way an understanding of the universe. 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, Wtr (Staff) TTh 2:15; discussion T or Th 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 (Susskind) TTh 9; one hour discussion T 10

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 (Susskind) TTh 9; discussion T 10

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 (Yearian) lec. MWF 10 or 11 and lab.

Sum (Staff) lec. MTWThF 10-12; 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 (Yearian) lec. MWF 10 or 11 and lab.

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 (Yearian) 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 (Hänsch) 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 (Hänsch) 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 with 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 and Magnetism—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 (Staff)

lec. MWF 9 or 10; and discussions

54. Electricity Laboratory—Concurrent registration in 53 is required.

1 unit, Spr (Staff)

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 (Yearian) lec. MWF 10 or 11 and lab.

Sum (Staff)

56. Light and Heat Laboratory—Concurrent registration in 55 is required.

1 unit, Win (Meyerhof)

57. Modern Physics—Relativity, experimental basis of quantum theory, Schrödinger equation, atomic structure, nuclear structure, high energy physics, elementary particles. Prerequisite: 55.

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

58. Modern Physics Laboratory—Concurrent or prior registration in 57 is required.

1 unit, Win (Staff)

61, 62, 63. Advanced Freshman Physics—An introduction to some topics in Newtonian mechanics, special relativity, electricity and magnetism, atomic physics and quantum mechanics from an advanced viewpoint. The format will consist of lectures and small discussion sections. This sequence is designed primarily for students contemplating a major in Physics. Prerequisites: high school physics and calculus; prior or concurrent registration in Math 43 (Aut), Math 44 and 130 (Win), Math 101 and 131 (Spr) or equivalent.

61. 4 units, Aut (Staff) TTh 9-10:50

62. 4 units, Win (Staff) TTh 9-10:50

63. 4 units, Spr (Staff) TTh 9-10:50

100, 101, 105, 106. Intermediate Physics Laboratory—Experimental work in mechanics, heat, electricity and magnetism, optics, atomic and nuclear 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. The emphasis is on experimental techniques and "demonstration" experiments rather than on extensive data taking or elaborate measurements. In addition to lab work, several seminars are offered on important experimental techniques,
e.g. electronics, computers, data analysis, detectors, low temperature techniques, vacuum techniques, etc. Students are expected to complete four units of intermediate lab work (100, 101) and two units of the Electronics Seminar (105), which they are strongly advised to take during Autumn Quarter when lectures are offered in parallel. When offered, 106 may be substituted for two units of 100, 101. Prerequisite: completion of Physics 55 or concurrent enrollment in Physics 60 series.

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
<th>Quarter</th>
<th>Time</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>100</td>
<td>2</td>
<td>Aut, Win, Spr</td>
<td>1:15-5:05</td>
<td>Fairbank, Hansch, Litke, Ritson</td>
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<tr>
<td>101</td>
<td>2</td>
<td>Aut, Win, Spr</td>
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<td>Fairbank, Hansch, Litke, Ritson</td>
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<tr>
<td>105</td>
<td>2</td>
<td>Win</td>
<td>1:15-5:05</td>
<td>Staff</td>
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<td>110</td>
<td>3</td>
<td>Win</td>
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<td>Freedman</td>
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<td>Spr</td>
<td>TTh 1:15-2:30</td>
<td>King</td>
</tr>
<tr>
<td>120</td>
<td>3</td>
<td>Aut</td>
<td>MWF 11</td>
<td>Van Bibber</td>
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<td>121</td>
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<td>Win</td>
<td>MWF 11</td>
<td>Van Bibber</td>
</tr>
<tr>
<td>122</td>
<td>3</td>
<td>Spr</td>
<td>TTh 1:15-2:30</td>
<td>King</td>
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<td>Aut</td>
<td>MWF 11</td>
<td>Schawlow</td>
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<td>150</td>
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<td>King</td>
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<td>160</td>
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<td>161</td>
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130,131. Quantum Mechanics—Origins of quantum theory; Schrödinger equation, one-and three-dimensional applications; matrix formulation of quantum theory; perturbation theory; angular momentum and spin; addition of angular momentum and Clebsch-Gordan coefficients; one- and many-electron atoms, molecules; electromagnetic interactions; radiative transitions. 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.

132. Quantum Mechanics—Continuation of 130, 131. Symmetry transformations; rotations, tensor operators, Wigner-Eckart theorem; scattering theory; elementary particles and their symmetries; nuclear structure and reactions. Prerequisites: 130 and 131.

161. Intermediate Optics—Electromagnetic waves, superposition, interference, Fraunhofer and Fresnel diffraction, crystal optics, matrix optics, laser beams and resonators, guided waves, quantum aspects of light. Prerequisites: 122.

170,171. Thermodynamics, Kinetic Theory, and Statistical Mechanics—Derivation of laws of thermodynamics from basic postulates; determination of relationship between atomic substructure and macroscopic behavior of matter. Temperature, equations of state, heat, internal energy, entropy, reversibility, applications to various properties of matter, absolute zero and low-temperature phenomena. Distribution functions, transport phenomena, fluctuations, equilibrium between phases, phase changes, the partition function for classical and quantum systems, Bose-Einstein condensation and the electron gas. Cooperative phenomena including ferromagnetism, the Ising model and the lattice gas. Irreversible processes. Prerequisites: 55, or admission to Advanced Sequence, and Mathematics 130.

170. 3 units, Aut (Will)
171. 3 units, Win (Will)

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 (Staff) MWF 9

190. Independent Study and Senior Thesis—Experimental or theoretical thesis under supervision of a faculty member. Prerequisites: superior work as an undergraduate major, approval of the instructor, and of the Undergraduate Study Committee of the Department of Physics. (DR:X)

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, alternate years, given 1981-82


3 units, Spr, by arrangement alternate years, given 1980-82

200, 201. Advanced Physics Laboratory—Experiments in atomic physics, nuclear physics, solid state physics, low-temperature physics, optics, and particle physics. In 200 students are expected to do two of the standard experiments and to prepare a proposal for an "original" experimental project. The standard experiments include: Zeeman effect, isotope shift, electron spin resonance, Hall effect, superconductivity, alpha scattering, beta spectrum, and muon lifetime. In 201 students complete their experimental projects. Current student projects include: Brillouin scattering, anomalous Zeeman effect, parity non-conservation, and development of an x-ray microscope. Students are urged to take 200 no later than Autumn Quarter of their senior year and 201 no later than Winter Quarter of their senior year. Prerequisites: 100, 101, 105, 121, and 131.

200. 3 units, Aut (Schwarz) MWF 10

201. 3 units, Win (Schwarz) MWF 10

220-221. Classical Electrodynamics—Electrostatics and magnetostatics: conductors and dielectrics, magnetic media, electric and magnetic forces and energy. Maxwell’s equations: electromagnetic waves, Poynting’s theorem, electromagnetic properties of matter, dispersion relations, wave guides and cavities, magnetohydrodynamics. Special Relativity: Lorentz transformations, covariant, equations of electrodynamics and mechanics, Lagrangian potentials, relativistic Larmor’s formula, frequency and angular distribution of radiation, synchrotron radiation. Energy losses in matter: Bohr’s formula, Cherenkov radiation, bremsstrahlung and screening effects, transition radiation. Prerequisites: 122 or equivalent; Mathematics 106 and 132, or concurrent registration in Physics 210 and 211.

220. 3 units, Aut (Wagoner) MWF 9

221. 3 units, Win (Wagoner) 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, in-
230, 231, 232. Quantum Mechanics—First quarter reviews limits to classical physics and develops wave mechanics and the Schrödinger equation. Eigenvalues and eigenfunctions are found for simple systems such as the harmonic oscillator, the hydrogen atom, and periodic potentials. Formal developments include matrix mechanics, abstract Hilbert space, and operator methods. The quarter concludes with a discussion of measurement theory and summarizes the postulates of quantum mechanics. Second quarter includes approximation methods for bound states, two-body problem, scattering theory, time-dependent perturbation theory, and electromagnetic radiation. The third quarter continues with electromagnetic radiation including the Wigner-Weisskopf theory of the line width. The quantum theory of angular momentum includes spin, irreducible tensor operators, the Wigner-Eckart theorem, finite rotations, and multipole analysis of the radiation field. Continuous groups in quantum mechanics. Many-body systems are discussed including the Thomas-Fermi theory of atoms and Hartree-Fock theory. Periodic system of the elements. Selected topics in atomic and molecular physics. Prerequisites: 132 and 211, Mathematics 106 and 132, and preferably Physics 221.

230. 3 units, Aut (Serot)  
MWF 11

231. 3 units, Win (Serot)  
MWF 11

232. 3 units, Spr (Serot)  
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 1981-82

240, 241. Nuclear Physics—Strong, weak, and electromagnetic forces in nuclei; properties of nuclei; nuclear models, nuclear structure; nuclear reactions; constituents of nuclear matter. Prerequisites: 132 and 231, or equivalents.

240. 3 units, Aut (Hanna)  
TTh 10-11:15

241. 3 units, Win (Hanna)  
TTh 10-11:15

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 1981-82

251. 3 units, Spr  
Alternate years, given 1981-82

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

3 units, Spr (Will) 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 (Staff)  
Win (Staff)  
Spr (Staff)

330, 331, 332. Advanced Quantum Mechanics—Review of quantum mechanics and relativity. Second quantization, relativistic one-particle equations (Klein-Gordon and Dirac), canonical field theory, relativistic scattering theory. Second quarter includes quantum electrodynamics: applications, radiative correc-
tions, renormalization theory, the Lamb shift. Unified gauge theories of weak and electromagnetic interactions. Third quarter includes special topics such as symmetry principles, the Heisenberg representation, dispersion relations, current algebras and sum rules, phenomenological field theories, quantum chromodynamics, and grand unified gauge theories. Prerequisites: 211, 221, 232.

330. 3 units, Aut (Walecka) TTh 9-10:50
331. 3 units, Win (Walecka) TTh 9-10:50
332. 3 units, Spr (Walecka) TTh 9-10:50


330. 3 units, Aut (Walecka) TTh 9-10:50
331. 3 units, Win (Walecka) TTh 9-10:50
332. 3 units, Spr (Walecka) TTh 9-10:50

341, 342. Nuclear Theory—First quarter concerns properties of the nucleus and many-body theory of nuclear structure: nuclear forces, nuclear matter, neutron matter, equation-of-state, nuclear moments, shell-model, Hartree-Fock theory, pairing, collective particle-hole states, deformed nuclei, and nuclear rotations. Also theory of angular momentum, group theory of nuclear structure, quark theory. The second quarter concentrates on various interactions with nuclei: electromagnetic interactions, electron scattering, semileptonic weak interactions with nuclei (β-decay, μ-capture, and neutrino reactions), weak-neutral current effects, muonic x-rays, hadronic scattering, including pion-nucleus interactions, theory of the optical potential, isobars, in nuclei, heavy-ion interactions, and nuclear reactions and symmetries. Special topics in intermediate-energy nuclear physics. Prerequisites: 232, 241, 340. Concurrent or prior registration in 331, 332 is recommended.

341. 3 units, Win, alternate years, given 1981-82
342. 3 units, Spr, alternate years, given 1981-82


351. Elementary Particle Theory—K-meson decays and CP non-conservation—pheno-

385. Long Range Order in Solids—(Enroll in Applied Physics 385.)

389. Research Orientation—The purpose of this course is to allow students to become fami-
lier with the activities of one or more research
groups, within the department or outside. Reg-
istration 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 distin-
guished 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 supervi-
sion of a faculty member outside the depart-
ment, Physics Graduate Study Committee ap-
proval is required.

Any quarter, (Staff) by arrangement

PROGRAMS OF STUDY

BACHELOR OF ARTS

MAJOR IN POLITICAL SCIENCE

The minimum requirements for recommenda-
tion for the degree of Bachelor of Arts with
political science as the major are:
1. The completion of 45 units of political sci-
ence, including:
   a) A minimum of 25 units of work taught by
      the Department of Political Science fac-
      ulty, whether teaching here or at an over-
      seas campus.
   b) An advanced course or seminar (num-
      bered 100 or above) in at least three of the
      following fields: public administration and
      public policy, comparative politics, inter-
      national relations, political theory, Ameri-
      can politics.
   c) At least one seminar, which may be
      counted toward fulfillment of b), above.
2. 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.
Directed reading, however, may not be used to
fulfill a field requirement. Courses used to fulfill
the major requirement must be taken for stand-
ard letter grades, although courses in excess of
the required 60 units may be taken on a pass/no
credit basis.

MAJOR IN POLITICAL SCIENCE
(CONCENTRATION IN PUBLIC POLICY)

The student who wishes to pursue a program
of interdisciplinary study with a focus on public
policy may elect a Concentration in Public Pol-
icy within the Political Science major. The pro-
gram will introduce the student to political and
economic institutions and processes, to analyti-
cal techniques, and to substantive courses in
public policy. All of the requirements of the
Political Science major must be met. A detailed
statement of the requirements of the program
can be obtained in the department office.

HONORS THESIS PROGRAM
IN POLITICAL SCIENCE

The honors thesis program offers qualified
students an opportunity to conduct independ-
ent research, and to write a thesis of superior
quality summarizing the results of their re-
search. The program provides for close contact
between students and their advisors, so that
students can receive intensive guidance and as-
sistance 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 letter grade equivalent of 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. Honors work done for credit (Political Science 199) may not be counted toward the required 45 units in Political Science, but may be counted as all or part of the additional 15 units which relate to the student's interest in Political Science.

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. Applicants whose native language is not English or who have not studied in an English-speaking country for at least one and a half years must take the Test of English as a Foreign Language (TOEFL). For details concerning these tests, 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 application deadline is January 15. Admission is offered for the Autumn Quarter only. The department expects all students to pursue a full-time program 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. There is no financial aid available to applicants for the A. M. program. The A. M. degree may be pursued as part of a joint degree program with one of the professional schools within the University. The student should apply for admission to the A. M. program in Political Science during the autumn of the first year in the professional school within the University.

Terminal A. M. students and doctoral candidates will be awarded the degree when they have completed the following requirements: completion of at least three quarters of residency 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 at least two graduate seminars in each of two fields and at least one graduate seminar in a third field. Of the remaining 20 units, not more than ten units of work from related departments may be accepted in lieu of a portion of the work in political science. Courses must be numbered above 100, and a grade of "B" or better must be attained in each course.

The University's basic requirements for the Master's degree are discussed in the "Degrees" section in this bulletin. Students receiving the A. M. degree from Stanford are not given preference for admission to the Ph. D. program. They must apply for admission in the regular manner, and are subject to the same selection process as other applicants. The department does not offer a coterminous Bachelor's and Master's Degree program.
The Ph. D. candidate is required to demonstrate competence in a language or a skill that is likely to be relevant to his or her dissertation research. Competence is required in:

a) a foreign language; and/or
b) a skill or skills such as statistics, mathematics for social science, computer science, interview techniques or historiography.

The level of competence needed for successful completion of the research shall be determined by the student's advisor. In consultation with the advisor, the student shall propose a program of preparation in a language and/or relevant research skill. In some cases, it may be necessary for the student to show competence in both a language and relevant research skills.

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.

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 taken and those planned to be taken to cover those 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.

At a regular meeting of the department faculty, it will be reviewed, and, if approved, filed with the Graduate Secretary. 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; and to facilitate assessment of progress toward the degree.

Following the plan outlined in (4), when both the student and the advisor feel that he or she is ready, the student will take one or more comprehensive examinations. Students may take these examinations either simultaneously or singly in different examination periods. Examinations are given in the third week of the Autumn and Winter Quarters, and late in the Spring Quarter. Students should normally expect to complete these examinations by the end of their second year in residence.

During a student's sixth quarter, he or she will file an Application to Candidacy for the Ph. D., which encompasses concrete course plans and records. This document, along with a student's examination performance, will be reviewed by the faculty at a regular
meeting. If it is approved, a student will then be advanced to candidacy.

7. During the third year, a formal dissertation proposal will be submitted by the student to his or her thesis committee of three faculty members including the principal advisor. The faculty will review these proposals. A list of students, their proposals, and their thesis committees will be circulated to the faculty, who will be asked to comment.

8. A candidate for the Ph. D. in Political Science is required to serve as a teaching assistant in the department for at least two quarters before a Ph. D. can be granted. The department considers teaching experience an essential part of the Ph. D. program. It is not recommended that this requirement be satisfied during the candidate’s first year of graduate study, but the requirement will normally be satisfied by the end of the candidate’s third year.

9. 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.

10. The candidate shall pass the University Oral Examination on the area of the dissertation, at a time after the passing of the written comprehensive examinations suggested by the candidate’s dissertation committee.

11. The candidate shall complete a dissertation satisfactory to the Dissertation Reading Committee and the University Committee on Graduate Studies.

PhD 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 a program of study for approval. Written approval for the program must be obtained from the Director of Graduate Studies before application for doctoral candidacy. 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, in separate fields of political science, must be 200-level and above. All grades must be of “B-” or better. Candidates will be examined in their fields in the general oral examination, by a member of the Political Science Department, chosen in consultation with the Director of Graduate Studies.

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 an introductory Political Theory course, 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)


5 units, Aut (Sniderman)
10. American National Government—Constitution; civil liberties and civil rights; political socialization, ideology, participation, parties, and elections; the President, Congress, the Supreme Court, and the bureaucracy; public policy and policy analysis.
5 units, Aut (Daneski)

35. How Nations Deal With Each Other—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)

44. Seminar: The American Presidency in Contemporary Context—(Same as Sophomore Seminar 55.) The seminar will consider the state of the Presidency in the contemporary era. The effects of Watergate and Vietnam on the conception of the Presidency will be considered. The nature of presidential power and the tasks of presidential leadership will be analyzed. Each student will write a substantial research paper on some aspect of the Presidency. There will be a number of readings that will serve as the basis for seminar discussion and also provide concepts and theories that should be helpful in the selection and writing of the research papers. (DR:S)

70. Politics and Public Policy—This course presents a broad historical look at national public policy-making from the New Deal to the present. Competing theories about the rise and development of liberal democratic capitalism are assessed within the general context of domestic policy-making by Congress and the Presidency. Special attention is paid to the role of the national government in the modern American political economy through the examination of selected public policies dealing with employment, economic development, social welfare, and equality.
5 units, Aut (Manley)

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

5 units, Spr (March)

103. Class and Politics—(Same as Sociology 147.) A discussion of the relationship between class and politics which will deal with parties, social movements, voting behavior, class organizations and power. The course will treat the applicability of different classical, social class theories, e.g., Marx, Weber, Durkheim, to contemporary political analysis.
5 units, Win (Lipset)

PUBLIC ADMINISTRATION AND PUBLIC POLICY

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.

105. Introduction to Models in the Social Sciences—(Same as Sociology 171 and Education 110.) Models of choice, exchange, transition, adaptation, and diffusion are used to predict and interpret human behavior. Emphasis is placed on the invention and application of models more than the testing of them. Pre-mathematical rather than mathematical.
5 units, Aut (March)

106R. Regulation, Welfare and Public Policy—(Same as VTS 150 and 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 environmen-
tal protection. In addition, the role of the courts in controlling administrative discretion will be explored.

4 units, Spr (Rabin)

107. Organizational Decision Making—(Same as 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.

5 units, Win (March) given 1981-82

109. Directed Reading in Public Administration—Advanced individual study in public administration. (DRX)

Any quarter, (Staff) by arrangement

COMPARATIVE POLITICS

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.

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)

113A. The Politics of Development in Latin America—Survey course on the principal political systems of Latin America. Deals with the three largest countries (Brazil, Mexico, Argentina) and the major socialist country (Cuba).

5 units, Win (Packenham)

113C. State and Society in Latin America—Patterns of relations between political authority and social groups 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 in 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, the succession to Mao Tse-tung, and China's political development.

5 units, Win (Harding)

117G. Government and Politics in Austria—Austrian politics is presented within a general framework as an example of a smaller European democracy. Its possible model character as a consociational system is stressed. Topics include development, societal and economic bases, international setting, interests and institutions, policy processes, achievements.

5 units, Spr (Gerlich)

118A. Political Change in Tropical Africa—Examines the colonial situation, the growth of nationalism, the achievement of political independence, ethnic patterns in new states, civil and military leadership, the role of party and bureaucracy, problems in development planning, and cases of cooperation and conflict among African states.

5 units, Aut (Abernethy)

118B. Southern Africa: Race, Class, and Political Change—Examines the political history of the region's ten countries, with special attention to relations among racial and ethnic groups. Analyzes diplomatic economic, and military interactions among these states. Studies the impact on southern Africa's politics and economic development of movements, corporations, states, and international organizations based outside the region.

5 units, Win (Abernethy)

118G. Politics and Policy Making in Western Europe—After a brief introduction to comparative analysis, the political institutions of six Western European countries (Austria, Germany, Britain, Sweden, France, Italy) are described. To show these institutions in action, trends in taxation, industrial regulation and welfare policies are analyzed. The concluding discussion speculates on future trends of European politics.

5 units, Win (Abernethy)

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, Aut (Lewis)

119. Socialism in Latin America—An examination of 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.
3 units, Spr (Dattin) given 1981-82

122. Seminar: Modernization and Democracy in Asia—Focus will be on patron-client systems in Asia and their implications for the modernization process and the viability of democratic politics.
3 units, Spr (Ike)

123D. Culture and Society in Latin America—(Same as Latin American Studies 80 and History 80.) An interdisciplinary course which surveys the interaction of Amerindian, African, and European cultures in the creation of the New World societies from 1500 to the present. The course is organized into four major topic areas: migration and culture contact, agrarian systems and agrarian changes, urban dominance and innovation, and relations between states and society. This is a basic introduction to courses of several departments in the Latin American field.
3 units, Aut (Durham, Wirth)

125F. Seminar: Development and the International System—Focus on external constraints on development in the Third World, and the interaction between national and international factors. No formal prerequisites, although previous work in International Relations, Economics, and/or Political Science is highly recommended.
3 units, Win (Fagen) given 1981-82

128G. Government and Politics in France—An overview of the contemporary French political system, with particular emphasis on the historical background and sociocultural context of politics in France and on the roles of interest groups, parties, leadership, and the bureaucracy in the policy-making process of the Fifth Republic.
4-5 units, Win (Meyers)

129. Directed Reading in Comparative Politics—Advanced individual study in comparative politics. (DRX)
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.

131. International Dependence—What is meant when we say that one state is dependent upon another, more powerful state? What are the implications of a dependent 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, France-Senegal, and the Soviet Union-Czechoslovakia. Desirable prerequisite: Political Science 35.
3 units, Win (Fagen) given 1981-82

132. International Communism—(Same as History 123B.) 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.
3 units, Spr (Abernethy)

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. Prerequisite: Political Science/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)

136C. The Soviet Union and the Role of Force in International Politics: Soviet Security Policy, 1953 to the Present—Provides a comprehensive overview of Soviet security and military policies from the death of Stalin in 1953 to the present. The course begins by examining Soviet attitudes toward a range of relevant issues, including: the utility and limitations of the use of force in the international environment; the character, likelihood and feasibility of general and limited nuclear war in the contemporary period; the notion of war as an instrument of national policy; the role of military power in influencing and/or determining the outcome of international political conflicts; the relationship between political and military power; the nature of the struggle between the capitalist and socialist world systems; and the importance of perception in the formulation and conduct of Soviet security and military policies. The second half of the course focuses on Soviet security policies in four specific geographic contexts: the Soviet-American strategic relationship; Soviet security policy in Europe; Soviet security policy in Asia; and the projection of Soviet military/political power in the Third World.
5 units, Spr (Blacker)

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)

137Y. American Foreign Policy—A survey of U.S. foreign policy in the post-World War II era. Analysis will focus on the process of policy making as well as American involvement in substantive issue-areas; an examination of strategic doctrines, foreign economic policies, and alliance politics; the dilemmas of power in a changing international system. Limited enrollment. Prerequisite: P.S. 35.
5 units Win (Yoffie)

138A,B. Arms Control and Disarmament—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, Blacker)
138B. Seminar: Arms Control
5 units, Spr (Blacker)

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, Spr (Harding)

139A,B. Japanese Foreign Policy—Analysis of the postwar evolution of Japanese foreign policy in terms of historical background, external environment, and domestic institutions. Construction of an analytic framework first term; application of that framework to concrete cases, the second term.
139A. 5 units, Aut (Okimoto)
139B. 5 units, Win (Okimoto)

140A,B,C. Ethics of Development in a Global Environment (EDGE)—(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 graduates and undergraduates, appropriate to both foreign and American students. 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. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures analyzed in terms of appropriateness to development in both less developed and industrialized societies. Addresses need for linkage between the necessary specialization of academia and the inherently interdisciplinary
and problem-oriented nature of our living societies. Development strategies viewed with recognition of need for improvement in quality of life within nations and among nations while also recognizing limitations of the earth’s physical life support system and constraints in our cultural systems. 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 including country case studies. Spring: The individual and social change; the engineer, political scientist, educator, etc., as designer of alternatives and as policy and decision-maker. Lectures, discussion, workshops. (DR:X)

140 A, B, C. 1-4 units, Aut, Win, Spr
(Cooper, Fagen, Fuenzalida, Lusignan, McWhorter, Siegel, Textor) Lectures M 7:30-9:30 p.m. and groups by arrangement

142D. Seminar: Political and Ethical Dimensions of Foreign Aid—Uses general and case study materials to examine characteristics of bilateral and multilateral “official development assistance”; trends in its volume and composition; the complex relationship between aid providers and recipients; ethical problems raised when one allocates, monitors, and evaluates impact of development assistance. Special attention to famine relief operations in Africa and Asia.
5 units, Win (Abernethy)

143. Seminar: Political Economy of U.S.-Latin American Relations—A seminar in which participants prepare and present materials on one of a number of problem-cases in U.S.-Latin American relations. Special emphasis on the U.S. and Mexico. No formal prerequisites, although previous work in U.S. foreign policy and/or Latin America is helpful.
5 units, Spr (Fagen) given 1981-82

144L. Seminar: The Origins of the Cold War, 1941-1947—This seminar will evaluate competing historical interpretations of the origins of the Cold War—orthodox, realist, domestic politics, revisionist, psychological—to illuminate the current debate over Soviet foreign policy intentions and America’s role in maintaining world order. Prerequisite: P.S. 35
5 units, Spr (Larson)

145L. Seminar: Paradoxes of Power: U.S. Foreign Economic Policy in the Postwar World—The seminar will focus on some major issues of U.S. foreign economic policy since 1945 with an emphasis on policy assessment. Prerequisite: P.S. 35.
5 units, Aut (Cahn)

146D. Soviet History and Politics Since 1917—(Same as History 326.)
5 units, Win (Dallin) given 1981-82

148. Colloquium: The Soviet Union and the United States: The Twentieth Century—(Same as History 220.) Soviet-American relations, focusing on both continuities and changes over time, historical roots, alliance systems, the role of ideology, and the “national interest.” Assignments will include different interpretations of the relationship, with attention to the strategic balance, mutual perceptions, conflicts over third areas, the role of domestic factors in shaping foreign policy, and conflict management.
5 units, Win (Dallin)

149. Directed Reading in International Relations—Advanced individual study in international relations. (DR:X)
Any quarter (Staff) by arrangement

POLITICAL THEORY

150. Ancient and Classical Political Thought—From the beginnings of political speculation in preliterate societies to the Stoics; Greek thinkers will be emphasized. (DR:A)
5 units, Aut (Drekmeier)

151. Roman, Christian and Medieval Political Thought—Jewish and Hellenistic influences on Christian ideas about society and government (Roman law, Augustine, Church-state relations, consiliar and other reform movements). (DR:A)
5 units, Win (Drekmeier)

152. Political Thought: Machiavelli to Rousseau—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, Win (N. Keohane)

153. Political Thought: The Modern Period—The organizing theme for readings and discussions will be theories of revolution, and analysis of the consequences of revolutions, in large modern states. The American, French and Russian revolutions, and some of the most import-
ant social theories written in connection with these events, will be our primary material. Theorists studied include the Federalists, Tocqueville, Burke, Marx, Lenin, Fourier, Bakunin and Luxemburg. (D.R.A)

5 units, Spr (N. Keohane)

157. Feminist Theory—A course in nineteenth and twentieth-century feminist philosophy and political analysis, which explores several theoretical approaches to understanding the situation of women past and present. Among the authors read: John Stuart and Harriet Taylor Mill, Marx and Engels, Charlotte Perkins Gilman, Virginia Woolf, Simone de Beauvoir, Mary Daly, Juliet Mitchell, Adrienne Rich. Special topics (motherhood, women and nature, women and work, feminist utopias) can be pursued in research papers, and in discussions in small collectives. (D.R.A)

5 units, Aut (N. Keohane)

162. Thought and Action—This seminar is concerned with the relation between knowing and doing, and making and doing; it ranges from the ideological presuppositions of psychological theories, the nature of revolutionary consciousness, the various types of knowing and types of ideology, to the responsibilities of science and the role of knowledge as a factor of a production. (D.R.A)

5 units Win (Drekmeier)

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. (D.R.A)

162A. 5 units, Win (Rogat)

162B. 5 units, Spr (Rogat)

169. Directed Reading in Political Theory—Advanced individual study in political theory. (D.R.X)

Any quarter, (Staff) by arrangement

AMERICAN POLITICAL

180. 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; emphasis on the politics of constitutional change. Prerequisite: third-year standing.

5 units, Aut (Danelski)

180C. Introduction to Public Policy Analysis—Introduction to descriptive and explanatory policy analysis organized around major policy processes: formulation, adoption, implementation and evaluation. Substantive focus on energy, the environment and the economy.

5 units, Spr (Chubb)

POLITICAL SCIENCE 489


5 units, Spr (Horn)

183. Civil Liberties In The United States—Civil Liberties in contemporary American culture; theory and history underlying them. Freedom of thought, speech and press; religious liberties and separation of church and state; rights of women and minority groups. Pre-requisite: third-year standing.

5 units, Win (Danelski)

183K. The Criminal Law and the Criminal System—(Same as Law 107 and Sociology 109.) 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)

183F. The Development of American Law—(Same as American Studies 171 and Law 105.) 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)

187P. The Social Sciences and Educational Analysis: Introduction the the Politics of Education—(Same as Education 220B.) 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. Application to educational settings and problems emphasized.

4 units, Win (Peterson) MW 11-12:30, and by arrangement

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?

190A. 5 units, Win (Sniderman)

190B. 5 units, Spr (Sniderman)
192. Seminar: Interest Groups and Political Parties—Thorough introduction to these two major forms of political organization, structured around themes of decline of parties and rise of interest group power. Topics include parties and policymaking, nominations and campaigns, money and politics, single interest politics, party realignment, and “interest group liberalism.”

5 units, Spr (Chubb)

192K. Seminar: The Military in Politics—Alternative explanations for coups and evaluation of the performance of military regimes in Latin America, Africa, and Asia. Exploration of the role of the American military in foreign policy-making, domestic economic development and race relations; the consequences of the Vietnam War for civil-military relations; and the controversies surrounding the draft. Readings will be drawn from widely divergent perspectives, both military and civilian.

5 units, Win (Knight)

195. Research Seminar: The 1980 Presidential Primaries, Conventions and Election—Intensive state-level analysis of the 1980 Presidential selection process; the cumulative effect of primaries as screening devices; comparison with caucus delegate selection; impact on national conventions; role of public opinion polls; the November election as culmination of state-level processes and their interactions. Prerequisite: third-year standing (open only to undergraduates).

5 units, Aut (Eulau)

197. British Origins of American Political and Legal Institutions—(Same as American Studies 215.) A seminar that examines the British and colonial origins of basic American political and legal institutions to ascertain and account for their peculiarly American features.

5 units, Win (Danski)

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—Applied introduction to quantitative methods for the analysis of political data. Topics include measurement, nominal and ordinal level analyses, research design, hypothesis testing, multiple regression and causal models. Lectures supplemented by computer usage and actual data analysis.

5 units, Win (Chubb)

205. Seminar: Topics in Political Sociology—(Same as Sociology 241.) This seminar will focus on analyses of social movements in the United States and abroad, dealing with different varieties of political movements.

5 units, Spr (Lipset)

PUBLIC ADMINISTRATION

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, Spr (Marshall)

209. Directed Reading in Public Administration—(DR:X)

Any quarter, (Staff) by arrangement

COMPARATIVE POLITICS

213P. Theories of State-Society Relations in Latin America—Dependencia, bureaucratic-authoritarianism, new authoritarianism. Corporatist, organo-statist, and other writings are given special attention.

5 units, Win (Packenham)

214. Theories of Fascism: Prewar Japan—Examination of the economic, political, social and cultural causes of what is called “fascism” in prewar Japan. Emphasis on critical evaluation of theoretical concepts.

5 units, Spr (Okimoto)

215A, B. Capitalism and the State in Japan—Study of the role of state and private enterprise
in Japan’s capitalist economy. Coverage of the international economy, political and economic institutions, policies and practices, and performance. First term, readings; second term, research paper.

215A. 5 units, Win (Okimoto)
215B. 5 units, Spr (Okimoto)

216R. Seminar: Theories of Political Modernization and Development—Various modes of defining, explaining, and evaluating political modernization and development in national units. Liberal, radical, and conservative approaches are considered.
5 units, Aut (Packenham)

220C. Seminar: Legislatures in Comparative Perspective—Development and activity of modern parliaments, interaction with their environment. Topics include: the institutionalization of parliaments; institutional arrangements; legislators: background, roles and behavior; activities and functions of parliaments.
5 units, Win (Gerlich)

5 units, Spr (Ward)

224. Latin American Dependency—Assessment of fundamental concepts and theoretical frameworks, single country case studies, and research and political strategies regarding dependency in Latin America.
5 units, Spr (Packenham)

225. Colloquium in Chinese Politics—A critical survey of the principal literature on leadership, organization, key policy issues, and political development in the People’s Republic of China. Prerequisite: 115 or the equivalent.
5 units, Spr (Packenham)

227. Seminar: Public Policy in African States—Examines the determinants of public policy formation and implementation in selected African states, with special attention to the role of non-African actors such as multinational corporations, aid agencies, and military missions.
5 units, Spr (Abernethy)

229. Directed Reading in Comparative Politics. (DR:X)
Any quarter, (Staff) by arrangement

INTERNATIONAL RELATIONS

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.
5 units, Win (Ward)

236. Research on Force and Diplomacy—This research seminar is designed largely for graduate students (upper-level undergraduate students with consent of instructor after interview). The seminar will include lectures, readings, discussion, and a research workshop. The seminar will focus on ways in which historical studies can be utilized for developing policy-relevant theory. The types of problems having to do with force and diplomacy that will be examined include the following: deterrence, coercive diplomacy, crisis management and escalation control, war termination, detente, crisis prevention, and negotiation.
5 units, Spr (George)

239. Colloquium: Chinese Foreign Policy—A critical survey of the principal literature on China’s international behavior and foreign policy-making process. Particular emphasis will be placed on the basic sources of China’s foreign policy and China’s relations with the United States, the Soviet Union and Asia. Prerequisite: consent of the instructor.
5 units, Win (Harding)

241. Seminar: International Political Economy—An analysis of how the world economy, and the international political system, are related to one another. Emphasis on theoretical approaches and historical analysis of the period between the mid-19th Century and 1971. A basic working knowledge of economics (at least the equivalent of Economics 51-52) is necessary, as well as some background in the study of world politics.
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, Win (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.
5 units, Spr (North)

249. Directed Reading in International Relations. (DR:X)
Any quarter, (Staff) by arrangement
POLITICAL THEORY

254. Essentials of Political Theory—(Same as Modern Thought and Literature 250.) Methods, concepts, concerns of political theory; its relation to science and philosophy. (DR:A)

5 units, Aut (Drekmeier)

255. Concepts of the State and the Public Realm—The most influential modern ideas of the function of the state and its relation to the larger social order. Theories of power and authority associated with these conceptions, with emphasis of the private/public discussion in recent social science literature. (DR:A)

5 units, Spr (Drekmeier)

257. Women, Power and Transcendence—A second look at The Second Sex, and other major writings in contemporary feminist theory, with specific attention to questions about women and authority, coercion, and creativity. Open to graduate students and to undergraduates who have already had a course in feminist theory. Preference given to those who help organize the collective discussion seminars for Political Science 157, Feminist Theory. (DR:A)

5 units, Aut (N. Keohane)

266. Political Science in Political Philosophy: Aristotle, Machiavelli, Hobbes—An analysis of the work of three major political theorists, each of whom has been regarded, by himself or by others, as "the first political scientist." Their methods, beliefs about their purposes and achievements, and statements on crucial questions in political theory will be compared and criticized. The seminar is designed especially for graduate students who want to develop some acquaintance with the teachings of important political thinkers of the past; it will also serve the needs of those who plan to take the examination in political theory. Exceptionally well-qualified undergraduates may be admitted with the consent of the instructor. (DR:A)

5 units, Win (N. Keohane)

267. Rousseau, Hegel, and Marx—Three seminal social thinkers, three very different modes of political analysis, and the opportunity to come to grips with some of the central issues in modern political thought: nature and human nature, the economic and social roots of alienation, the individual in the community, theories of power and social change, the development of dialectic. (DR:A)

5 units, Win (N. Keohane) given 1981-82

269. Directed Reading in Political Theory. (DR:X)

Any quarter, (Staff) by arrangement

AMERICAN POLITICS

284A, B. Seminar: Public Opinion and American Democracy—The late 1960s saw the explosion of dramatic and divisive issues—the Vietnam war, the activation of the disadvantaged, the near impeachment of a President. The purpose of this course is to discover telltale changes in public opinion, to contrast the recent years of conflict and uncertainty with the comparatively placid and predictable 1950s. Have Americans become increasingly militant and ideological? Is there a widening fissure between generations? Have Americans strengthened their attachment to the basic values of a democratic society, such as tolerance, or has their commitment weakened or narrowed under stress? This course will attempt to answer questions such as these as much by original inquiry as by literature review.

284A. 5 units, Aut (Sniderman)

284B. 5 units, Win (Sniderman)

289P. Urban Policy-Making in the Federal System—(Same as Education 323A.) The formulation and implementation of federal policies in urban contexts, analyzing the way features of local politics affect national programs. Comparisons of education with other policy arenas.

4 units, Spr (Peterson)

293A, B. Seminar: Politics, Analysis and Public Policy—An advanced exploration of the role of political analysis in understanding public policy. The course will focus sequentially on: political theories of policy making, the politics of policy processes, and a political critique of formal analysis. Students should plan to take both quarters of the seminar, but credit for 293A alone may be arranged. Recommended preparation: P. S. 180C

293A. 5 units, Aut (Chubb)

293B. 5 units, Win (Chubb)

298. Directed Reading in American Politics. (DR:X)

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, Spr (George)

306. Seminar: Advanced Organization Theory—(Same as Sociology 365.) Topics in organization theory for advanced students. Prerequisite: permission of instructor.

5 units, Aut (March)

313. Seminar: Development and the International System—Participants will address a number of key issues raised by external constraints and influences on development in the Third World. Emphasis is on the interaction between national and international factors.

5 units, Win (Fagen)

325. Research Seminar: The Chinese Political System—Participants will examine the roles of leadership, law, and the existing political and economic systems in China's effort to modernize. Special emphasis will be placed on methods used to reform administrative and economic organs, to enhance systematic performance, and on the social limits to politically-induced change. Prerequisite: consent of the instructor.

5 units, Aut (Lewis, Li, Fingar)


5 units, Aut (Ike)

326B. Seminar: Research on Soviet Politics and Society—(Same as History 419.)

5 units, Win (Dallin)

380. Seminar: Contextual Analysis—Review of contextual analysis in social and political science during last twenty-five years; problems of aggregation and disaggregation; units and levels of analysis; implications of unit properties (distributive, emergent, integral) for analysis and inference; examples from different levels of political integration (international, national, sub-national, group); reading and discussion of relevant theoretical, methodological and empirical studies. Prerequisite: permission of instructor.

5 units, Spr (Eulau)

400. Seminar: Introduction to Methods of Political Science—An overview of methodological issues in political science: of problem and solution; of induction and deduction; of cause and effect; of reliability and validity; of time and change; of units and levels; of quality and quantity; of structures and functions; of fact and value; of knowing and the known, Pre-

requisite: graduate standing; recommended to all graduate but especially entering students.

5 units, Aut (Eulau)

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**PSYCHOLOGY**

Emeriti: Edith M. Dowley, Ernest R. Hilgard, Douglas H. Lawrence, Quinn McNemar, Lois Meek Stolz, Robert R. Sears (Professors)

Chairman: Gordon H. Bower

Vice Chairman: J. Merrill Carlsmith


Associate Professors: Mark R. Lepper, Lee D. Ross, Jeffrey J. Wine

Assistant Professors: Irvin Brown, S. Shirley Feldman, Ellen Markman, Brian A. Wandell

Senior Lecturers: Lyn Carlsmith, Harriet N. Mischel, Barbara Tversky


**OFFERINGS AND FACILITIES**

The Department of Psychology comprises facilities and personnel housed in Jordan Hall, where it maintains extensive laboratory and shop facilities. Several of the laboratories are equipped with computers and others are linked directly to the University's Computer Center. The department maintains a nursery school close to the Escondido married students' housing area. This provides a laboratory for child observation, for training in nursery school practice, and for research.

The department provides: (1) courses designed for the general student; (2) a major pro-
gram 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, 106, 107, 108, 109, 110, 120, 146, 147, 163, 164
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 or her specialized interests with the body of basic general psychology essential for all students who are undertaking concentrated study in the field. The Program includes arrangements for continuous supervised research activity during the student's senior year. At the end of the year, the student will submit a written report of his or her research, as a thesis.

ADVANCED DEGREES

There are no specific course requirements for admission to the doctoral program. However,
an applicant should have research experience as an undergraduate, as well as the equivalent of an undergraduate major in psychology. The major focus of the doctoral program is on research training, and admission is highly selective.

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).

MASTER 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 152 must be selected as well as two other courses from the content areas, one to be selected from 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 (Pro-seminar for First-Year Graduate Students), 152 (Analysis of Data), and 153 (Statistical Theories, Models and Methodology). 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

209. Perception
210. Cognitive Psychology
214. Psycholinguistics
215. Mathematical Psychology

Group S

211. Advanced Developmental Psychology
212. Social Psychology
213. Personality
216. Abnormal Psychology
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 or her 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.

PhD MINOR IN 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 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 do not exist in the abstract; they are ways of behaving with the people or animals who are being studied. They are skills, and they require guided practice for their perfection. Students are provided with whatever opportunities they need to reach those levels of competence representative of doctoral standing. Continuing research programs, sponsored by members of the faculty, offer direct opportunities for experience in the fields represented by the faculty's 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 or 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 holding teaching assistantships 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 the 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 displayed upon entrance, he or 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, 1981.

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 (Kasschau) MWF 10
   Win (Kasschau) MWF 10
   Spr (B. Tuersky) TTh 11-12:30

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, Spr (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) NOTE: Students who receive credit for Psychology 60, will not be given credit for Statistics 60.
   5 units, Aut (Carlsmith)
   MTWThF 1:15-2:05
   Win (Thomas) MTWThF 9
   Spr (Horowitz) MTWThF 9

80. Applications of Social Psychology—This course surveys the application of social psychological theory and research to a variety of issues and problems, including the following: evaluating the impact of social interventions, strategies and shortcomings in personal and social decision making, effects of mass media and other sources of social persuasion, applications of social psychology in legal, medical, educational, and business settings. Prerequisites: 1 and 60, or permission of instructor (DR:S)
   4 units, Spr (Carlsmith, Hastorf, Lepper and Ross) MWF 10

102. Perception—A discussion of how our senses both limit and augment our experience of the world around us. Topics will include the perception of color, sound, pain, and smell. Includes a laboratory section to be arranged. (DR:T)
   4 units, Aut (Wandell) MWF 11

104. Special Laboratory Projects—Independent study. Offered for pass/no credit. Can be
106. **Introduction to Cognitive Psychology**—A survey and analysis of the major topics in cognitive psychology, including perception, memory and thought, with an emphasis on contemporary research and theory. Prerequisites: Psychology 1 and 60. (DR:S)

4 units, Spr (Kasschau) TTh 11-12:30

107. **Introduction to the Nervous System**—A survey of neural interactions underlying behavior. Prerequisite: 1 or equivalent and elementary biology. (DR:T)

4 units, Aut (Wine) MWF 10

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

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 10 offered 1981-82

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. (DR:S)

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 (Maccoby, Markman) MWF 11

114. **Exceptional Children**—The study of children who deviate markedly in respect to mental, emotional, or social development. (DR:S)

4 units, Spr (Staff) TTh 4:15-5:05 offered 1981-82

115. **Social Development**—The child’s acquisition of social knowledge and skills is traced and organized theoretically. The period covered ranges from birth to sexual maturity or adolescence. Topics include: early attachment and the development of affection, the development of emotions and the role of other human beings in the process, the development of social attitudes, roles and values, the role of television in social development, and, lastly, the development of individuated identity. Special attention will be devoted to the question of motivation throughout the period of development. (DR:S)

3-4 units, Win (Lepper) TTh 10-11:30

117. **Observation of Children**—Enrollment limited to 16. Prerequisites: 111 or equivalent, and consent of instructor. (DR:S)

3-5 units, Aut, Win, Spr (Young-Holt) T 2:15-4:05 and by arrangement

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:S)

118A. **Teaching Strategies**—Seminar discussions focus on the ecology of the classroom— influences of physical arrangement of the classroom on learning—teacher roles, effect of different teaching strategies, teacher communication styles, and assessing teacher behaviors. (DR:S)

4-5 units, Aut (Young-Holt) Th 2:15-4:05 and by arrangement

118B. **Curriculum Development**—Seminar discussions focus on the identification, development, and assessment of curricula materials. (DR:S)

4-5 units, Win (Young-Holt) Th 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:S)

4-5 units, Spr (Young-Holt) Th 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. Prerequisite: Psychology 1. (DR:S)

3 units, Win (Markman) MW 1:15-3:05

121. **Social Psychology**—The study of interpersonal behavior. A survey of relevant research concerning attitudes, groups, person percep-
tion, and selected topics in social psychology. Prerequisite: 1 or equivalent. (DR:S)

3-4 units, Win (Ross) MW 1:15-3:05

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 1:15-2:30

126B. Seminar in the Psychology of Black Experience—(Graduate students register for 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) W 2:15-5:05

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)

3-4 units, Win (H. Mischel) TTh 11-12:30

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)

4 units, Spr (W. Mischel) TTh 1:15-2:45

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. Abnormal Psychology: A Clinical Perspective—This course examines the role of interpersonal problems and interpersonal processes in producing different forms of psychopathology, ranging from neurotic reactions to schizophrenia. It combines the clinical (case study) approach with the usual empirical approaches to clarify the origin, nature, and treatment of emotional disorders. Prerequisite: Psychology 136. (DR:S)

3 units, Win (Horowitz) WF 11-12:30


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

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:S)

3 units, Aut (Hastorf) TTh 11:00-12:15

141A. History of Psychology Discussion Section—Optional supplement to Psychology 141. (DR:X)

1 unit, Aut (Hastorf) by arrangement,

142. Undergraduate Seminar: Research Methods in Applied Settings—A survey of experimental and quasi-experimental research techniques in non-laboratory settings. Emphasis on policy-oriented research. Students will be expected to design a research project in some setting with which they are familiar. Pre-
requisites: Psychology 60 or equivalent. Prior or concurrent registration in Psychology 184 or equivalent field experience. (DR:S)

3 units, Win (Carlsmith) MW 1:15-2:30
alternate years, given 1981-82

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. (DR:S)

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

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

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, Spr (Gage) MW 3:15-5:05

146. Language and Thought—(Same as Linguistics 170.) 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, Aut (H. Clark) MWF 1:15

147. Animal Behavior: Neurobiological Aspects—Ethological studies of behavior with an emphasis on understanding the physiological substrates. Prerequisites: Psychology 107, 108, or 109, or Biology 22, or Human Biology 3A. (DR:T)

4 units, Win (Wine) MWF 10
alternate years, given 1981-82

150. Drugs and Behavior—An introduction to behavioral pharmacology, which will consider the effects and mechanisms of action of major classes of psychoactive drugs. Prerequisites: 1 and 60; prior exposure to physiology recommended. (DR:T)

4 units, Spr (Weinberger) by arrangement

152. Analysis of Data—Exploratory data analysis. Robust and resistant measures. The analysis of variance and covariance. This course will offer a nonmathematical approach to the practical issues faced by the data analyst. (DR:T)

3-4 units, Win (Carlsmith) MTWF 9

153. Statistical Theory, Models and Methodology—To review elementary probability theory and the theory underlying the more popular statistical techniques, paying attention to applications of these ideas and methods in psychology and the social sciences. Topics include: random variables, expected value, correlation, Chebyshev and other inequalities; the binomial, Poisson, and normal distributions; limit theorems; small sample distributions; estimation and hypothesis testing; simple analysis of variance; elementary principles of sample design. (DR:T)

3 units, Spr (Thomas) MWF 9

154. Women and Competence: Responding to Social Change—(Same as Education 171 and Undergraduate Special 71.) In this cross-disciplinary course students examine gender role behaviors and apply psychological techniques to strengthen or change self-selected socialized responses. Self-management skills based on research in social learning are designed to help students learn positive ways to exert more control over their environments and deal with such problems as double binds, socialized fears, autonomy and identity. Open to graduates and undergraduates. Enrollment limited. Prerequisite: consent of instructor. (DR:S)

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

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

3 units, Spr (Snow) MWF 10

156. Decision Making—(Graduate students register for in 256.) This course will review major theoretical developments and empirical findings regarding individual decision making. The course will focus on decision making under risk or uncertainty and the attempt to understand and explain attitudes towards risk. The manner in which observed decisions depart from the rational theory of choice will be examined and their implications will be explored. (DR:S)

3 units, Aut (A. Tversky) TTh 11-12:30 offered 1981-82

157. The Psychology of Judgment and Decision Making—This course will explore the strategies and shortcomings of human judgment and decision making. Contributions from cognitive psychology and social psychology will be integrated, with a heavy emphasis on the central question: when and why are people rational or
irrational, both in the inferences they make about themselves, their peers and the world around them, and in the courses of behavior they follow. Enrollment limited. Prerequisite:

1. (DR:S) 3 units, Aut (Ross) MW 1:15-3:05

160. Management of Chronic Stress—(Same as Education 235.) Introduction to conceptual models of chronic stress in home, work, and community environments. Particular attention to methods and programs to assess as well as to alter chronic stress. Using a cognitive social learning model, psychosocial factors will be emphasized in considering the etiology, maintenance, and modification of stress, along with biochemical-physiological processes. The Type A Behavior Pattern will be examined as one perspective of chronic stress in humans. Intended for students (upper division undergraduates or graduates) interested in psychosocial as well as physiological factors in health-related problems, especially intervention methods. (DR:S)

4 units, Win (Thoresen T 2:15-4:05 and by arrangement

163. Mathematical Psychology—(See 215.) (DR:T)

164. Mathematical Representation of Structures in Psychological Data—(See 218.) Offered 1980-81

165. Graduate Seminar: On Selected Topics in Memory—(See 219.)

166. Applied Problems in Visual Perception—(Graduate students register for 266.) Prerequisite: 102 or consent of instructor (DR:S)

3 units, Win (Wandell) by arrangement

177. Social Psychology of Physical Deviance and Disability—(Same as Human Biology 177.) This course will consider 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. (Plus one mandatory study section.) (DR:S)

4 units, Spr (Hastorf) TTh 11-12:15 and by arrangement

184A. Paraprofessional Internship Program—This course is designed primarily for students interested in exploring the areas of counseling, clinical, educational and community psychology through field experience. A variety of programs within the broadly defined areas of Community Mental Health utilize Stanford undergraduates as volunteer “paraprofessionals”. Each program provides on-site training and supervision. Students learn to use behavior modification and other techniques in working with emotionally and behaviorally disturbed youngsters at three children’s centers. A number of opportunities for working with troubled adolescents are provided in varied settings: small residential group homes for teenagers; a special education and counseling program at Los Altos High School; and work with young people in and out of Juvenile Hall through the Probation Department in San Jose. Volunteers at the Menlo Park V.A. Hospital work with middle-aged outpatients, both in classroom settings and in “community outreach” programs designed to improve the patients’ social skills and confidence. Other adult programs provide experience in working with prisoners, either in jail or on release, and a variety of approaches to understanding the needs and problems of older people.

Each of these internships demands a heavy commitment in terms of time and energy (8 to 12 hours per week) for two consecutive quarters, but each offers an unusual opportunity for mature, responsible and dedicated students. To supplement the field experience, students meet bi-weekly in small groups for a two-hour seminar which will explore specific therapeutic techniques, discuss professional opportunities in the community, and investigate the relevance of clinical field research. The seminar also offers students a chance to discuss the progress and problems in their individual placements. Prerequisite: students must be prepared to take this course for two consecutive quarters; especially recommended for Juniors. (DR:X)

3-5 units, Aut (L. Carlsmith) T 3:15-5:05 and by arrangement

184B. Paraprofessional Internship Program—(Same as 184A.) (DR:X)

3-5 units, Win (L. Carlsmith) T 3:15-5:05 and by arrangement

184C. Paraprofessional Internship Program—(Same as 184A and 184B.) (DR:X)

3-5 units, Spr (L. Carlsmith) T 3:15-5:05 and by arrangement

184D. Paraprofessional Internship Program—(Same as 184A, 184B, and 184C.) (DR:X)

3-5 units, Spr (L. Carlsmith) T 3:15-5:05 and by arrangement

186. Personality and Its Cultural Context—This course will be organized around the dynamic relationship between the individual
and his or her social environment. Contemporary approaches to personality will be applied to such topics as identification and personality development, self control, alienation and aggression. (DR:S)

3-4 units, Win (Brown) TTh 2:15-3:30

188. Reading and Special Work—Independent study. Offered for Pass/No Credit. Can be repeated for credit. Prerequisite: consent of instructor. (DR:X)

1-3 units, any quarter (Staff) by arrangement

190A. Early Experience—(Same as Human Biology 143.) 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 instructor. (DR:S)

3-5 units, Win (Bandura) M 2:15-4:05 offered 1981-82

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 (Levine) Th 4:15-6:05

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 offered 1981-82

194A. Parent-Child Interaction—Prerequisite: consent of instructor. (DR:S)

3 units, Spr (Maccoby) T 2:15-4:05 offered alternate years, 1981-82

194B. Undergraduate Seminar: The Childhood Development of Memory, Comprehension, and Communication—A survey of current theory and research concerning the development of social cognition — cognition about people rather than objects. Prerequisite: consent of instructor. (DR:S)

3 units, Spr (Flavell) 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, Spr (H. Mischel) W 1:15-3:05

COURSES PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:X)

Undergraduate students may be admitted only by consent of instructor.

207. Pro-seminar for First-Year Graduate Students—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 (Bower) TTh 11-12:30

209. Perception—Advanced treatment of visual perception. Prerequisite: graduate standing in Psychology or consent of instructor.

3 units, Aut (Ganz) TTh 9-10:30

210. Cognitive Psychology—Prerequisite: graduate standing in psychology or consent of instructor.

3 units, Win (Flavell, Markman) MW 10-12

212. Social Psychology—Prerequisite: graduate standing in psychology or consent of instructor.

3 units, Aut (Lepper, Ross) TTh 1:15-3:05

213. Personality—Prerequisite: graduate standing in psychology or consent of instructor.

3 units, Spr (W. Mischel) M 2:15-5

214. Psycholinguistics—(Same as Linguistics 270.) Prerequisite: graduate standing in psychology or consent of instructor.

3 units, Spr (H. Clark) TTh 1:15-2:30

215. Mathematical Models of Psychological Processes—(Undergraduates register for 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 or consent of instructor.

3 units, Aut (Thomas, A. Tversky) MW 2:00-3:30

216. Abnormal Psychology—This course will examine selected literature in abnormal psychology approached from a cognitive and interpersonal perspective. It attempts to integrate psychoanalytic and behavioral views of the nature, origin, and treatment of abnormal be-
behavior. Prerequisite: graduate standing in psychology of consent of the instructor.

3 units, Aut (Horowitz) WF 11:00-12:30

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. Prerequisite: graduate standing in psychology or consent of instructor.

3 units, Spr (Brown) by arrangement

218. Mathematical Representation of Structures in Psychological Data—(Undergraduates register for 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 11:00-12:30

219. Graduate Seminar on Selected Topics in Cognition—(Undergraduates register for 165.) Prerequisite: consent of instructor.

2-3 units, Win (B. Tversky) Th 3:15-5:05

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; and heuristic programming; information processing models as explanations of human cognitive and affective behavior. Prerequisite: Computer Science 107 or equivalent.

2 units, Spr (Lenat) TTh 1:15-2:30


227. Seminar: Cellular Neurophysiological Approaches to Behavior—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

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

237. Graduate Seminar in Cognitive Science—(Same as Linguistics 203 and Philosophy 203.)

3 units, Win, Spr (Moravcsik and Bower) 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; developmental aspects of perception, attention, memory, comprehension, communication, and social cognition. Prerequisite: 211 or consent of instructor.

2-3 units, Win, Spr (Flavell) M 7-9 p.m.

240. Child Language Acquisition I—(Same as Linguistics 165.) Review of present knowledge of processes of language acquisition from a linguistic point of view. Survey of recent and past literature. Prerequisites: Linguistics 10 or 230, or consent of instructor.

4 units, Aut (E. Clark) by arrangement


4 units, (E. Clark) offered alternate years, 1981-82

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.
3 units, Spr (Markman) by arrangement

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. Students with an undergraduate mathematical major or equivalent preparation should enroll in Educ. 252A.
3–4 units, Aut (Snow) MW 2:15-4:05

252. Multivariate Analysis—Multiple regression, analysis of covariance, multivariate analysis of variance. Prerequisite: 152 or equivalent.
2-3 units, Win (Carlsmith) TTh 9
offered alternate years, 1981-82

3 units, Aut (Thoresen) M 2:15-4:05
and by arrangement

254. Principles of Personality Change—Prerequisite: graduate standing in psychology.
3 units, Aut (Bandura) M 10-12
offered 1981-82

254A. Principles of Personality Change—(See 191.)

256. Decision Making—(See 156.)

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. Selected Topics in Human Learning—Prerequisite: consent of instructor.
3 units, Spr (Bower) Th 1:15-3:15

266. Applied Problems in Visual Perception—(see 166.)

269. Graduate Seminar: Personality—Prerequisite: consent of the instructor.
3 units, Win (W. Mischel) by arrangement

272. Special Topics in Psycholinguistics—Prerequisite: consent of instructor.
3 units, Win (H. Clark) by arrangement

275. Graduate Research—Research of intermediate nature whether or not to be used toward Master’s thesis, to be undertaken with members of departmental faculty. Prerequisite: consent of instructor.
(Staff) by arrangement

278. Graduate Seminar: Internal Representation—Can be repeated for credit. Prerequisite: consent of instructor.
3 units, Aut (Shepard) by arrangement

279. Graduate Seminar in Sensory Psychophysics—Prerequisite: Graduate standing or consent of instructor.
3 units, Win (Wandell)
M 3:15-5:05

280. Doctoral Research—For dissertation. Prerequisite: consent of instructor.
(Staff) by arrangement

281. Graduate Seminar: Selected Topics in Decision and Judgment—This seminar will review recent findings regarding the manner in which people make intuitive judgments and predictions under conditions of uncertainty. These results indicate that these judgments depart from the statistical theory of prediction in a large and systematic manner. The educational, practical and theoretical implications of these findings will be explored.
3 units, Win (A. Tversky)
T 3:15-5:05

282. Research Seminar on the Analysis and Representation of Similarity Relations—This seminar will review new theoretical and empirical 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.
3 units, Aut (A. Tversky) T 3:15-5:05

283A. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 286A, Graduate School of Business 494A, and Operations Research 366A.) This seminar aims to study a normative and descriptive decision making, particularly in the face of uncertainty. It will examine general studies on the way decisions are made and the problems arising in making decision analyses in applied policy contexts. The seminar will meet once every two or three weeks throughout the academic year. Prerequisite: consent of instructors.
1-2 units, Aut (Arrow, A. Tversky and Wilson) by arrangement

283B. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 286B, Graduate
School of Business 494B, and Operations Research 366B.) See 283A.
1-2 units, Win (Arrow, A Tversky and Wilson) by arrangement

283C. Interdisciplinary Seminar in Decision Analysis—(Same as Economics 286C, Graduate School of Business 494C, and Operations Research 366C.) See 283A.
1-2 units, Spr (Arrow, A Tversky and Wilson) by arrangement

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

307. Research Seminar in Integrative Neurobiology—Can be repeated for credit. Prerequisite: consent of instructor.
1-3 units, Spr (Wine) F 1:15-3:05

308. Research Seminar in Brain and Behavior—Can be repeated for credit. Prerequisite: consent of instructor.
1-3 units, Aut, Win, (Pribram, and 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 (Carlsmith, Hastorf, Lepper and Ross) by arrangement

351. Children and the Law: A Policy Analysis—(Same as Law 242.) This course will be a seminar limited to 20 graduate and law students. Admission by consent of 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. Area focused on will include child custody decisions, "children's rights", definitions of child abuse and neglect, informed consent in 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 policy makers.
3 units, Aut (Maccoby and Wald) 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 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. Prerequisite: consent of instructor.
3 units, Aut (Rosenhan) by arrangement

353. Psychopathology and Mental Health Law—(Same as Law 338.) Prerequisite: consent of instructor.
4 units, Aut (Rosenhan) by arrangement

PUBLIC POLICY PROGRAM

Director: Nathan Rosenberg
Assistant Director: David C. Mowery
Program Committee: Michael T. Hannan (Sociology), John W. Lewis (Political Science), John Manley (Political Science), Robert E. McGinn (Industrial Engineering), Lincoln E. Moses (Statistics), Margaret Race (Human Biology), James N. Rosse (Economics), W. Richard Scott (Sociology), John B. Shoven (Economics), James L. Sweeney (Engineering-Economic Systems), David B. Tyack (Education)

STATEMENT OF PURPOSE
A central aspect of contemporary American society is the expanded role of government. With this expanded role has come an increased complexity of government in its organizational forms, in the nature of its policies, and in its informational requirements. Public policies rely for their effectiveness upon the nature of the responses of actors and organizations in the private sector; hence effective public policy analysis and operation needs to be based on a thorough understanding of social, political, and economic factors. Similarly, private sector decision-makers must increasingly deal with public sector responses to private initiatives.

The Public Policy Program offers undergraduates an interdisciplinary approach to the analysis, management, and design of public sector programs and institutions. The core courses of the program are designed to provide a strong background in analytical skills, an appreciation for the operation of large organizations in the implementation of public programs, and training in humanistic studies to prepare the student to understand the sharp conflicts in values that unavoidably pervade many policy issues.

REQUIREMENTS
Students planning formally to undertake the Public Policy Program should submit proposals
to the Committee on the Individually Designed Major for approval. The Public Policy Program advisors and staff should be consulted for help in this regard.

Completion of the program in Public Policy requires 70 units of coursework:

1. 30 units of prerequisite courses: Political Science 10, Statistics 60 and 61, and Economics 1, 51, and 52.
2. The 25-unit sequence of core courses (see below for descriptions).
3. Following the core courses, majors must complete 15 units of coursework in some problem-focused area, such as energy policy, health care, food and nutrition policy, or the economics of regulation.

The core courses are open to all students who have fulfilled the prerequisites for a specific course. The 15 units of post-core coursework will be chosen by students in consultation with their advisors from the program. At least one of the courses comprising these 15 units should be a small seminar course, involving a piece of individual research. A maximum of 10 units may be taken on a Pass/No credit basis in fulfillment of the major requirements. An optional summer internship is also being developed.

**COURSES**

101. Politics and Public Policy—(Enroll in Political Science 70.) This course presents a broad historical look at national public policy-making from the New Deal to the present. Competing theories about the rise and development of liberal democratic capitalism are assessed within the general context of domestic policy-making by Congress and the Presidency. Special attention is paid to the role of the national government in the modern American political economy through the examination of selected public policies dealing with employment, economic development, social welfare, and equality.

5 units, Aut (Manley) MWF 10

102. Organizations and Public Policy—(Enroll in Sociology 166.) This course provides concepts and methods for analyzing the influence of organizations on the setting and implementation of public policy. Varying conceptions of organizations, both as corporate actors and as social contexts, will be reviewed and evaluated. The several roles of organizations in relation to public policy will be examined, including organizations as decision makers and problem solvers, as change agents, and as clients.

5 units, Win (Scott) MWF 9

103. Philosophical and Ethical Issues in Public Policy—(Enroll in VTS 110.) This course examines ethical and human value aspects of public policy. It develops analytical tools useful for understanding such aspects and utilizes case materials as a means of exploring their complexity and role in the formulation of socially responsible public policy. Topics include: justice, human rights, the public interest, and other key terms in public policy discourse; anthropological, psychological, and sociological accounts of the origin and development of ethical and other value orientations in individuals and social groups; models for incorporating consideration of ethical and value issues into public policy decisionmaking; the types of ethical and value issues arising in different spheres and types of policymaking; and cases from medicine (e.g., euthanasia, embryological research), communications (e.g., children's television advertising, computers and privacy), and the environment (e.g.: toxic waste disposal, national parks policy).

5 units, Win (McGinn) MTW 2:15-3:05

104. Economics and Public Policy—(Enroll in Economics 150.) An examination of the reasons for, the varieties of, and the consequences of government policies in economic affairs. This course will explore the means of policy formation and the means and effects of policies by focusing on specific case materials in three topic areas—market regulation policies (antitrust and commission regulation), tax and income redistribution policies, and macroeconomic stabilization policies.

5 units, Spr (Rosse) MTWTh 11

105. Quantitative Methods and Their Application to Public Policy—(Enroll in Statistics 105.) Focusing upon applications of statistical methods, rather than methodology per se, this course will consider such topics as risk assessment in the evaluation of biohazards and medical techniques and technologies; comparisons of such information-gathering techniques as surveys, experiments, or simulation studies; methods of expressing and evaluating uncertainty; and the interpretation of such quantitative methods of data analysis as regression.

5 units, Spr (Moses) MTWThF 9

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**RELIGIOUS STUDIES**

Chairman: Van A. Harvey

Professors: William A. Clebsch (Religious Studies and Humanities, on leave 1980-81), Edwin M. Good, Van A. Harvey, David S. Nivison (Asian Languages and Philosophy and, by courtesy, Religious Studies), Lewis...
Spitz (History and, by courtesy, Religious Studies)

Associate Professors: Lawrence V. Berman, Lee H. Yearley

Assistant Professors: Carl W. Bielefeldt, Henry S. Levinson, Diana Y. Paul

Lecturers: Robert G. Hamerton-Kelly, Paul H. Mosher

Visiting Professor Emeritus: Wilhelm Pauck

Mellon Fellow: Paula L. Fredriksen

PROGRAMS OF STUDY

The study of religion aims to understand and interpret the history, literature, thought, and social structures of various religious traditions and cultures. The Department offers courses at several levels, indicated by course numbers and units:

1 World Religions (3 units)
5 Western Culture (5 units)
11-89 Introductory (3 or 4 units)
101-189 Intermediate (5 units)
198-199 Undergraduate Directed Reading (variable units)
201-299 Graduate Courses (4 units)
301-399 Graduate Seminars, Research, and Teaching (variable units)

BACHELOR OF ARTS

The major in Religious Studies is designed to give the student a broad knowledge of major religious traditions, several different approaches to the study of religion, and appreciation for the diversity and depth of the problems that religions seek to solve.

The following departmental requirements are in addition to the University's basic requirements for the bachelor's degree: 60 units of course work in the department (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 Religious Studies may be earned by students who are endorsed by their advisors and by the undergraduate director and who meet additional requirements, available from the undergraduate director.

DOCTOR OF PHILOSOPHY IN RELIGIOUS STUDIES

University regulations regarding the Ph.D. are found in the "Degrees" section in this bulletin. The following requirements are in addition to the University's basic requirements. Complete information is contained in the Handbook of Graduate Religious Studies, available from the departmental secretary.

Residence—Each student completes three years (nine quarters) of full-time study, or their equivalent, in graduate work beyond the Bachelor of Arts degree, to a minimum of 90 units of graduate work in addition to the dissertation, of which the last 60 units must be taken at Stanford.

Courses—Each student completes satisfactorily the four graduate seminars (RS 301, 303, 305, 307) before the Candidacy Essay. Other courses are taken on approval of a faculty advisor and in consideration of the student's field of concentration.

Fields of Concentration—In the second year, each student proposes for approval a substantial field of concentration in which there is a coherence of strengths in the faculty in Religious
Studies and other faculty in the University. Fields may fall within such areas as East Asian religions, Western religions, modern religious thought, and American religions.

**Supporting Programs**—Each student takes a coherent and substantial supporting program, consisting of no fewer than 20 and no more than 27 units in advanced and graduate courses in other departments of the University.

**Candidacy Essay**—Written in the sixth quarter of graduate study, the essay (RS 392) demonstrates the student's ability to apply to the field of concentration the scholarly approaches of the required graduate seminars. After the essay has been judged satisfactory, the student is eligible to be recommended for candidacy for the Ph.D. degree.

**Teaching Internships**—At least two teaching internships under supervision by designated faculty members are undertaken after the student has advanced to candidacy for the Ph.D. Students receive academic credit for the required internships (RS 390), which are projects of academic training and not of employment.

**Languages**—Each student demonstrates 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, each student demonstrates reading knowledge of other ancient or modern languages necessary for the field of concentration. Dissertation topics may require knowledge of additional languages.

The University oral examination is normally taken in Spring Quarter of the third year of graduate work.

**Dissertation**—Part of the University oral examination is a colloquium on the student's proposed dissertation topic, demonstrating readiness to proceed with the research. The dissertation contributes to the humanistic study of religion and is written under the direction of the candidate's dissertation advisor and at least two other members of the Academic Council.

**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 the section "Humanities Special Programs" in this bulletin. Doctoral students in Religious Studies taking the Graduate Humanities Program meet thereby the requirement of a "supporting program" described above.

**COURSES**

Until the beginning of the last four weeks of the quarter, a student may add units of credit to a fixed unit course provided the student's total registration does not exceed the normal load limits. The increase, subject to the approval of the instructor, may be up to one hundred percent of the published unit value of the course. All courses (DR:H) unless noted otherwise.

**WORLD RELIGIONS**

Designed as a series but may be taken individually. Comparative study of religions such as Buddhism, Christianity, Confucianism, Hinduism, Islam, Judaism. 1A focuses on the ways in which rituals express, bind, and elicit forms of religious community. 1B compares religions by studying the lives of similar and different religious persons. 1C compares religions by studying forms of thought exploring relationships among people, divinities, and the world.

1A. **Comparative Religious Communities**—Ritual expression of community in various religious traditions and cultures, including Balinese, Zuni, Oglala Sioux, Ndembu, Jewish, Christian, Yogic, Magic, and Civil (American, Nazi German).

3 units, Win (Levinson) MWF 10

1B. **Comparative Religious Personalities**.

3 units (Staff) given 1981-82

1C. **Comparative Religious Thought**—Differences and similarities between Christian, Hindu, Confucian, Taoist, and Buddhist views (among others) on topics such as mysticism, morality, death, and self-cultivation; relation of religious thought to contemporary philosophic, sociological, and psychoanalytic thought.

3 units, Aut (Yearley) MWF 10

**WESTERN CULTURE**

Ideas in Western Culture. This sequence introduces the students to important works in Western culture, and attempts to set them in their historical contexts. It fulfills the Western Culture requirement.

5A. **Ideas in Western Culture: The Birth of Western Philosophy**—(Enroll in Philosophy 5A.) 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 entering students.

5 units, Aut (Moravcsik) MWF 10 plus 2-hour section dhr
5B. Ideas in Western Culture: Faith and Reason—(Enroll in Philosophy 5B.) Great philosophical, religious, scientific, and literary works of the Middle Ages and Renaissance will be studied. Authors studied include Boethius, Augustine, Dante, St. Thomas, Locke, Galileo, and Shakespeare. Recommended for entering students.

5 units, Win (Staff) MWF 10
plus 2-hour section dhr

5C. Ideas in Western Culture: The World Demystified—The breakdown of traditional Western culture and society under the impact of revolutions in science, industry, politics, literature, and philosophy; the emergence of "modern" thought and institutions; works by Voltaire, Rousseau, Hume, Goethe, Marx, Darwin, Nietzsche, and Freud. Recommended for entering students.

5 units, Spr (Levinson) MWF 10
plus 2-hour section dhr

INTRODUCTORY AND INTERMEDIATE COURSES

Courses listed below numbered 11-89 expect work at an introductory level. Those numbered 101-189 expect work at an advanced undergraduate level. (Units are stated in the order of the course numbers.)

TRADITIONS

13/113. Hinduism—Major Hindu doctrines, myths, and symbolic expressions from Vedic times to the present; the Krsna cults, Yogic experience, and images of the feminine and masculine.

3/5 units, Win (Paul) MWF 11

14/114. Buddhism—The philosophical, religious, and aesthetic heritage of Indian and Chinese Buddhism.

4/5 units, Aut (Paul) MWF 1:15

15/115. Religion in Japan—History and characteristics of the Japanese religious tradition.

3/5 units, Aut (Bielefeldt) MWF 11


3/5 units, Win (Bielefeldt) MWF 1:15

18/118. Ch'an and Zen Buddhism—History, teachings, and practices of the Zen tradition in China and Japan.

3/5 units, Spr (Bielefeldt) MWF 9

19/119. Taoism.

3/5 units (Staff) given 1981-82

20/120. Confucianism.

3/5 units (Staff) given 1981-82


4/5 units, Spr (Good) MTWTh 11

22. Greek Religion and Society—(Same as Classics 117.) (DRA)

3 units, Win (Jameson)

23/123. Judaism—Talmudic, rationalistic, and mystical trends from post-Biblical to modern times.

3/5 units, Aut (Berman) MWF 9

24/124. Christianity—Tradition and innovation in the history of Christianity. The changing views of revelation, charisma, and authority; concerns for who belongs to the church, who can function within the church in certain ways, who is excluded; Paul, Irenaeus, Tertullian, Gregory of Tours, Aquinas, Luther, Ignatius Loyola, Schleimacher, Newman, Küng.

3/5 units, Win (Fredriksen) MWF 9

27/127. Islam—Salient social and intellectual trends from Muhammad to modern times.

3/5 units, Win (Berman) MWF 11

PROBLEMS

31/131. Prophets and Prophecy—Moses, Jesus, and Muhammad in the traditions of Judaism, Christianity, and Islam.

3/5 units, Spr (Berman) MWF 1:15

32. Jesus in the Gospels.

3 units, (Hamerton-Kelly) given 1981-82

34/134. Women, Religion and Politics—How men and women in various religious traditions have identified themselves through personal experience as "religious"; sexual identities, political goals, and images of the sacred; the holy man and woman, prophet, sage, mystic, virgin, homosexual, woman ruler, witch.

3/5 units, Spr (Fredriksen, Paul) MWF 11

35A. Buddhist Views of Death and the Afterlife.

3 units (Paul) given 1981-82

38. Psychological Theories of Religion.

3 units, (Harvey) given 1981-82

40A. Eastern and Western Conceptions of the Self—Models of the self in Confucianism, Taoism, Christianity, and contemporary Western thought, especially psychoanalysis and Anglo-American philosophy. Comparisons among those models.

4 units, Win (Yearley) TTh 8:30-9:50

42. Philosophy of Religion.

3 units, Win (Levinson) MWF 1:15

49. Approaches to the Study of Religion.

3 units, Aut (Harvey) MWF, 11
THINKERS
64/164. Muhammad and the Koran—The founder of Islam in the Koran and the traditional literature; his changes throughout history.
3/5 units, Aut (Berman) MWF 1:15

66. Theology of Paul—The religious thought of Paul within its cultural and historical context.
3 units, Win (Hamerton-Kelly) TTh 11 plus section dhr

69/169. Early Christian Thinkers—Different and competing modes of Christian thought in the period c. 100-400 concerning Christianity and authority, orthodoxy and heresy, gnosticism, classical culture, persecution, Judaism, the mystery religions, the conversion of Christianity.
3/5 units, Spr (Fredriksen) MWF 1:15

72/172. Maimonides.
3/5 units, (Berman) given 1981-82

77/177. Religious Existentialists.
3/5 units (Levinson) given 1981-82

OTHER INTERMEDIATE COURSES
Courses listed below are not offered at the introductory undergraduate level.

TRADITIONS
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) MW 4:15-6:05

126. The Christian Humanists, Lutheran, Calvinist, Catholic, and Radical Reformations—(Same as History 110.)
5 units, Win (Spitz) MTWTh 9

PROBLEMS
132B. The Sayings of Jesus—Their form and content and the history of the tradition in the Synoptic gospels. Prerequisite: consent of the instructor.
5 units, Spr (Hamerton-Kelly) MW 2:15-4:05

5 units, Win (Bielefeldt) TTh 2:15-4:05

140B. Self-Deception—(Same as Philosophy 190.) Philosophical, religious and psychological thinkers from the Anglo-American, European, and Chinese traditions. Prerequisite: consent of the instructor.
5 units, Spr (Bratman, Yearley) TTh 2:15-4:05

141. Humanists and Reformers—(Same as History 213.)
5 units, Spr (Spitz) TTh 2:15-3:45

144. Nineteenth Century German Religious Thought—The criticism of religion as "alienation" in Hegel, Feurbach, Marx, and Nietzsche. Prerequisite: consent of the instructor.
5 units, Spr (Harvey) MW 2:15-4:05

145. Religion and the Literary Imagination.
5 units (Good) given 1981-82

146. American Religious Movements.
5 units (Clebsch) given 1981-82

THINKERS
151. Chinese Buddhist Thought—Philosophy of consciousness in Chinese Buddhism. Texts read in English. Prerequisite: consent of the instructor. (Texts read in Chinese, limited and by advance consent of the instructor.)
5 units, Spr (Paul) TTh 2:15-4:05

152. Chuang-Tzu—The classical Taoist thinker on such topics as skepticism, mysticism, morality, and tranquility. Prerequisite: consent of the instructor.
5 units, Win (Yearley) TTh 2:15-4:05

154. Confucianism Since Wang Yang-ming—(Same as Philosophy 124 and Asian Languages 144.)
5 units, (Nivison) given 1982-83

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

174A. Sigmund Freud—The analysis in the later work of behavior with respect to identification, the superego, transference, sublimation, the life and death instincts. Prerequisite: consent of the instructor.
5 units, Aut (Yearly) TTh 2:15-4:05

174B. William James—James’s efforts to transform American religious thought in light of the varieties of religious experience, scientific developments like Darwin’s theory of natural history, political developments like the emergence of America as a world power, and cultural developments like the appreciation of non-Western forms of humanity.
5 units, Aut (Levinson) TTh 2:15-4:05

5 units (Staff) given 1981-82

179. Kant—(Same as Philosophy 287.)
4 units, Spr (Staff) Th 4:15-6:05
UNDERGRADUATE 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.

221. Old Testament. 
4 units, Spr (Good) MTWTh 11

224. Christianity 
4 units, Win (Fredriksen) MWF 9

242. Philosophy of Religion. 
4 units, Win (Levinson) MWF 1:15

243. Humanism and the Reformation—(Same as History 319.) 
4 units, Win (Spitz) W 2:15-4:05

243A. Interpretations of the Reformation—(Same as History 319A.) 
4 units, Spr (Spitz) W 2:15-4:05

244. Nineteenth Century German Religious Thought. 
4 units, Spr (Harvey) MW 2:15-4:05

245. Religion and the Literary Imagination. 
4 units, (Good) given 1981-82

5 units (Clebsch) given 1981-82

251. Chinese Buddhist Thought. 
5 units, Spr (Paul) TTh 2:15-4:05

252. Chuang-Tzu. 
4 units, Win (Yearley) TTh 2:15-4:05

259. Early Christian Thinkers 
4 units, Spr (Fredriksen) MWF 1:15

274A. Sigmund Freud. 
4 units, Aut (Yearley) TTh 2:15-4:05

274B. William James. 
4 units, Aut (Levinson) TTh 2:15-4:05

277. Religious Existentialists. 
4 units (Levinson) given 1981-82

278. American Religious Thought. 
4 units (Staff) given 1981-82

299. Individual Work—Prerequisite: consent of the instructor and of the department. (DR:X) 
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

1980-81: Genre and Style. Prerequisite: consent of the instructor. 
4 units, Aut (Good) 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 1981-82

305. Analyses of Religious Thought—Required of all graduate students in Religious Studies; may be repeated for credit. Topic for 1980-81: Religion and theodicy. Prerequisite: consent of the instructor. 
4 units, Win (Harvey) 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 1981-82

GRADUATE RESEARCH AND TEACHING

Topics vary from year to year based on student initiatives and faculty research interests.

319. East Asian Religions. 
(Bielefeldt, Nivison, Paul, Yearley) 
by arrangement

(Berman, Good, Hamerton-Kelly) 
by arrangement

339. Medieval Western Religions. 
(Berman, Fredriksen, Mosher, Pauck, Yearley) by arrangement

349. Modern European Religions. 
(Harvey, Levinson) by arrangement

359. American Religions. 
(Harvey, 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

4-6 units, Aut, Win, Spr (Staff) 
by arrangement
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 Coterminus 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—(Same as History 117.)
4-5 units, (Vucinich, Staff)

Slavic 184: Introduction to Slavic Bibliography—(DR:X)
2 units, Aut (Zalewski)

SLAVIC LANGUAGES AND LITERATURES

Emeriti: Edward J. Brown, Jack A. Posin (Professors); Elisabeth Stenbock-Fermor (Assistant Professor)

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 (on leave Spring Quarter, 1980-81), Gregory Freidin (on leave Autumn & Winter Quarter, 1980-81)

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.

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, 161, either 163 or 187, or 188, and 192, 193. The remaining units are to be selected from among the following: 167, 168, 169, 187, 188, 191, 195, 196, 198, 220. Note, as part of the requirements for 192 and 193, 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.)

In addition to the 35 units mentioned above, students majoring in literature or language who are 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.

Note: Students not majoring in Slavic Languages and Literatures can qualify for the departmental Translators Certificate by meeting the following requirements: (1) completing with a grade of B- or better the following courses: 111, 112, 113, 161, 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.

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 may do honors work in Russian Literature or in Russian Language. Requirements are listed below.

RUSSIAN LITERATURE

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.

RUSSIAN LANGUAGE

Required

1. Four years of Russian, including Slavic 111-116, 161, 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

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.

MASTER OF ARTS: RUSSIAN

Admission to Candidacy—The requirements for admission to candidacy are:

1. A Bachelor of Arts degree (or its equivalent) from an accredited college or university.
2. A command of the Russian language sufficient to permit the student to do satisfactory graduate work in his or her area of specialization.
3. A familiarity with Russian literature sufficient to permit the student to perform adequately in courses at the graduate level.

The applicant's previous academic training in Russian language and literature must normally serve as a tentative indication of competence. Accordingly, the department will not ordinarily consider applications from students who have not had at least three years of college Russian and some undergraduate training in Russian literature of the 19th and 20th centuries.

However, before registering for the first quarter's work in the department, all entering graduate students are required to take placement examinations in language and literature. Students who fail to perform satisfactorily on such examinations will be required to register for remedial courses in the area or areas in which they are deficient. Such remedial courses, which must normally be completed within the first three quarters of residence, will carry no credit toward either the A.M. or the Ph.D. degree.

Course Requirements—Candidates for the A.M. who are not also candidates for the Ph.D. should plan their course load to insure that they will be adequately prepared for the A.M. Final Examination by the end of their third quarter of work. Those who are also candidates for the Ph.D. degree with a concentration in language and linguistics should include in their first year's work any courses needed for the A.M. examination in that area. Candidates for the Ph.D. with a concentration in literature should attempt to include as many of the department's basic course offerings as possible in their first-year program in order to insure that they have sufficient time to complete the A.M. thesis during their fourth quarter of registration. In any case, the course work should be planned in consultation with the graduate advisor whose written approval of the overall course load is required.

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

During the course of study, students must develop substantial expertise in a field contiguous to their main area of specialization. A candidate may elect to present a full minor or, in consultation with the graduate advisor, develop a special program. In either case, a student is required to complete a sequence of basic courses (12 units) in a chosen discipline outside the Department of Slavic Languages and Literatures. The choice of patterns given below 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 "Degrees" section 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 Slavic 211, 212, and 213 with grades of "B+" or better, Slavic 221, 222, and either Slavic 187 or Slavic 188. They should also have taken Slavic 145, 146, 147 or show equivalent training.

Admission to candidacy for the Ph.D. degree will be determined no later than at the end of the sixth quarter of graduate studies. By that time, the candidate must (1) have demonstrated a commitment to graduate studies by having successfully completed a minimum of 72 quarter units of credit with an average grade of "B+" or better; and (2) in the case of students wishing to specialize in literature, have 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, have 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 the following requirements.

1. Accumulate at least 72 quarter units of credit for course work completed in the graduate program. No less than half of these courses must be taken at the Department of Slavic Languages and Literatures.

2. Have a reading knowledge of French and German, to be demonstrated by passing an examination.

3. 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, 147 or show equivalent training.)

4. Pass a University Oral Examination in the defense of a dissertation proposal which outlines the area of study and describes the method to be employed in the research.

5. Write a dissertation that embodies such results of research as would merit publication.

Specialization—Candidates in Slavic Languages and Literatures specialize in Slavic languages, English, Comparative Literature, and History. They should be prepared to handle successfully survey courses dealing with Russian literature of either the 19th or 20th century, to be selected in consultation with the advisor, the chairman of the Slavic department, and the chairman of their minor department. 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 to suit their individual program of study. 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 have non-Slavic language courses will be expected to pass both German and French 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.

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.

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**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.

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**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: Russian Literature of the First Half of the 19th Century**—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 (Stahlberger) MWF 10

**146. Survey of Russian Literature in English Translation II: The 1860's and Their Aftermath**—Close reading of selected novels and short fiction by Turgenev, Chernyshevsky, Dostoevsky, Tolstoy, 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—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 Sl. 145 and 146, but may be taken independently of them. Graduate students should register for Sl. 222. (DR:H)
4 units, Spr (Freidin) MWF 10

149. Introduction to the Culture and Literature of the Slavic Peoples—No foreign language required.
4 units (Stahlberger) given 1981–82

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 1981–82

151. Fyodor Dostoevsky—The Double, Notes from the Underground, Crime and Punishment, The Possessed, and The Brothers Karamazov will be read with special attention to Dostoevsky’s irony as it arises in parody, develops and finally resolves itself in his last novel. Open to all students. (DR:H)
4 units (Anschuetz) given 1981–82

152. Leo Tolstoy—Reading of major works in English translation including War and Peace, Anna Karenina, and Resurrection. Discussions will also correlate materials from Tolstoy’s social and religious thought. Some comparative reference to the European novel in general, English and French. Open to all students. (DR:H)
4 units, Win (Stahlberger) MWF 1:15

153. The Russian Drama—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. (DR:H)
4 units, Win (Stahlberger) MWF 1:15

SLAVIC 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.
ceding 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

161. 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, Aut (Van Campen) MWF 1:15

163. Third-Year Russian (for Translators)—Continuation of 161. Reading and translation of technical materials in the physical sciences and mathematics, as well as other areas.
3 units, Win (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: 161 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)

167-8. Fourth-Year Russian Seminars I—A general introduction to the critical analysis of Russian literature, based on the figure of the traditional hero of the epic genre and followed by a study of the romantic hero and anti-hero.
3-4 units, Aut (Anschuetz) MW 11-12:30

168. Fourth-Year Russian Seminars II—Continuation of 167.
4 units, Win (Anschuetz) MW 11-12:30

169. Fourth-Year Russian Seminars III—Prerequisite: 167 and 168 or equivalent. The course will concentrate on a close reading and discussion of a single major work of Russian literature.
4 units, Spr (Freidin) TTh 11-12:30

172. Pushkin.
4 units, (Stahlberger) given 1980-81

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. (DR:X)
3 units, Aut (Zakwski) 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) MW 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, Aut (Stahlberger) MW 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.
4 units, Spr (Todd) MWF 12
190. Russian Literature of the Eighteenth Century—Emphasis on poetry; theory of genres, the satire, the ode, the mock-epic.
4 units (Stahlberger) given 1981-82

191. Structure of Russian—A survey of major problems encountered by English-speaking learners of Russian; includes orthography, pronunciation, morphology, and syntax.
3 units, Win (Schupbach) MWF 10

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, (Schupbach) given 1981-82

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, (Schupbach) given 1981-82

197. Russian Lexicology and Phraseology. 3 units, (Staff) given 1981-82

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 1981-82

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) by arrangement

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) W 2-4

211. Introduction to Old Church Slavic.
3 units (Van Campen) given 1981-82

212. Reading of Old Church Slavic and Old Russian Texts. Prerequisite: 211.
3 units (Van Campen) given 1981-82

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 (Schupbach) given 1981-82

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 1981-82

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 1981-82

222. Early Soviet Prose: Osip Mandelstam, Isaak Babel and Mikhail Zoschenko—A study of these two writers in the literary, social and historical context of the decade following the 1917 Revolution.
4 units, Spr (Freidin) Th 2-4

4 units (Stahlberger) given 1981-82

225. Problems of Romanticism in Russia—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 (Anschuetz) given 1981-82

226. Problems of Symbolism in Russia—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 (Anschuetz) given 1981-82

230. Russian Formalism and Structuralism—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 Soviet Structuralists. No knowledge of Russian is required.
4 units, Aut (Brown) T 2:15

231A,B. Russian Parodies and Theories of Parody—Some of the most original modern critical theories of parody are formalist studies of the early Dostoevsky. In the Autumn Quarter they will provide the basis for an interpretation of The Possessed and, in the Winter Quarter, for an interpretation of Bely's novel, Peterburg, which is itself a parody of The Possessed.
A. 4 units (Anschuetz) given 1981-82
B. 4 units (Anschuetz) given 1981-82
271. **Solzhenitsyn**—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.” No knowledge of Russian is required, but concentrators in Slavic will be expected to do a major portion of the reading in Russian. (DR:X)

4 units (Brown) given 1981-82

272. **Osip Mandelstam**—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 ready will be done in Russian.

4 units (Freidin) given 1981-82

277. **Gogol**—Also open to undergraduates with advanced training in Russian. (DR:X)

4 units (Todd) given 1981-82

278. **Tolstoy and Free Will**—War and Peace initially poses the question of free will in terms of Russian history; the late short stories, like that of Platon Karatev, finally answer the question in terms of myth.

4 units (Anschuetz) given 1981-82

279. **Dostoevsky**—A study of Dostoevsky’s shorter works in the context of European thought and literature. (DR:X)

4 units (Todd) given 1981-82

299. **Individual Work**—Exclusively for graduate students in Slavic working on theses or engaged in special work. Prerequisite: written consent of instructor. (DR:X)

1-12 units, any quarter (Brown, Shupbach, Shahlberger, Van Campen, Todd, Anschuetz, Freidin) by arrangement

300. **Graduate Seminar: Theory of Narrative**—(Same as English 330.) Studies of fiction as representation, social institution, and verbal structure. Discussions will relate theories (Gombrich, Auerbach, Barthes, Lukacs, Bakhtin and others) to selected Russian and European novels. A seminar for graduate and advanced undergraduate students. Prerequisite: consent of instructor.

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

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.

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**SOCIAL THOUGHT AND INSTITUTIONS**

**Chairman:** Charles Drekmeier  
**Committee:** Barton Bernstein, St. Clair Drake, Margot Drekmeier, John Felstiner, Raymond Giraud, R. Hamerton-Kelly, Halsted Holman, Henry Levin, Robert North, H. Pierre Noyes, Martin Perl, Charles Stein, Wilfred Stone, Walter Weisskopf, Dow Woodward

**STATEMENT OF PURPOSE**

As an interdisciplinary honors program, Social Thought and Institutions is designed to meet the needs of students wishing special preparation in areas of study which draw on the materials of two or more of the social sciences. It aims at a clearer understanding of the contributions the social sciences are able to make to one another and to a specific problem, an awareness of differences and agreements in their theoretical assumptions, and facilitation of communication among these disciplines. It seeks to combine rigorous training with the breadth of knowledge interdisciplinary study provides.

The objective is a balanced and comprehensive program responsive to student interest in the role of values in social life, responsive to the social need for informed institutional analysis and innovative recommendations for social change, and the academic need for closer association of theory and research with short- and medium-range proposals and policies.

**REQUIREMENTS**

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 of this bulletin 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 autumn 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.) Theory and practice of development in a global setting. Open to graduates and undergraduates, appropriate to both foreign and American students. 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. Access to resources, new technology, political and economic institutions, social structures, education and communication procedures analyzed in terms of appropriateness to development in both less developed and industrialized societies. Addresses need for linkage between the necessary specialization of academia and the inherently interdisciplinary and problem-oriented nature of our living societies. Development strategies viewed with recognition of need for improvement in quality of life within nations and among nations while also recognizing limitations of the earth's physical life support system and constraints in our cultural systems. 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. Winter: Alternative development strategies including country case studies. Spring: The individual and social change; the engineer, political scientist, educator, etc., as designer of alternatives and as policy and decision maker. Lectures, discussions, workshops.
1-5 units, Aut, Win, Spr (Cooper, Fagen, Fuenzalida, Lusignan, McWhorter, Siegel, Textor, Weiler) Lectures M 7:30-9:30 p.m. and groups by arrangement

SOCILOGY

Emeritus: Richard T. LaPiere (Professor)
Chairman: Joseph Berger


Associate Professor: Nancy Tuma

Assistant Professors: Patricia R. Barchas, Carol Conell, Diana P. Dutton (by courtesy), JoAnne Martin (by courtesy), Ann Swidler, Joan Talbert (by courtesy), Henry Walker

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.

At the undergraduate level, a variety of major programs are available. In addition to the general Sociology major and the Honors Program, five specialized programs of study have been developed, each leading to a specialized degree; for example, A.B. in Sociology: Organizational Behavior. These options are described below.

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 200-299 are open to advanced undergraduates and graduate students. Courses numbered 300 and above are primarily for graduate students.

DESCRIPTION OF AREAS OF CONCENTRATION

Five major areas of concentration for undergraduate students within the department have been identified, as follows:

a. Applied Sociology
b. Social Psychology and Interpersonal Processes
c. Organizational Behavior
d. Comparative Social and Political Institutions
e. Research Methods

Each of the areas identifies not only a specialized arena of inquiry or set of skills within sociology but also provides background preparation leading to different possible careers.

A brief description of each of these areas follows:

a. Applied Sociology
   This field of study emphasizes the contributions which sociological knowledge—both theory and methods—can make to the solution of social problems. Problem areas considered include: deviance, poverty, mental illness, alcoholism, as well as problems in the definitions of sex roles and the relations among ethnic groups. Foundation courses emphasize the specialized skills involved in applying sociological explanations and the special methodologies used in evaluation and policy-relevant studies. Careers linked to this area of study include social work, parole and probation, clinical sociology, evaluation and policy research positions.

b. Social Psychology and Interpersonal Processes
   This field of inquiry focuses on the social organization of individual identity, beliefs, and behavior, and upon social structures and processes which emerge in and define interpersonal interactions. Processes studied include social acceptance and competition for prestige and status, the generation of power differences, the development of intimacy bonds, the formation of expectation states which govern performance in task oriented groups, and social pressures to constrain deviance. Foundation courses emphasize the effect of social processes on individual behavior and the analysis of group processes. Careers which relate to this study area include therapy and counseling of individuals, couples and families, and group work.

c. Organizational Behavior
   This area encompasses both the study of individual behavior within organizations as well as the behavior of organizations as collective actors and the factors which affect their functioning. Organizations are the primary tool by which specialized goals are pursued in modern societies; they are found in every sector of modern life. Organizations studied include private profit taking firms and public organizations; voluntary associations and total institutions such as prisons; small, single purpose companies as well as giant diversified corporations. Foundation courses stress the environmental and technological factors which shape the structure of organizations and the social psychological and interpersonal processes which shape the behavior of individuals within organizations. Careers which relate to this study area include all areas of management and administration—public, business, education; management consulting and analysis and organizational development.

d. Comparative Social and Political Institutions
   This field of study encompasses all of the major types of social institutions—family, stratification, political, religious—that make up societies. Attention is also focused on the emergence over time of nation states and the processes which lead to convergence or similarity in institutional arrangements as well as the processes which produce diversity. Evolutionary, ecological, and comparative perspectives are utilized. Foundation courses introduce students to one or more of these perspectives as well as to specific institutional areas. Careers related to this area of study include law and governmental service.

e. Research Methods
   This field of study emphasizes the acquisition of research and analytical skills relating to the collection, reduction and interpretation of data.
Students are encouraged to acquire facility with a variety of research gathering techniques — e.g., participant observation, survey research, laboratory studies — as well as to acquire competence in the processing of data, including the acquisition of statistical and computer skills. Direct involvement in a research project is required as a part of this training. Careers related to this type of training include positions as data analyst, jobs in planning and evaluation departments and in applied research organizations.

Most of the courses offered by the department can be categorized as primarily oriented to one of these five areas; a few courses are relevant to more than one area of concentration. And within the four substantive areas, one or more Foundation Courses are identified which provide a general introduction to the area or some portion of it. Courses for the current academic year, classified by area, are as follows:

a. Applied Sociology
   Foundation Courses: 100, 101.
   Other Courses: 102-119; 125, 145, 150, 155.

b. Social Psychology and Interpersonal Processes
   Foundation Courses: 120, 121.
   Other Courses: 122-134; 220-239; 102, 104, 106, 161.

c. Organizational Behavior
   Foundation Courses: 160, 161.
   Other Courses: 162-169; 260-269; 125, 140, 143, 148, 240.

d. Comparative Social and Political Institutions
   Foundation Courses: 140, 141, 142, 143, 144.
   Other Courses: 135-159; 240-259; 109, 111, 119, 282, 283.

e. Research Methods
   Courses: 180A, 180B.

UNDERGRADUATE PROGRAMS OF STUDY

BACHELOR OF ARTS

Six different programs of study, in addition to the Honors Program, are offered. These programs, and the requirements for each, are described below.

GENERAL SOCIOLOGY MAJOR

This major is designed for the student who wishes a broad, general exposure to the various facets of sociology. To qualify for this degree, the student must:

1. Take at least three Foundation Courses, one each from three of the four substantive Areas of Concentration.

2. Take a minimum of 20 additional units in the department at or above the 100 level.

3. Take Sociology 180A and 180B, Introduction to Sociological Research, or its equivalent.

4. Take Sociology 195, Departmental Seminar for Undergraduate Majors. (This course is offered each Autumn Quarter, and it is recommended that students take it early in their program. This course is also suggested for students who are considering a major in Sociology.)

5. Complete a minimum of 60 units of course work in the major. Related courses in other departments, if approved in advance by the departmental advisor, may fulfill up to 20 units for the degree.

SPECIALIZED SOCIOLOGY MAJOR

The following programs are designed for those students who wish to pursue a somewhat more specialized program of study within the department.

a. Sociology: Concentration in Applied Sociology

To qualify for this degree, the student must:

1. Take at least two Foundation Courses, one each from two of the four substantive Areas of Concentration.

2. Take at least 20 additional units in the area of Applied Sociology.

3. Take Sociology 180A and 180B, Introduction to Sociological Research, or its equivalent.

4. Take Sociology 195, Departmental Seminar for Undergraduate Majors.

5. Complete a minimum of 60 units of course work in the major, 20 units of which may consist of related courses in other departments if approved in advance by the departmental advisor.

b. Sociology: Concentration in Social Psychology and Group Behavior

To qualify for this degree, the student must meet the five requirements listed under (a) above except that requirement (2) is met by taking at least 20 additional units in the area of Social Psychology and Interpersonal Processes.

c. Sociology: Concentration in Organizational Behavior

To qualify for this degree, the student must meet the five requirements listed under (a) above, except that requirement (2) is met by taking at least 20 additional units in the area of Organizational Behavior.
d. Sociology: Concentration in Comparative Social and Political Institutions

To qualify for this degree, the student must meet the five requirements listed under (a) above, except that requirement (2) is met by taking at least 20 additional units in the area of Comparative Social and Political Institutions.

e. Sociology: Concentration in Research Methods

To qualify for this degree, the student must:
(1) Take Sociology 180A and 180B, Introduction to Sociological Research, or its equivalent.
(2) Take Sociology 381A, Sociological Methodology I: Design and Analysis.
(3) Take at least 10 units of Sociology 190 or Sociology 192, Undergraduate Directed Research or Undergraduate Research Apprenticeship.
(4) Take Sociology 195, Departmental Seminar for Undergraduate Majors.
(5) Complete a minimum of 60 units of course work in the major, 20 units of which may consist of related courses in other departments if approved in advance by the departmental advisor.

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 involve close contact with one or more faculty as the student carries out an independent research project. Projects can often be developed in association with ongoing faculty research.

To be eligible for the Honors Program, the student must have completed an acceptable proposal endorsed by a member of the departmental faculty no later than the end of the Autumn Quarter of his or her senior year.

To qualify for Honors in the department, the student must:
(1) Take Sociology 180A and 180B, Introduction to Sociological Research or its equivalent.
(2) Take Sociology 195, Departmental Seminar for Undergraduate Majors.
(3) Complete an Honors Thesis, for which up to 15 units of credit will be granted.
(4) Complete a minimum of 60 units of course work in the major, 20 units of which may consist of related courses in other departments if approved in advance by the departmental advisor.

MAJOR IN SOCIAL SCIENCES (SOCIOLOGY)

This degree is designed for students interested in interdisciplinary work with some emphasis on Sociology. The requirements for the bachelor's degree in Social Sciences (Sociology) are 60 units of course work with 40 units from Sociology including an introductory course in Sociology and a course in methodology (Sociology 180A 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 PROGRAMS OF 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. In this instance 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 depart-
ment 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 for three quarters in a faculty research program and collaborating in associated publications or preparing a report of professional quality based on his or her experiences; (c) complete a teaching apprenticeship, working for three quarters as a teaching assistant under the supervision of a faculty member; (d) develop a thorough grounding in sociological theory and research methods (to accomplish this, five graduate courses are required: Sociology 370A, 370B, 381A, 381B, and 381C. 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 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

BASIC COURSES

All courses (DR:S) unless noted otherwise.

1A, B, C. 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
1. Introduction to Sociology—An examination of how humans connect themselves and thereby structure their experience. Topics include: small intimate relations, family groups, organizational and institutional settings, deviance, and the myth of personality. The rules and processes which determine the nature of our personal experiences will be examined.

5 units, Aut (Talley) MWF 11; one section by arrangement

2. American Society In Film and Literature—Various aspects of American society are studied as observed in films and literature. One reading (a novel or play) and one film (shown in class on Thursdays) studied per week. The film is shown first, in order to allow a fresh response, followed by a 1½ hour lecture (Tuesdays) covering the film and a novel or play on the same subject (read before the lecture), followed by a one hour discussion (in section). Lectures provide any necessary sociological background. Reading includes works of Arnow, Ellison, Faulkner, Fitzgerald, James, Miller, Steinbeck, and Wharton. Viewing includes A Thousand Clowns, Hester Street, The Little Foxes, Streetcar Named Desire, Nothing But A Man, The Children's Hour, Harlan County, USA, and One Flew Over the Cuckoo's Nest.

5 units, Win (Zelditch) TTh 3:15-5:05 section by arrangement

3. 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 chance to examine these processes in terms of the theoretical ideas, empirical research, and clinical strategy. Enrollment limited.

3-5 units, Win (Talley) MWF 10 one 2-hour section M or W 2:15-4:05

3-5 units, Spr (Berger) MWF 9 one 2-hour section M or W 2:15-4:05

4. The World of Organizations—Organizations are the mechanisms by which work gets done in modern societies. Various organizational forms are discussed and their impact to individuals and society evaluated. Organizations studied include schools, hospitals, prisons, public bureaus, and corporations.

3-5 units (Scott) alternate years, given 1981-82

SOCIAL ISSUES IN CONTEMPORARY SOCIETY

All courses (DR:S) unless noted otherwise.

100. Clinical Sociology—Lectures, discussions, and simulations on the structure and process of applied social science: how general theories are used to analyze and solve concrete problems. Case studies, used to explore the clinical process, will range from personal and family therapy to national policy research. Excellent background course for careers in the helping professions and applied sciences. Prerequisites: Soc 180/280, any background in the philosophy of science, or permission of instructor.

5 units, Aut (Talley) alternate years, given 1981-82

101. Policy Research and the Social Sciences—Social scientists are increasingly called on to conduct research relevant to the formulation of policy. Among the questions raised by this development are: What types of policy questions are amenable to research approaches? How does policy research differ from basic re-
search? What organizational and political arrangements are best suited to support policy research? What factors affect the utilization of research findings? These types of questions will be addressed by readings, discussions, lectures, and in-depth analysis of one policy study by each student.

5 units (Staff) alternate years, given 1981-82

102. 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 love 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 other’s everyday world? How are social objects (persons) constructed and maintained in such relationships? Extensive use will be made of structured exercises and simulations to help students understand the operation of social processes. Prerequisites: Sociology 5, or with special permission of instructor. Enrollment limited.

3-5 units (Berger) alternate years, given 1981-82

103. 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.

3-5 units, Spr (Talley) TTh 2-4 and tutorial to be announced

104. The Social Construction of Masculinity and Femininity—This course examines both the way in which societies create gender-based social roles and how these roles affect individual behaviors. The course begins with an analysis of the origins of contemporary definitions of masculinity and femininity and then considers the consequences of these definitions both for individuals and for the society as a whole. Specific topics include the mechanics of role learning, consequences of meeting and not meeting role demands, and the possible implications of changes in current sex-role definitions. Course structure emphasizes simulation of common situations and application of the ideas introduced.

5 units, Win (Staff) MWF 11

105. 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 1:15

106. Deviance and 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 people as “deviants” will be explored. Examine various institutions and agencies mandated to keep “the public order,” how labeled persons are separated from the rest of society both physically and symbolically, and the consequences for those individuals and for society.

3-5 units (Staff) alternate years, given 1981-82

107. Alcohol, Drinking and Alcoholism—Deals with the use of alcohol in the United States and its impact on interaction. Cross-cultural studies are also drawn upon and some comparisons of alcohol with other drugs of social use are made. Reading lectures, class discussions, and individual and group projects permit students to become informed about the uses and effects of this social drug and the ways in which it is studied and understood.

3-5 units, Aut (Barchas) MWF 10 one section by arrangement

109. The Criminal Law and the Criminal System—(Same as Law 107 and Political Science 183K.) 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) TTh 10-11:30

110. Interpersonal Aggression—Interpersonal aggression is a multifaceted phenomenon. This course is concerned with aggression which takes place in a social context; the minimum requirements being that there is an actor who commits the aggressive act and a recipient or target for the act. Major conceptualizations and observational methods are compared, and specific aspects of face to face group interaction which may act to enhance or inhibit occurrence of aggression are considered. The environment sur-
rounding the small group is seen as an important influence on group dynamics. Brief consideration is given to institutionalized aggression and to putative alternative "pathways" or "behavioral mechanisms", such as humor. Students are encouraged to incorporate their special interests, curiosities, or expertise into the course.

3-5 units, Win (Barchas) MW 1:15-2:45

111. Social Issues in Health Care—(Same as FCPM 250.) Provides an overview of major policy issues and problems in health care which have important social dimensions. Emphasizes 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.

5 units (Dutton) alternate years, to be given 1981-82

112. Sex and Education—(Same as Education 170.) This course examines gender as a critical variable in educational institutions and labor markets. It takes an interdisciplinary approach to issues such as the distribution of power in schools, the determinants of occupational choice, the relative payoff of schooling for women and men, the causes of differential behavior and treatment between the sexes in schools and in the work force, and the legal redress of inequalities. The course will include readings, lectures and discussions on theoretical, empirical and policy materials and will be coordinated with the Center for Research on Women (CROW) Wednesday noon lecture series. The three primary disciplines in the course will be economics, history and sociology, but professors of psychology and law will also take part in the analysis.

3-4 units, Spr (Cohen, Strober and Tyack) MW 2-3; W 12-1; one section by arrangement

SOCIAL PSYCHOLOGY AND INTERPERSONAL BEHAVIOR

All courses (DR:S) unless noted otherwise.

120. Interpersonal Relations—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 (Johnston) MWF 9

121. 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 (Cohen) MWF 11
one section by arrangement

122. Physiological Correlates of Social Behavior—The course will focus on the interaction of social and physiological events with particular attention given to small group settings. The illustrative literature, class discussions and lectures are based on both human and animal studies and serve as a springboard for individual or group projects.

3-5 units (Barchas) alternate years, given 1981-82

124. Evaluation and the Social Self—This course will attempt to develop an integrated theory relating evaluation processes to the development of the self-concept. Students will actively participate in theory construction. Prerequisite: a course in social psychology.

5 units (Dornbusch) alternate years, given 1980-81

125. Small Group Behavior in the Work Environment—(Same as Business 373.) This course emphasizes those aspects of group behavior that are most relevant to managers in task-oriented group settings. Topics 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 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.

4 units, Aut (Martin) MF 10-12

126. Evaluation and Social Control—Evaluation is the basic process by which persons control themselves and control others. Examine evaluation processes within the individual, in small groups, in organizations, and in the institutions of a society. Study how evaluations control behavior, and 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 units, Spr (Dornbusch)
W 2:15-5:05

127. Power in Interpersonal Relations—Conceps of power, bases of power, dynamics of power-dependence relations, networks of power-dependence relations, authority and the legitimation of power. Applications to families, task groups, other small groups, and implications for the study of power in larger social units.

3-5 units, Win (Walker)
T 2:15-5:05

COMPARATIVE SOCIOLOGY: SOCIAL INSTITUTIONS AND SOCIAL CHANGE

All courses (DR:S) unless noted otherwise.

135. Culture, Economy and Politics in Western Societies—Examines major sociological interpretations of the history of modern Western societies, tracing the role of cultural, economic, social, and political factors in shaping modern industrial society. Focus is on England, France, and the United States. Topics include love and individualism in Western culture; political revolution and the origins of the modern state; class conflict and authority relations in industrial society; and changing ideologies of poverty, madness, and crime.

5 units, Spr (Swidler) MWF 1:15

140. Ecology, Evolution and Society—Considers a variety of strategies for explaining order and change in social institutions using general principles of evolutionary and ecological theory. Perspectives covered include socio-biology, cultural materialism, Marxian theory, and sociological ecology. Topics covered include the division of labor between the sexes, evolution of the modern state, ethnic boundary dynamics, and the ecology of collective movements.

3-5 units, Win (Hannan) MWF 9

141. Politics and Society—A review of the main themes of political sociology: the origins and expansion of the modern state; the linkages between state and society; the impact of the modern world system on national politics; the internal distribution of power and authority; and the structure of political group formation and individual participation in modern states. Emphasizes the modern empirical literature.

3 units, Aut (Meyer) MWF 11

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 10

143. Education and Society—(Same as Education 220C.) 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; one section by arrangement

144. 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, Aut (Goode) MWF 10

145. Race and Ethnic Relations—Considers structural features of relations between racial and ethnic groups in modern society. Focus on processes that maintain racial and ethnic boundaries; also examines processes that change racial and ethnic boundaries and alter the power position of racial and ethnic groups.

3-5 units, Aut (Walker) MWF 9

146. The World of Work—A study of the occupations and professions: the transition from school to work (choosing occupations, finding jobs), the social organization of work places, the relation between work and identity, between work and the family, and between other statuses (race and sex) and labor force participation.

3-5 units, Spr (Conell) MWF 10

147. Class and Politics—(Same as Political Science 103.) A discussion of the relation between class and politics which will deal with parties, social movements, voting behavior, class organizations and power. The course will treat the applicability of different classical social class theories, e.g., Marx, Weber, Durkheim, to contemporary political analysis.

5 units, Win (Lipset) MWF 11

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.

5 units, Spr (March) TTh 9-10

149. Youth in Modern Society—A study of the ways the lives of children, adolescents, and youth are organized in modern society, how this situation is changing, and how it influences experience in later life. Special focus is on how institutional arrangements (organizations, legal structures, normative systems) structure the status of "child," "adolescent," and "youth." Of particular interest for students anticipating careers in education, problems of juveniles, social work, or other helping professions.

3-5 units, Win (Meyer) MWF 1:15; one section by arrangement

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 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, Aut (Connell) MWF 10

151. Population in the American Economy and Society—(Same as Economics 131 and Food Research 135.) Basic demographic concepts applied to evaluation of trends in U.S. population, especially as measured by 1980 Census. Socio-economic causes and consequences of changes in age structure; of dramatic reduction of mortality (e.g., longer duration of education, working life, marriage and retirement); of smaller families; of immigration, internal migration and population concentration in metropoles; of slower population growth. U.S. population policy and the politics of population.

5 units, Aut (Kirk) MTWTh 10

152. Social Structure of World Society—(Same as Education 147.) This course pursues a sociological analysis of human 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 and its dynamics will be reviewed and compared. Special attention will be given to the question of whether once distinctive societies and cultures are converging on a common standard. Among the topics to be covered will be worldwide population dynamics, the nature of the world economy, communication and exchange of persons on a global scale, socio-economic stratification of the world population, and education, science and technology as global systems. The course will utilize a mixed lecture-discussion format.

5 units, Spr (Inkeles) MWF 11

155. Power Elites in American Society—Analysis of conflicting views on the reality and importance of "power elites" in American society, including Domhoff's Who Rules America?, Mills' The Power Elite, Dahl's A Preface to Democratic Theory and Lowi's The End of Liberalism. The basic premises of each view are analyzed and compared with available evidence. The last lecture attempts to assemble whatever survives this examination into a coherent view of power in America.

3-5 units, Spr (Zelditch) MWF 1:15

156. Sociology of Ideas: Religion, Ideology, and Culture—This course examines major theories of the role of ideas in social life, drawing on classic works in the sociology of science and religion, the study of political ideology, and the study of culture and cultural change. Attempt to find innovative strategies for studying questions implicit in works such as those of Weber, Geertz, Bendix, and Kuhn: questions such as how ideologies and beliefs are structured, how ideas change, and when (and whether) ideas influence social life.

5 units (Swidler) alternate years, given 1981-82


3-5 units, Win (Connell) MWF 10

159. Revolutionary Processes—A comparative, historical examination of social processes in classical as well as other types of revolutions. Causal theories of revolutions will be reviewed, as well as the dynamics of force and force-threat. The changing roles of peasants and of the military will be analyzed, along with family changes,
terrorism, problems of legitimation, and the consequences of revolution.

5 units, Aut (Goode) Th 2:15-5:05

FORMAL ORGANIZATIONS

All courses (DR:S) unless noted otherwise.


5 units, Aut (Scott) MWF 9
one section by arrangement

161. Social Psychology of Organizations—(Same as Business 471.) This seminar focuses on social psychological theories and research relevant to interaction in organizations. Topics will include current research on organizational myths, scripts, and schemas; social comparison process, equity, and perceptions of injustice as they relate to income inequality and sex and race discrimination. Other topics of interest, time permitting, will be selected by students. Consent of instructor required.

4 units, Win (Martin) MF 1:15-3:05

163. Organizational Decision Making—(Same as 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.

5 units (March) alternate years, given 1981-82

165. Power and Politics in Organizations—(Same as Business 377.) The definition and usefulness of power and politics in organizational settings for understanding actions and outcomes are explored. The topics of the relative power of subunits and individuals will be considered both in terms of vertical power and authority differences and from the perspective of power differences that arise among subunits formally on the same hierarchical level. Topics to be covered include the definition of power and politics, and whether power is a measurable and meaningful concept; the sources and determinants of both individual and subunit power; how power is used in organizations, the conditions under which power and politics dominate organizational activity; the consequences of power and political activity; political tactics; and the implications of a political perspective for issues or organizational structure and design, the stratification of positions within the organization, and for organizational adaptation and change.

4 units, Aut (Pfeffer) TTh 10-12

166. Organizations and Public Policy—This course provides concepts and methods for analyzing the influence of organizations on the setting and implementation of public policy. Varying conceptions of organizations, both as corporate actors and as social contexts, will be reviewed and evaluated. The several roles of organizations in relation to public policy will be examined, including organizations as decision makers and problem solvers, as change agents, and as clients.

5 units, Win (Scott) MWF 9
one section T or Th at 9

SOCIOLICAL THEORY

All courses (DR:S) unless noted otherwise.

170. Classics of Social Theory—An in-depth introduction to the works of Marx, Durkheim, Freud, and Tocqueville. Examination of the questions these theorists pose and the answers they offer to fundamental problems of the relationship of individuals to society, the distinctive characteristics of modern societies, and the sources of reason and freedom in social life.

5 units, Spr (Swidler) MWF 9
two sections hours by arrangement

171. Introduction to Models in the Social Sciences—(Same as Political Science 105, Education 110.) Models of choice, exchange, transition, adaptation, and diffusion are used to predict and interpret human behavior. Emphasis is placed on the invention and application of models more than the testing of them. Pre-mathematical rather than mathematical.

5 units, Aut (March) TTh 8-10
and by arrangement

RESEARCH 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:T)

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. (DR:T)
4 units, Aut (Cohen) by arrangement

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

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. Undergraduate Honors Seminar—Designed for students participating in, or expecting to apply to the Honors Program.
1-3 units, Win, Spr (Staff) by arrangement

194. 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 (Staff)
(six weeks course) W 12

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATE STUDENTS

All courses (DR:S) unless noted otherwise.

207. 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 status distinctions are maintained; how and under what conditions status-distinctions determine an individual's expectations and behavior; how the effects of status distinctions can 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: Soc 5 or Soc 120 or by permission of instructor.
5 units (Berger) alternate years, given 1981-82

208. Seminar: Social Structure and Social Processes—Applications to be selected.
5 units, Spr (Tuma) F 2:15-5:05

210. Sociology of Education—(Meets with Sociology 310.) (Same as Education 210.) Introduction to sociological approaches to educational phenomena. Topics include school organization and environment, the relationship of education to adult roles, the impact of social class and ethnicity on classroom learning and the social structure of the classroom. Course work includes reading and evaluating social science research. Features short written assignments and individual feedback.
4 units, Win (E. Cohen and Talbert)
TTh 1:15-3:05

211. Seminar: Social Issues in Health Care—(Same as FCPM 350.) Course will cover selected social and policy issues in health and medical care, including topics such as the influences of social factors on illness and use of medical care, patient-provider interactions, the socialization of physicians, incentive structures in various health institutions, policymaking in biomedical innovation and alternative health care reform strategies. Sociological perspectives and research findings are contrasted with other approaches, with particular emphasis on the critical evaluation of alternative viewpoints, methodologies and evidence. A major research paper on one of the topics covered is required. Prerequisites: Soc. Ill or Human Biology 40 or consent of instructor.
4-5 units, Win (Dutton) TTh 10-12

220. Seminar: Social Structure of World Society—This seminar pursues a sociological analysis of society on a world-wide basis, i.e., 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 technol-
ology 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 (Inkeles) alternate years, given 1981-82

251. Biomedical Innovation and Public Policy—(Same as FCPM 252.) This course offers a limited number of advanced undergraduates and graduate students the opportunity to participate in an ongoing National Science Foundation-funded study entitled, "Medical Progress and the Public: Ethical Issues in Biomedical Innovation." The research deals with the policymaking process in four controversial biomedical innovations: diethylstilbestrol (DES); the artificial heart program; the swine flu vaccination program of 1976; and recombinant DNA research. Policy issues being studied include public participation, informed consent, risk assessment, political economy, compensation systems, and distributive justice. Prerequisite: consent of instructor.

3-5 units, Aut, Win, Spr (Dutton, Bunker) by arrangement

252. Research Problems on Demography of the Third World—(Same as Food Research 372.) This course is intended to introduce students to the topics of international relations and the external control of organizational behavior and to provide them with some experience in analyzing and thinking about organization-environment issues. Topics considered include the dimensions of organizational environments, the theoretical status of environment, and how environments are perceived and enacted by organizations; the implications of the resource dependence perspective for the topics of goals, effectiveness, and efficiency; organizational responses to interdependence including internal structural modifications, avoidance, adaptation, and attempts to manage the environment using strategies such as merger, cooptation, and joint ventures; the analysis of collective structures of interorganizational behavior, and how such structures emerge; and an analysis of some of the social consequences of interorganizational activity. Students will be expected to complete a major term paper in which the analytical concepts are
applied to the analysis of a small set of organizations.
4 units, Win (Pfeffer) MF 10-12

270. Seminar: Topics in Sociological Theory—Close study of a selected number of contemporary theoretical approaches to sociology, including examples drawn from ethnomethodology, functionalism, critical theory, exchange theory, structuralism and conflict theory. 5 units, Spr (Goode) M 2:15-5:05

282. Seminar: Quantitative History—A seminar on the use of the methods of quantitative history for sociological analysis. Open to advanced undergraduates and graduates in both history and sociology. 5 units, Win (Conell) Th 2:15-5:05

283. Seminar: Empirical Study of Moral Life—A seminar exploring various research strategies for studying contemporary moral life. Survey research, depth interviewing, case studies of social and religious movements, and structured techniques such as Kohlberg-style moral-choice vignettes will be examined as ways of exploring the dimensions of moral experience in contemporary America. Underlying interest in understanding how symbols and ideology ground moral life, and simultaneously, how ways of life and patterns of action transform moral belief. (DR:T) 5 units, (Swidler) alternate years given 1981-82

284. Demographic Methods—(Same as Food Research 286.) Methodology of population analysis, stressing demographic research methods which are widely applicable techniques in sociology, economics, anthropology, and other social sciences. (DR:T) 3-5 units, Win (Staff) MW 3:15-5:05

285. Seminar: Political and Economic Organization of the World System—Reviews current theory and research on the structures of the world economy and polity as they affect the organization and development of national societies. Covers dependency theories, current world-economy theories, and especially world effects on the evolution, dominance, and modern forms of states and regimes. (DR:T) 5 units, (Meyer) alternate years given 1981-82

287. Seminar: Convergence and Divergence in Industrial Societies—Focus on the question of whether, and how far, the industrial and the “developing” societies are converging or diverging in their social and cultural patterns. The special theory of convergence will be reviewed and evaluated in relation to more general theories of social change. Particular attention, will be given to the family and kinship, education, social stratification and mobility, but other institutional complexes of interest to the students will also be considered. (DR:T) 5 units, Spr (Inkeles) T 2:15-5:05

COURSES PRIMARILY FOR GRADUATE STUDENTS

All courses (DR:X).

300A,B,C. Graduate Proseminar—Limited to first-year graduate students in Sociology.
2 units, Aut (Staff) 12
Win (Staff) 12
Spr (Staff) 12

309A,B,C. Workshop on Organizational Ecology—A year long workshop on theoretical and research issues in population and community ecology of organizations. Topics covered include specialization-generalism, r and k selection, life cycle effects. Students will be required to prepare and present major research papers. Consent of instructor required for registration. 5 units, Aut, Win, Spr (Hannan) F 3:15-5:05

310: Sociology of Education—(Same as Education 310.) For doctoral and master’s students. Meets with Sociology 210 (See course description.) Emphasis on conceptualizing and analyzing applied sociological research in education. Features short written assignments, individual feedback and work with actual research data. 4-6 units, Win (E. Cohen, Talbert) TTh 1:15-3:05

320A,B,C. Trainee Seminar: Evaluation Processes—Required of trainees in the NIMH program on evaluation and processes but open to other interested graduate and advanced undergraduate students.
2 units, Aut, Win, Spr (Zelditch) T 12-1:30

360A,B,C. Trainee Seminar: 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) T 3:15-5:05

365. Seminar on Advanced Organization Theory—(Same as Political Science 306.) Topics in organization theory for advanced students. Prerequisite: Permission of instructor.
5 units, Aut (March) TTh 3:15-5:05

370A,B. Basic Problems in Sociological Theory—A two-quarter course on (1) the logical analysis of theories and (2) basic strategies of sociological analysis. Basic concepts required for the logical analysis of theories are introduced
in a preliminary way in the first four weeks of the course. These tools are then used for the analysis of various strategies of sociological analysis in the last six weeks of the Autumn and first six weeks of the Winter Quarter. Each strategy is illustrated by the study of one program of theoretical research starting with its origins in the classical literature and carried up to one or more contemporary formulations. The strategies studied vary from year to year but will be selected from among functionalism, historical materialism, human ecology, the theory of action, interactionism, behaviorism, decision-theory, and phenomenology. The last four weeks of the course are used to refine and extend the tools of theory construction, and require a self-directed computer course in logic. Prerequisite: consent of the instructors.

380A. Introduction to Sociological Research—(Same as 180A but restricted to Ph.D. candidates in Sociology or Sociology of Education.) For associated Laboratory see 380B.
3 units, Aut (Cohen) MWF 11

380B. Introduction to Sociological Research—(Laboratory, Same as 180B but restricted to Ph.D. candidates in Sociology or Sociology of Education.) Students must enroll concurrently in 380A.
4 units, Aut (Cohen) by arrangement

381A. Sociological Methodology I: Design and Analysis—Considers the basic principles of experimental and non-experimental design and applies them to the various observation plans used in sociological research. Introduces measurement theory. Reviews statistical foundations, including exploratory data analysis and the general linear model. Prerequisite: Statistics 160 or equivalent.
4-6 units, Win (Hannan, Tuma)

381B. Sociological Methodology II: Static Analysis—Introduces the various methods used in static sociological analysis. Topics include: single-equation structural equation models and path analysis, simultaneous equation systems, methods for cross-classified data, and models with latent variables. Prerequisite: Soc 381A or equivalent.
4-6 units, Spr (Hannan, Tuma)

381C. Sociological Methodology III: Dynamic Analysis and Mathematical Modeling—Introduces procedures for analyzing change, emphasizing the use of explicit continuous-time stochastic models. Topics covered include: event-history and panel analysis of change in qualitative variables, and panel analysis of quantitative variables. Also gives broad introduction to strategies of mathematical modeling of sociological processes and considers several classes of models. Prerequisite: Soc. 381B or equivalent.
4-6 units, Aut (Hannan, Tuma)

W 2:15-5:05

383. 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, Spr (Cohen) T 2:15-5:05

GRADUATE INDIVIDUAL STUDY

All courses (DR:X)

390. Graduate Individual Study.
(Staff) by arrangement

391. Special Colloquia.
(Staff) by arrangement

392. Graduate Research.
(Staff) by arrangement

393. Teaching Apprenticeship.
(Staff) by arrangement

394. Research Apprenticeship.
(Staff) by arrangement

(Staff) by arrangement

SPANISH AND PORTUGUESE

Emeriti: Aurelio M. Espinosa, Jr., Ronald Hilton, Juan B. Rael, Isabel Magaña Schevill (Professors); Grace Knopp (Assistant Professor)

Chairman: Joaquim-Francisco Coelho

Professors: Fernando Alegria, Joaquim- Francisco Coelho, Jean Franco (on leave 1980-81), Bernard Gicovate, Sylvia Wynter (on leave Winter, Spring).

Assistant Professors: Robert Ball, Rina Benmayor, Héctor Mario Cavallari (on leave Autumn), Mary Pratt, Tomás Ybarra-Frausto

Senior Lecturer: María Paz Haro (Director, Undergraduate Language Program)

Lecturer: Karin Van den Dool

The Department of Spanish and Portuguese accepts candidates for the degree of Bachelor of
Programs of Study

Bachelor of Arts

Recognizing that students have different interests and reasons for pursuing a major in the Department of Spanish and Portuguese, 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. Of all the courses taken, two should be literature prior to 1750.

Recommended: Courses in Chicano Literature, Linguistics, and Literary Theory.

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); 201 and 202 (Advanced Grammar and Composition); two courses in Peninsular Literature; two courses in Latin American Literature. Of all the courses taken, two should be literature prior to 1750.

Recommended: Courses in Chicano Literature, Linguistics, and Literary Theory.

III. Chicano Studies

The aim of this path is to permit more flexibility to students in Chicano Studies, allowing them to take courses in, for instance, the Departments of Literature, Linguistics and History, including optional courses in Chicano Studies. 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. In addition, they must take 25 units in Latin American or Peninsular Literature from courses numbered 100 or higher.

Requirements: Spanish 140 (Introduction to Methods of Literary Analysis); 180 (Undergraduate Winter Colloquium); two courses in Chicano Literature; four courses in Latin American and Peninsular Literature.

IV. Language

This path is intended for students whose primary interest is in the study 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, (Advanced Grammar and Composition); 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: Spanish 203; two literature courses in one area; Portuguese 109 (Portuguese for Students of Spanish).

Suggested Sequence:

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:

<table>
<thead>
<tr>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>180</td>
<td>152</td>
</tr>
<tr>
<td>151</td>
<td>161</td>
<td>162</td>
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Courses numbered 130, 131, 132 (130B, 131B, 132B) are recommended 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 109 (Portuguese for Students of Spanish) so as to acquire a basic reading kno
edge 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 from courses numbered 100 and higher, plus 15 or 20 units in a related field such as History, Latin American Studies, etc.

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 PROGRAMS ABROAD

SALAMANCA, SPAIN

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 Overseas Studies (Room 112, Old Union).

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 Filosofia y Letras at the University of Salamanca.

Students may take up to 20 units at Salamanca to apply toward their majors.

For information consult Overseas Studies.

LIMA, PERU

SAO PAULO, BRAZIL

Stanford participates in two consortium-based programs in South America: one in Lima, Peru, and one in Sao Paulo, Brazil. Each is a full-year program beginning early in the summer and continuing through the following June. Students enroll in the Pontificia Universidad Catolica del Peru in Lima or at the Universidade de Sao Paulo in Brazil. For credits in these and other programs abroad, consult your advisor.

INTENSIVE SUMMER PROGRAM

Stanford University offers intensive language study in Spanish 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 Administrator, 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 advisor and two other faculty members.

ADVANCED DEGREES

MASTER OF ARTS IN SPANISH

This program is designed for those students who do not intend to continue their studies through the Ph.D. degree. By University regulation, students desiring the A.M. degree must complete a minimum of 45 units, 36 of which must be completed at Stanford.

Requirements: 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 other than Spanish (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.

COTERMINAL 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 Portuguese and one other foreign language; (4) the preliminary, qualifying and University Oral examinations, as described below; (5) the teaching of at least two courses in the department; (6) 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) Luso-Brazilian 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 appren-
ticeship 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 on the first day of the Autumn Quarter of their second year. This evaluation constitutes the preliminary examination.

After the preliminary examination, students concentrate on the major field of study. After completion of course work requirements at the end of the third year of study they will take the qualifying examination. Before taking the qualifying examination, and after completion of the course work, students will hand in a long research paper and a course syllabus as part of the qualifying procedure. The qualifying examination is based on a comprehensive list of readings in the candidate's major field. (For further information, consult the Departmental Guidelines for Graduate Students.)

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. (For further information consult the Departmental Guidelines for Graduate Students.)

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 choose a member of the department as his or her advisor. The advisor will request the Chairman 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.

The dissertation must be submitted to the advisor 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.
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 (250-289)
   Special Topics (290-298)
   Individual Work (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 Work (399)
F. Portuguese Program (1-399)
   Language (1-199)
   Portuguese Literature (210-245)
   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. All courses (DR:H)

120A. Don Quixote in Translation.
3-5 units, (Ball)

121A. Spanish Drama in Translation.
3-5 units, (Gicovate)

123A. Spanish-American Literature in Translation—Analysis, discussion of representative works.
3-5 units, Win (Ybarra-Frausto)

126A. Brazilian Literature in Translation—Analysis, discussion of representative works.
3-5 units (Staff)
by arrangement

162A. Contemporary Chicano Literature—(Same as English 162A.)
5 units, Aut (Islas)

SPANISH LANGUAGE PROGRAM

Maria-Paz Haro
Director

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. For courses 11B, 12B, and 13B see special section for bilingual students. (No auditors permitted in language courses.)

INTRODUCTORY COURSES

1. First-Year Spanish (1st quarter)—An introductory course with emphasis on speaking and oral comprehension. (DR:X)
   5 units, MTWThF, plus additional work in the Language Laboratory

2. First-Year Spanish (2nd quarter)—As above, with additional development of reading and writing skills, and cultural readings.
   Prerequisite: Spanish 1 or equivalent. (DR:X)
   5 units, MTWThF, plus additional work in the Language Laboratory

3. First-Year Spanish (3rd quarter)—As above, with additional cultural and/or literary readings. Prerequisite: Spanish 2 or equivalent. (DR:X)
   5 units, MTWThF, plus additional work in the Language Laboratory

5. Intensive First-Year Spanish—An all in Spanish method is used, offering preparation in listening, speaking, reading and writing the language with oral presentations and small group conversation sections. Written exercises, short compositions, and daily work in the language laboratory are also an integral part of the course.
   (Classes limited to 15 students. No auditors permitted.) (DR:X)
   9 units, Sum (Staff)

10. 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. Given Pass/No Credit only. (DR:X)
2 units, (Staff)

11R. Grammar Review.

11. Second-Year Spanish (1st quarter)—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 (F optional)

12. Second-Year Spanish (2nd quarter)—As above, with composition and conversation based on primarily literary readings. Prerequisite: Spanish 11 or equivalent. (DR:H)
4-5 units, (Staff) MTWTh (F optional)

13. Second-Year Spanish (3rd quarter)—Application of grammatical concepts to composition, conversation, and oral presentation. Prerequisite: Spanish 12 or equivalent. (DR:H)
4-5 units, (Staff) MTWTh (F optional)

50. Intermediate Conversation—Recommended as a complement to Second Year courses. Prerequisite: Spanish 3 or equivalent. Given Pass/No Credit only. (DR:H)
3 units, (Staff)

100. Advanced Conversation—Prerequisite: Spanish 13 or equivalent. Given Pass/No Credit only. (May be counted only once for the major.) (DR:H)
3 units, (Staff)

SPECIAL COURSES

1S, 2S, 3S. First-Year Individualized Spanish—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 Spanish, 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. It is advisable that students also take Spanish 10 for conversational practice. (DR:X)
1-15 units, Aut, Win, Spr (Staff)

15. Reading Spanish—Intensive course designed for those seeking to fulfill the University requirement of a reading knowledge of Spanish. (DR:X)
3 units, Spr (Staff)

21M. Spanish for Medical Personnel—Course is geared to achieving a practical, rapid, and immediately useful command of spoken Spanish. It covers such essential topics as the human body, hospital procedures, diagnostics, food, and essential phrases for on-the-spot reference when dealing with Spanish-speaking patients. (DR:X)
3-5 units, Aut (Staff)

22M. Spanish for Medical Personnel—Same as above.
3-5 units, Win (Staff)

23M. Spanish for Medical Personnel—Same as above.
3-5 units, Spr (Staff)

99. Individual Work—Cannot be taken as a substitute for any of the regularly scheduled language courses. (DR:X)
1-5 units (Staff) by arrangement

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 13 or equivalent. For courses 130B, 131B, 132B see special section for bilingual students.

130. Journalism and Composition. (DR:H)
3-5 units, Aut (Pratt)

131. Latin American Cultural Readings and Composition—La nueva trova, La nueva canción: Poetry and Song in Cuba, Brazil, Chile, and Spain. (DR:H)
3-5 units, Win (Benmayor)

132. Spanish Cultural Readings and Composition. (DR:H)
3-5 units, Spr (Benmayor)

135. Chicano Culture—Interdisciplinary approach to the study of Chicano life and culture. Topics will include formation of the barrio; labor conflict, folklore and beliefs; forms and figures of cultural resistance (corridos, bandits, popular leaders); patterns of immigration; and stereotypes and self-images in fiction, poetry and teatro. (DR:H)
3-5 units, Win (Benmayor)

COURSES FOR BILINGUAL STUDENTS

11B. Second-Year Spanish for Bilingual Students—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

12B. Second-Year Spanish for Bilingual Students—Continuation of 11B. Prerequisite: 11B or interview with instructor. (DR:H)
5 units, Win (Staff) MTWThF

13B. Second-Year Spanish for Bilingual Students—Continuation of 12B. Prerequisite: 12B or interview with instructor. (DR:H)
5 units, Spr (Staff) MTWThF

100B. Advanced Conversation for Bilingual Students—Given Pass/No Credit only. (May be counted only once for the major.) (DR:H)
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 (Staff)

131B. Latin American Cultural Readings and Composition—Includes selected grammatical problems and introduction to literary texts. (DR:H)
3-5 units, Win (Staff)

132B. Hispanic Cultural Readings and Composition—Selected grammatical problems and emphasis on composition. (DR:H)
3-5 units, Spr (Staff)

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.) (DR:X)
3-5 units, Win (Alegria)

LITERATURE

Courses will emphasize a broad perspective on Hispanic literature and provide an introduction to literary studies. Prerequisite: Spanish 13 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 13 or equivalent. (DR:H.)
3-5 units, Aut (Ybarra-Frausto) Aut 1981-82 (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 courses. 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 13 or equivalent.

151. Spanish Literature I—Major works of the Middle Ages and the Renaissance. (DR:H)
3-5 units, Aut (Ball) Win (Bennemayor) given 1981-82

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 (Gicovate)

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 courses. 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 13 or equivalent.

161. Spanish American Literature I—Readings in 20th century Latin American fiction and drama. (DR:H)
3-5 units, Win (Cavallari)

162. Spanish American Literature II—"Contemporary Latin America: Poems and Songs." Readings in outstanding poets (Vallejo, Neruda, Guillén, Cardenal, Benedetti) and song-writers (Violeta Parra, Dorival Caymi, Atahualpa Yupanki, Chico Buarque,
SCHO"L OF HUMANITIES
AND SCIENCES

Silvio Rodríguez, etc.) in their corresponding social context. (DR:H)

3-5 units, Spr (Cavallari)
Spr 1981-82 (Pratt)

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 13 or equivalent. (DR:H)

Oral Literature—Old Spanish epic and ballad, contemporary folk tales, Nuyorican poetry and song, oral narratives of personal experience, and many other manifestations of oral, popular art in Spain and Latin America. (DR:H)

3-5 units, Win (Benmayor)

199. Individual Work—Open only to majors in Spanish. (DR:X)

1-12 units (Staff) by arrangement

COURSES FOR ADVANCED UNDERGRADUATES AND GRADUATES (200-299)

ADVANCED LANGUAGE AND LINGUISTICS

200. Spanish Pronunciation and Phonetics. (DR:X)

3 units, Spr (Gicovate) given 1981-82

201. Advanced Grammar—Problems of grammar at an advanced level. (DR:H)

3 units, Aut (Gicovate)

202. Advanced Composition—Workshop on syntax and style. (DR:H)

3 units, Win (Gicovate)

203. Problems in Translation—A workshop for advanced language students. (DR:H)

3 units (Gicovate)

204. Introduction to Spanish Versification. (DR:X)

3 units (Gicovate)

205. Introduction to Bilingualism—(Same as Linguistics 160.) 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. (DR:A)

4-5 units (Staff)

206. Topics in Bilingualism—(Same as Linguistics 260.)

3 units (Staff)

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. (DR:X)

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:H)

3-5 units, Spr (Benmayor)

209. Variation in Spanish—(Same as Linguistics 288.) 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. (DR:S)

5 units (Staff)

PENINSULAR LITERATURE

210. Prose Narrative in Spain—Texts from the Medieval, Golden Age and Modern periods. (DR:H)

3-5 units (Benmayor) given 1981-82

211. Drama in Spain from 1492 to the Present—Selected plays including La Celestina, Cervantes, Lope de Vega, Calderón de la Barca, Moratín, Zorrilla, Benavent, García Lorca and Arrabal. (DR:H)

3-5 units (Ball)

212. Poetry in Spain from the Beginnings through 1970.

3-5 units, Spr (Ball)

216. The Epic and the Ballad—Graduates enroll in 316. (DR:H)

3-5 units (Benmayor) given 1981-82

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. (DR:H)

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.) (DR:H)

3-5 units (Benmayor)


3-5 units (Ball)

222. Golden Age Drama from Gil Vicente to Calderón. (DR:H)

3-5 units (Staff)

223. The Literature of Delinquency—See 323 for description. (DR:H)

3-5 units, Aut (Benmayor)

224. Don Quijote and the Theory of the Novel—Undergraduates enroll in 224. See 324 for description. (DR:H)

3-5 units, Win (Ball)

225. Introduction to the Lyrical Poetry of Camões—See Portuguese 225. (DR:X)

3-5 units (Coelho)

237. Spanish Post-War Novel—Social, political and ideological processes in Spain after 1950 as reflected in specific changes in world view and novelistic form in the nation’s narrative production Goytisolo, Martín Santos, Marsé, and others. (DR:H)

3-5 units (Cavallari)

240. Main Currents of the Literature of Portugal—For description see Portuguese 240. Enroll in Portuguese 240. (DR:H)

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 (Staff)

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, Henriquez Urena, 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)


3-5 units (Ybarra-Frausto)

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)


3-5 units (Franco)

253. Western Culture and the Latin American Experience. The Semiotics of Self and Other—This course will explore, in their socio-historical context, the relations of the imagination between Western culture and that of the New World experience designated as Latin American. A semiotic analysis of the term Latin America in relation to the complex Indian/European/African sociocultural reality which it designates, will serve as the point of departure for the analysis of a dual process—the impact of the New World upon Western conceptual thought and imaginative literature, and the impact of Western culture upon the emerging reality of the Southern and Caribbean areas of the Americas. (DR:H)

3-5 units, Aut (Wynter) given 1981-82

260. The Cuban Short Story—Benítez Rojo, Cabrera Infante, Jesús Diaz. (DR:H)

3-5 units, Aut (Alegria)

The Mexican Short Story—Rulfo, Revueltas, Arreola, Castellano. (DR:H)

3-5 units, Aut (Alegria)

given 1981-82

263. Latin American Literature in Exile—During the present period of social regression in Latin America a new literature of exile has developed. Drawing away from the technical experimentations of the 60’s, this literature (narrative, poetry, theater, testimony) appears as a direct and powerful statement of social consciousness and political commitment. Works by Chilean, Uruguayan, Argentinean, and Central American authors will be read. (DR:H)

3-5 units (Alegria)
264. Post-Revolutionary Cuban Fiction—Exploration of essential themes and definition of fundamental structures characterizing Cuba since 1959. (DR:H)
3-5 units, Spr (Cavallari) given 1981-82

266. Contemporary Argentine Fiction—The disintegration of traditional structures and the search for personal and national identity; the status of writing and the limitations of knowledge; the deconstruction of power; and other outstanding themes. Readings in Arlt, Mallea, Sábat, Marechal, Viñas, Puig and others. (DR:H)
3-5 units, Win (Cavallari)

3-5 units, Aut (Coelho)

268. Brazilian Literature II—(Enroll in Portuguese 268.) See Portuguese 268 for description. (DR:H)
3-5 units, Win (Coelho)

CHICANO STUDIES

280. Introduction to Chicano Literature—Study of selected works by major Chicano writers including poetry, fiction, and drama with emphasis on 20th-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, Spr (Ybarra-Frausto)

281. History of the Chicanos in the U.S. 19th Century Roots and 20th Century Developments—See History Department for listings. 4-5 units (Staff)

282. La poesía chicana. (DR:H)
3-5 units (Ybarra-Frausto)

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—Knowledge of Spanish required. (DR:X)
5 units

288. Undergraduate Colloquium: Chicano History—(Same as History 262.)
5 units, Aut (Camarillo)

SPECIAL TOPICS

290. The Hispanic Elegy. (DR:H)
3-5 units (Coelho)

291. The Poem In Context—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:H)
3-5 units (Coelho)

292. Ideology and Mass Culture—Against stereotypes. The course will deal with the new Latin American cinema in contrast to the Hollywood movie and its stereotypes of the Latin. (DR:H)
3-5 units (Franco)

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. (DR:H)
3-5 units, Win (Gicovate) given 1981-82

295. Hispanic Poetry of the Twentieth Century II. (DR:H)
3-5 units, Spr (Gicovate) given 1981-82

296. Interpretive Strategies / Strategic Interpretations: Western Views of the Non-West through the Literature of Travel—This course focuses on the Western traveler in the Third World as cross-cultural mediator and interpreter, and on the ideological appropriation of foreign contexts as related to developments in world history and economy. Course materials include travelogues, journals, letters, essays, works of fiction, documentary and ethnographic writings, and film. Open to all students; no prerequisites. Readings will be in English. (DR:H)
3-5 units, Win (Pratt, Benmayor)

298. Creative Writing in Spanish: A Workshop. (DR:X)
3-5 units, Spr (Alegria) given 1981-82

299. Individual Work—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) unless noted otherwise.

301. Methods of Teaching Spanish—A practical guide to the teaching of language. Analysis and discussion of classroom practices and instructional material.
3-5 units, Spr (Haro)

304. Proseminar in Problems and Methods of Research in Hispanic Literature I.
3-5 units (Gicovate)

305. Proseminar in Problems and Methods of Research in Hispanic Literature II.
3-5 units (Gicovate)

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.
3-5 units, Win (Pratt)

307. Semiotics and the Theory of Textuality—Readings in contemporary theory.
3-5 units (Ball)

308. Marxism and Aesthetics: Problems of Narrative Discourse—(Same as Modern Thought and Literature 308.) Fundamental propositions of historico-dialectical materialism concerning the status and function of literary discourse, with special attention to epistemological and structural problems of fiction. Readings in Jameson, Williams, Benjamin, Brecht, Bakhtin, Lukacs, Althusser, Kristeva, and others.
3-5 units, Win (Pratt) given 1981-82

309. Critique of Structuralism and Poststructuralism—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)

310. Linguistics and Literature—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)

311. Drama in Spain from 1492 to the Present—See 211 for description. (DR:H)

312. Poetry in Spain from the Beginnings through 1970—See 212 for description. (DR:H)

316. The Epic and the Ballad.
3-5 units, Aut (Benmayor) given 1981-82

3-5 units (Benmayor)

3-5 units (Ball)

3-5 units, Aut (Benmayor)

324. Don Quixote and the Theory of the Novel—(Same as Spanish 224.) A close reading of Don Quixote in the light of recent theories of narrative structure.
3-5 units, Win (Ball)

326. Seminar on Baroque Poetics—Poetic imitation and originality in Gongora. Reading knowledge of Spanish required.
3-5 units (Ball)

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 (Franco) given 1981-82

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 (Franco) given 1981-82

3-5 units, Win (Alegria) given 1981-82
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 Véliz. The course will include discussion of general theoretical problems.
3-5 units, Aut (Cicovate)

3-5 units, Win (Alegria)

355. Contemporary Spanish American Poetry—Main lines in the development of poetic production since Parra's influential Poemas y antipoemas. Readings in Cardenal, Lihn, Trejo, Garcia Robles, Cisneros, Benedetti, and others, seeking to define each writer's poetics in its relation to the corresponding textual practice.
3-5 units, Spr (Cavallari)

356. Latin American Writing of the Colonial Period—A contextual study of the chronicles, poetry and drama of Colonial Latin America. The course will include both the culture of the elite studied in social context and the literature of the conquered.
3-5 units (Franco) given 1982-83

357. Latin American Writing in the Nineteenth Century I.
3-5 units (Alegria) given 1982-83

358. Latin American Writing in the Nineteenth Century II.
3-5 units (Cavallari) given 1982-83

370. The Luso-Brazilian Short Story—For description see Portuguese 370. Enroll in Portuguese 370.
3-5 units, Spr (Coelho)

3-5 units, Aut (Alegria) given 1981-82

3-5 units, Aut (Alegria)

3-5 units (Coelho)

380. Interdisciplinary Research Seminar in Chicano Studies—Problems of literature in a bicultural bilingual context. (Same as 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 (Staff)

392. Research Seminar on Dante—Topics of theoretical and methodological interest from the Vita Nuova, Convivio, and Commedia.
3-5 units (Ball)

3-5 units (Ball)

399. Individual Work—Exclusively for graduate students in Spanish working on thesis or engaged in special work.
1-12 units, any quarter (Staff) by arrangement

PORTUGUESE
INTRODUCTORY COURSES
All courses (DR:X) unless noted otherwise.

1. First-Year Portuguese (1st quarter)—An introductory course with emphasis on speaking and oral comprehension.
5 units, Aut (Staff) MTWThF, plus additional work in the Language Laboratory

2. First-Year Portuguese (2nd quarter)—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. First-Year Portuguese (3rd quarter)—As above, with additional cultural and/or literary readings. Prerequisite: Portuguese 2 or equivalent.
5 units, Spr (Staff) MTWThF, plus additional work in the Language Laboratory.

11. Second-Year Portuguese (1st quarter)—Emphasis on reading, discussion, and composi-
tion. Grammar review included. Prerequisite: Portuguese 3 or equivalent. (DR:H)
4-5 units (Staff)

12. Second-Year Portuguese (2nd quarter)—Continuation of 11. Prerequisite: 11 or equivalent. (DR:H)
4-5 units (Staff)

13. Second-Year Portuguese (3rd quarter)—Continuation of 12. Prerequisite: 12 or equivalent. (DR:H)
4-5 units (Staff)

99. Individual Work—Cannot be taken as a substitute for any of the regularly scheduled language courses.
1-5 units (Staff) by arrangement

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, Aut (Van den Dool)

199. Individual Work—Enrollment only by permission. Prerequisite: 13 or equivalent.
1-5 units, any quarter (Staff) by arrangement

ADVANCED UNDERGRADUATE AND GRADUATE COURSES (200-299)

225. Introduction to the Lyrical Poetry of Camões—Study of the most significant lyrical poems of Camões, with emphasis on the sonnets. (DR:H)
3-5 units (Coelho)

240. Portuguese Literature—Main currents of the literature of Portugal. Major authors and socio-esthetic ideas from the 12th century to the present. (DR:H)
3-5 units (Coelho)

267. Brazilian Literature I—Survey of literary trends and authors of Brazilian literature. (DR:H)
3-5 units, Aut (Coelho)

268. Brazilian Literature II—Survey of literary trends and authors of Brazilian literature. (DR:H)
3-5 units, Win (Coelho)

290. The Hispanic Elegy—(Same as Spanish 290.) (DR:H)
3-5 units (Coelho)

291. The Poem In Context—(Same as Spanish 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:H)
3-5 units (Coelho)

299. Individual Work—May be repeated for credit. (DR:X)
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 "heterônimos" 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, Spr (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), Rosedith Sitgreaves (Professor by Courtesy)
Chairman: Paul Switzer


Professor of Biostatistics: Byron W. Brown

Associate Professor: Persi Diaconis

Assistant Professors: James A. Fill, J. Michael Steele, Werner Stuetzle
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, Werner Stuetzle). 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 two practicum workshops, in biology-medicine, 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.

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 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, 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, 227, 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, 206, 210, 225, 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 202, 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 202, 206, 207 and 240 within the department.

Students interested in sociology, political science, or communications may take 140, 160, 161, 203, 204, 205, 206, 208, 226, 257.

Students interested in computer science may easily arrange a program for a Master's degree in Statistics.

In general, combinations of courses may be arranged to suit particular interests in most fields.

A 2.75 letter grade indicator will be required for all Statistics courses which are taken for a letter grade toward an M.S. degree, and all Statistics courses required for the M.S. degree (116, 217, 218, 219, 220, and 3 additional courses) which are offered for letter grades must be taken for letter grades.

MASTER OF SCIENCE: DATA ANALYSIS AND STATISTICAL COMPUTING

The goal of this new program is to teach data analytic procedures and their applications to real world problems. Special emphasis is placed on the use of computers and on the design of efficient algorithms for statistical computations. The program is thus more practically oriented than the Ph.D. program and mathematically less demanding. The degree is a terminal degree. Students planning to obtain the Ph.D. degree are advised to apply directly to the Ph.D. program.

Upon entrance to the program, students are expected to have proficiency on the level of Statistics 60 and Computer Science 106. Students lacking in one or both of these areas should enroll in and complete these courses prior to entering the program. Experience in practical applications of statistics and/or a background in mathematical sciences is advantageous.

The course requirement is 45 units of work from offerings in the Statistics Department or from authorized courses in other departments. Each student will normally fulfill the following requirements for the degree:

3. Additional units to complete the requirements. These are normally taken from the group of courses Statistics 203, 204, 217, 218, Computer Science 144, 145.
4. Each student is required to work on a practical project (3-5 units). This can be either the development of a reasonably sophisticated computer program or the application of statistical procedures to a current data analytic problem.

A 2.75 letter grade indicator will be required for all Statistics courses required for the M.S. degree in Data Analysis and Statistical Computing. All courses which are offered for letter grades must be taken for letter grades.
DOCTOR OF PHILOSOPHY

Candidates for the degree of Doctor of Philosophy in Statistics will follow such courses as are approved by the department faculty, subject to general University regulations. Each student's program should be arranged to include work in pure mathematics, 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 probes 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, 60, 61, 70. 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. 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.

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 (Solomon) MWF 11

40. Chance and Strategy—Precalculus course for nonmathematical students in probability theory and game theory. Permutations and combinations, conditional probability, expectation, two-person games, risk and minimax theory, simple gambling and other games.
3 units, Aut (Miller) MWF 2:15

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.) NOTE: Students cannot receive credit for both Statistics 60 and Psychology 60.
5 units, Aut (Solomon) 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 (Solomon) MTWThF 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

105. Quantitative Methods and Their Application to Public Policy—Focusing upon applications of statistical methods, rather than methodology per se, this course will consider such topics as risk assessment in the evaluation of biohazards and medical techniques and technologies; comparisons of such information-gathering techniques as surveys, experiments, or simulation studies; methods of expressing and evaluating uncertainty; and the interpretation of such quantitative techniques of data analysis as regression. Prerequisites: Statistics 60 and 61.
5 units, Spr (Moses) MTWThF 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 hypotheses, nonparametric methods, curve fitting by least squares, analysis of variance, elementary experimental design. Prerequisite: One year of calculus.
4 units, Aut (Solomon) TTh 10

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 (Willits) MTWF 10

116E. Theory of Probability—A course similar to 116 designed especially for engineering students. Prerequisite: Mathematics 44.
3 units, Aut (Switzer) 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. Pre-
requisite: Statistics 116. (Graduate students enroll in 219, 220.)

119. 4 units, Win (Cover) MWF 11

120. 4 units, Spr (Cover) MWF 11

119, 120. 8 units, Sum (Staff) MTWThF 8-9:50

140. Chance and Strategy—For graduate students. Lectures same as 40.
3 units, Aut (Miller) MWF 2:15

152. Introduction to Operations Research I—(Enroll in Operations Research 152.) Theory and computation of optimal selection of decisions under uncertainty. 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 11-12:05

4 units, Win (Iglehart) TTh 1:15-3:05

160. Introduction to Statistical Methods I—For graduate students. Lectures same as 60.
5 units, Aut (Solomon) MTWThF 11:15
Spr (Miller) MTWThF 11:15
Sum (Staff) MTWThF 11:15

161. Introduction to Statistical Methods II—For graduate students. Lectures same as 61.
5 units, Win (Moses) MTWF 1:15

199. Independent Study—For undergraduates. (DR:X)
(Staff) by arrangement

B. COURSES PRIMARILY FOR STUDENTS IN OTHER DEPARTMENTS AND FOR MASTER'S CANDIDATES

All courses (DR:T) unless noted otherwise.

Courses in this category have been designed for particular use in applications, either by professional statisticians or by researchers in other fields. The core courses for the Master's degree program are 116, 217, 218, 219, 220, plus additional 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 1981-82

5 units, Aut (Friedman) MTWThF 10

201B. Data Analysis II—Classification and discriminant analysis. Dimensionality reduction. Principal components, factor analysis, multidimensional scaling. Cluster Analysis, Canonical correlation and general multivariate association. Treatment of missing values. Data validation. Topics will be discussed from the point of view of their application and the emphasis will be on conceptual rather than theoretical understanding. Prerequisites: Statistics 201A or equivalent.
3 units, Win (Diaconis) MWF 10

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, given 1981-82

203. Introduction to Analysis of Variance and Design—The most widely used statistical technique. The proper design for and interpretation of observational data. Topics include regression, one- and two-way factorial experiments, orthogonal contrasts, model II. Prerequisites: a basic course in Statistics (Statistics 61, 110, or 120).
3 units, Spr (Steele) 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; particular emphasis on applications. Prerequisite: A basic course in statistics (Statistics 61, 110, or 120).
3 units, given 1981-82

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 independence. Nonparametric confidence interval estimates. Prerequisites: A basic course in statistics (Statistics 61, 110, 120, or 200). (Concurrent registration in 120 is permitted.)
3 units, Win (Fill) MWF 1:15

206. Applied Multivariate Analysis—Introduction to statistical analysis of several quantitative measurements on each observational unit. Emphasis on concepts, methods, computation, interpretation. Examples drawn from substantial fields such as economics, education, geology, psychology. Topics include multiple regression, multivariate analysis of variance, principal components, factor analysis, canonical correlations. Prerequisites: A basic course in statistics (Statistics 61, 110, 120, or 200). (Concurrent registration in 120 is permitted.)
3 units, Spr (Anderson) MW 1-3

207. Introduction to Time Series Analysis—Time series models used extensively in economics, engineering, physics, geology, etc. Trend fitting, autoregressive schemes, moving average models, periodograms, second order stationary processes, spectral analysis. Prerequisites: Statistics 116 and a basic course in statistics (Statistics 61, 110, 120, or 200). (Concurrent registration in 120 is permitted.)
3 units, Spr (Olkin) MW 1-3

208. Mathematical Models in Behavioral Sciences: Psychometrics—Examination of mathematical models and applications in psychometrics. Illustrative topics are factor analysis, mental testing, clustering and classification, multidimensional contingency tables. Prerequisite: Statistics 120.
3 units, Win (Solomon) M 4:15-6

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, Aut (Olkin) MW 1-3

217. 3 units, Aut (Fill) MWF 2:15
Win (Karlin) MWF 3:15
218. 3 units, Win (Fill) MWF 2:15
Spr (Karlin) MWF 3:15

217,218. 6 units, Sum (Staff) MTWThF 10-11:50

219, 220. Statistical Inference—For graduate students. Lectures same as 119, 120.
219. 3 units, Win (Cover) MWF 11
220. 3 units, Spr (Cover) MWF 11
219,220. 6 units, Sum (Staff) MTWThF 8-9:50

3 units, Spr (Golub) MWF 10

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, Spr (Willits) MWF 9

229. Selected Topics in Data Analysis—In this seminar each student will choose a topic in the area of statistical computing or data analysis. He will read relevant journal articles and give an expository one hour presentation to the class.
3 units, Spr (Stuetzle) W 1:15-3:05

251. Stochastic Models in Operations Research—(Enroll in Operations Research 251.) Introduction to stochastic modeling. Orienta-
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 queueing theory, inventory theory, Markov decision processes, dynamic programming, reliability theory. Prerequisite: Statistics 217.

3 units, Spr (Taksar) 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 2:45-4:45

299. Literature of Statistics—Intensive study of literature of any special topic, usually culminating in the preparation and presentation of reports upon topics studied. (DR:X)

(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 (Steele) MWF 11
230B. 3 units, Win (Steele) MWF 11
230C. 3 units, Spr (Steele) MWF 11

233A,B,C. Applied Statistics—Analysis of variance, multiple regression, components of 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 (Stuetzle) MWF 3:15
233B. 3 units, Win (Stuetzle) MWF 3:15
233C. 3 units, Spr (Efron) 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 (Johns) MWF 2:15
236B. 3 units, Win (Johns) MWF 2:15
236C. 3 units, Spr (Johns) MWF 2:15

240. Linear Programming—(Enroll in Operations Research 240.) This course will survey linear programming, emphasizing standard model formulation, fundamental theorems, variations of the simplex method and parametric programming. Corequisite: Mathematics 113.

3 units, Aut (Cottle) TTh 4:15-5:30


3 units, Win (Staff) 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, Moses) Th 1:15-3:05
260B. 1 to 5 units, Win (Brown, Efron, Miller, Moses) Th 1:15-3:05
260C. 1 to 5 units, Spr (Brown, Efron, Miller, Moses) 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. Inequalities: Theory and Applications—Presentation of underlying themes to the development of a theory of inequalities with particular emphasis on applications in reliability, probability, and statistics (as well as economics, matrix theory, combinatorics). (a) Totally positive functions. These arise in a variety of contexts; they possess reproductive and smoothing properties that make them exceedingly useful. (b) Schur functions and majorization. Majorization is a partial ordering that is extremely rich. Applications from a broad class of fields are discussed. (c) Convexity in stochastic orderings. Some of the types of inequalities discussed are: matrix inequalities, moment inequalities, stochastic inequalities, norm inequalities, extremal inequalities.

3 units, Spr (Karlin, Olkin)
MW 1:30-3


317. 3 units, given 1981-82
318. 3 units, given 1981-82

324A, B. 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 1981-82
324B. 3 units, given 1981-82

325. Advanced Multivariate Analysis—Topics will be selected from among the following: the central and noncentral distributions of covariance matrices, characteristic roots of covariance matrices, and functions of these in terms of hypergeometric functions with matrix arguments, involving zonal polynomials. Asymptotic expansions of these distributions. The group structure of likelihood ratio tests (Danish school). Admissibility of invariant tests; unbiasedness and monotonicity of power functions of such tests. Linear functional and structural relations. Estimation of simultaneous equations systems. Estimation of mean vectors and covariance matrices with linear structure.

3 units, Aut (Anderson) MWF 11

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, given 1981-82
326B. 3 units, given 1981-82

328A, B. Nonparametric Statistical Inference—Statistical inference without strong model assumptions; hypothesis testing and estimation using permutations and ranks; nonparametric model-fitting, tolerance limits, discriminant analysis, and analysis of variance.

328A. 3 units, Aut (Johns) MWF 11
328B. 3 units, Win (Efron) MWF 11

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.

3 units, given 1981-82

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.

3 units, given 1981-82

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, asymptotics, the influence curve. Robustness in hypothesis testing. Survey of recent literature. Prerequisite: Statistics 236A, B, C.

3 units, given 1981-82

336A, B. Decision Theory and Statistical Inference—Minimax theorem, admissibility and complete class theorem, formulation of statistical decision problems, sufficient statistics, testing hypotheses, estimation, comparison of experiments, and sequential problems.

336A. 3 units, Aut (Diaconis) MWF 2:15
336B. 3 units, Win (Diaconis) MWF 2:15


343A. 3 units, Win (Stein) MWF 3:15
343B. 3 units, Spr (Stein) MWF 3:15
351. 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.

3 units, given 1981-82


3 units, Aut (Taksar) TTh 9-10:15


3 units, Spr (Iglehart) TTh 11-12:15


3 units, Spr (Taksar) TTh 8-9:15


3 units, given 1981-82

399. Research—Research work as distinguished from independent study of nonresearch character listed in 199 and 299. (DR:X)

Staff by arrangement
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 Western Culture requirement and the Writing Requirement that all undergraduates must fulfill for graduation.

091. SLE: 9 units, Aut (Staff)
TTh 9, 3:15 and 7

092. SLE: 9 units, Win (Staff)
TTh 9, 3:15 and 7

093. SLE: 9 units, Spr (Staff)
TTh 9, 3:15 and 7

WESTERN CULTURE PROGRAM

As part of the newly defined Distribution Requirements, the University has implemented a Western Culture requirement. Beginning with this year's freshman class, students must complete a three-quarter sequence of courses which are expressly designed to introduce them to major works and historical movements in Western Culture. Sponsored by different departments and programs, the seven sequences nevertheless share a core of readings, so that all students will be exposed to certain great works.

The sequences have different formats, but in addition to the core readings they share one other important feature. Each sequence provides at least two hours per week of small group instruction with an experienced teacher-scholar, often a regular member of the Stanford faculty.

All students should fulfill the Western Culture requirement during their freshman year if at all possible. Since the sequences do not all proceed at the same pace, or cover the material in the same order, students must complete one entire sequence to satisfy the Western Culture portion of the Distribution Requirements. For 1980-81, the sequences listed below are expected to be available. (DR) markings pertain to students who entered Stanford prior to Autumn, 1980.

WESTERN CULTURE 557
GREAT WORKS OF WESTERN CULTURE
(formerly Western Culture 1, 2, 3)

This sequence was specifically created to meet the requirement. Students meet for four hours per week in classes of twenty or less to discuss great works of philosophy, religion, imaginative literature, history and science. These discussions are led by members of the faculty from departments and programs throughout the University. Once a week a lecture by an outstanding scholar helps analyze these works and place them in their historical contexts.

Participating faculty:

Ronald A. Rebholz (English) Coordinator,
Fernando Alegria (Spanish and Portuguese),
Theodore Andersson (German Studies), Jean-
Marie Apostolides (French and Italian), John
Bender (English), Stephen Ferruolo (History),
David Halliburton (English), Eric Hutchinson
Chemistry), Charles Lyons (Drama), Richard
Morse (History), Kathleen Namphy (Western
Culture Program), David Riggs (English), Lucio
Ruotolo (English), Douglas Russell (Drama),
Paul Seaver (History), Edward Spofford (Cla-
cases), Lawrence Stahlberger (Slavics), Susan
Stephens (Classics), John Winkler (Classics),
Ellen Woods (Western Culture Program)

1. From the Beginnings to the End of the Ancient World—The course will explore the great writings of the Jews, Greeks, Romans and Christians from Genesis to St. Augustine's.

5 units, Aut (Staff)

2. From the Middle Ages to the Enlightenment—The course will emphasize great works of imaginative literature and religious, philosophical and scientific writings of the Medieval, Renaissance, Reformation and Enlightenment periods of European history.

5 units, Win (Staff)

3. From the Enlightenment to the Present—Through the study of major political treatises, works of imaginative literature, historical documents and scientific works, the course will focus upon major trends in western culture from the late eighteenth through the twentieth century.

5 units, Spr (Staff)

EUROPE: FROM THE RENAISSANCE TO THE PRESENT
(Enroll in History 1, 2, 3). This sequence explores the inter-relationships between the literary and philosophical masterpieces of
Western culture on the one hand and political, social, and economic developments in Europe since the Middle Ages on the other. Special attention is focused on the rediscovery of classical learning in the age of the Renaissance and Reformation, the consolidation of the European state system, intellectual innovations emerging with modern industrial society, and the global consequences of the breakdown of traditional Europe. Students meet three hours a week with lecturers from the regular history faculty and two hours a week for discussions in small groups (less than twenty) led by postdoctoral fellows.

5 units, Aut, Win, Spr, MTW 9 plus section

WESTERN THOUGHT AND LITERATURE
(Enroll in Humanities 61, 62, 63). With the same format as History 1, 2, 3, this sequence emphasizes the role of literature and the arts in western culture. The lecturers are drawn from various Stanford departments, particularly the Classics and English departments.

5 units, Aut, Win, Spr, MWF 11 plus section

IDEAS IN WESTERN CULTURE
(Enroll in Philosophy or Religious Studies 5A, 5B, 5C). This sequence has been developed by the Philosophy Department and the Religious Studies Department. The format is the same as History 1, 2, 3 and Humanities 61, 62, 63, with lectures by faculty and two-hour discussion classes taught by younger scholars. The courses are titled "The Birth of Western Philosophy", "Faith and Reason," and "The World Demystified". The emphasis is placed on the development of philosophical and religious ideas.

5 units, Aut, Win, Spr, MWF 10 plus sections

MAJOR TEXTS IN WESTERN CULTURE
(Enroll in Comparative Literature 21, 22, 23) This sequence, developed by faculty from various literature departments, approaches Western culture thematically rather than chronologically through the study of closely-related literary and philosophical texts. Each quarter’s reading will stress a particular set of problems dominant throughout the history of Western culture. The courses are titled "The Literature of Interaction and Conflict," "The Literature of Introspection," and "The Literature of Speculation". Especially recommended for students who have taken either world history or a survey of the humanities in secondary school. Limited to 20 students per quarter.

5 units, Aut, Win, Spr, MTWTh 10

WESTERN CULTURE AND TECHNOLOGY
(Enroll in Values, Technology, and Society 1, 2, 3.)—This sequence, designed by faculty in the Program in Values, Technology, and Society, studies the development of Western culture by exploring the changing interconnections among the three major realms of culture: the intellectual (i.e., ideas and worldviews), the material (i.e., technological devices and systems), and the societal (i.e., organizations and institutions). For example, subjects studied in the first quarter (the Ancient World) include: Homer’s heroic ideal; Plato’s concept of justice, Stoicism and Epicureanism; writing and writing technologies in antiquity; the role of technology in the rise and fall of the Roman Empire; Roman religion; the origins of Western law; and everyday life in ancient Greece. This course is designed to be of equal appeal to all entering students, whether their present academic interests center on the humanities, the social sciences, natural sciences, medicine, or engineering. The course will not require the use of mathematics. Three one-hour lectures per week and a weekly two-hour seminar discussion section.

5 units, Aut, Win, Spr

The Structured Liberal Education (SLE) program is also designated as a Western Culture sequence. For details see the SLE section in this bulletin.
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 3, 1980, and spring term will end on June 4, 1981.

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:

226. 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; art napping and insurance; legal problems of art museums, etc. Merryman and Elsen, *Law, Ethics and Visual Arts* (1979).

3 term units, Spr (Li)

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, Aut (Maccoby, Wald)

243. Law and Economy in China—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)

325. Comparative Law—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, Aut (Maccoby, Wald)

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 pre-trial 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 183F.) 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. (DR:S)

5 units, Aut (Friedman) MTWTh 9

109. The Criminal Law and the Criminal System—(Same as Political Science 183K and Sociology 109.) 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 role of the attorney, the trial, sentencing, corrections, and "non-victim" crimes. (Open to all undergraduate and graduate students.) (DR:S)

5 units, Spr (Kaplan) TTh 10-11:30

149. Communication Law—(Same as Communication 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.

4 units, Spr (Rabin)

157. Law in Radically Different Cultures—(Same as Anthropology 157 and 257.) Comparison of legal systems in Western capitalist, secular, industrialized democracies with legal systems in radically different cultures. Using American law as a benchmark, this course examines comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt (religious law), and the Republic of Botswana (traditional law) in order to identify the historical, philosophical, social, and cultural factors which contributed to the development of different attitudes and practices regarding law. Issues considered are the passing on of status and property rights — especially at death, the handling of anti-social or "criminal" behavior, the handling of promises and contracts, and the use of law as an instrument of social change in the introduction of family planning. (Open to graduate students and to juniors and seniors. Graduate students, who will have special assignment and papers, should enroll in Anthropology 257. Undergraduates should enroll in Law 157 or Anthropology 157.) (DR:S)

3 units, Spr (Barton, Gibbs, Li, Merryman) MTTh 2:15
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 Stanford University School of Medicine provides an educational environment that encourages intellectual diversity and offers stimulation and opportunity for self-motivated students who are interested in developing a scholarly, investigative approach to problems in medicine.

Accordingly, the School offers a curriculum with a two-fold purpose: To develop in all students the capacity for leadership in the clinical practice of scientific medicine, and to provide opportunities for as many students as possible to prepare themselves for careers in research and teaching in the various branches of basic, clinical and social medicine.

The admissions process is directed to the selection of individuals who will most benefit from this environment. Recognizing that minorities and women are underrepresented in the medical profession, and especially in academic medicine, the School has a strong commitment to identify, recruit and educate such students.

The curriculum which has been adopted to serve the objectives of the School, is an elective one in which students must register for a minimum of 13 quarters following which a student may take additional quarters of instruction for a nominal University registration fee. The required period of registration may be reduced to as few as 11 quarters for those students who have already completed appropriate graduate level work approved by the Committee on Academic Credit.

The curriculum, being elective, is one which provides the student with relative flexibility in formulating an individualized curriculum which best takes into account the student's past experience and future career goals. Additionally, this electivity offers the student the time to take advantage of some of the special investigative opportunities available at the School through such programs as the Medical Science Training Program, the Scholars Program and the Research Assistantship Program. The School participates to an exceptional extent in the intellectual life of the University, and counts among its strengths interdisciplinary research and teaching at the interface between physical and social sciences and medicine.

Students interested in the combined MD/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.
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. For the masters degree students must complete: the courses preparatory for state licensure, one of the three advanced study areas 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 date for the Graduate Record Examination that can be taken to meet this deadline is the prior December. Upon request of the Division, a personal interview and the completion of supplemental admission tests and forms may be required. Applicants will be considered without regard to race, color, creed, religion, handicap, sex, age or national origin.

Students are admitted Autumn Quarter each year. Registration for entering students and commencement of classes will take place two weeks earlier than the published registration and matriculation dates. Dates for registration and general information will be found in the Information Bulletin of the University.

TRAINEESHIPS, SCHOLARSHIPS, AND LOANS

The resources for traineeships and scholarships awarded by the Scholarship Committee of the Division of Physical Therapy are few and vary from year to year.

The Marian Williams Memorial Scholarship and the Stanford Physical Therapy Alumni Scholarship are 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 the 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) MWF 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 (Coon, Parker)
MW 1:15-3:05

230. Physical Agents—Introduction to kinesiologic electromyographic techniques; functional activities.
2 units, Win (Parker, Staff)
MW 1:15-3:05

3 units, Aut (Staff) by arrangement

232. Clinical Electromyography—Clinical application of electromyographic procedures and techniques.
3 units, Win, Spr (Staff)
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.
2-3 units, (Kent, 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.
3-8 units, (Kent, Staff) by arrangement

250. Social and Psychological Aspects of Illness and Disability—Perspectives on illness and wellness behaviors from the health care consumers and providers viewpoints; effective patient-family therapists relationships; emphasis on awareness of total patient needs relative to specific physical disabilities and unique life styles.
5 units, Spr (Shepard) MW 1:15-3:05; F 1:15-2:05

255. Physiology of Exercise—Basic concepts of the function of the human body including bioenergetics, oxygen transport and utilization, exercise, cardiovascular disease, body composition, and environmental physiology as related to physical therapy.
3 units (Sanford) by arrangement

257. Organizational Behavior and Physical Therapy—Major perspectives on organizational theory; macro and micro-level structure of health care organizational settings; interprofessional relations, leadership styles and group dynamics related to physical therapy practice within the health care system.
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, (Staff) by arrangement
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) by arrangement

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. Each student must complete one three quarter sequence. Three of the four areas listed below will be available as Advanced Study Areas. The fourth area will be represented by an elective course. Students will be notified during the selection process of the Advanced Study Areas being offered.

Administration and Community Health—260, 261, and 262
Advanced Approaches to Neuromuscular Dysfunction—265, 266 and 267
Advanced Approaches to Musculoskeletal Dysfunction—270, 271 and 272
Curriculum Development and Instruction—275, 276, 277

260. Administration and Community Health in Physical Therapy I—Program planning, budgeting, cost analysis, selected management techniques; systems for delivery of health care; community strategies; economic, sociocultural, legal, and political impacts on care. Includes projects and field work.
4 units, Aut (Sanford Blood) 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 (Coon, Staff) by arrangement

266. Advanced Approaches to Neuromuscular Dysfunction II—Continuation of 265.
4 units, Win (Coon, Staff) by arrangement

267. Advanced Approaches to Neuromuscular Dysfunction III—Continuation of 265 and 266.
2 units, Spr (Coon, Staff) 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 (Medeiros, Staff) by arrangement

271. Advanced Approaches to Musculoskeletal Dysfunction II—Continuation of 265.
4 units, Win (Coon, Staff) by arrangement

272. Advanced Approaches to Musculoskeletal Dysfunction III—Continuation of 265 and 271.
2 units, Spr (Coon, Staff) by arrangement

275. Curriculum Development and Instruction in Physical Therapy I—Philosophical orientations to curriculum design; unique problems of professional curricula; learning theory; objectives, content and evaluation 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.
1-8 units, any quarter
(Staff) by arrangement

BIOCHEMISTRY

Chairman: Dale Kaiser
Associate Professor: Douglas Brutlag
Assistant Professors: James Rothman

OFFERINGS AND FACILITIES

The Department of Biochemistry is part of the Graduate Division of the University and a department of the Medical School. Departmental offices and laboratories are located in the Stanford Medical Center. Courses offered by the department may be taken by undergraduate, graduate, and medical school students. Postdoctoral fellows as well as house staff members are also welcome to attend. A basic series in biochemistry (200, 201) is taught by the entire staff as well as by a number of guest lecturers from the campus and from other institutions. Students who elect to enroll in either of the above courses should have a good background in general and organic chemistry, as well as in cell biology, equivalent to the core series offered by the Department of Biological Sciences. For those medical students who have taken biochemistry courses at other universities, the Biochemistry teaching staff presents a spring quarter course which relates basic principles in biochemistry to problems in physiology and medicine.

Advanced courses in more specialized areas are offered as well, and they emphasize the most recent developments in biochemistry, cell biology, and molecular biology. These courses include the physical chemistry of proteins and nucleic acids, membrane biology and biochemistry, mechanisms and regulation of nucleic acid metabolism, the biochemistry of bacterial and animal viruses, the molecular basis of morphogenesis, and the structure and function of both eukaryotic and prokaryotic chromosomes. The Department of Biochemistry conducts a noon research seminar in the departmental library on Tuesdays and Thursdays, and special seminars by guest investigators and from other institutions are presented regularly.

Opportunities exist for directed reading and research in biochemistry and molecular biology, utilizing a small but excellent departmental library as well as the most advanced research facilities, including those for light and electron microscopy, chromatography and electrophoresis, enzyme purification and analysis, analytical and preparative ultracentrifugation, and amino acid and radioisotope analysis. Computer as well as text editing facilities are available. Laboratories are equipped for research with bacteria and bacteriophage, animal cells and their viruses, as well as with yeast and Drosophila.

ADVANCED DEGREES

The Department of Biochemistry offers a Ph.D. program which begins in the fall quarter of each year. The program of study is designed to prepare men and women for productive careers in biochemistry; its emphasis is training in research, and 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 six advanced courses in biochemistry and related areas, and at least three of these courses must be taken in the Department of Biochemistry. Selection of these courses is tailored to fit the background and interests of each student. A second requirement involves the submission of three research proposals, which are presented by the student to a small advisory committee of departmental faculty members, who are also responsible for monitoring the progress of the curricular and research program for each student. All Ph.D. students are expected to participate actively in the department noon seminar program and are also given the opportunity to attend, as well as to present papers at, regional and national meetings in biochemistry and molecular biology. Teaching experience is an integral part of the Ph.D. curriculum and is required for the degree. During each year of study, every student assists in teaching sections in the basic or advanced courses, and such activities involve at least one afternoon per week during each quarter, with assignments scheduled by both the appropriate course director and the students.

General University regulations concerning the Ph.D. degree are summarized in the "Degrees" section in this bulletin. The department offers neither master's nor undergraduate degrees.

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 at least a baccalaureate degree, and should have completed work in cell and developmental biology,
basic biochemistry and molecular biology, and genetics. Also required are at least one year of university physics, differential and integral calculus, as well as analytical, organic, inorganic, and physical chemistry. The department is especially interested in those applicants who have research experience in biology or chemistry. Students must complete a preliminary application form, submitting it to the department before December 1. Those students subsequently invited to submit a formal application must see to it that all materials pertinent to the formal application are received by the Department of Biochemistry before January 15. All applicants will be notified by April 15 of a decision on the application. Stanford University requires scores from the Graduate Record Examination (verbal, quantitative, and analytical) and in addition applicants must submit scores from the GRE Advanced Test in either Biology or Chemistry.

All applicants are urged to compete for non-Stanford fellowships or scholarships, and American citizens must complete application for a National Science Foundation Predoctoral Traineeship. Those who are not awarded stipends and tuition from such sources will receive an annual basic stipend of $5040. A supplement to this stipend maybe granted, depending upon the availability of other funds. In addition Stanford tuition costs will be paid by the department.

All applicants for admission to the Department of Biochemistry will be considered without regard to race, color, creed, religion, sex, age, national origin, or marital status.

Postdoctoral research training is available to graduates who hold a Ph.D. or an M.D. degree. Qualified individuals may write to individual faculty members for further information.

At present the primary research interests of the department are: proteins and nucleic acids, including their enzymatic synthesis, chemical structure, physical chemistry, and function; the biochemistry of bacterial and animal virus infection; structure and function of chromosomes; control and regulation of gene expression; the biochemistry and control of developmental processes; and the structure, function, and biosynthesis of cellular membranes and organelles.

**COURSES**

All courses (DR:X)

**200. Biochemical Structure, Metabolism, and Energetics**—The structure and function of biochemical molecules, enzyme kinetics and mechanisms, bioenergetics, pathways of intermediary metabolism and their control, and membrane structure and function. Alternative lectures dealing with special topics also presented. Prerequisites: organic chemistry, cell biology (equivalent to Biology 21).

- 5 units, Aut (Kaiser, Kornberg, Lehman, Rothman, Stark) MTWTh 11:00-11:50

**201. Advanced Molecular Biology**—Lectures providing the most recent information about rapidly developing frontiers in polynucleotide metabolism and its control, chromosome structure and function, transcription and translation, hormone action, and virus biochemistry, all with emphasis on the eukaryotes. Prerequisite: Biochemistry 200 and an understanding of basic molecular biology.

- 5 units, Win (Berg, Brutlag, Davis, Hogness, Lehman, Kornberg) MTWThF 11:00-11:50

**202. Cellular and Molecular Basis of Disease**—A continuation of the 200-201 series, or to be taken separately by those students who have completed a senior level course in biochemistry elsewhere. Designed to show how current biochemical concepts can be applied to problems in physiology and pathology. Consideration of a specific disease or disease process, along with a brief review of the relevant biochemistry, followed by a discussion of the molecular basis for the disorder.

- 3 units, Spr (Staff) by arrangement

**204. DNA Repair, Recombination and Replication**—Will emphasize enzymes and molecular mechanisms, and will consider how some physiological aspects of these DNA transactions may be explained at the molecular level. Prerequisites: Biochemistry 200, 201.

- 2 units, Win (Kornberg, Lehman) by arrangement

**210. Advanced Topics in Membrane Biochemistry**—Structure, function, and biosynthesis of cellular membranes and organelles. Based upon the current literature, with extensive student participation. Prerequisites: Biochemistry 200, 201 or equivalent, as well as permission of the instructors. Also listed as Biology 210.

- 4 units, Spr (Rothman, Simoni) TTh 10-11:50

**217. Advanced Tutorial in Special Topics**—Readings and tutorial in membrane biochemistry, enzyme mechanisms, chromosome structure, biochemical genetics, bacterial and animal viruses, and nucleic acid enzymology. Conducted under the guidance of advanced graduate students and post-doctoral fellows.

- 1-3 units, any quarter (Staff)

**218. Chromosome Structure and Function**—Correlation of chromosomal structure and gene expression. Topics include structure and topology of DNA in solution; DNA topoisomerases; histone-histone and histone-DNA interaction;
assembly, transcription and replication of chromatin; folding of mitotic chromosomes. Student participation includes critical evaluation of the literature. Prerequisites: Biochemistry 200, 201 or equivalent.

3 units, Aut (Brullag) MWF 10-11:50

221. The Teaching of Biochemistry—To be taken by all students as teaching assistants in Biochemistry 200, 201, 202 or 217. Emphasizes practical experience in teaching on a one-to-one basis, as well as in problem set design and analysis. Familiarization with current lecture and text material is expected, along with evaluations of class papers and examinations. Prerequisites: enrollment in the Ph.D. program in the Department of Biochemistry.

3 units, Aut, Win, Spr (Staff) by arrangement

222. Research Techniques in Biochemistry and Molecular Biology—Lectures, demonstration, and laboratory practice, including growth of bacteria and viruses, and analysis of macromolecules using ultracentrifugation, restriction enzyme analysis, electrophoresis, autoradiography, and electron microscopy. Enrollment limited at present to students in the Biochemistry Ph.D. program and to those in the Stanford Medical Scientist Training Program.

3 units, Aut (Davis) by arrangement

270. Seminar.
2 units, any quarter (Rothman) TTh 12

299. Research.
1-15 units, any quarter (Staff) 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; Steven G. Boxer, Ph.D., Assistant Professor of Chemistry; Henry S. Kaplan, M.D., Professor of Radiology; James P. Whitlock, Jr.; M.D., Assistant Professor of Pharmacology

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):
   a) Biochemistry 200, 201
   b) Pathology 230A
   c) Family, Community, and Preventive Medicine 202
   d) Molecular and Cellular Aspects of Cancer Biology (Inde 241, 242, 243)

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 candi-
date 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 or her 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 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.

241. 2 units; Aut (Staff) dhur
242. 2 units, Win
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, Win, Spr (Staff) dhur

GENETICS

Chairman: Stanley N. Cohen


Adjunct Professor: Elliott C. Levinthal

Assistant Professors: Lawrence J. Korn, Douglas C. Wallace

PROGRAMS OF STUDY

The Department of Genetics offers programs of study and advanced research training in genetics and related fields of chemical and cellular biology leading to a Ph.D. degree. An extensive program in postdoctoral work is carried out within the department by holders of the Ph.D. or M.D. degree. In addition, a limited number of M.D. candidates can combine research training with their medical studies.

The training program is designed as preparation for a career in biomedical research and teaching. The program is intended to provide students with conceptual and experimental tools available for modern geneticists who wish to approach a variety of biomedical problems of fundamental or clinical importance.

While the program provides formal course training as well as informal seminars and lectures, the emphasis is on laboratory research that involves close interaction between the student and the faculty advisor. Principal subject areas for research training include molecular and biochemical genetics, immunogenetics, somatic cell genetics, developmental genetics, medical and population genetics, and cytogenetics. Special opportunities exist for the application of advanced instrumentation and sophisticated computer capabilities to a number of problems, including cell detection and sorting, and aspects of human biochemical and population genetics. Interdisciplinary programs can also be formulated with other departments within the medical center in such fields as clinical genetics, pharmacogenetics, and bioengineering (instrumentation.)

Students have the opportunity to rotate through the laboratories of several faculty members soon after admission. Arrangements for carrying out dissertation research in a particular laboratory are negotiated with a faculty preceptor during or following this rotation. The usual course of study for the Ph.D. degree involves three to four years of graduate work, concentrated mainly on dissertation research.

The departmental facilities are located in the main building of the Stanford Medical Center, and include modern, well-equipped laboratories. Advanced instrumentation and specialized facilities are available for such work as chemical and biophysical analysis with sophisticated computer support, electron microscopy and work with cell cultures, bacteria and viruses.

Accepted students who are U.S. citizens may qualify for full-support stipends under an NIH-supported training grant. Stipends are also available through other sources. Applicants are strongly encouraged to apply independently for National Institutes of Health, National Science Foundation and other fellowships.
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, the Program in Human Biology and the Department of Medical Microbiology.

**COURSES**

All courses (DR:X)


3 units, Aut (Cavalli-Sforza) TTh 9-10:30 alternate years, given 1981-82

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.

3 units, Spr (Wallace) TTh 2:15-3:45

213. Molecular and Cellular Immuno Genetics—Diversity and regulation of antibodies, diversity and interactions of lymphoid cells. Minimum 6 students. Prerequisites: Biochemistry 200, 201, Biology 10, Medical Microbiology 200, or equivalents, or consent of instructor. Can be given to selected students as Genetics 260.

3 units, Win (Herzenberg) MW 4:15-6:05, given 1981-82


3 units, Aut (Canesan) MWF 10 given 1981-82

260. Supervised Study—Prerequisite: consent of instructor.

Any quarter, (Staff) by arrangement

270. Genetics Seminar.

Any quarter, (Staff) by arrangement

299. Directed Reading.

Any quarter, (Staff) by arrangement

399. Individual Research.

any quarter (Staff) by arrangement

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**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 Professor: Diana B. Dutton, Ph.D.

Lecturers: Harold S. Luft, Ph.D., 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 undergraduates; 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, Department 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.) Cost-effectiveness studies of medical technologies. Analytical techniques from the biological and social sciences will be used in developing methods for solution of specific problems and their implementation. Cases will be drawn from areas of current controversy and concern (e.g., heart disease, arthritic joint disease, gynecological disorders, and intensive care) and will include comparisons of preventive strategies with technologic intervention.

4 units, Spr (Bunker, Staff) given 1980-81

250. Social Issues in Health Care—(Same as Sociology 111.) 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 (Dutton) alternate years, given 1981-82

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. Open to undergraduates with permission of instructor.

1 unit, Aut, Win (Bunker, Marton, Staff) F 12-1 A126

252. Biomedical Innovation and Public Policy—This course offers a limited number of advanced undergraduates and graduate students the opportunity to participate in an ongoing National Science Foundation funded study entitled, "Medical Progress and the Public: Ethical Issues in Biomedical Innovation." The research deals with the policymaking process in four controversial biomedical innovations: diethylstilbestrol (DES); the artificial heart program; the swine flu vaccination program of 1976; and recombinant DNA research. Policy issues being studied include public participation, informed consent, risk assessment, political economy, compensation systems, and distributive justice. Prerequisite: consent of instructor.

3-5 units, Aut, Win, Spr (Dutton, Bunker) by arrangement

253. Analysis of Medical Policies—(Same as Engineering-Economic Systems 271 and Human Biology 174.) Project course in the quantitative analysis of complicated medical problems. Focus will be on a new problem that is current, important, and difficult. Whenever possible the analyses will be performed for sponsors, decision makers who actually face the problem. Each analysis will involve 1) problem formulation; 2) a critical analysis of medical research literature, focusing on quality of research design and interpretation of research results; 3) construction of mathematical and economic models of clinical problems; 4) the application of decision theory; and 5) the presentation and writing of reports. Course will review the existing information on the costs, risks and benefits
of screening for various diseases; construct models with which to estimate the outcomes of decision analysis to design a screening program and set research priorities. Prerequisites: experience in either quantitative policy analysis or medicine/biology. Open to undergraduates with permission of instructor.

**4 units, Aut (Eddy) MW 3:15-5:05 given 1981-82**

**255. Research Workshop on Social Issues in Health**—(Same as Sociology 251.) Offers students experience in applied health services research. Individually or in groups, students will define a researchable problem, review relevant literature, perform statistical analyses if appropriate, and synthesize findings in a major research paper. Possible topic areas include subjects covered in FCPM 350. Considerable independent work required. Prerequisite: consent of instructor.

**3-5 units, Spr (Dutton) given 1981**

**256. Economics of Health and Medical Care**—(Same as Economics 156/256.) 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 economic 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 (Fuchs)**

**279. Management of Hospitals and Other Health Care Institutions**—Covers various administrative aspects of health care institutions. Among those discussed are: organizational elements of hospitals, administration, financial issues and problems, hospital departmental relationships, quality of patient care, principal external pressures (both governmental and non-governmental), consumerism, and community influence.

**2 units, Win (Lecin, Mecklenburg)**

**Th 3-5**

**350. Seminar in Social Issues in Health Care**—(Same as Sociology 211.) Course will cover selected social and policy issues in health and medical care, including topics such as the influence of social factors on illness and use of medical care, patient-provider interactions, the socialization of physicians, incentive structures in various health institutions, policymaking in biomedical innovation, and alternative health care reform strategies. Sociological perspectives and research findings are contrasted with other approaches, with particular emphasis on the critical evaluation of alternative viewpoints, methodologies, and evidence. A major research paper on one of the topics covered is required. Prerequisites: Sociology 111 or Human Biology 40 or consent of instructor.

**4-5 units, Win (Dutton) TTh 10-12**

**391. Public Policy Analysis of Health Care**—(Same as Business 391.) The purposes of this 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, hospital investment decisions and regional planning, health care costs and national health insurance.

**4 units, Aut (Enthoven) MF 8-10**

**394. Cost-Benefit Analysis in Health Care**—(Same as Business 392.) How do you do cost-benefit analysis when the "output" is difficult or impossible to measure? How do the MBA analytic tools apply in health services? The course will begin with study and discussion of the main literature on the principles of cost-benefit analysis applied to health care. It will then focus on a critical review of a number of actual studies. The emphasis will be on insights into the art of practical application. Prerequisites: Business 200, Micro Economics: Business 309, Public Sector Economics is recommended.

**4 units, Spr (Enthoven) MF 8-10**

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**PROGRAM IN HEARING AND SPEECH SCIENCES**

**Emeriti:** Virgil A. Anderson, Jon Eisenson (Professors)

**Director:** Earl D. Schubert

**Professor:** Earl D. Schubert

**Associate Professors:** James H. Dewson III (on leave 1980-81), Dorothy A. Huntington

**Cooperating in the offerings of the Program is:** Clara N. Bush, Professor of Linguistics
OFFERINGS AND FACILITIES

The aims of the Program are two-fold: (a) to make available to doctoral and postdoctoral students the material essential to a complete understanding of behavioral and physiological aspects of normal and defective processes of human communication; and (b) to provide, at the undergraduate level, a systematic understanding of these processes as a complement to formal study in such disciplines as Psychology, Biology, Linguistics, etc. Students may be preparing for careers in university teaching or research, or they may have primary interest in another discipline, e.g., Medicine, with a desire for specialized study in some area of human communication.

The available facilities include 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 selected 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 "Degrees" section 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 224.) 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

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

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 mechanics 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 (Staff) by arrangement

400. Doctoral Research.

1-15 units, any quarter (Staff) by arrangement

MEDICAL MICROBIOLOGY

Emeriti: Sidney Raffel (Professor), Monroe D. Eaton (Adjunct Professor)
Chairman: Stanley Falkow

Professors: Hugh O. McDevitt, Carlton E. Schwerdt, Bruce A. D. Stocker

Associate Professors: Robert J. Roantree, Leon T. Rosenberg

Adjunct Professors: Esther M. Lederberg, John P. Steward

Assistant Professor: Abdul Matin

PROGRAMS OF STUDY

The department of Medical Microbiology offers programs leading to degrees of Bachelor of Science, Master of Science (in exceptional circumstances only), and Ph.D. In addition, research experience is offered to medical students in the course of an M.D. program and to postdoctoral trainees. The current research interests of the department include microbial genetics and molecular biology as related to the pathogenic process; microbial physiology with special emphasis on energetics and regulation; genetic studies of complement and the immune response; and structure and function of animal viruses.

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.

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 enable the student to participate in 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 diploma, and in the Commencement Program. (See MM198 under "Courses").

MASTER OF SCIENCE

The department does not offer a regular Master of Science program, but the degree is awarded under special circumstances. Students for master's degree will be expected to have completed the preliminary requirements listed above for the B.S. degree, or their equivalent. In addition, the candidate is expected to complete 45 quarter units of work related to microbiology; at least 25 of these units should concern research devoted to a thesis. The thesis must be approved by at least two members of the department faculty. There will also be an oral examination, which may cover the general fields of the department's offerings.

DOCTOR OF PHILOSOPHY

Application, Admission, and Financial Aid—Prospective Ph.D. candidates should possess a bachelor's degree with background in biology or chemistry and preferably also in biochemistry. Formal 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 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. 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 Financial Aid Officers at their institutions for information and applications.

Preparation for Graduate Study—A candidate for the degree of Doctor of Philosophy must meet the preliminary requirements (or equivalent) listed for the bachelor’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) are recommended; these general recommendations should be discussed with a faculty advisor.

Other recommendations contingent upon individual previous experiences and interests include: parasitology (Family, Community and Preventive Medicine 204); histology (Structural Biology 210); genetics (e.g., Biological Sciences 252; Genetics 201, 249); biochemistry (e.g., Biochemistry 208, 215); physical chemistry (e.g., Chemistry 171, 173); calculus (Mathematics 19, 20, 21, 22, 23); virology (Biological Sciences 213); pathology (Pathology 230A, B, C); electron microscopy (Pathology 207, 291). The choice among these (or other) formal courses should be discussed with an advisor.

Teaching experience and training are part of the graduate curriculum. During their career in graduate study, students will be expected to serve as teaching assistants in at least three departmental courses.

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
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 (McDevitt, 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.
5 units, Spr (Staff) MWF 2:15-4:05

203. Bacterial Physiology and Ecology—Designed for graduate and advanced undergraduate students. Provides in-depth coverage of selected topics in microbial physiology and ecology: bacterial nutrition and growth kinetics in batch and continuous cultures; bacterial phenotype during nutrient-limited growth; structure and function; terminal energy-yielding pathways (aerobic and anaerobic respiratory chains, oxidative phosphorylation, nutrient transport); and special bacterial groups or processes. Prerequisites: Biological Sciences 1 and 21; Chemistry 31, 33, and 35; and some background in biochemistry.
3 units, Win (Matin) MWF 11

204. Bacterial Genetics—A course of lectures (optional minilab may be available) on inheritance in bacteria. Prerequisite: 101 (or equivalent); consent of instructor for minilab.
3-4 units, Win (Stocker) MWF 9, Lab. 10, by arrangement

206. Virology—Lectures on the general nature of plant and animal viruses, and their relationships with their hosts. Some background in biochemistry recommended. Prerequisites: 101 or 202.
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

213. Mechanism of Antibody Synthesis: Genetic, Molecular, and Cellular Considerations—(Same as Genetics 213.) Structure and genetics of immunoglobulins, cellular and molecular events in antibody induction and synthesis, theories of antibody formation, genetics of the immune response. No final exam. Limited to 84 students, minimum of 6. Prerequisites: an understanding of elementary biology, general biochemistry, and previous or concurrent enrollment in Biochemistry 201, and consent of instructor.
3 units, Win (Herzenberg, McDevitt) MW 4:15, alternate years, given 1981-82

270. Seminar—Reports, discussions on selected topics by departmental and outside speakers. Required of all graduate students.
1 unit, Aut, Win, Spr (Staff) T 9

299. Directed Reading—Prerequisites: Consent of instructor.
15 units maximum, any quarter (Staff) by arrangement

399. 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

NEUROSCIENCES PROGRAM

Committee: Eric M. Shooter, Professor of Neurobiology, Chairman; Jack D. Barchas, Professor of Psychiatry & Behavioral Sciences; K.L. Chow, Professor of Neurology; Corey Goodman, Assistant Professor of Biological Sciences; John G. Nicholls, Professor of Neurobiology; David A. Prince, Professor of Neurology; Carla J. Shatz, Assistant Professor of Neurobiology; John G. Nicholls, Professor of Neurobiology; Richard Thompson, Professor of Psychology; Jeffrey J. Wine, Associate Professor of Psychology; Student Members: Leslie Henderson and Larry Bernardo

The Neurosciences Program is an interdepartmental program which offers instruction and research opportunities leading to a Ph.D. in Neurosciences. The Faculty of the Program is drawn from the Departments of Biological Sciences, Anesthesiology, Neurobiology, Neurology, Pathology, Pharmacology, Physiology, Psychology, Psychiatry, Structural Biology and Surgery.
PROGRAM OF STUDY

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.

Applicants are encouraged to familiarize themselves with the research interests of the faculty and, if possible, to indicate their preference on the application form.

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 student's 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.

SELECTED COURSES

The course selections of individual departments participating in the Neurosciences Program should also be consulted for complete offerings.

Biology 109. Neuronal Development—A study of the development of the nervous system at the
cellular level, including the proliferation, determination and differentiation of neurons, the formation of synaptic connections, cell death and the modification of neurons and synapses during maturation. Some topics in cellular neurobiology will be covered. Prerequisites: Biology core and Psychology 107, or Biology 166H, or Neurobiology 200 (neurobiology component), or consent of instructor.

4 units, Win (Goodman) MWF 9

Biology 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 40, 41, 42, 43) or Psychology 107.
3 units, given 1979-80.

Biology 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 postdoctoral students. Previous exposure to neurobiology is suggested.
6 units, (Thompson) by arrangement

Neurobiology 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. This is an integrated course in which the neuroanatomy and neurobiology components must be taken together. Final exam will be given. No limitation. Prerequisites: none.
9 units, Aut (Baylor, Knudsen, Nicholls, McMahan, Rahamimoff, Shatz, Shooter, and Wallace)

Neurobiology 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 student presentations. No limitation. Prerequisite: Neurobiology 200 or its equivalent.
3 units, (Baylor, Nicholls)

Neurobiology 211. Structure and Function of Synapses—This seminar course is intended for students interested in an interdisciplinary understanding of the synapse. The topics to be covered include: synaptic excitation and inhibition; structure of presynaptic and postsynaptic elements; release, synthesis, storage and inactivation of neurotransmitters; noise analysis of transmitter action; synthesis, properties and distribution of receptor molecules; synaptic immunology; electrical synapses and gap junctions; slow synaptic potentials; and principles of development, denervation and reinnervation. Limited to 12 students. Prerequisites: 200 The Nervous System or equivalent.
3 units, (Rahamimoff, McMahan) given 1979-80

Neurobiology 212. Neurochemistry—An advanced seminar and reading course dealing in detail with the biochemistry of neurons and synaptic transmission. Topics covered will include neurotransmitter metabolism, neuro-hormones and peptides and nerve growth factor. Emphasis will be placed on the study of original papers and on student presentations. Prerequisites: Principles of Neurobiology 200 or equivalent.
3 units, (Shooter, Wallace) given 1979-80

Neurobiology 213. Functional Organization of Sensory Systems—An advanced seminar and reading course which will examine the way in which the vertebrate brain processes and codes sensory information. Attention will be focused on the visual, auditory and somatosensory systems. Emphasis will be placed on the study of original papers and on student presentations. Prerequisites: Neurobiology 200 or the equivalent.
3 units, Spr (Knudsen, Shatz)

Neurobiology 214. Membrane and Cellular Mechanisms of Neural Function—Selected topics in mechanisms of excitability, sensory transduction, and synaptic transmission will be treated by reading original papers. Student presentations and small group discussions will
be the usual format. The general aim is to look at a few topics in some depth, with emphasis on the nature of the experimental evidence and the scientific context. In previous years, course topics have included: microanalysis of transmitter action by iontophoretic application and noise analysis, visual transduction in vertebrates, gating currents and Hodgkin-Huxley experiments, trophic effects of nerve on muscle and quantal release of neurotransmitter.

3 units, Win (Nicholls, Baylor)

Neurobiology 215. Development of the Nervous System—An advanced seminar and reading course which will deal with various aspects of the development of the nervous system from both cellular and systemic viewpoints. Topics will include the development of the differentiated properties of neurons (transmitters, receptors), synaptogenesis, and the development of the neuromuscular junction and the mammalian central nervous system. Factors—trophic, genetic and environmental—which may influence development will be considered.

3 units (Staff)

Neurology 204. Physiology of Mammalian Central Nervous System—Laboratory course designed for advanced students interested in neurological sciences. Introduction to a variety of techniques used in current research in physiology of mammalian central nervous system. No final exam. Limited to 8 students. Prerequisites: consent of instructors.

4 units, Spr (K. Chow, Staff) by arrangement given 1979-80

Neurology 205. Pathophysiology of Nervous System Diseases—A seminar series on application of the neurosciences to the understanding of disease processes affecting the human nervous system. No final exam. Limited to 20 students. Prerequisites: neurobiology, neuroanatomy or consent of instructor.

2 units, Spr (D. Holtzman, Staff) given 1979-80


4 units, Aut (Wine)

Psychology 227. Seminar: Cellular Neurophysiological Approaches to Behavior—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

Chairman: Eric M. Shooter

Professors: Denis A. Baylor, Uel J. McMahan, John G. Nicholls, Eric M. Shooter

Assistant Professors: Eric I. Knudsen, Carla J. Shatz, Bruce G. Wallace

ADVANCED DEGREES

Graduate students in the department obtain the degree of Doctor of Philosophy through the interdepartmental Neurosciences Ph.D. Program. Remission of fees and a personal stipend are available to those students accepted. Application should be made through the Graduate Admissions Office which will submit completed applications to the department. Applicants are encouraged to familiarize themselves with the research interests of the faculty and, if possible, to indicate their preference on the application form. Medical students 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)

The Neurobiology Department offers a one quarter course on the structure and function of the nervous system open to medical students, qualified students and advanced undergraduates. Advanced courses given by the department are open to students who have completed the basic course.

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.
This is an integrated course in which the neuroanatomy and neurobiology components must be taken together. Final exam will be given. No limitation. Prerequisites: none.

9 units, Aut (Baylor, Knudsen, Nicholls, McMahan, Shatz, Shooter and Wallace)

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

213. Functional Organization of Sensory Systems—An advanced seminar and reading course which will examine the way in which the vertebrate brain processes and codes sensory information. Attention will be focused on the visual, auditory, and somatosensory systems. Emphasis will be placed on the study of original papers and on student presentations. Prerequisites: Neurobiology 200 or the equivalent.

3 units, Spr (Knudsen, Shatz)

260. Supervised Study—Prerequisite: consent of instructor.

Any quarter (Staff) by arrangement

270. Neurobiology Seminar—Prerequisite: consent of instructor.

Any quarter (Staff) by arrangement

199. Directed Reading (Undergraduate)—Prerequisite: consent of instructor.

Any quarter (Staff) by arrangement

299. Directed Reading—Prerequisite: consent of instructor.

Any quarter (Staff) by arrangement

399. Individual Research—Prerequisite: consent of instructor.

Any quarter (Staff) by arrangement

PATHOLOGY

Emeriti: Bruno Gerstl, David Click, 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, F. Carl Grumet, Mary M. Herman, Howard H. Sussman, Irving L. Weissman

Adjunct Professor: Lawrence Eng

Assistant Professors: Margaret E. Billingham, Jerome S. Burke, Edgar G. Engleman, Michael Hendrickson, Lorin Johnson, James A. Strauchen, Roger A. Warnke

Acting Assistant Professor: Thomas V. Colby

Acting Instructor: Robert V. Rouse

Physician Specialist and Clinical Instructor: Phyllis J. Cornbleet

Senior Research Associate: Teresa S-F Wang

Research Associate: Thomas Bonura

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 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 or the Cancer Biology 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.
   Win, Spr (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.
   Win (Rubinstein, Forno, Herman)

   Aut, Win, Spr (Haydon) by arrangement

208. Interpretation of Electron Micrographs.
   Spr (Haydon) by arrangement

213. Gross Autopsy Pathology Laboratory—Students examine and discuss unfixed dissected organs from current autopsies and correlate the autopsy findings with a brief history.
   Aut, Win (Carrington, Staff) T 3:15-4; F 2:15-4

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 biochemical and histology is strongly recommended.
   3 units, Spr (Rosenberg, Weissman, McDevitt) MWF 9

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.
   230A. 4 units, Spr (Kempson, Carrington, Friedberg, Staff)
   T WTh 10-11:50
   230B. 4 units, Aut (Kempson, Carrington, Bensch, Staff)
   WF 10-11:50, T 2:15-3:05
   230C. 4 units, Win (Kempson, Carrington, Bensch, Staff)
   MW 10-11:50, T 2:15-3:05

231A,B. Topics in Clinical (Laboratory) Pathology—The objectives of this course are the biologic principles, interpretation, and clinical relevance of the various laboratory tests used in a hospital setting. The course will serve as an introduction to clinical immunopathology and to complement the lectures in general and special pathology (Pathology 230). The curriculum will run for two quarters and will be organized into three consecutive series of weekly lectures and laboratories on immunopathology, hematopathology, and clinical chemistry. Students may elect to enroll in the entire course or in the individual sections. Topics to be covered in immunopathology include red cell immunohematology, the physiologic role and clinical applications of HLA system, immunologic assays and immunopathology of lymphomas. The hematology section will concentrate on techniques in examination of the peripheral blood and bone marrow, as well as discussing the laboratory approach to the patient with various hematologic disorders, including anemias and systemic diseases. Subjects in clinical chemistry include clinical enzymology, toxicology, and assays for measurements of various tissue receptors and tumor markers. No exam will be given.
   231A. 1 unit, Aut (C. Grumet, Staff)
   1 hr/week. By arrangement
   (10 students minimum)
   231B. 1 unit, Win (J. Burke, Staff)
   1 hr/week. By arrangement
   (10 students minimum)

   Aut, Win, Spr (Bensch)
   Alternating Thursdays, 8-10 p.m.

271. Immunology/Viral Oncology Literature Reviews—Weekly literature reviews requiring student presentation of 1-3 papers per meeting in detail. Each student will present 1-3 times per year. This course is designed for students working in immunology or virology laboratories. See also Interdepartmental listings for Medical Scientist Training Program Seminars.
   2 units. Any quarter (Weissman)
   T 8-10 p.m. L201.

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) 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 (Hanawalt, Friedberg, K. Smith) given alternate years

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) full-time 6 or 12 weeks;
(Veterans Administration Hospital—Kosek, Fajardo, Staff)
full-time for 4 or 8 weeks

301. Neuropathology Clerkship—Participation in the neuropathological diagnostic service of the department and conferences for the members of the neuropathology unit.
Any quarter (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 four or eight weeks

CONFERENCES

Autopsy Demonstration.
Any quarter, (Carrington) M, T, Th, F 4:00

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: Leo Hollister, Kenneth Melmon

Assistant Professors: Helen M. Blau, Gordon Ringold, Howard Schulman, James P. Whitlock, Jr. Terrence Blaschke (Jointly with Medicine)

Consulting Professors: Ralph I. Dorfman, Richard K. Richards, Alejandro Zaffaroni

Consulting Associate Professor: Brian M. Cox

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 of research in a field that lies between biology and medicine. Modern pharmacology is concerned with understanding the mechanisms of drug action at the cellular and molecular levels, and utilizing this knowledge for the rational development of new drugs, and their proper use in man.

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, bio-transformation 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 function, 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 'Degrees' section 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 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. Students are expected to have had Biochemistry and Physiology before taking this sequence. 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, drug metabolism and 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, hormones and toxicology. 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.

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

209. Developmental Biology: Genetic and Environmental Influences—The course will deal with several aspects of developmental biology, including the effects of drugs on developmental processes. Topics will include analysis of model systems for the study of regulation of differentiation, mechanisms of normal and abnormal fetal development, and the molecular basis of genetic variability in drug metabolism. Open to graduate students, medical students and advanced undergraduates.
2 units, Win 1980-81 (Blau) by arrangement

270. Research Seminar—Weekly conference for discussion of current research in pharmacology. Seminars presented will be reviewed and discussed in a separate conference with a member of the faculty.
2 units, Aut, Win, Spr (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

399. Research.
Any quarter (Staff) by arrangement

COURSES REGULARLY OFFERED, BUT NOT DURING 1980-81

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

not given 1980-1981
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
not given 1980-1981

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)
not given 1990-1981

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 1990-1981

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 1980-1981

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 1980-1981

PHYSIOLOGY

Emeritus: Jefferson M. Crismon, Ronald Grant, Maurice E. Krahl (Professors)

Acting Chairman: Eugene D. Robin

Professors: Julian M. Davidson, George A. Feigen, Frederick A. Fuhrman, Eugene D. Robin

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)

200. Clinical Physiology (Physiology and Medicine)—Cardiovascular physiology. An interdepartmental course with Medicine, Normal and disordered function in the cardiovascular system. Lectures, clinical presentations, demonstrations.

6 units, Aut (Perlroth, Staff) MWF 9-11

201. Clinical Physiology (Physiology and Medicine)—Endocrinology, reproductive and gastrointestinal function. An interdepartmental course.

7 units, Win (Davidson, Feldman, Luetscher, Gray) MWF 9-11; T 8-9

202. 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) MF 8-10; TTh 10-12


3 units, Win (Thompson) W 4:15-6:05 and F 4:15-5:05, alternate years

207. Immunophysiology Laboratory—A laboratory course in quantitative immunophysiology emphasizing basic immunological 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

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 215.

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 illus-
trate 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 1980–81).

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 1980–81)

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

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: William H. Marshall, Jr., Frederic N. Silverman

Associate Professors of Clinical Radiology: Bruce R. Parker, James F. Silverman

Assistant Professors: Malcolm F. Anderson, Barbara, A. Carroll, Paul R. Cipriano, C. Norman Coleman, Dieter R. Enzmann, Peter Fessenden, David M. Gross, Diana F. Guthaner, Richard T. Hoppe, Alvaro Martinez, Peter S. Moskowitz, Stuart W. Young

Acting Assistant Professors: Stephen I. Marglin, Michael Brant-Zawadzki

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; similarly, students in the Cancer Biology Ph.D. Program may major in Radiobiology. 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, studies of cell kinetics and reoxygenation in animal tumors after irradiation, chemotherapy, heat, and combinations of these modalities, 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

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 permissible dose standards. Prerequisite: Biochemistry 200, or consent of instructor.
   2 units, Win (Kallman, Staff) TTh 4:15, alternate years, given 1980-81

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 1980-81

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 DNA 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

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

241, 242, 243. Molecular and Cellular Aspects of Cancer Biology—Same as Inde. 241, 242, 243.) 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) dhr
   243. 2 units, Spr

299. Research.
   Any quarter, (Staff) by arrangement

STRUCTURAL BIOLOGY

Emeriti: Donald J. Gray, William W. Greulich, Hadley Kirkman, Robert S. Turner (Professors)
Chairman: James A. Spudich
Professors: Robert A. Chase, Roger D. Kornberg, James A. Spudich, Lubert Stryer, Nigel Unwin
Assistant Professors: Peter Parham, Peter Sargent
Lecturers: Patricia Cross, Sylvia H. Friedberg, Lawrence H. Mathers, Jr.
Clinical Lecturer: Reuben Stutch

PROGRAMS OF STUDY

The department offers courses in cell biology and histology which are open to medical students, qualified graduate students, and ad-
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. degrees. Postdoctoral research training is available to graduates holding a Ph.D. or M.D. degree.

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, development, and gene expression.

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, Parham, Spudich, Stryer, Unwin, Cross, Friedberg)

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 (Staff)

201. Human Anatomy—Dissection, demonstrations, lectures. Enrollment normally limited to medical students.
5 units, Aut (Mathers, Staff)

202. Human Anatomy—Continuation of 201. Prerequisite: 201.
5 units, Win (Mathers, Staff)

1 unit, Aut, Win (Vistnes)

207. Human Embryology—A survey of prenatal development. Course objectives are (1) to understand human anatomy in terms of its development, and (2) to understand the embryological basis of congenital abnormalities. Where possible emphasis will be placed on tissue interactions and on cellular and subcellular mechanisms of morphogenesis.
2 units, Aut, (Sargent, Staff)

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.
2 units, Aut, Win (Staff)

296. Individual Work—Specialized work carried on under supervision of one or more members of the staff.
Any quarter, (Staff) by arrangement
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 1980–81 individual course listings, please check with Administrative Assistant, Chicano Fellows Program, Bldg. 590, Rm. F (The Nitery).

110. Principios de redacción en español.
   3 units, Aut (Montenegro)

118. Minorities: A Legal Perspective.
   3 units, Win (Nava)

119. Problem Solving in the American Political Structure: From Desegregation to White Flight, the Roles of the Judiciary, Congress, and Regulatory Agencies.
   3 units, Win (Lopez)

134. Education and Ethnicity: Creating a Philosophy of Cultural Diversity—(Same as Education 299S.)
   3 units, Aut (Navarro)

135. Cultural Content in Childrens Books and Other Media.
   3 units, Win (Delgado)

   3 units, Win (J. Hernández)

138. Physical Education and Its Relationship to Chicano Education.
   3 units, Spr (R. Garcia)

   3 units, Win (Molina)

158. Racial Differences, TQ, Racism.
   3 units, Spr (Molina)

CHICANO-RELATED COURSES OFFERED BY DEPARTMENTS

For (DR) notation, see the respective department.

EDUCATION

216. Culture Pluralism and American Education Policy.
   3 units, Aut (Castañeda)

381. Practicum in Cultural Pluralism.
   3 units, Win (Castañeda)

242. Bicultural Processes in Education.
   3 units, Sum (Castañeda)

381. Practicum in Cultural Pluralism.
   3 units, Sum (Castañeda)

ENGLISH

162A. Contemporary Chicano Literature.
   3-5 units, Aut (Islas)

HISTORY

262. Chicano History: Undergraduate Colloquium.
   3-5 units, Aut (Camarillo)
140. Introduction to Methods of Literary Analysis.
3-5 units, Aut (Ybarra-Frausto)

123A. Spanish-American Literature in Translation.
3-5 units, Win (Ybarra-Frausto)

3-5 units, Win (Ybarra-Frausto)

GRADUATE DIVISION SPECIAL PROGRAMS

Vice Provost and Dean of Graduate Studies and Research: Gerald J. Lieberman
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 full-time quarters and no more than three years enrollment in doctoral study at Stanford University.
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.

5 units, any quarter (Gann or Duignan)

297A,B,C. Ethics of Development in a Global Environment (EDGE): Cross-Discipline Seminar—(Same as Education 274A,B,C; Engineering 297A,B,C; Anthropology 133A,B,C; Political Science 140A,B,C; Social Thought and Institutions 197A,B,C.) Theory and practice of development in a global setting. Open to graduates and undergraduates, appropriate to both foreign and American students. 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. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures analyzed in terms of appropriateness to development in both less developed and industrialized societies. Addresses need for linkage between the necessary specialization of academia and the inherently interdisciplinary and problem-oriented nature of our living societies. Development strategies viewed with recognition of need for improvement in quality of life within nations and among nations while also recognizing limitations of the earth's physical support system and constraints in our cultural systems. 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, life-styles. Development examined in terms of relative satisfaction of human needs. Winter: Alternative development strategies including country case studies. Spring: The individual and social change; the engineer, political scientist, educator, etc., as designer of alternatives and as policy and
GRADUATE STUDIES AND RESEARCH

decision-maker. Lectures, discussions, workshops. (DR:X)
A,B,C. 1-4 units, Aut, Win, Spr (Cooper, Fagen, Fuenzalida, Lusignan, McWhorter, Siegel, Textor)
Lectures M 7:30-9:30 p.m.
and groups by arrangement

NONMATRICULATED GRADUATE STUDY

Graduates of colleges and universities of recognized standing are eligible to apply for nonmatriculated 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. Should a nonmatriculated student later apply for matriculated status, the normal admission requirements must be completed at that time. Nonmatriculated students should not anticipate any special priority for admission to a degree program because of work completed in nonmatriculated status.

No more than one academic quarter of course work as a nonmatriculated student may be counted towards a master's level degree and no more than two quarters may apply toward completion of requirements for Engineer's or doctoral degrees at Stanford.

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.

Application forms for nonmatriculated status may be obtained from the Graduate Admissions Office.

COMMITTEE ON HYDROLOGY

Committee in Charge: Irwin Remson (Chairman), William E. Brigham, Joseph B. Franzini, David L. Freyberg, 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</th>
<th>Units</th>
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<tbody>
<tr>
<td>AES 135</td>
<td>Soil Science</td>
<td>4</td>
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<tr>
<td>AES 192</td>
<td>Geomathematics I: Computer Applications in Geology</td>
<td>4</td>
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<tr>
<td>AES 194</td>
<td>Geomathematics II: Numerical Methods for Geologists</td>
<td>3</td>
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<td>AES 225</td>
<td>Surfaces and Interfaces</td>
<td>3</td>
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<tr>
<td>AES 277A</td>
<td>Problems in Applied Aqueous Thermodynamics</td>
<td>3</td>
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<td>AES 255</td>
<td>Introduction to Solute Transport</td>
<td>2</td>
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<tr>
<td>AES 294</td>
<td>Engineering Geology</td>
<td>4</td>
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<tr>
<td>CE 201</td>
<td>The Creation and Solution of Environmental Models</td>
<td>3</td>
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<tr>
<td>CE 203</td>
<td>Statistical Models in Civil Engineering</td>
<td>4</td>
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<tr>
<td>CE 226</td>
<td>Optimization Techniques in Civil Engineering</td>
<td>3</td>
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</tbody>
</table>
CE 260. Engineering Hydrology 3
CE 261A. Stochastic Hydrology 4
CE 261B. Surface Water Hydrology 4
CE 261C. Soil Moisture and Groundwater Hydrology 3
CE 262 Transport and Mixing Processes in the Environment 4
CE 263. Fluid Mechanics of Closed Conduits 3
CE 264. Sedimentation Problems 3
CE 266. Water Resources Development Engineering 4
CE 267. Water Resources Systems Engineering 3
CE 270. Water Quality in Water Resources Development 3
CE 273. Water Chemistry 3
CE 273A. Water Chemistry Laboratory 2
CE 274. Water Microbiology 2
CE 275. Environmental Impact of Power Generation 3
CE 277. Nuclear Environment Engineering 4
Geol. 171. Introduction to Geochemistry 4
Geol. 193. Geomathematics III: Introduction to Probability and Statistics in Geology 3
Geol. 221. Photogeology 3
Geol. 230. Hydrogeology 5
Geol. 232. Numerical Methods in Hydrogeology 2
Geol. 250. Marine Geology-Ocean Basins 4
Geol. 293. Geomathematics V: Applications of Probability and Statistics in Geology 3
Pet.E. 150A, B Well Log Analysis I, II 6
Pet.E. 151E. Core Analysis Laboratory 3
Pet.E. 170. Elements of Reservoir Engineering 3
Pet.E. 270A, B,C Advanced Reservoir Engineering 9
Pet.E. 275A, B Well-Test Analysis 6
Pet. 281 Applied Mathematics in Reservoir Engineering 3
Stat. 110. Statistical Methods in Engineering and the Physical Sciences 4

The program is subject to approval by the Committee and must comprise 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".

ACTION RESEARCH LIAISON OFFICE (ARLO)

Director: Cissie Rafferty

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. ARLO identifies faculty who are interested in supervising this research in conjunction with their teaching. Both undergraduate and graduate students incorporate these projects into their programs of study and receive academic credit through normal departmental procedures for their work.

ARLO promotes action research, as opposed to volunteer work or internship assignments. A student may participate in a project for one or more quarters. Examples of projects include assessing the feasibility of solar space and water heating for City of Palo Alto municipal buildings; determining neighborhood need for paramedic services in Sunnyvale; designing environmental education curricula for handicapped individuals; and investigating the physiological and psychological effects of noise from San Francisco International Airport.

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, Monday through Thursday, 120 Old Union, or call 497-1568.

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 variably 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.

In cooperation with the School of Education, CRIS administers a program to develop internationally oriented curriculum materials for use by public school teachers and to provide in-service training for pre-collegiate educators who teach in this field. These activities are undertaken by four area-oriented projects (Bay Area China Education Project; Teaching Japan in the Schools; Africa Education project and Recursos Educationales de America Latina) which are organized within the Stanford Program on International and Cross-cultural Education (SPICE).

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 qualified doctoral candidates may develop an area specialization within their discipline. Students may also design a cross-disciplinary specialization which emphasizes the area interest within an individually organized program of interdisciplinary preparation.
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

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 J400 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

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

CENTER FOR RESEARCH ON WOMEN (CROW)

Committee in Charge: Myra H. Strober, Acting Associate Professor, School of Education, Graduate School of Business (By courtesy), Director; Marilyn Yalom, Lecturer in Modern Thought and Literature, Associate Director; and members of the Policy Board.
CROW Faculty and Academic Staff Affiliates: Barbara A. Babcock, Professor, Law; Albert M. Camarillo, Assistant Professor, History; Elizabeth Cohen, Professor, Education and Sociology; Jane F. Collier, Assistant Professor, Anthropology; Carl N. Degler, Professor, History; Estelle Freedman, Assistant Professor, History; Barbara C. Gelpi, Lecturer, English; Carol N. Jacklin, Senior Research Associate, Psychology; Nannerl O. Keohane, Associate Professor, Political Science; Herbert P. Leiderman, Professor, Psychiatry; Carolyn C. Lougee, Associate Professor, History; Eleanor Maccoby, Professor, Psychology; Joanne Martin, Assistant Professor, Graduate School of Business; Anne K. Mellor, Professor, English; Diane W. Middlebrook, Associate Professor, English; William G. Miller, Professor, Graduate School of Business; Michelle Z. Rosaldo, Associate Professor, Anthropology; Myra H. Strober, Acting Associate Professor, Education, Director of CROW; Joan E. Talbert, Assistant Professor, Education; David H. Tyack, Professor, Education and History; Marilyn Yalom, Lecturer, Modern Thought and Literature, Associate Director of CROW: Sylvia J. Yanagisako, Assistant Professor, Anthropology.

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 advises students on women's studies courses.

COURSES

Feminist Theory—(Enroll in Political Science 157.) A course in nineteenth and twentieth-century feminist philosophy and political analysis, which explores several theoretical approaches to understanding the situation of women past and present. Among the authors read: John Stuart and Harriet Taylor Mill, Marx and Engels, Charlotte Perkins Gilman, Virginia Woolf, Simone de Beauvoir, Mary Daly, Juliet Mitchell, Adrienne Rich. Special topics—motherhood, women and nature, women and work, feminist utopias—can be pursued in research papers, and in discussions in small collectives.

5 units, Aut (N. Keohane)


5 units, Spr (Freedman, Gelpi, Staff) Not offered in 1980-81

142. The Female Experience: Victorian Heritage, Part II—(Enroll in Anthropology 142 or Modern Thought and Literature 142.) This course focuses on the Woman Question at the turn of the century (1880-1914). It examines the works of major social and political thinkers according to their conceptions of the sexes. Readings will include: Engels, Gilman, Mill, Wharton, Freud and others.

5 units, Spr (Collier, M. Rosaldo, Staff)

See departmental listings for other courses on women.

INSTITUTE FOR ENERGY STUDIES

Chairman: William C. Reynolds
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.

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 or her 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 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.

For further information, please write to:
Institute for Energy Studies
Building 500, Room 500C
Stanford University
Stanford, CA 94305

INSTITUTE FOR PLASMA RESEARCH

Executive Committee: Frederick W. Crawford (Chairman), Donald Baganoff, Daniel Bershadler, 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 Jr., John M. Wilcox

The Institute is an interdepartmental organization coordinating teaching and research in plasma physics, astrophysics and space science at Stanford and incorporates seven specialized research groups.

The Aerophysics Group (Baganoff, Bershadler, 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, and chemical kinetics, and includes studies of diagnostic techniques and analysis of energy conversion systems.

The Experimental Plasma Physics Group (Crawford, Self) carries out experimental research, with supporting theoretical studies, on waves and instabilities, beam-plasma interactions, and nonlinear processes such as wave-wave and wave-particle interactions, and generation of high power microwaves.

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, Sturrock, Walker) is engaged in both theoretical and experimental studies: the experimental work is concerned primarily with x-ray spectroscopic observations of the solar corona, 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. In addition, three-dimensional turbulence in fluids and gases is being studied by computer simulation.

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, astrophysics and space science. A number of plasma courses are listed by these departments and by the School of Engineering.

Students interested in graduate programs in astrophysics and space science should also consult the sections pertaining to the Astronomy Course Program, and Space Science and Related Programs.

Further information is available from members of each group and from the Chairman of the Executive Committee.

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 Stanford Solar Observatory (solar magnetic field; and solar-terrestrial relations); 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, interplanetary media and solar corona), operated jointly with Stanford Research Institute and the Institute for Plasma Research.

The experimental work is supported by theoretical studies and by a program of laboratory simulation of space plasma wave and instability phenomena.

A program in theoretical astrophysics provides for study and research over a wide range of topics including solar physics, solar-terrestrial relations, and nonthermal phenomena related to pulsars, radio galaxies, quasars and cosmic rays.

Stanford is a member of the Universities Space Research Association, a consortium of universities which operates the Lunar Science Institute in Houston, Texas. Opportunities and financial support for graduate students interested in advanced lunar research are available.

Courses related to many of the above topics are listed below. The descriptions of these courses will be found listed under Aeronautics and Astronautics, Applied 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, Physics, 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), MWF 1:15

50. Astronomy Laboratory and Observational Astronomy—(Enroll in Astronomy 50.)
   3 units, Aut (Staff) lecture T 4:15, laboratory by arrangement

100. Introduction to Observational Astronomy and Astronomy Laboratory—(Enroll in Applied Physics 100.)
   4 units, Spr (Walker) lecture M 3:15, laboratory by arrangement

   3 units, Aut (Staff)
   MWF 1:15-2:05, alternate years, given 1980-81

103. Stellar and Galactic Astrophysics—
   (Enroll in Applied Physics 103.)
   3 units, Win (Sturrock) MW 1:15-2:30

104. Solar-Terrestrial Relations—(Enroll in Astronomy 104.)
   3 units, Win (Scherrer) MWF 1:15-2:05, alternate years, given 1981-82

105. Extragalactic Astrophysics and Cosmology—
   (Enroll in Applied Physics 105.)
   3 units, Spr (Petrosian) MW 1:15-2:30

106. Planetary Exploration—(Enroll in Electrical Engineering 106.)
   3 units, Win (Eshleman)
132. Optical Methods in Engineering Science—(Enroll in Aeronautics and Astronautics 132.)

3 units, Win (Bershader) MW 2:15-3:30 alternate years, given 1980-81

150A. Advanced Astronomy Laboratory—(Enroll in Astronomy 150A.)

150A. 3 units, Aut (Staff) lecture T 4:15 laboratory by arrangement, alternate years, given 1980-81

190A, B, C. Independent Study in Astrophysics and Honors Thesis—(Enroll in Astronomy 190A, B, C.)

190A. 3 units, Aut (Staff) by arrangement
190B. 3 units, Win (Staff) by arrangement
190C. 3 units, Spr (Staff) by arrangement


3 units, Aut (Petrosian) by arrangement alternate years, given 1981-82

211. Physical Gas Dynamics—(Enroll in Mechanical Engineering 262A.)

3 units, Aut (Mitchiner) MWF 10

227. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)

3 units, Spr (Spreiter) TTh 2:45-4, alternate years, given 1981-82

260. Geophysical Fluid Dynamics—(Enroll in Mechanical Engineering 260.)

3 units, Spr (Spreiter) TTh 2:45-4:00, alternate years, given 1980-81

279A. Space Mechanics—(Enroll in Aeronautics and Astronautics 279A.)

3 units, Win (Breakwell) TTh 9:30-10:45

279B. Advanced Space Mechanics—(Enroll in Aeronautics and Astronautics 279B.)

3 units, Spr (Breakwell) MWF 10, alternate years, given 1980-81

345. Ionospheric Processes—(Enroll in Electrical Engineering 348.)

3 units, Spr (Waterman) alternate years, given 1981-82

350. Radioscience Seminar—(Enroll in Electrical Engineering 350.)

1 unit, Aut, Win, Spr (Lusignan)

352. Wave Propagation in the Ionosphere and Magnetosphere—(Enroll in Electrical Engineering 352.)

3 units, Spr (Helliwell) alternate years, given 1980-81

354. Introduction to Radio Wave Scattering—(Enroll in Electrical Engineering 354.)

3 units, Spr (Tyler) alternate years, given 1981-82

SYNCHROTRON RADIATION LABORATORY

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 1980-81


3 units, Win (Petrosian) MWF 11:00, alternate years, given 1980-81

366. Cosmology and Extragalactic Astrophysics—(Enroll in Applied Physics 366.)

3 units Win (Petrosian) MWF 11, alternate years, given 1981-82.


3 units, Aut (Staff) by arrangement

STANFORD SYNCHROTRON RADIATION LABORATORY (SSRL)

Director: A. Bienenstock
Deputy Director: H. Winick
Associate Director: R. Gould
Consulting Director: W.E. Spicer


The Stanford Synchrotron Radiation Laboratory (SSRL) is a national facility now being used by about 400 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. The radiation
emitted by SPEAR 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 proteins by measurement of Extended X-ray Absorption Fine Structure (EXAFS), X-ray Diffraction and Small-Angle X-ray Scattering.

Surface physics studies by measurement of ultraviolet reflection, absorption, and scattering.

Time-resolved fluorescence studies of proteins and semiconductors.

Four beam lines are now in operation capable of serving up to thirteen simultaneous experiments. The laboratory has a variety of general and specialized experimental equipment including custombuilt, high-vacuum grating monochromators, crystal monochromators, an automated four circle goniometer, PDP-11 computers, and detectors including one-dimensional position sensitive systems. A two dimensional area detector is in development. Wiggler magnets are used to provide enhanced radiation and undulator magnets are in development.

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.
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, 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 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 British Studies, Medieval Studies within Humanities Special Programs, Public Policy, Social Thought and Institutions, Urban Studies and Values, Technology and Society. 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.

THE PROGRAM ON URBAN STUDIES

The Committee on Urban Studies: Clay Carson, Assistant Professor of History; Jarir Dajani, Associate Professor of Civil Engineering; Richard Muth, Professor of Economics; Leonard Ortolano (Program Director), Associate Professor of Civil Engineering; Nancy Tuma (Chairman), 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 Core 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 Core 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 the “Program for Individually Designed Majors” section of this bulletin 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 Leonard Ortolano, 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 of 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 Core Seminar. It is strongly recommended, though not required, that all Urban Studies majors take “Introduction to Urban Studies” (Urban Studies 105). 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:
- Sociology 150. “Urban Sociology.”
- Urban Studies 175. “Managing Local Government.”

Group B:
- Applied Earth Sciences 130 or 131 or 132. “Environmental Earth Sciences I, II, III.”
- Civil Engineering 133. “Introduction to Urban Planning” or 234 “Land Use 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.

CORE SEMINAR

188. The City as Human Experience: Politics of U.S. Urban Development—The first quarter of the Senior 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 (Carson, Weiss) M 2-4

189. The City as Human Experience: Theories of Urban Design/Planning—The second quarter of the Senior Seminar systematically examines the urban design ideals which have motivated 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 (Turner, Stout) M 1-3

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.

105. Introduction to Urban Studies—What makes a city? Why do some people rejoice in city life while others reject it? This course examines the component systems of the city, by means of direct student investigation exercises. For example, the course will look at how people interact in public settings, what contributes to a sense of neighborhood, and how goods such as newspapers or bread are produced, distributed, and consumed. The course introduces the beginning student to the various aspects of urban studies, including sociology, politics, economics, and urban design. (DR:X)

4-5 units, Aut (Phillips) M 12-2

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:

ARCHITECTURE/DESIGN TRACK

Anthropology: 146, 164
Civil Engineering: 130, 133, 170, 171, 221, 222, 224, 229, 233, 235, 236, 237
Human Biology: 103
Values, Technology and Society: 180

ENGINEERING/PLANNING TRACK
Applied Earth Sciences: 130, 131, 132
History: 270
Industrial Engineering: 100, 107
Mechanical Engineering: 101, 102, 115A, 137, 138, 180
Operations Research: 151, 152, 153, 154
Values, Technology, and Society: 180

SOCIAL SCIENCE/ POLICY ANALYSIS TRACK
Anthropology: 132, 139, 146, 147, 155, 156, 164, 243, 260
Civil Engineering: 133, 170, 171, 221, 222, 223, 224, 226, 227, 233
Computer Science: 101, 103, 104, 105, 106, 107
Economics: 51, 104, 113, 141, 145, 147, 148, 150, 170, 171, 249
Engineering Economic Systems: 100A, B, C
Human Biology: 148, 178, 181
Psychology: 121, 126A
Sociology: 135, 140, 141, 143, 144, 145, 147, 150, 151, 155, 160, 161, 163, 166
School of Education: 220A, B, C; 221A, B, C
Statistics: 116, 120, 152, 153
Values, Technology and Society: 101, 106, 107, 110, 113, 142, 150, 151, 170, 172

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 SWOPI. (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: Walter G. Vincenti
Associate Chairman: Robert E. McGinn
Administrative Committee: Barton J. Bernstein, Edwin M. Good, Stephen J. Kline, Robert E. McGinn, Nathan Rosenberg, Walter G. Vincenti
Director, Western Culture Sequence: Edwin M. Good

Professors: Harumi Befu (Anthropology), Ronald Bracewell (Electrical Engineering), Raymond B. Clayton (Psychiatry), Thomas J. Connolly (Mechanical Engineering), Mark Edwards (Classics), Edwin M. Good (Religious Studies), Eric Hutchinson (Chemistry), Stephen J. Kline (Mechanical Engineering), Robert L. Rabin (Law), Everett M. Rogers (Communications), Nathan Rosenberg (Economics), Walter G. Vincenti (Aeronautics and Astronautics)

Associate Professors: Barton J. Bernstein (History), Paul Turner (Art)


Lecturers: Barry M. Katz (VTS), Dorothy Leonard-Barton (Communications), Sharon Traweck (VTS),

STATEMENT OF PURPOSE
Values, Technology, and Society (VTS) studies the ways technology affects and is affected by human values and social institutions. 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 important to obtain a broad understanding of technology in its individual human, social, and cultural contexts. To this end, VTS courses approach the study of technology and its interrelations with other sectors of the cultural system from a variety of humanistic and social scientific perspectives.

GENERAL INFORMATION
VTS courses may be used, individually or in integrated groups, in a variety of ways:
1. To satisfy both the old and the newly adopted Area Distribution Requirements.
2. To satisfy the Technology and Society category in the breadth requirement of the School of Engineering.
3. In student-designed concentrations required for majors in Humanities in the Department of Humanities Special Programs.
4. To form a minor complementing a regular departmental major.

For information on which Distribution Requirement Area(s) 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, students may elect to create an "Individually Designed Major" in VTS or in a VTS-related area in consultation with Program faculty and the Dean’s Advisory Committee on Individually Designed Majors. In the past students have designed majors in areas such as “Computer Science and Technology in Society,” “Government, Technology, and Society,” and “Environmental Studies.”

VTS courses will be particularly valuable for undergraduates planning further study in graduate professional schools (e.g., business, education, engineering, law, medicine) as well as for students wishing to relate the specialized knowledge of their major fields to broad, technology-related aspects of life in modern society and culture.

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 should 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):
   a) Technology and Human and Cultural Values: VTS 101, 105 and 110.
   b) 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) (3-5 units, ordinarily freshman or sophomore years): VTS 142, 145, and 180.

3. Advanced Courses—two courses from the following group (8 units, ordinarily junior year): VTS 122, 130, 150, 151, 152, 165, 170, 172.

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 Project and each of the courses taken in conjunction with requirements 1-3 must be completed with a grade of at least “B”.

Students who fulfill these requirements will have the designation “Honors Program in Values, Technology, and Society” affixed to their permanent academic records.

COTERMINAL A.B./M.S. PROGRAM WITH ENGINEERING-ECONOMIC SYSTEMS DEPARTMENT

The VTS Program and the Engineering-Economic Systems Department of the School of Engineering 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: (1) a modicum foundation in mathematics, engineering, and economics; (2) courses from the VTS Program; (3) a VTS project; (4) an individually designed concentration of courses in the humanities and/or social sciences; (5) 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
the 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 and other information can be obtained at the VTS office in Building 370. General requirements and procedures governing coterminous Bachelor's/Master's programs can be found under "Undergraduate Degrees" at the beginning of this volume.

To complete the coterminous 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.

WESTERN CULTURE SEQUENCE

1,2,3. Western Culture and Technology—The development of Western culture from the ancient world to the 20th century through exploration of the interconnections among the three major realms of culture: the intellectual (e.g., philosophies), the material (e.g., technologies), and the social (e.g., institutions). The course does not require the use of mathematics.

1. The Ancient World—Culture and technology from the earliest civilizations in the Near East to the fall of the Roman Empire. Topics: Homer’s heroic ideal; philosophical and religious concepts of justice; metallurgical, architectural, and writing technologies; origins of Western law; technology and the Roman Empire; everyday life in antiquity. Readings from Homer, Hesiod, Aeschylus, Thucydides, Plato, the Bible, Cicero, Augustine, and Vitruvius. (DR:A)
   5 units, Aut (Edwards, Good, and Hutchinson) MTW 10 two-hour section by arrangement

2. Middle Ages, Renaissance, and Enlightenment—Society, religion, and technology in the Middle Ages, Renaissance Europe, and the widening of horizons. Topics: monastic life; medieval towns; Renaissance utopias; the mechanical clock, Gothic cathedrals, and printing; daVinci; navigation and exploration; rationalism, empiricism, and the codification of knowledge. Readings from authors such as St. Benedict, Aquinas, Alberti, Galileo, Frances Bacon, Pascal, and Diderot. (DR:A)
   5 units, Win (Bracewell and Vincenti) MTW 10 two-hour section by arrangement

3. The Modern World—The Industrial Revolution and its impact on social and economic structures, and on cultural values and everyday life. Topics: industrialization, Marxism, romanticism, realism, rise of large-scale industry, Edison, evolutionism, psychoanalysis, expressionistic art, WWI, fascism, existentialism, mass communications and mass culture, biotechnology, and world society. Readings from Rousseau, Goethe, Marx, Flaubert, Nietzsche, Freud, Lawrence, Taylor, Weber, and Sartre. Required listening to one work each of Bach, Mozart, Beethoven, Berlioz, Wagner, Brahms, Verdi, Mahler, and Stravinsky. (DR:A)
   5 units, Aut (McGinn and Staff) MTW 11 two-hour section by arrangement
   5 units, Spr (McGinn and Staff) MTW 10 two-hour section by arrangement

101. Contemporary Technological Society—The nature, problems, and potentials of contemporary technological society, with special reference to America. Materials from anthropology, philosophy, psychiatry, literature, religious studies, history, and policy analysis. Topics: technology and the transformation of cultures; frameworks for assessing social changes arising from technological innovations; technology, science, and the emergence of modern consciousness; technology and everyday experience in pre-modern English village and 20th-century American urban life; case studies in technology and public policy (e.g., agricultural mechanization, noise pollution, limits to urban growth, technologies of human reproduction and behavior control.) (DR:A)
   4 units, Aut (McGinn) given 1981-82

105. Ethics and Human Values in 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, social interaction, and attitudes toward nature; “scientism” and “reductionism”; ethical and human value aspects of important technologies and technology-related phenomena; values and the future. Readings from Nietzsche, Marx, Rilke, Kafka, Thoreau, Hardin, Mishan, Terkel, Schaefer, and Rudofsky. (DR:A)
   4 units (McGinn) given alternate years

106. The Nature of Technology in Modern Society—The nature and function of technology in modern Western society. The relationship between the physical bases of Western societies and their social and value elements; contrasts with several types of non-industrial cultures. The rise of science and the relationship between science and technology. The worldview of sci-
ience and technology as contrasted with those of other disciplines. Changes in the nature of technological organizations underlying the creation of societies of abundance: e.g., structure, production, marketing, and distribution. Edison and the rise of the research and development laboratory. The role of technological systems in extending human functions. The rate of technological change and its social effects. Processes of innovation in the 20th century. Technology, basic human needs, and the future. (DR:C)

4 units, Spr (Kline) TTh 10
section 2, 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 socio-economic 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, Spr (Rosenberg) MW 2:15-4:05

110. Philosophical and Ethical Issues in Public Policy—(Same as Public Policy 103.) Ethical and human value aspects of public policy. Analysis of ethical and value conflicts in policy-making and use of case studies as a means of exploring their complexity and role in the design of socially responsible public policy. Topics: "justice," "human rights," "the public interest" and other key value-laden terms in public policy discourse; anthropological, psychological, and sociological accounts of the origin and development of ethical and other value orientations in individuals and groups; value-laden models of decision-making in public policy; types of ethical and value issues arising in different spheres and types of policymaking; cases from medicine (e.g., euthanasia), communications (e.g., children's television advertising), the environment (e.g., toxic waste disposal), and civil service. (DR:A)

5 units, Win (McGinn) MTW 2:15-3:05
section by arrangement

115. Models and Progress in Science and Technology—The nature and conditions of progress in science and technology will be illuminated by examining the successes and failures of selected models of natural and man-made phenomena. Examples from several historical periods, including antiquity and the twentieth century. Attention will be paid to the reasons—technical, social, philosophical, and psychological—that led to the eventual acceptance, temporary abandonment, or outright rejection of various models. Examples will include: ancient Greek models of the earth and solar system, models of quantity and space and their measure in mathematics, Aristotle's models of natural processes and physical laws, models of heat, models of flight, and Einstein's models of the universe (relativity). Intended for the non-technical student.

4 units, Win (Koutsoyannis) offered 1981-82

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. Not open to students who have taken VTS 1, 2, 3. (DR:C)

4 units, Aut (Vincenti) MW 1:15
Section Th 9:00-10:50 or 2:15-4:05

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. Not open to students who have taken VTS 1, 2, 3. (DR:B)

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

130. Industrial Society: Its Theorists and Its Critics—Taking "industrialism" as the institutional, cultural, administrative, and technological apparatus of modern society, the course will trace its consolidation as an integrated social system as reflected in the art and ideas of 19th and early 20th century Europe. We will confront such thinkers as the French utopian socialists, Marx, Ruskin, Nietzsche, and Max Weber, relating them to the evolving European context. Enrollment limited to 15. (DR:A)

4 units, Spr (Kätz) MW 2:15-4:05

142. Information: The Communications Revolution in Contemporary Society—The nature of the communications revolution and its impact on society. Basic concepts of information and
communications theory. Brief introduction and examination of the limitations and possibilities of information and communications technology. Use of the computer for information manipulation. Impact of communications and information technology on information access, politics, libraries, education, employment, human values. Issues regarding privacy, information ownership (copyright), participatory democracy, etc. (DR:T)

4 units, Aut (Kincheloe) MWF 2:15

145. Chemistry and the Life Sciences in Historical and Philosophical Perspective—Development of chemical and biological ideas in the context of Western social, philosophical and religious thought, emphasizing the impact of these ideas on the concept of man in the 20th century. Topics include: the enduring human drive to understand and control nature, including the life process; the 17th-century religious roots of the scientific establishment; 18th-century context of the chemical and physiological revolutions; 19th-century Romanticism's impact on science; scientific creativity; tension between vitalistic, and mechanistic, interpretations of life; challenges to traditional values posed by recent biomedical science and technology. Open to juniors and above. Requirement: at least one course in chemistry or biology (or consent of instructor). Limited enrollment. (DR:H)

4 units, Win (Clayton) MWF 1:15

150. Regulation, Welfare and Public Policy—(Same as Law 150, and Political Science 106R.) 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 (Inkeles) MWF 11:00 a.m.

152. Ecology, Industrialization, and Culture in Japan—(Same as Anthropology 122.) Social and cultural ramifications of environmental destruction in Japan resulting from industrialization will be explored. Modes of coping with the impact of industrialization—social, political, legal, etc.—will be analysed in relation to Japan's cultural premises and traditional social structure and values. (DR:S)

(Befu) given alternate years

155. Social Structure of World Society—(Same as Sociology 152 and Education 147.) This course pursues a sociological analysis of human 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 and its dynamics will be reviewed and compared. Special attention will be given to the question of whether once distinctive societies and cultures are converging on a common standard. Among the topics to be covered will be worldwide population dynamics, the nature of the world economy, communication and exchange of persons on a global scale, socioeconomic stratification of the world population, and education, science and technology as global systems. The course will utilize a mixed lecture-discussion format. (DR:S)

5 units, Spr (Inkeles) MWF 11:00 a.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 cases of the history of specific instruments or instrument groups. (DR:B)

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

170. Work and Society—(Same as Industrial Engineering 107.) Perspectives on work, particularly as conditioned by technology and transformed by technological change. Topics: historical studies of work in the pre-industrial world; the impact of the industrial revolution on work and community; philosophies of work and work-society relations; literary and sociological portraits of work life; contemporary issues in the theory and practice of work, e.g., self-management and job-enrichment experiments, worker rights, professional ethics, work and government regulatory agencies, the ethics of corporate conduct, trends in work manage-
FRESHMAN-SOPHOMORE SEMINAR PROGRAMS

Dean's Advisory Committee in Charge: John D. Goheen (Director of the Program 1980-81), Nancy Cartwright, Amy Hayes, Henry S. Levinson, Diane Middlebrook (ex officio), Judy Moreland, Benjamin D. Paul, Richard Scott, David K. Stevenson, Steven St. Laurant, Kathryn Thoelecke (ex officio)

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.

Sophomore seminars will be offered for the first time in 1980-81. The program will offer approximately 45 seminars taught by members of the Stanford community. Some seminars will fulfill part of the University’s Distribution Requirements.

Approximately 90 seminars will be offered 1980-81; 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. All 1980 Freshman seminars fulfill part or all of the Writing Requirement, and Sophomore seminars may count toward the University’s Distribution Requirement.

FRESHMAN-SOPHOMORE SEMINAR PROGRAMS

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

199. Individual Work. (DR:X)

1-5 units, Aut, Win, Spr (Staff) by arrangement

FRESHMAN-SOPHOMORE SEMINAR PROGRAMS

172. Diffusion of Innovations—(Same as Communications 167.) Course takes multidisciplinary approach to diffusion in business, education, law, government, and consumer groups. Emphasis is on role of communication in spread of new technology, new ideas, and new values among individuals within organizations, and among organizations in the U.S. and abroad. Special emphasis upon energy, conservation innovations and on scaling down in a limited growth future. (DR:S)

3-4 units, Win (Leonard-Barton, Rogers)

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 new materials, technology, and environmental conditions. (DR:H)

4 units, Aut, Win (Turner) given 1981-82

180. Energy and Society—(Same as Mechanical Engineering 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 nonengineering student. Prerequisites: high school physics, mathematics 21, and junior standing or consent of instructor. (DR:T)

3 units, Aut (Connelly) 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
APPLICATION AND ADMISSION PROCEDURES

Enrollment in Freshman seminars is limited to freshmen. All incoming freshmen will receive a copy of Approaching Stanford in June which includes descriptions of the seminar offerings for the following academic year. Students register for seminars by mail during the Summer.

Correspondence regarding the Freshman Seminar Program should be addressed to the Academic Information Center, Old Union, 306, Stanford University, Stanford, CA 94305.

Enrollment in Sophomore Seminars is limited to members of the Sophomore class. See the Time Schedule for enrollment information. Inquiries may be directed to the Sophomore Seminar Program, Academic Information Center, Old Union 306, Stanford University, Stanford, CA 94305.

EXTRADEPARTMENTAL UNDERGRADUATE PROGRAMS

The programs below are extradepartmental undergraduate programs sponsored by the Dean of Undergraduate Studies. They include the Freshman-Sophomore Seminar Programs, 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 Program. 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 SWOPSI and/or SCIRE. See the program descriptions below for additional information.

LEARNING ASSISTANCE CENTER (LAC)

Director: Carolyn Walker
Lecturers: Bernie Rihn, Patrick Von Bargen
Teaching Fellows: David Elias, Donald Tanzer

The Learning Assistance Center (LAC) offers courses and services designed to teach study, reading, tutoring, and peer counseling 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, self-management, research and writing techniques, study-reading, and how to prepare for taking exams. 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 (Rihn, Von Bargen)

6. Effective Reading—Introduction to the techniques of effective reading, with emphasis on memory and concentration, comprehension, vocabulary development, and the critical 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 (Rihn)

   Note: the rate improvement section of this course is available separately either in a classroom or 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 study-reading techniques, memory, vocabulary development, techniques of persuasion, the logical analysis of argument/essays, and discovering organization, assumptions, tone, bias and emphasis in prose passages. Writing sessions will deal with the basic elements of composition (grammar, mechanics, syntax, diction, unity, coherence, the thesis) and will focus on the development of individual style in expository and argumentative
essays. Satisfies one half of the Writing Requirement. (DR:W) (Not open to students enrolled in LAC 6.)

9. Critical Reading and Writing II—(Same as English 2.) Continuation of LAC 8/English 1. Reading sessions will build on reading/study techniques developed last quarter and will concentrate on understanding the demands made upon the reader by various literary and non-literary genres (poetry, fiction, expository/argumentative essays, advertising, journalism, and film reviews). Similarly, writing sessions and tutorials will review and build on last quarter’s instruction in the basic elements of composition while giving students practice in additional critical strategies (evaluation of advertising techniques, explanation of poetry, analysis of fiction, reviews of film, and the research paper). Satisfies one half of the Writing Requirement. (DR:W) Prerequisite: LAC 8 or consent of the instructor.

5 units, Aut, Sum (Walker, Copeland and Staff)

10. 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 (Von Bargen)

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, Sum (D’Andrea, Staff)

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 instructors of LAC 1.

2 units, Win, Spr (Tanzer)

173. Peer Counseling: Chicano—Same as 170 with additional instruction in the theory and practice of peer counseling Chicano.

2 units, Aut, Win Spr (Martinez)


2 units, Aut, Win, Spr (Matsumoto)

172. 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
(D’Andrea, Staff)

175. Peer Counseling: Career Development—Same as 170 with additional instruction in the theory and practice of career counseling.

2 units, Spr (Filice)

176. Peer Counseling: Contraception—Same as 170, Basic Attending Skills, but open only to students who are enrolled concurrently in the Contraception Peer Counseling course, Medicine 299, Section 39.

1 unit, Win, Spr (Dorman, Staff)

177. Peer Counseling: Advising Associates—Same as 170 with additional instruction in the theory and practice of undergraduate advising.

2 units, Spr (D’Andrea, Staff)

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 classroom or self-managed reading rate improvement course. Not for credit.
4. Individual meetings with staff and peer study skills counselors available on an appointment or a 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 program initiated by students in 1969 to harness the research capabilities of Stanford 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 approximately 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 recommendations. 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 placement such as a day care center, a school for children with learning disabilities or the county Commission on the Status of Women. All workshops 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 interdisciplinary 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 registration through the residences or the SWOPSI office, 590-A Old Union.

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THE STUDENT CENTER FOR INNOVATION IN RESEARCH AND EDUCATION (SCIRE)

The Student Center for Innovation in Research and Education (SCIRE) is a student-initiated, extradepartmental program. The program's overall objective is to support the educational needs of undergraduate students. This is accomplished through assistance to individual students and by work done to improve the general state of undergraduate education.

Best known among SCIRE's activities is its support of individual or small group, student-initiated projects. SCIRE facilitates these projects in several ways. The staff works with interested students in developing and refining project ideas. Members of the academic community and other qualified individuals with interests similar to the students' are sought out by the staff and students jointly. Academic credit is then granted to those project proposals which receive the approval of the SCIRE Policy Board. The Board consists of five students and four faculty members.

SCIRE projects allow undergraduates to directly affect their education by giving them the opportunity to experiment with new subject matter, creative research and learning approaches, and unique field experiences. The number of units granted for a project may range from 2 to 7 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 their own 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 welcomes 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.

A different type of off campus study encouraged by SCIRE is field research of an oral traditions nature. This could include work such as collecting folktales, researching folk medicine, or undertaking oral history and family history projects.

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.

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 options open to undergraduate students by drawing upon the educational resources of the entire University community, including some parts which customarily have not participated in undergraduate work. Members of the faculties of the graduate professional Schools may offer 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 teaching 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.
LIBRARIES AND INFORMATION SERVICES

HOOVER INSTITUTION
ON WAR, REVOLUTION AND PEACE

Director: W. Glenn Campbell
Associate Directors: Richard F. Staar, Richard T. Burress, Darrell M. Trent, Dennis L. Bark
Assistant Directors: Laverne M. Klebofski, Nancy W. Collins, Dennis Spellmire
Public Affairs Coordinator: George Marotta
Finance Officer: Sally Vandors

RESEARCH AND PUBLICATIONS

Honorary Fellows: Friedrich A. Hayek, Ronald Reagan, Alexander Solzhenitsyn
By Courtesy: Michael Boskin, Heinz Eulau, William J. Goode, Robert E. Ward
Consultant: Yuan-li Wu

Senior Research Fellows: Dennis L. Bark, Michael K. Block, John H. Bunzel, Robert Conquest, Aaron Director, John Emmerson, Milton Friedman, Paul R. Hanna, Robert T. Hartmann, Sidney Hook, George Lenczowski, George Marotta, Chiaki Nishiyama, Paul Craig Roberts, Kenneth E. Scott, Dan Throop Smith, Edward Teller, Darrell M. Trent, Eric Voegelin.

Research Fellows: Annelise Anderson, Constantine Galkovskiy, Robert Hessen, Frederick Nold, Molly Sturges

Russian Review Editor: Terence Emmons

Executive Secretary for the National, Peace and Public Affairs Fellows Program: Dennis L. Bark

Publications General Manager: Mickey Hamilton

THE LIBRARY AND ARCHIVES

Associate Director for Library and Archival Operations: Richard F. Staar
Technical Services: Joseph Kladko

East Asia Collection–Curator: Ramon H. Myers, Deputy Curators: Emiko Moffitt, Mark W. Tam

Africa and Middle East Collection–Curator: Peter J. Duignan, Deputy Curator: Lewis H. Gann, Assistant Curator: Karen Fung

Eastern Europe Collection–Slavic Bibliographer: Joseph D. Dwyer
Latin America Collection–Curator: Joseph W. Bingaman

Western Europe Collection–Curator: Agnes F. Peterson

British Labour Collection–Honorary Curator: Richard W. Lyman

Boris I. Nicolaesky Collection–Curator: Anna M. Bourguina

Imperial Russian Collection–Honorary Curator: Vasili Romanov


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.

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.

The Institution has expanded its domestic research program, which has become comparable in size and quality to international studies. Dennis L. Bark directs the National Fellows Program in which scholars conduct advanced research on current political, economic, and social issues. In addition, there are conferences, seminars, and lectures that deal with these issues. Thomas G. Moore is director of domestic studies. Research currently underway is concerned with income redistribution, government regulation, taxation, domestic health and energy problems, and an econometric analysis of crime.

In addition to its own research staff, the Institution has been visited over the years by tens of thousands of American and foreign scholars. In recent years, increased use of the Institution's resources has been encouraged 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 380 volumes have been published.

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 Robert Hall on joint appointment with the Economics Department, senior fellow Seymour Martin Lipset on joint appointment with the Political Science and Sociology Departments; senior fellow James G. March on joint appointment, as the Fred H. Merrill Professor of Management, with the Graduate School of Business and the Departments of Political Science and Sociology and, by courtesy, Education; senior fellow Alex Inkeles on joint appointment with Sociology and, by courtesy, Education. Professors Michael Boskin in Economics, Heinz Eulau in Political Science and Robert E. Ward in Political Science, and William J. Goode in Sociology are senior fellows (by courtesy). East Asian curator Ramon Myers is adjunct professor at the Food Research Institute; senior fellow Thomas Moore and deputy archivist Robert Hessen teach in the Graduate School of Business; and senior research fellow 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.

Hoover scholars have received many awards and distinctions. In addition to the three Nobel laureates associated with the Institution, nine scholars hold memberships in the American Academy of Arts and Sciences and four in the National Academy of Science.

With the dedication of the Herbert Hoover Federal Memorial in July 1978, the Institution has become one of the outstanding research facilities in the United States. The Hoover Institution's complex now includes the Tower and two adjacent buildings. An exhibit building displays selected archival and library materials for the public.

LIBRARIES

Emeriti: M. Celeste Ashley (Drama Librarian); Joseph A. Belloli (Senior Reference Librarian); Virginia Bonnici (Physics Librarian); Edward Colby (Music Librarian); Kathryn N. Cutler (Earth Sciences Librarian); Florence Furst (Chemistry Librarian); Elmer R. Grieder (Associate Director of Libraries); Charles R. Gorham (Chief Gifts Librarian); Jennette E. Hitchcock (Chief Catalog Librarian); Grace E. Stillson (Assistant Chief Catalog Librarian); Margaret Windsor (Assistant Chief Librarian)
The Libraries of Stanford University sponsor a variety of instructional activities in order to promote awareness of the library resources and services that are available to the campus community and to expedite their effective use. The reference librarians in all major library units provide professional advice and consultation in locating and utilizing published information. Curators and branch librarians offer similar bibliographic help within their subject specialties. Other types of instructional aid include tours, audio-visual presentations, and lectures to classes at the instructor’s request.

Numerous library publications are prepared to inform and instruct library users. The most general and basic of these are the guide series entitled “Guides to the Stanford University Libraries,” which 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 (DR:X)

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 Univer-
sity 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. May not be repeated for credit.

3 units, Aut, Win, Spr (Staff)

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)

German 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.

(DR:X)

2 units, Aut (Frank)

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)

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 (Persons)

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)

**LOTS COMPUTER FACILITY**

Manager: Ralph E. Gorin

**OFFERINGS AND FACILITIES**

The LOTS (Low Overhead Time-Sharing) Computer Facility supports instruction and unsponsored research programs on campus. The LOTS DECSYSTEM 2060 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. Students and faculty may use LOTS without charge. Information about obtaining accounts is available at the LOTS office, CERAS Building.

Interactive services available include a text editor, many programming languages such as FORTRAN, BASIC, PASCAL, LISP 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 adaptations 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, (497-3214).

**COURSES**

All courses (DR:X). No registration required.

2. Getting Started at LOTS—Two one-hour orientation sessions designed for users who are familiar with computing concepts but who need a guide to the use of the LOTS facility. The course includes information about obtaining ac-
counts, 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

10. An Introduction to FORTRAN—This
course assumes that the student knows FOR-
TRAN already and discusses the particular fea-
tures 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 Technology (CIT), or Computer
Science 103.

0 units, by arrangement

11. Introduction to PASCAL—A one hour ses-
sion dealing with the characteristics of PASCAL
at LOTS. PASCAL is an ALGOL-like language
gaining in popularity due to its clarity, simplic-
ity and powerful data-structure manipulation
and type definition facilities. Familiarity with
some programming language is assumed.

0 units, by arrangement

12. Minitab—An introduction to Minitab, an
easy to use statistical computer package for
small to moderate sized statistical problems.
The lecture assumes little previous experience
with computers, but previous attendance in
Getting Started at LOTS helpful.

0 units, by arrangement

13. SPSS—A one hour orientation session de-
signed 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 CIT. If you are not already familiar with
SPSS, the Stanford Center for Information
Technology (CIT) offers a course each quarter.
No previous computer experience is required,
but a knowledge of elementary statistics is
necessary.

0 units, by arrangement

14. SAIL—(an ALGOL-like language.) Intro-
duces the student to the specifics of using SAIL
at LOTS. Covers control structures, decla-
rations, procedures, and input/output
facilities. This one session course lasts one hour.
Familiarity with an ALGOL-style language is
assumed.

0 units, by arrangement
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. 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 C.I.T. in a special flyer. Contact the Campus Facility Information Desk (497-4392) 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, C.I.T., Fine Hall (497-3907).

COURSES

All courses (DR:X)

1. Campus Facility Overview (for beginning computer users)—Designed for anyone who is new to computing and intends to use the Campus Facility services for the first time. A prerequisite for any first-timer intending to take one of the beginning level courses. Not a survey of computing in general, but an overview of kinds of work you can do on the Campus Facility computer and an introduction to some basic computing concepts. Topics covered include different kinds of computer use, defining a program, descriptions of interactive and basic computing, and a brief description of hardware and software. Computer languages, accounts, charges, and documentation are discussed.

   0 units, Aut, Win, Spr, Sum

2. Campus Facility Overview (for experienced computer users)—Practical orientation designed for users who have programming experience and are familiar with computing concepts but have never used the Campus Facility. Topics covered include the hardware, software, and services available at the Campus Facility, as well as a general discussion of terminal use, charges, and documentation. Previous computing experience is required.

   0 units, Aut, Win, Spr, Sum

10. WYLBUR—Intended to familiarize students with the use of the terminal and with the text editing capabilities of WYLBUR. 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.

   0 units, Aut, Win, Spr, Sum

12. Text Formatting with SCRIPT—An introduction to SCRIPT, a program useful for producing a report, proposal, thesis or other manuscript with the help of the computer. Presentation includes page and section numbering, page headings, footnote placement, creation of a table of contents and aids to producing an index. Knowledge of WYLBUR is required.

   0 units, by arrangement

18. Introduction to PL/I—Provides the student with an introduction to PL/I, a general-purpose programming language suitable for a wide range of applications. The features of the PL/I language will be taught with an emphasis on structured programming. The IBM PL/I Optimizer and the IBM Checkout Compiler are used in the course. A knowledge of WYLBUR and programming experience in a higher level language such as FORTRAN, BASIC, etc., are required.

   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 experiences is required, but a knowledge of elementary statistics is necessary.

   0 units, Aut, Win, Spr, Sum

27. Easy Plotting with Top Drawer—Introduces the student to an easy-to-use program for drawing graphs and histograms of two-dimensional data. Top Drawer can be used interactively or in batch mode, drawing reasonable plots from nothing more than specified data points. Output can be easily directed to a terminal, a CalComp plotter or a Versatec plotter.

   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 em-
phasis on the effective use of the language. Knowledge of the system architecture is advised.

0 units, by arrangement

30. Searching and Updating in SPIRES—Introduces students to the Stanford Public Information Retrieval System. Primary emphasis is placed on the search capabilities of SPIRES, using examples from a collection of public data files. Anyone interested in information systems applications should take this course. Students need no prior programming experience but a knowledge of WYLBUR is required.

0 units, Aut, Win, Spr, Sum

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, 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, by arrangement

40. Introduction to SAS—Introduces students to the Statistical Analysis System (SAS), a package of computer programs used for the analysis of data. It contains sophisticated data management capabilities as well as routines for handling complex statistical procedures. Covers the general format and conventions for running SAS programs at the Campus Facility and introduces some of the more commonly-used procedures. Knowledge of WYLBUR and elementary statistics is necessary and knowledge of another statistical package (such as SPSS or BMDP) would be helpful.

0 units, by arrangement
OTHER DEPARTMENTS, INSTITUTES AND PROGRAMS

AFRICAN STUDIES

Emeriti: St. Clair Drake (Anthropology and Sociology), William O. Jones (Food Research Institute)

Professors: James L. Gibbs, Jr. (Anthropology), Joseph Greenberg (Anthropology), Bruce Johnston (Food Research Institute), Hans Weiler (Education and Political Science), Sylvia Wynter, (African and Afro-American Studies)

Associate Professors: David B. Abernethy (Political Science), Kennell A. Jackson, Jr. (History), William R. Leben (Linguistics), Scott R. Pearson (Food Research Institute)

Assistant Professor: Don Donham (Anthropology)

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 Schedules.)

COURSES

For (DR) notations, see respective departments

The Black Experience in Fact and Fiction: Parallelism/Divergences, Relation/Opposition to the Western Model—(Enroll in African and Afro-American Studies 101.) This seminar will use both "factual" and fictitional 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 (Wynter) given 1981-82

African Societies in a Changing World—(Enroll in Anthropology 108.) This lecture course examines the social institutions and cultural forms of black Africa in the wider context of colonialism, political independence, and national strategies of development. Topics explored include: shifts in patterns of marriage and family life, the emergence of new classes, the impact of Islam and Christianity, and the use of art and oral literature to consolidate and express ethnic power. Botswana, Ethiopia, and Liberia will be used as case studies, while supplemental material will be drawn from other Sub-Saharan nations.

5 units, Win (Gibbs, Donham)

Law and Conflict Management—(Enroll in Anthropology 156.) A lecture course focusing on 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:A)

given alternate years

Social Institutions and Economic Theory—(Enroll in Anthropology 161.) This is a course on economics in radically different societies. Besides advanced societies, many other types of economic organization exist in the record of human existence; from hunters and gatherers in the Kalahari Desert to peasants in Imperial China to present-day farmers in underdeveloped countries. The purpose of the course is to confront this range of empirical material with a variety of elementary economic and social theory, including neoclassical, substantivist, and Marxist contributions to economic anthropology.

given alternate years

Law in Radically Different Cultures—(Enroll in Anthropology 157 or Law 157.) (Graduate students register in Anthropology 257.) Comparison of legal systems in Western, capitalist, secular, industrialized democracies with legal systems in radically different cultures. Using American law as a benchmark, this course examines comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt (religious law), and the Republic of Botswana (traditional law) in order to identify the historical, philosophical, social, and cultural factors which contributed to the development of
different attitudes and practices regarding law. Issues considered are the passing on of status and property rights — especially at death, the handling of anti-social or "criminal" behavior, the handling of promises and contracts, and the use of law as an instrument of social change in the introduction of family planning. This course is open to law students, graduate students in other departments and to juniors and seniors. (DR:A)

3 units, Spr (Barton, Gibbs, Li, Merryman)

Hunter-Gatherers in Archeological Perspective—(Enroll in Anthropology 187.) The archeological record of Africa, Europe and the New World provides examples of how archeological data is used to reconstruct the cultural systems of extinct hunter-gatherers. Artifact typology, settlement pattern analysis, modeling approaches, ethnoarcheological methods, and other techniques are used to determine the similarity of early groups to their modern counterparts.

5 units (Rick)

Sex Roles in Society—(Enroll in Anthropology 11.) 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.

3-5 units, Win (J. Collier, M. Rosaldo)

The United States and Africa—(Enroll in History 146A.) A history of the many connections that have existed between the United States and Africa. The emphasis will be on determining the impact and influence the two cultural areas have had upon one another; the slave contribution of the early colonial economies; African influences on the formation of American English; American images of Africa as found in novels in 19th and 20th century writing; "Back-to-Africa" movements in the 1920's; African students in the United States; United States-Africa trading history; American foreign policy toward Africa in the 19th century and under John F. Kennedy to Jimmy Carter; and the emerging concepts of American alliance with prominent African regional powers such as Nigeria and Kenya.

5 units, Spr (Jackson)

Women in African History—(Enroll in History 147B.)

5 units, Win (Jackson)

Undergraduate Seminar: Mau Mau—Anti-Colonial Rebellion in 1950's Kenya—(Enroll in History 247S.)

5 units, Aut (Jackson)

Graduate Seminar: African Oral History—(Enroll in History 447S.)

5 units, Spr (Jackson)

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, Aut (Abernethy)

Southern Africa: Race, Class and Political Change—(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, Win (Abernethy)

International Dependence—(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 in Africa and Latin America and through contemporary case studies, including U.S.-Peru, U.S.-Canada, France-Senegal, and the Soviet Union-Czechoslovakia.

5 units, Spr (Abernethy)

Seminar. Political and Ethical Dimensions of Foreign Aid—(Enroll in Political Science 142D.) Explores a number of important, complex, and controversial issues relating to "official development assistance", that is financial, human, and material resources provided on concessional terms by a government or international government agency to a recipient government for the stated purpose of stimulating the recipient's economic development.

5 units, Win (Abernethy)


5 units, Spr (Abernethy)
Practicum in Phonology and Morphology: Structure of an African Language—(Enroll in Linguistics 223.) 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, given 1981-82

Structure of Hausa—(Enroll in Linguistics 285.) A sketch of Hausa syntax, morphology and phonology with emphasis on points of current theoretical interest. Prerequisite: Linguistics 220 and 230 or consent of instructor.

4 units, given 1981-82

Beginning Swahili—(Enroll in Linguistics 606 A, B, C.) Swahili is the major lingua franca of East Africa. Conversation, grammar, reading. (DR:X)

5 units, Aut, Win, Spr (Staff) by arrangement

Intermediate Swahili—(Enroll in Linguistics 607A, B, C.) (DR:X)

3-5 units, Aut, Win, Spr (Staff) by arrangement

Beginning Yoruba—(Enroll in Linguistics 610A, B, C.) Yoruba is spoken by 12 million people in Nigeria and the Republic and Benin. Conversation, grammar, reading, composition, discussion of Yoruba culture. (DR:X)

5 units, Aut, Win, Spr (Staff) by arrangement

Intermediate Yoruba—(Enroll in Linguistics 611A, B, C.)

3-5 units, Aut, Win, Spr (Staff) by arrangement

Beginning Hausa—(Enroll in Linguistics 602A, 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. (DR:X)

5 units, Aut, Win, Spr (Staff) by arrangement

Intermediate Hausa—(Enroll in Linguistics 603A, 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. (DR:X)

5 units, Aut, Win, Spr (Staff) by arrangement

(Any other African language can be taught, through the Special Language Program, provided a tutor is available. Some languages which have been taught in the past are: Amharic, Kikuyu, Twi, Ewe, and Oromo.)

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 macroperspective 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 (Johnston) MWF 10

Seminar: International Agricultural Policy—(Enroll in Food Research 367.) Prepares students for comprehensive examination and dissertations in the international agricultural policy field.

3 units, Spr (Falcon, Josling, Pearson) by arrangement

International Trade and Investment Policy—(Enroll in Food Research 166, or Economics 166.) (May be taken as 266 by graduate students.) This course is concerned with the formulation, implementation, and effects of selected government policies affecting international trade and foreign investment. Topics include trade policy and economic welfare, government responses to competition from imports, issues underlying the international negotiation of reductions of barriers to trade, influences of domestic agricultural policies on international commodity trade, multination commodity agreements and cartels, policies affecting international trade in energy resources, and special trade and investment arrangements for developing countries. 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.

5 units, Spr (Pearson) MW 11-1

Nutritional Problems of Developing Nations—(Enroll in 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, Win (Martorell) TTh 8:30-10

Food and Nutrition Strategies and Development—(Enroll in Food Research 251.) 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, Spr (Johnston) TTh 10-12

Population Perspectives in the Third World—(Enroll in Food Research 285.) Differing demographic situations of selected major less developed countries and regions in relation to development. Population prospects. Political, cultural and socio-economic factors governing policies and means of restricting population growth. Each student will be required to lead a seminar and write a research paper. Prerequisite: 135/235 or consent of instructor,

5 units, Spr (Staff) MW 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.

Teaching a Global Perspective: Cross Cultural Approaches—(Enroll in Education 271S.) 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 inservice education, as well as doctoral students planning research in this field. (CTE, IDE)

4 units Win (Grossman) MW 4:15-6:05

Workshop on Problems of Instructional Development Education—(Enroll in Education 206 A,B,C,D.) This course sequence is designed as a core workshop throughout the year for M.A. students in SİDEC and with the consent of the instructor, other interested students. 206A is required for all first-year SİDEC students (A.M. and Ph.D.). (IDE)


3 units, Aut (Carnoy, Weiler, Fenzalida) M 12-2 and by arrangement


3 units, Win (Weiler, Carnoy, Fuenzalida) M 12-1:05 and M 4:15-6:05

Workshop on Problems of Development Education III—(Enroll in Education 206C.) Issues of research methodology and strategy.

3 units, Spr (Fuenzalida, Carnoy, Weiler) M 12-2 and by arrangement

Workshop on Problems of Development Education IV—(Enroll in Education 206D.)

3 units, Sum (Staff) by arrangement

Education and Economic Development—(Enroll in Education 306A.) 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 (Carnoy) TTh 2:15-4:05

Education and Political Change—(Enroll in Education 306B, or Political Science 221.) Introduction to the analysis of the relations between education and politics from a comparative perspective. Of special interest are: alternative paradigms for the study of education and politics, international elements in educational development, the politics of educational planning and reform, processes and conditions of political learning (IDE, SSE).

5 units, Win (Weiler) TTh 2:15-4:05 and by arrangement

Education and Sociocultural Change—(Enroll in Education 306C.) Examines the role of education in modernization, within a context of ecological and energy constraints, dependence,
and culturally engendered value conflicts, utilizing a variety of theories and models of sociocultural change. Examines ethnocentric and ethical implications of "development" and, through in-depth case studies, seeks to promote empathic, culture-specific understanding of the needs of non-Western peoples whom development programs are intended to serve.

3-5 units, Spr (Textor)

Sociology of Development and Education—(Enroll in Education 306D.) This course offers a systemic 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) MW 4:15-6:05

and by arrangement

Research Seminar on the Politics of Education—(Enroll in Education 408, or Political Science 323.) The seminar combines a systematic review of key methodological issues (Conceptualization, assessment of different kinds of evidence, explanation and interpretation) with a thorough critique of seminar members' own research designs and proposals. Consent of instructor required. (IDE, SSE)

5 units, Spr (Weiler) M 4:15-6:05

and by arrangement

Social Structure of World Society—(Enroll in Education 147, or Sociology 152.) This course 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. (IDE)

5 units, Spr (Inkeles) TTh 1:15-3:05, plus dhr

and by arrangement

Education and Work—(Enroll in Education 375X.) The course will examine traditional models of socio-economic structure and educational change, concentrating on the relationship between education and work. Emphasis will be put on functionalist and dialectical models. The literature covered by the course will include work done in the U.S., Europe and the Third World. Specific case studies will be used to illustrate the models. The course is open to students from all areas. (IDE)

5 units, Win (Carnoy) by arrangement

Higher Education Institutions in Developing Countries I—(Enroll in Education 373.) This course analyses 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)

3 units, Win (Fuenzalida) T 4:15-6:05

and by arrangement

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

3 units, Spr (Fuenzalida) T 4:15-6:05

and by arrangement

Ethics of Development in a Global Environment (EDGE). Cross Discipline Course—(Enroll in Political Science 140 A,B,C; Education 274 A,B,C; Anthropology 133 A,B,C; Social Thought 197 A,B,C; Graduate Specials 297 A,B,C; Engineering 297 A,B,C.) Theory and practice of development in a global setting. Open to graduates and undergraduates, appropriate to both foreign and American students. 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. Access to resources, new technologies, political and economic institutions, social structures, education and communication procedures, analysed in terms of appropriateness to development in both less developed and industrialized societies. Addresses need for linkage between the necessary specialization of academia and the inherently interdisciplinary and problem-oriented nature of our living societies. Development strategies viewed with recognition of need for improvement in quality of life within nations and among nations while also recognizing limitations of the earth's physical life support system and constraints in our cultural systems. 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 life-styles. Development examined in terms of relative satisfaction of basic human needs. Winter: Alternative development strategies including country case studies.
Spring: The individual and social change; the engineer, political scientist, educator, etc., as designer of alternatives and as policy and decision maker. Lectures, discussions, workshops. (DR:X)

A.B.C. 1-4 units, Aut, Win, Spr (Cooper, Fagan, Fuenzalida, Lusignan, McWhorter, Siegel, Textor)
M 7:30-9:30 p.m. and groups by arrangement

Interpretive Strategies/Strategic Interpretations: Western Views of the Non-West through the Literature of Travel—(Enroll in Spanish and Portuguese 296.) This course focuses on the Western traveler in the Third World as cross-cultural mediator and interpreter, and on the ideological appropriation of foreign contexts as related to developments in world history and economy. Course materials include travelogues, journals, letters, essays, works of fiction, documentary and ethnographic writings, and film. Open to all students: no prerequisites. Readings will be in English. (DR:H)
3-5 units, Win (Pratt, Bennet)

Freshman Seminar—Southern Africa: Racial Conflict and Power Politics.
3 units, Aut (Windrich)

Comparative Mythology: Topics from Greek and Roman, Near-Eastern and African Culture—(Enroll in Comparative Literature 163.)
3-4 units, Spr (Davis)

The Contemporary Literature of Africa—(Enroll in English 161C.)
5 units, Spr (Drake)

ATHLETICS, PHYSICAL EDUCATION, AND RECREATION

Emeriti: Allen Elward (Director); Margaret C. Barr, Luell W. Guthrie, Miriam B. Lidster, Marian S. Ruch (Associate Professors); C. Myron Sprague (Associate Director); William P. Fehring (Director of Intramurals); Joseph H. Ruetz (Athletic Director)

Director: Ferdinand A. Geiger

Associate Director – Development and Intercollegiates: Douglas Single

Associate Director – Educational Programs: Pamela L. Strathairn

Associate Director – Business and Finance: Allan A. Cummings

Associate Director – Public Affairs: Gary Cavalli

Assistant Director – Operational Services: J. Raymond Young

Chairman of Physical Education: Wesley K. Ruff

Director of Intramurals: Howard Dallmar

Director of Dance: Inga Weiss

Coordinator of Club Sports: Jeffrey W. Hammett

Coordinator of Lifetime Activities: Elizabeth P. Weeks

Coordinator of Recreation: Shirley H. Schoof

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), Cladia Thomas (Swimming and Diving-women), Frank Brennan (Tennis-women), Richard Gould (Tennis-men), Sadao Hamada (Gymnastics-men), Jean P. Hellwell (Fencing), Brooks Johnson (Cross Country, Track and Field), Frederick Sturm (Volleyball), Nelson Lodge (Soccer), Mark Marquess (Baseball), Dorothy McCrea (Basketball-women), David Yates (Golf), Jacqueline Walker (Gymnastics-women), Paul Winig (Football)

Sport Assistant Coaches: Thomas Pagani (Cross Country, Track and Field), James Fassell (Football), Ray Handley (Football), Kenneth Maxey (Basketball-Men), Timothy Miller (Basketball-Men), Susan Rojecewicz (Basketball-Women), Dean Stotz (Baseball), Michael Tomasello (Cross Country, Track and Field), Laurel Treon (Cross Country, Track and Field)

Senior Teaching Associates: Carroll G. Diaz, Inga Weiss

Teaching Associates: Susan Cashion, Kathleen Hill, Mary Margaret Neal, Elizabeth P. Weeks

Teaching Specialists: Jeffrey Hammett (Aquatics), Shirley H. Schoof (Sports), Juan Valenzuela (Dance) Leslie A. Williams (Dance)

The department is responsible for the development and administration of the University’s programs in athletics, dance, physical education, and physical recreation. The department’s aims are to: (1) increase understanding of the value and role of physical activity as an important dimension of the human condition; (2) develop performance skills; (3) encourage, through satisfying learning experiences, the participation habit; and (4) develop leadership competency in aquatics, dance, sport, and...
other physical activities. To this end, the program encompasses a diversity of learning and participating opportunities which extend from informal recreation through organized intramural competition, basic instructional classes, and theoretical study to, and including, intercollegiate athletic competition and dance performance.

**ACADEMIC DEGREES AND SPECIAL CURRICULUM**

Although the Bachelor of Arts in Physical Education and Dance degrees are not offered, the department's curriculum provides course work which satisfies most requirements for admission to graduate study in physical education and dance here at Stanford or elsewhere. Undergraduate students interested in a teaching and/or coaching career are encouraged to plan their study schedules for inclusion of theoretical course work offered by the department and by the School of Education. Specific information may be found in the School of Education section of this bulletin or is available from Professors Nixon, Ruff, and Strathairn and Director of Dance, Inga Weiss.

The Sports Theory and Special Curriculum Section has been developed to focus on the interests undergraduate and graduate students have in the theoretical dimensions of sport and human movement. In conjunction with other University departments and programs sharing common and related interests, the department sponsors special lectures, course work, mini-courses, conferences and workshops for the University Community. Current collaborators in these programs include the Heart Disease Prevention Program, School of Education, School of Law, Graduate School of Business, Boys Town Research Center, the Cowell Health Center, and the Psychology Department.

**LIFETIME ACTIVITIES**

The Lifetime Activities basic instructional program is diverse to accommodate the interests and needs of undergraduate and graduate students. 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. Skill level in and knowledge about a specific activity as well as available space during class-list signing are the only limitations to enrollment.

**Academic Credit**—Units for satisfactory completion of a lower skill level class in the same sport or activity in which units have been received previously will not count toward graduation.

**Equipment and Uniforms**—No department uniform is required. Specific information on equipment and recommended class attire is available from the department, on Registration Days, and at the first day of class instruction.

**Lockers**—Lockers are available for students, without charge, from the Gym Store in Encina Gym and from the Roble Gym Equipment Keeper. The number of lockers at the Roble Gym requires that students not enrolled in a class wait until the second week of each quarter for locker assignment.

**Towels and Swim Caps**—Towels may be purchased at the Encina Gym Store or the Roble Gym locker room. The towel laundry and exchange service is available, without charge, for those who purchase towels. Swim caps are required at the Roble Gym pool only and these caps may be purchased at the Roble Gym locker room.

**Class Fees**—Fees are charged for enrollment in badminton, bowling, CPR, equitation, fencing, golf, skin and SCUBA diving, and the Club Program classes.

**DANCE PROGRAM**

The dance curriculum has been developed to present dance as a performing art, as recreational activity, and as a discipline for a teaching career. Undergraduates intending specialization or graduate study in dance should confer with the Director of Dance, Inga Weiss, to plan their study programs for admission to and completion of the Master of Arts in Education (Dance Specialization).

In addition to classes in modern, ballet, folk, jazz, and tap dance, special attention is given to selected forms of ethnic dance. Guest artists for master lessons, dance workshops, film series, and concerts are presented for and by students throughout the year. Students and faculty of the Dance Division, in conjunction with other University resources, are instrumental in providing a comprehensive dance experience for all members of the University community.

**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, water polo, and wrestling. 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, track and field, and volleyball.

Additional intercollegiate athletic competition is available for junior varsity teams (for men and for women) in selected sports. Club Sport teams (for men and for women) provide similar intercollegiate competition opportunities.

**CLUB SPORTS PROGRAM**

The Stanford Club Sports Program is coeducational and exists to provide additional opportunities in competition, instruction, and recreation for undergraduate and graduate students in those physical activities which are not funded through the intercollegiate athletic, physical education, intramural, and/or recreation programs of this department. Although the department will provide encouragement to, guidance for, and general supervision of the various affiliated clubs, the emphasis in the Club Program is on student interest and leadership to initiate, organize, and conduct their respective clubs. Clubs, which meet criteria for inclusion in the formal curriculum, may apply for academic credit through Professor Ruff. Those Club Sport Teams competing against other college, university, and/or club teams and requiring eligibility certification for their team members must make such arrangements through the department. For further information, contact Jeffrey Hammett.

**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 and Women’s Intramural championships 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 for faculty, staff, and students (and, for some activities, their families) to participate in aquatics, conditioning, dance, and sports for general recreation. Swimming pools, gymnasium, tennis courts, fields, and jogging trails are all available with specific recreation hours publicized throughout the year. The Golf Course and Driving Range are also available for use by faculty, staff, and students, on a fee basis; information available from the Golf Pro Shop or department Information Desk. For further information on recreation, contact the department Information Desk or Secretary for Educational Programs.

**FACILITIES**

Athletic fields, gymnasium buildings, swimming pools, tennis and volleyball courts, and weight training facilities are located at the Roble Gym Complex and near the Encina Gym. The deGuerre Complex houses swimming and diving pools as well as handball, racquetball, and squash courts. The Dance Studio (for classes and performances) and small activity rooms are located at the Roble Gym Complex along with the department’s library and repository for the University Dance Collection of reference materials. The 18-hole championship golf course and driving range, Lake Lagunita, Tressider Bowling Lanes, and the Stanford Riding School are also available for the department’s programs.

**COURSES**

All courses (DRX).

Courses are open for enrollment to male and female undergraduate and graduate students. Only intercollegiate teams, men’s and women’s, are limited to undergraduate enrollment. There is no limitation on the number of Physical Education courses in which a student may enroll. However, only twelve (12) units of activity courses will count toward graduation. Courses which are exempt from this University policy are identified as (PEX).

Courses which are listed for 0-units are those, although instructional in nature and taught by qualified individuals, do not include sufficient in-class and/or out-of-class work to qualify for academic credit. Some activities are listed as a means of publicizing the existence of the activity.

Students, faculty, and staff may audit any course (exception: no faculty, staff or graduate students in intercollegiate JV or varsity team classes), with permission of the respective instructors, only on a “space-available” basis after enrollment of the “credit-enrollees” is completed. Students have first priority for auditing and must record this enrollment on their Official Study Lists. Enrollment and grade received will be reflected on the End-Quarter Grade Reports and student transcripts.
SPORTS THEORY AND SPECIAL CURRICULUM

See "School of Education" section for additional course offerings.

54. Cardio-Pulmonary Resuscitation (CPR) — Red Cross Program. Combination of artificial respiration and manual artificial circulation for use in cases of cardiac arrest. Includes mannequin practice in performing both individually and as a part of a team. Successful completion leads to certification. Fee.

0 unit, Aut, Win, Spr (Staff)

81. Multi-Media First Aid — Red Cross Program. Personal safety and accident information to acquaint individuals with causes of accidents so appropriate action can be taken to eliminate or minimize such causes. Knowledge and skills for emergency care while awaiting medical assistance.

0 unit, Aut, Win, Spr (Staff)

100. Individual Study — In-depth study of topics related to the discipline of Physical Education, the scientific basis of Physical Education, and related topics subject to instructor's approval. (PE:X)

3-5 units, Aut, Win, Spr (Ruff, Staff)

104. Analysis of Human Movement — Review of skeletal anatomy and study of the mechanical principles of movement as related to efficient performance in athletics, dance, sports. (PE:X)

3 units, Aut, Win, Spr (Weeks) TTh 9-11

105. Physiology of Exercise — Physiological adaptations of the human organism to exercise stress. Limited to those who have had or are taking Anatomy. Same as Ed. 177. (PE:X)

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

105T. Sport Physiology — A study of the stress of exercise upon the body and the benefits to be derived. Includes bio-energetics, nutritional factors, environmental stress and theory and principles of training. (PE:X)

1-2 units, Aut, Win, Spr (Ruff, Dettamanti) T 11

106. Psychological Aspects of Learning and Performance — A comprehensive analysis of psychological factors that can both improve and inhibit motor learning and performance. (PE:X)

3 units, Spr (Schavone)

107. Sport and the Law — An in-depth study of the legal status and problems in collegiate and professional sports. Problems discussed include, but not limited to legal structure of sport, medical (injury, drugs and rehabilitation), contracts, Title IX, crowd control, recruiting practices, anti-trust, and federal legislation. (PD:X)

3 units, Spr (Staff)

180T. Sports Instructor Internship — For the highly skilled student in a given sport who anticipated becoming a teacher/coach of that sport. Teaching and coaching opportunities under close, experienced guidance of specified teacher/coaches. Prerequisites: the respective Theory and Technique course or equivalent and consent of instructor. (PE:X)

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

181T. Athletic Training — For students intending a teaching/coaching, athletic training, or sports medicine career. Includes the spectrum of prevention, care and rehabilitation of injuries associated with dance and sports activities. Prerequisite: consent of instructor and course in Human Anatomy or Analysis of Human Movement. (PE:X)

2 units, Spr (Scott) MWF 9

182T. Athletic Team Management — For student managers of intercollegiate teams. Prerequisite: consent of respective varsity team coaches. (PE:X)

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

183. Intramural Sports Management — For student managers of IM sports and competitive organizations. Prerequisite: consent of instructor.

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

200. Individual Study — Continued in-depth study of specific topics related to the discipline of Physical Education (PE:X)

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. (PE:X)

3 units, (Nixon) by arrangement

205T. Sports Medicine: Medical Aspects of Land, Underwater and Altitude Sports — (Same as Medicine 280). Emphasis on basic physiology, proper training, and conditioning for endurance sport, underwater sports, racquet and contact land sports, and altitude sports. Biomechanics and weight training introduced; goal to enhance understanding and enjoyment of these sports and to prevent injury. Prerequisite: biology of basic physiology highly recommended. (PE:X)

2 units, Aut (Spivak) F 3:15-5

290. Seminar on contemporary Sport Sociology — The study of sport as a social institution, its value orientations, major social con-
cerns, modes of interaction and structural relationships with other social institutions. (PE:X) 3 units, Aut (Staff) T 7-9 p.m.

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. For the high intermediate and advanced skill level performer. Lecture-discussions of relevant theory in support of teaching and coaching methods and performance techniques, psychological and interpersonal relationship phenomena, training dimensions. Analysis of Human Movement and/or Foundations of Physical Education highly recommended as prerequisites. All courses are 2-units (PE:X)

101T. Adapted Physical Education
   Aut, Win, Spr (Ruff)

116T. Gymnastics
   Aut (Hamada, Walker)

117T. Track
   (Johnson)

123T. Golf
   Spr (Diaz)

129T. Badminton
   Aut, Win, Spr (Schoof)

131T. Fencing
   Spr (Helliwell)

133W. Tennis
   Spr (Ned)

136W. Basketball
   (McCrea)

137W. Field Hockey
   (Longstreth)

149W. Swimming
   (Thomas)

DANCE ACTIVITY AND THEORY

All courses are coeducational. Qualified undergraduate students can be admitted to advanced performance courses. For additional and related courses, see African and Afro-American Studies, Drama, and Music.

57. Tap Dancing: Beginning—Basic instruction in the multi-ethnic dance form emphasizing the syncopated rhythms and stylization endemic to black dancers. Prerequisite: consent of instructor.
   1 unit, Aut (Williams)

57A. Tap Dancing: Intermediate—Review of basic steps and introduction to the more intricate steps; continued work in stylization. Prerequisite: consent of instructor.
   1 unit, Win, Spr (Williams)

58. Black American Dance: Beginning—Introduction to dances created by American blacks to supplant forbidden African dances, endure discrimination, and compete in the theatrical arena.
   1 unit, Aut, Win, Spr (Williams)

60. Dance Fundamentals—Designed for students of all levels as an introduction to movement skills and forms covering a wide range of activity, supplemented with films. Special emphasis on movement vocabulary, rhythm, and concepts of motion.
   1 unit, Aut (Weiss, Staff) TTh 11-12:30

DANCE ACTIVITY AND THEORY

SPORTS OFFICIATING

Each course is concerned with the rules, scoring records, responsibilities and limitations of officials for the respective sports. Includes practical experience in organizing meets and tournaments as well as development of officiating skill and technique in the game situation. All courses are 1 unit.

123W. Golf
   (Diaz)

131W. Fencing
   (Helliwell)

133W. Tennis
   (Neal)

136W. Basketball
   (McCrea)

137W. Field Hockey
   (Longstreth)

149W. Swimming
   (Thomas)
   1 unit, Aut, Win, Spr (Staff)

63. Modern Dance III—Modern dance technique developed to develop heightened body awareness in movement as well as rhythmic versatility.
   1 unit, Aut, Win, Spr (Staff)

64. Ballet Technique I—Elementary ballet technique stressing placement, basic barre exercises, and simple movement combinations in center and across the floor.
   1 unit, Aut, Win, Spr (Staff)

163. Improvisation—Group improvisation techniques. Class work based on many aspects of dance such as time, space, energy. Assignments dealing with sculpture, music, costume and other related art forms take place in a studio setting as well as elsewhere. Works leads to performance in lecture demonstrations for the community.
   1 unit, (Hill)

65. Ballet Technique II—Extension of 64. Expansion of movement vocabulary developed in Ballet I. More complicated work in the center and on the diagonal.
   1 unit, Aut, Win Spr (Staff)

71. Folk Dance I—Regional dances from many countries with emphasis on learning traditional folk dance steps and styling.
   1 unit, Aut, Win Spr (Rockwell)

72. Folk Dance II—Extension for 71. Emphasis on specific folk dance forms.
   1 unit, Aut, Win Spr (Rockwell)

74. Jazz I—Modern jazz technique including a warmup stressing stretch, strength, and rhythmic coordination. Each class will develop a movement combination set to music.
   1 unit, (Staff or Cashion)

100. Individual Study—Topics and selected assignments in theoretical or choreographic work. Prerequisite: consent of instructor. (PE:X)
   3-5 units, Aut, Win, Spr (Staff)

158. Black American Dance: Advanced—Examination of the unique movements and rhythms culminating in the black dancers’ contributions to American culture (jazz dancing).
   1 unit, Aut, Win Spr (Williams)

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

161. Contemporary Dance Forms I—Sequences for manipulation of movement and advanced technique. Prerequisite: consent of instructor.
   1 unit, Win (Weiss) MW 4:15-6

162. Contemporary Dance Form II—Extension of 161, for more advanced performance. Prerequisite: consent of instructor.
   1 unit, Spr (Weiss) MW 4:15
170T. Topics in Dance: Music—The interrelationship of music and movement in the classroom and in theatrical settings. Special attention to accompaniment techniques and basic music vocabulary as well as to stylistic theories derived from the historic association of music and movement. (PE:X)

2 units, Spr (Watson, Staff)

171. Ballet Technique: Advanced—Prerequisite: consent of instructor.

1 unit, Aut, Win Spr (Staff)

173. Folk Dance Exhibition—Work on developing stylistic versatility in the execution of complex traditional folk dance forms from a wide variety of regions. Several performances each quarter.

1 unit, Aut, Win Spr (Rockwell) F 4:15-6

200. Individual Study—Continued in-depth study of topics related to the discipline of dance. Prerequisite: consent of instructor. (PE:X)

3-5 units, Aut, Win Spr (Staff)

260T. Dance Practicum—Fundamentals for the teaching of dance. Movement analysis and teaching assignments. Dance degree candidates only. (PE:X)

2 units, Aut (Weiss) TTh 11-12:50

261T. Dance Production Practicum—Analysis of the process of staging and performing dance in schools and university theaters. Prerequisite: consent of instructor. (PE:X)

2 units, Spr (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 (PE:X)

2 units, Aut (Weiss) F 11-12:50

266T. Dance Repertory—Dance sequences, phrases, and contrasting progressions, emphasizing fluency of movement, accuracy of timing, clarity of form, and dance accompaniment. Development of performing skills, teamwork for dancers, the training to function within a group. Prerequisite: consent of instructor. (PE:X)

A. 2 units, Win (Weiss) TThF 11-12:50
B. 2 units, Spr (Weiss) F 11-12:50 plus dhr

267T. Dance Exploration for Educators—Exploring the connections between dance and related activities, such as art, music, physical education, and intellectual pursuits. (PE:X)

2 units, Win, Spr (Valenzuela)

363. Dance Thesis—Individual development of thematic material for a creative project leading to completion of the M.A. degree in Dance. Dance degree candidate only. (PE:X)

5 units, Aut, Win, Spr (Weiss, Staff)

365. Dance Educator's Core—The cohesive unit of dance stressing competencies required for the M.A. degree of Dance Specialization: technique, choreography, production, teaching skills, ethnology, history, notation, music, and philosophy. (PE:X)

5 units, Aut, Win, Spr, (Staff) MTWThF 11-1

369. Dance Research—Individual Study. Dance degree candidates only (PE:X)

3-5 units, Aut, Win, Spr (Staff)

OTHER DANCE OFFERINGS

Stanford Dance Ensemble—Choreographic works leading to quarterly performances as well as the Annual Dance Production. Academic credit assigned under 100.

Individual Study—Prerequisite: by audition.

Stanford Dance Quorum—Members of the Stanford dance community coordinate their interests and abilities to extend and diversify the Stanford dance program. Activities include classes, workshops, master lessons, lecture demonstrations, and a film series.

Modern Dance I—Emphasis on flexibility, coordination, and movement vocabulary through exposure to the discipline of modern dance technique and the creative stimuli of improvisation.

Ballet I—Emphasis on the fundamentals of ballet technique stressing correct placement. Class will include barre work and combinations in the center and across the floor.

Ballet II—Extension of Ballet I working toward more complicated center work and across the floor.

Modern Jazz—Class begins with a warm-up using jazz exercises and culminated in a final choreographed combination set to music.

LIFETIME AQUATICS, INDIVIDUAL, AND SPORTS ACTIVITIES

AQUATICS

48. Swimming: Beginning—For non-swimmers 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—enjoy swimming as a recreational activity.

1 unit, Aut, Win, Spr (Hammett, Staff, McCrea)

49. Swimming: Intermediate—Continued work on crawl, elementary backstroke, sidestroke, and safety skills. Introduction to or re-
view of breaststroke and back crawl. Basic water safety. Conditioning as time permits. Prerequisites: fair crawl, elementary backstroke, and sidestroke; fair level of conditioning.

1 unit, Aut, Win, Spr (Weeks, Weeks, Kenney)

51. Water Polo: Beginning—Introduction to and refinement of skills used in the sport of water polo.

1 unit, Aut, Win, Spr (Hammett, Dettamanti, Dettamanti)

52T. Lifesaving—Increasing awareness of water hazards and preventing accidents, in on, and around the water. Learning appropriate rescue techniques. American Red Cross Advanced Lifesaving Certificate upon successful completion of the course. Prerequisites: Strong crawl, breaststroke, sidestroke, and safety skills; 500 yard continuous swim. (PE:X)

2 units, Aut, Win, Spr (Weeks, Hammett)

55. Sailing: Beginning—Basic skills, theory, and techniques to enable beginners to sail with confidence. Fee.

1 unit, Aut, Win, Spr (Staff)

55A. Windsurfing—Theory and techniques of windsurfing safely and confidently. Fee.

1 unit, Spr (Staff)


1 unit, Aut, Win, Spr (Staff, Hammett, Thomas)

152. Water Safety Instructor Course—Basic swimming and WSI courses resulting in American Red Cross certification for successful course completion. Prerequisites: current Red Cross Advanced Lifesaving certificate and advanced swimming skills. (PE:X)

3 units, Spr (Weeks)

153. Skin and SCUBA Diving—A highly rigorous program for expert swimmers. Includes classroom lectures and two skin, three SCUBA dives in open water. NAUI Basic Certificate for successful completion of course. Fee assessed for equipment. Prerequisites: medical clearance, skill test and consent of instructor.

3 units, Aut, Win, Spr (Weeks)

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. Fee.

1 unit, Aut, Win, Spr (Yates, Diaz)

23. Golf: Intermediate—Improvement and perfection of previously learned fundamentals. Utilization of these skills in the game. Fee. 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 (Yates, Diaz)


1 unit, Aut, Win, Spr (Yates, Diaz)


1 unit, Aut, Win, Spr (Schoof)


1 unit, Aut, Win, Spr (Helliwell, Hurst)

31. Fencing: Intermediate—Improvement in technique, speed, control, coordination and timing. Psychology of fencing introduced. Fee. Prerequisite: promoted from 30 or equivalent.

1 unit, Aut, Win, Spr (Helliwell, Hurst)

32. Tennis: Beginning—Covers fundamental strokes (forehand, backhand, service and net play), rules and scoring.

1 unit, Aut, Win, Spr (Gould, Neal, Staff)

33. Tennis: Intermediate—Review of fundamental strokes, introduction to the lob and overhead strokes, and utilization of strategy and tactics in game playing. Prerequisites: knowledge of rules and scoring, average ability in fundamental strokes.

1 unit, Aut, Win, Spr (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, Rojcewicz)

37. Field Hockey: Basic—Focus on conditioning, stick work, individual tactics, team play, strategy and rules.

1 unit, Spr (Longstreth, Staff)

38. Field Hockey: Intermediate—For students with background in hockey; emphasis on developing a higher level of skill and tactical understanding.

1 unit, Spr (Longstreth, Staff)

40. Soccer: Beginning—Introduction to the sport covering basic skills and laws of the game. Small-sided games utilizing basic skills.

1 unit, Aut, Win, Spr (Igwe)

40A. Soccer: Intermediate—Review of basic skills and introduction to the full game of soccer. Tactics and techniques used in small and full game situations. Prerequisite: 40 or equivalent or experience on a club team.

1 unit, Aut, Win, Spr (Igwe, Lodge)

41. Volleyball: Beginning—For those with limited volleyball background. Extensive use of drills to improve skills and game playing strategy.

1 unit, Aut, Win, Spr (Sturm, Staff)


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: Advanced—For students who are ready for workouts beyond the beginning level. Emphasis on proper stretching, interval training, and continuous runs. Physiological aspects of training. Prerequisite: ability to run two miles with relative ease.

1 unit, Aut, Win, Spr (Staff)

103. Weight Training: Advanced—Instruction includes use of Nautilus and other variable resistance apparatus, weight lifting, use of free bars, and appropriate physiological principles. Prerequisites: pre-test and consent of instructor.

1 unit, Aut, Win, Spr (Ruff)

119. Bowling: Advanced—Concentration on adjustments to different lane conditions with individual attention given to bowlers who average 150 and above. Fee.

1 unit, Aut, Win, Spr (Schoof)

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 distance and swing with good form.

1 unit, Aut, Win, Spr (Diaz, Yates)
128. Baddminton: Advanced—Emphasis on refinement of all strokes; concentration on developing high level of ability and on strategic skills practiced in a competitive atmosphere. Fee.
1 unit, Aut, Win, Spr (Schoof)

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)

131A. Fencing: Sabre and Epee—Concentration on moves of each of the weapons for offense and defense. Fee. Prerequisite: promoted from 31 or equivalent.
1 unit, Spr (Helliwell, Hurst)

132. Tennis: Advanced—Drills to emphasize footwork, service and return, approach shot and volley, lob, and overhead. Strategy for competition in singles and doubles. Prerequisite: well above average stroking and game playing ability.
1 unit, Aut, Win, Spr (Neal, Brennan)

132A. Tennis: Tournament—Advanced drills and practice sessions for tournament-experienced players of near varsity level ability.
1 unit, Aut, Win (Brennan, Gould)

140. Soccer: Advanced—Advanced passing skills and techniques; new and old defensive and offensive systems utilized in actual game situations. Considerable soccer experience desirable.
1 unit, Win (Lodge)

141. Volleyball: Advanced—Refinement of all skills with emphasis on offensive and defensive strategies. Prerequisites: strong skills and general knowledge of game plans.
1 unit, Aut, Win, Spr (Staff)

OTHER LIFETIME ACTIVITY OFFERINGS

Sports Clinics—Participation, demonstration, lecture clinics are conducted through the academic year during the noon hour and at other times. Program schedule and locations are announced quarterly.
0 units, Aut, Win, Spr (Staff)

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, (men's and women's teams).
1 unit, Aut, Win, Spr (Hamada, Walker) MTWThF 2:15

117V. Track and Field: Varsity, (men's and women's teams).
1 unit, Aut, Win, Spr (Johnson, Staff) MTWThF 2:15

118V. Cross Country: Varsity, (men's and women's teams).
1 unit, Aut (Tomasello, Treon) MTWThF 3:15

123V. Golf: Varsity, (men's and women's teams).
1 unit, Aut, Win, Spr (Yates) MTWThF 2:15 and by arrangement

131V. Fencing: Varsity—Men's foil, epee and saber teams and women's foil team.
1 unit, Aut, Win, Spr (Helliwell) MTh 3:15 p.m. and T 7:00-9:45

133V. Tennis: Varsity, (men's and women's teams).
1 unit, Aut, Win, Spr (Brennan, R. Gould) MTWThF 2:15

134V. Wrestling: Varsity.
1 unit, Aut, Win (Staff) MTWThF 3:15

135V. Baseball: Varsity.
1 unit, Aut, Win, Spr (Marquess, Stotz) MTWThF 2:15

136V. Basketball: Varsity.
1 unit, Aut, Win (DiBiase, Maxey, Miller) men's team MTWThF 3:30-6:30 (McCrea, Rojcewicz) women's team. Aut, 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, MW 2:15

137J. Field Hockey: Junior Varsity—Women's team.
1 unit, Aut (Staff) MTWThF 2:15

138V. Football: Varsity.
1 unit, Aut, Spr (Wiggin, Staff) MTWThF 3:15

140V. Soccer: Varsity.
1 unit, Aut (Lodge) MTWThF 3:15 Spr, MTWThF 2:15

141V. Volleyball: Varsity, (men's and women's teams).
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, (men's and women's teams).
1 unit, Aut, Spr (Kenney, Thomas) MTWThF 3:15 Win MTWThF 2:15
OTHER DEPARTMENTS, INSTITUTES, AND PROGRAMS

150V. Diving: Varsity (men's and women's teams).
   1 unit, Aut, Win (Schavone)
   MTWThF 2:15

151V. Water Polo: Varsity.
   1 unit, Aut (Dettamanti) MTWThF 2:15
   Spr, MWF 3:15

CLUB SPORTS PROGRAM

The Stanford Club Sports Program currently includes twenty-nine (29) student initiated, organized, and conducted physical activity groups affiliated with the department. Clubs, which meet the criteria for academic credit, are scheduled for regular instruction times as published each quarter in the Time Schedule. Teams desiring formal affiliation in Pac-10, NorCal, NCAA, and/or AIAW conferences may be so certified upon request. For additional information, contact Mr. Hammett.

6C. Self Defense.
   1 unit, Aut, Win, Spr, Sum

7C. Aikido
   1 unit, Aut, Win, Spr, Sum

9C. Karate Do.
   1 unit, Aut, Win, Spr

10C. Kenpo Karate.
   1 unit, Aut, Win, Spr, Sum

12C. Tai Chi Chuan.
   1 unit, Aut, Win, Spr, Sum

47C. Synchronized Swimming.
   1 unit, Aut, Win, Spr

100C. Ultimate Frisbee.
   1 unit, Aut, Win, Spr

124C. Ski Club.
   1 unit, Aut, Win

125C. Cycling Club.
   1 unit, Aut, Win, Spr

126C. Squash Club.
   1 unit, Aut, Win, Spr

129C. Badminton Club.
   1 unit, Aut, Win, Spr

139C. Rugby Club (Men's and Women's).
   1 unit, Aut, Win, Spr

140C. Soccer Club (Women's).
   1 unit, Win, Spr

142C. Lacrosse Club (Men's and Women's).
   1 unit, Aut, Win, Spr

143C. Ice Hockey Club.
   1 unit, Aut, Win.

145C. Women's Softball Club Team.
   1 unit, Win, Spr

151C. Water Polo Club (Women's).
   1 unit, Aut, Win, Spr

155C. Crew Club (Men's and Women's).
   1 unit, Aut, Win, Spr

The Bowling Club (Men's and Women's), Cricket Club, Dance Quorum, Racquetball Club and the Surf Club have activities scheduled each quarter for no credit.

STANFORD LINEAR ACCELERATOR CENTER

Director: Wolfgang K. H. Panofsky
Deputy Director: Sidney D. Drell
Executive Officer of the Faculty: Robert F. Mozley

Associate Directors: Joseph Ballam (Research Division), Richard B. Neal (Technical Division), John Rees (PEP Division), Eugene B. Rickansrud (Business Services Division)

Emeritus Professor: Jean V. Lebacqz


Associate Professors: Elliott Bloom, Gary Feldman


Assistant Professors: William Atwood, Robert Hollebeek, John Jaros

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 480 acres of Stanford property west of the main campus, parallel to and south of Sand Hill Road and is operated under a contract with the 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 29 GeV and at beam intensities up to 30 microamperes average current. Positrons can
also be accelerated to a maximum energy of about 10 GeV, at average beam currents up to about one microampere.

A new method of operation was put into effect this year which permits producing electron beams of up to 30 GeV at lower current. Polarized electron beams can be produced with polarization 40% at full beam intensity and energy, and up to 85% at lower intensities. In 1978 one of the experiments performed using this beam established the existence of clear connections between the weak and electromagnetic interactions.

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, is 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; and a large aperture superconducting solenoid spectrometer system (LASS) for studies of multihadron final states. 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. Among other major discoveries was that of a new heavy lepton, the \( \tau \), made in 1976.

Construction is virtually complete 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 its construction has been 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.

SLAC physics groups (and a U.C. Berkeley collaboration) have moved the Mark II solenoidal detector from SPEAR to PEP to continue its research program at the higher energies available there. In addition, a SLAC group (together with a Stanford Physics Department group) is installing a modified Deleco detector (Direct Electron Counter), previously used at SPEAR, at another PEP interaction region.

At SPEAR, experiments will continue using the SLAC Crystal Ball detector (a detector utilizing NaI crystal for a large solid angle electron photon detector). A new detector, Mark III, is being constructed by SLAC and collaborating universities for use at SPEAR starting in 1981.

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 1980, physicists from 60 other institutions have had research programs accepted for execution at the Center. The faculty of the Center leads a group of some 90 physicists in research programs on theoretical and experimental particle physics. In addition, the faculty offers lecture series on various aspects of high energy physics, and conducts seminars on topics of current interest. The 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 individual faculty members. There are also opportunities for summer employment in the research groups at the Center. Interested students should apply to Professor David Leith, Graduate Student Advisor.

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. Pro-
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 mostly 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 Paris and Salamanca, students are regularly enrolled in local universities and live in dorms and apartments; a similar program for advanced language students in German exists at the Free University (FU) of Berlin.

Stanford Overseas Studies also administers and/or participates in consortium programs in Lima, Peru; Sao Paulo, Brazil; 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 all 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 Berlin, Cliveden, Florence, Tours, and Vienna are:
- To begin Spring Quarter, 1980–81
  December 5, 1980
- To begin Summer Quarter, 1980–81
  January 30, 1981
- To begin Autumn Quarter, 1981–82
  March 6, 1981
- To begin Winter Quarter, 1981–82
  May 29, 1981

Application deadlines for the advanced language university-based programs (Paris, Berlin-FU, Salamanca, Nairobi, Lima, Sao Paulo) will be due in mid-January 1981; the date will be announced in Autumn 1980. For more information about offerings, requirements, fees, and application deadlines, see the publication Stanford Overseas Studies, 1980–81 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 Overseas Studies Course Abstracts. Courses are not listed for the FU-Berlin, Paris, Sao Paulo or Salamanca programs 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:*
- Hans Weiler, Director
- Karen Kramer, Acting Associate Director
- Hannelore Noack, Secretary
- Franz Neckenig

**Politics in Germany: Between Consensus and Conflict**—(Same as Political Science 111). The course deals with the tensions between consensus and conflict which have played a major role in four different political systems in Germany in recent times: The Weimer Republic, Hitler's Germany, the Federal Republic of Germany, and the German Democratic Republic. Special attention is paid to policy processes and group politics in the Federal Republic. (DR:S)

- 5 units, Win, Spr (Weiler)

**The Politics of Educational Reform in West Germany and Berlin**—Educational reform has been and continues to be a major political issue in West Germany, primarily from the point of view of enhancing educational equality. This seminar deals with the political forces and obstacles involved in several educational reforms, notably the attempt to overcome the inequalities of the traditional German system of three-tiered post-primary education by the introduction of the comprehensive secondary schools (Gesamtschulen). (DR:S)

- 5 units, Win (Weiler)

**Critical Issues in Contemporary German Politics**—With the help of a selected group of German specialists, this seminar will examine a number of particularly critical and controversial policy and political issues in contemporary German politics. Tentative topics include: Codetermination in German industry; Germany and the crisis of the Nato alliance; Germany's role in the North-South Conflict; The politics of educational equality; The development of Marxist thought in the Federal Republic. (DR:S)

- 5 units, Spr (Weiler)

**Berlin: Its History, Politics & Culture: 1250-1871**—This course will study the vital role Ber-
lin has played in German history, through an interdisciplinary approach including on-site examination of Berlin art, historical sites and contemporary cultural events. (DR:A)

4-5 units, Win (Neckenig)

**Berlin: Its History, Politics & Culture: 1871-1949**—A continuation of the above course, tracing Berlin’s role through World War II and into the Cold War era. (DR:A)

4-5 units, Spr (Neckenig)

**German Art and Culture in the Age of Bourgeois Revolution: 1780-1848**—A general introduction to German art, relating its development to the political and economic developments in German society of the same period. (DR:H)

4 units, Win (Neckenig)

**German Painting After 1945**—A continuation of the above art course, exploring post-war German art in the European context. (DR:H)

4 units, Spr (Neckenig)

**Modern German Literature**—This seminar will examine the development of modern German literary forms through analysis of works by Kafka, Mann, Benn, Brecht, Grass and Wolf, as well as other contemporary writers in East and West Germany. (DR:H)

4 units, Spr (Kramer)

**German Theatre As Seen in Berlin**—Plays and productions of German theatre will be discussed in their historical, literary and sociopolitical context. Attendance at theatrical productions from the classical and modern repertory in both East and West Berlin will be an integral part of the course. (DR:H)

4 units, Win, Spr (Kramer)

**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)

6 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)

3-4 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)

3-4 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)

2 units, Win, Spr (Staff)

**STANFORD PROGRAM IN BRITAIN**

*Academic and administrative personnel:*

George A. B. Docker, *Director*
Pamela Murray, *Assistant Administrative Director*
Audrey Garrini, *Academic Secretary*

Felix Aprahamian
Barrie Axford
John Bender
Richard Brody
John Burnett
Paul Cheshire
Nicholas Crafts
Graham Crampton
Colin Crawford
Ruth Evans
John Felsteiner
Loraine Fletcher
Marc Franklin
David Mairowitz
Annette Morgan
Michael Neve
Henry Riggs
Michael Sullivan
Geoffrey Tyack
V. C. D. Vowles
John Wood
Eric Wright

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 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, 1850-1960—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)

146. Social Change in Victorian England—An examination of the transformation of English society during (and largely as a result of) the Industrial Revolution. Through novels, historical texts, and visits, explore development of the cities and their impact on British society. (DR:S)
5 units, Win (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 Neo-Platonism; 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, Win (Neve)

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, Win (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, Win (Axford)

139. Constitutional Law and English Legal System—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 (Crawford)

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)

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 capitalist development, in general. Related developments in Germany, the U.S. and Western Europe will be considered, as well. (DR:S)
5 units, Win (Wood)

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, Spr (Vowles)

111. The Roots of Social Welfare Policy: The English Perspective—Exploration of the historical roots of modern social welfare policy in Britain. Main themes will include how the poor are perceived by society, what obligations exist towards them, and how aid is handled. Lectures and readings will trace these themes from the Middle Ages to the present. (DR:S)
5 units, Aut (Brody)

189C. The British and American Voters—This seminar will consider voting behavior in the two democracies, and explore the effects of a structured class system and a more differentiated class system on the choices voters make. Includes research paper developed through individual tutorials. (DR:S)
5 units, Aut (Brody)

182. Shakespeare—Intensive study of about eight plays, including histories, tragedies, and comedies. Where possible, readings will be paralleled by attendance at performances in London or Stratford. Student production of scenes will form part of the course work. (DR:H)
5 units, Aut (Bender)

183. Prisons and Madhouses: Institutions and Literature in Enlightenment Britain—Study of social roles and classes, captivity and boundaries, escape and reform, sanity and insanity in 18th century literature, thought and art. Attention to interaction with the Continent; Michel Foucault will provide an intellectual framework out of which to shape ideas about the specific character of these institutions in Britain. Field trip to relevant institutions. (DR:A)
5 units, Aut (Bender)
184. British Comic Writing and Drama—British comic writing since Lewis Carroll, in plays, novels, and stories, both reflects and satirizes national mores and institutions, as well as revealing modernist themes and practices. As a climax to the course, students will research, discuss, rehearse, and stage a work by Wilde or Shaw. (DR:H)

5 units, Spr (Felsteiner)

185. Modern British and American Poetry—A study of two cognate but distinct traditions, beginning with Whitman and Yeats, William Carlos Williams and T. S. Eliot, Frost and Hardy. Students will gather and present examples of most recent British poetry and will also have opportunity to write their own poems. (DR:H)

5 units, Spr (Felsteiner)

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 (Fletcher)

254. British Theatre Season—Focusing largely on 20th century theatre, this course will explore important themes and dramatists using productions currently being staged in London or nearby. (DR:H)

5 units, Win (Matrowitz)

202. English Attitudes to Emotion: The Romantic Novel—An introduction to Romantic attitudes in Britain, as expressed primarily through the novel. Course will run from 1760 until 1846, and explore the growth of this particular novel form and its relation to other Romantic writing, as well as its concern with the "sense of place"—with physical settings, landscape, architecture, etc. (DR:H)

5 units, Win

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, Spr (Tyack)

233F. 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, Spr (Tyack)

124. English Architecture: 1485-1800—Examination and analysis of architectural development in England from the Tudors to the 19th Century will be accompanied by discussion of the social context in which architectural change took place. Links between English and Continental architecture will be traced. Many sites will be visited. (DR:H)

5 units, Aut (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, Spr (Aprahamian)

271C. The Technical Entrepreneur: U.S. and European Views—An exploration of the cultural, sociological, and economic view of entrepreneurial activities—and entrepreneurs—in the U.S. and Europe. Through case materials, readings, field work and discussions with invited guests, students will explore the British and American views, to gain a better understanding of the role of entrepreneurial activities in different societies and the conditions that foster or inhibit those activities. This seminar qualifies as a Technology and Society course for engineering students. (DR:T)

5 units, Spr (Riggs)

161C. Engineering Investment Analysis—(Parallels Engineering 161). 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. The course will also consider the impacts of inflation, including differentials in inflation rates between countries; effects of alternative tax laws in the U.K. and the U.S.; and the link between investment analysis and the capital markets, including the London-based international money market. This seminar will fulfill the engineering breadth requirement of E 161 and is also appropriate for non-engineering students interested in economics, finance, and business. No prerequisites. (DR:T)

3-4 units, Spr (Riggs)

SUMMER FOCUS PROGRAM

Comparative Aspects of Anglo-American Law and Society—Previously offered at Cliveden in Summer 1977, this eight-week program will explore the origins and evolution of divergent and similar legal practices in the two countries and examine the ramifications of these approaches in other areas of society. The curriculum, designed by Professors Marc Franklin of Stanford Law School and Eric Wright of University of Santa Clara Law School, will be jointly...
taught by them and supplemented with lectures from visiting British faculty and practitioners.

The eighty undergraduates selected for the program will be expected to enroll in the six-unit core course, "Comparative English and American Legal Systems", and to take one or more "satellite" courses offered in this program. Among those which may be offered are "Comparative Problems of Race and Sex Discrimination", "Freedom of Communication in the U.S. and Britain", and "Comparative Criminal Systems". Complete course descriptions and application information will be available in Autumn Quarter 1980-81. The application deadline for this summer program is January 30, 1981; no formal prerequisites have been set, although preference in the selection process may be given to candidates with background knowledge of British history and society, American legal system, or comparative law.

In addition to the focus coursework, students in the program will be able to enroll in at least one of the two following courses which will also be available at Cliveden next summer:

**Britain's Response to the Orient**—The course will explore European ideas and misconceptions of the culture and arts of Asia, from the 16th century to the present, and their influence on the arts of Europe and of Britain in particular. Lectures and readings will be supplemented by visits to museums, performances and famous buildings. (DR:H)

4 units, Sum (Sullivan)

**English Architecture**—An exploration of English architecture as an expression of changing social needs and evolving techniques, through the study of books, architectural drawings, and visits to key buildings which students will be asked to describe and analyze. (DR:H)

4 units, Sum (Sullivan)

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**STANFORD PROGRAM IN FLORENCE**

**Academic and administrative personnel:**

Giuseppe Mammarella, Director
Carla Lekai, Assistant Director
Joan M. Mammarella, Language Program Coordinator
Lucia Benini
Franca Celli
Napoleone Colajanni
Roberto D'Alimonte
N. Gregson Davis
John Freccero
Gueith Frulla
Umberto Giovine

Paola Gori
Alberto Martinelli
Sergio Moravia
Jeffrey Schnapp
Giovanni Scichilone
Maria Todorow

**The Italian System: An Introduction**—Autumn quarter, students at the Florence program will be required to take this introductory course, providing a brief overview of Italian history, geography, politics and culture. An integrated, interdisciplinary course, it will be taught by members of the Florence faculty and will be coordinated with field trips, cultural events in Florence, and visiting lecturers. (DR:X)

4-5 units, Aut (Staff)

**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 Win (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)

**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, Win, (G. Mammarella)

**117. Economia dell'Italia Moderna**—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, Aut (G. Mammarella)

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, Spr (Giovinne)

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 independently and there are no prerequisites.

110A. Masterpieces of Italian Literature: From the Origins Through Dante (DR:H)
4-5 units, Aut (J. Mammarella)

110B. Masterpieces of Italian Literature: 1300-1500 (DR:H)
4-5 units, to be given in 1981-82 (J. Mammarella)

110C. Masterpieces of Italian Literature: 1500-1900 (DR:H)
4-5 units, Spr (J. Mammarella)

Dante's Divine Comedy—The following three courses can be taken as a series or separately. A reading in English translation of Dante's Divine Comedy that seeks both to situate the poem within the tradition and to discuss its continuing influence on modern literary thought.

140. Dante's Divine Comedy: Inferno. (DR:H)
4 units, Aut 1981-82 (Freccero)

141. Dante's Divine Comedy: Purgatorio. (DR:H)
4 units, Win (Freccero)

142. Dante's Divine Comedy: Paradiso. (DR:H)
4 units, Spr (Freccero)

Machiavelli's Prince—An analysis of Machiavelli's Prince and the history of its interpretation. An effort will be made to compare the political philosophy of that work with the philosophy of the Discorsi and to contrast it with the varied and sometimes contradictory readings to which Machiavelli's work has been subjected through the centuries. Requires a reading knowledge of Italian. (DR:H)

4 units, Spr (Freccero)

Petarch and Petrarchism—The course will seek to define "Petrarchism" in its historical context through a reading of the Canzoniere and of relevant background texts, primarily by Dante and St. Augustine. Some effort will be made to characterize the various "Petrarchisms" of the Renaissance and of Romanticism. (DR:H)

4 units, Win (Freccero)

Major Themes in Greco-Roman Mythology—Through lectures and discussion, the course will analyze some of the major recurrent themes in the mythological traditions of Greece and Rome. Emphasis will be on those themes (and associated figures) which became important to Renaissance artists (e.g., the motif of rebirth, the culture hero, Eros and Aphrodite, the golden age). (DR:H)

4 units, Spr (Davis)

Ovid's Influence on Renaissance and Baroque Artists—The aim of this seminar will be to study in depth a selection of Renaissance and Baroque works of art which are based on passages in Ovid's Metamorphoses. Our focus will be on famous "cycles" of art painted on ceilings in both Rome and Florence. (DR:H)

4 units, Spr (Davis)

115. Firenze nel Rinascimento—A study of Florentine civilization from Dante to Machiavelli, including intellectual and political history. Students visit important Florentine sites of the Renaissance. (DR:A)

5 units, Spr (Frulla)

125. Art and Culture of the Greek World—A discussion of the generally agreed upon sequences 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 cultures of ancient Italy as interpreted by archaeological 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 development of Tuscan art from the 13th to 15th centuries, 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 Bronzino, 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. L'Opera Italiana—An historical and aesthetic introduction to some of the best Italian operas, including Monteverdi's Orfeo, Mozart's Don Giovanni, and Rossini's Barbiere di Siviglia. (DR:H)
4 units, Win (Frulla)

THE ITALIAN LANGUAGE PROGRAM

Intensive Italian—Grammar, conversation, and composition. Students enroll in Intensive Italian at the appropriate level during their first quarter in Florence.

70. Elementary Italian—(DR:X)
5 units, Aut, Win, Spr (J. Mammarella, Benini, Celli, Gori)

80. Intermediate Italian—(DR:H)
5 units, Aut, Win, Spr (J. Mammarella, Benini, Celli, Gori)

90. Advanced Italian—(DR:H)
5 units, Aut, Win, Spr (J. Mammarella, Benini, Celli, 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 Continuation at the appropriate level during their second and third quarters in Florence. (DR:H)
5 units, Aut, Win, Spr (J. Mammarella, Celli, Gori)

STANFORD PROGRAM IN TOURS

Academic and administrative personnel:
Paul LeMoal, Director
Claude Doubinsky, Assistant Director
Anne Durand, Assistant Director
Paul Bachelerd
Patrick Baleynaud
Jean Noel. Billard
Joelle Blot
Daniel Dayan
Andrea Dimino
John Burt Foster, Jr.
André Gorgues
Annie Guedez
Michelle Jomaron
Guy Leboucher
Francoise Perdoux
Claude Petitfrère
Jacques Roger

The Development of Rural France in the Middle Ages—The structures of rural France as we know it today were, for the most part, invented in the Middle Ages. The purpose of the course will be to explain both the socio-economic factors and the mental and spiritual transformations that made such a development possible. (DR:S)
5 units, Aut (Gramain)

The Rise of the State: Centralism and Absolutism in the Ancien Régime of France—The three-fold objective of this course is: to pose the problem of Absolutism as a form of government and examine its structure; to study the specific development of Absolutism in 16-17th century France; and to trace the effect of traditional French centralism and state control on present-day France. (DR:S)
5 units, Spr (Chaix)

120A. Introduction à l'art français: Médiéval—To acquaint students with the great periods, monuments and masterpieces of French Art. Lectures will focus on the architecture and interior decoration of the castles and churches of the period, on French painting and sculpture, and on the chief artistic techniques used over the centuries. Field trips will be organized to major sites nearby. This course can be taken alone or as part of a sequence with 120B. (DR:H)
4 units, Win (Smee)

120B. Introduction à l'art français: Le Classicisme—An independent ten-week course introducing the student to monuments and masterpieces of Classical French Art, this course can also be taken as the second part of a sequence, following 120A. Focusing on the architecture and interior decoration of castles and churches, on French painting and sculpture, and on furniture and artifacts of the period, the course will include field trips to nearby sites of interest. (DR:H)
4 units, Spr (Smee)

134. La gauche dans la politique française moderne—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 (Petitfrère)

115. Les problèmes contemporains de la croissance économique—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, Spr (Leboucher)

160. A Semiological Approach to Film—Textual theory will be applied as a tool to study a group of modern French films by Renais, Godard, Bresson and others. The contrast with "classical" French films by Renoir, Carne and Clement and with foreign films will be emphasized. (DR:A)
4 units, Aut (Dayan)
124. La politique française contemporaine—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, Spr (Gorgues)

163. Le système légal français—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, Win (Baleyraud)

136. La politique extérieure de la France—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, Aut (Billard)

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, and the possibility of natural or political sciences. (DR:A)

4 units, Win (Roger)

70, 80, 90. Intensive French—Grammar, conversation, and composition, emphasizing rapid acquisition of verbal skills necessary to use the French language in daily life.

70. Elementary French—(DR:X) 6 units, Aut, Win, Spr (Blot, Jomaron, Perdoux)

80. Intermediate French—(DR:H) 6 units, Aut, Win, Spr (Blot, Jomaron, Perdoux)

90. Advanced French—(DR:H) 6 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. (DR:H)

4 units, Spr (LeMoal)

123. French Language Continuation—This will be an advanced language class dealing with more sophisticated grammatical analysis, composition and explication de textes. (DR:H)

4 units, Win, Spr (Jomaron, Perdoux)

Literature and Feminism: A Comparative Approach—We will explore the relation of feminist ideas to the work of major French and American women writers. Readings will include novels, memoirs, and poetry. Using Simone de Beauvoir's *The Second Sex* as the cornerstone of our analysis, we will discuss such writers as Mme. de Lafayette, George Sand, Colette, Edith Wharton, Lillian Hellman, and Adrienne Rich. (DR:H)

4-5 units, Aut (Dimino)

Comedy in France and America—Beginning with the comic masterpieces of Rabelais, Moliere and Mark Twain, we will then compare modern comedy in France and America, with particular emphasis on absurd humor. The course will include visits to stage and film comedies in Tours and Paris. Throughout, we will consider how statements of comic theory relate to the works read, focusing on psychological and social aspects of comedy and the question of national characteristics in comedy. (DR:H)

4-5 units, Win (Dimino)

L'aventure héroïque au XXe siècle: glorification et dérision—This course will study two opposite treatments of heroic adventure in 20th century French literature: glorification and derision. The first will be illustrated by works of St. Exupery and Malraux; the second by Celine and Vian. Through an historic adventure, and discuss contemporary forms of courage and trends of pacifism in French youth of the 1980's. (DR:H)

4-5 units, Spr (Perdoux)

162N. Nietzsche and the French—(Also listed under Modern Thought and Literature). This seminar will study the interaction of ideas between Nietzsche and French culture. It will serve as an introduction both to the philosopher's work and several masterpieces of French literature, including works by Gide, Pascal, Malraux, and contemporary writers. (DR:H)

5 units, Aut (Foster)

136B. Society and Psychology in the French Novel—(Also listed under Modern Thought and Literature). Focusing on works written in the late 19th and early 20th centuries, this course will explore the insights provided into the dynamics of society and personal psychology in a period of limited expectations and disillusionment. Background reading from Marx and Freud will set the context for study of Stendahl, Balzac, Flaubert, and Proust. (DR:H)

5 units, Win (Foster)

101. La littérature française du XVII siècle—Starting with a brief introduction to Renaissance humanism, this course will consider the Age of Classicism by focusing on the work of the
French moralists and some of the more important plays of Corneille, Racine and Moliere. (DR:H)
4 units, Spr (C. Doubinsky)

102. La litterature francaise: Le roman au XIXe siecle—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, Aut (C. Doubinsky)

103. The Surrealist Revolution—French surrealism will be studied mainly as a revolution in the concepts and practice of poetry and painting, and as a modern revival of the lyricism of love. Theory will be explored through the writings of Andre Breton, and practice in the poems of Breton, Aragon, and Eluard, and the paintings of Chirico, Ernst, and Dali among others. (DR:H)
4 units, Win (C. Doubinsky)

STANFORD PROGRAM
IN VIENNA

Academic and administrative personnel:
Siegfried Korninger, Director
Hedwig Thimig, Associate Director
Margaret Mehrl, Language Program Coordinator
Roswitha Benesch
Joseph Harris
Helga Maly
Guiseppe Mammarella
Maximillian Peyfuss
Wendelin Schmidt-Dengler
Gottfried Scholz
Amy Sims
Karl Wagner

The Habsburgs and Europe: 1809-1918—A general history of the Habsburg Empire and its interactions with Europe from the age of Metternich through the fall of the monarchy. Course will survey major political, cultural, and social developments within the Habsburg Empire. (DR:S)
4-5 units, Aut (Sims)

Right Wing Movements in Modern Austria and Germany—An examination of right wing movements in Austria and Germany (1850-1945) which includes the social, political, and cultural context in which they developed. Course will deal with Schoenerer and Pan-Germanism, Lueter and the Christian Social Party, the growth of national workers associations, extreme nationalism, Social Darwinism, anti-semitism, Fascism, and National Socialism. Emphasis will be on National Socialism. (DR:S)
4-5 units, Aut (Sims)

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, Italy and Austria. Socialism, Communism, and the history of the Christian Democratic Party in Italy, Germany, and Austria will be the main topics of discussion. (DR:S)
4-5 units, Spr (G. Mammarella)

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)
4 units, Win (Peyfuss)

The Volsungs and Nibelungs: A Thematic Study—The stories of Siegfried have inspired poets and artists from (at least) the ninth century through the early twentieth, and the permutations of the theme comprise a number of first-rank literary works, culminating perhaps in Wagner's The Ring of Nibelung. This course will retrace Wagner's footsteps to the Old Scandinavian tales and to the great Austrian epic of the early 13th century. The story will be followed through Wagner's libretto and music, into Thomas Mann's short story on this theme, and perhaps through Fritz Lang's expressionist films. All the texts will be read in translation. (DR:H)
4-5 units, Win (Harris)

Introduction to Middle High German, with Reading in the Nibelungenlied—Middle High German is the language of the first great flowering of Austrian literature. With some knowledge of modern German, students can learn to read this classical literature with only a little effort and discipline. This course will first work through the grammar and many of the readings in a recent English-language handbook. Then we will turn to the Nibelungenlied, the masterly heroic epic from 13th century Vienna, reading selected passages in the original and studying the whole poem in translation. (DR:H)
3-5 units, Win (Harris)

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 (Wagner)

167. Austrian Literature—A survey of the major Austrian literary works of the 19th and 20th centuries. (DR:H)
4 units, Spr (Korninger)
243. The Intellectual and Literary Scene in Vienna Since the Turn of the Century—An introduction to the literary, cultural, and political contributions of Austrian intellectuals, such as Freud, Wittgenstein, Schnitzler, Hofmannsthal, and Kafka. (DR:H)

4 units, Spr (Schmidt-Dengler)

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, Stanislawski'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:X)

2 units, Win, Spr (Scholz)

THE GERMAN LANGUAGE PROGRAM

70. Intensive German—The equivalent of German 3, using the Lo-Stro text with supplementary material which will concentrate on the speaking and comprehension of everyday German. (DR:X)

6 units, Aut, Win, Spr (Mehrl, Staff)

80. Intermediate Intensive German—Review of grammar, reading of texts and essay writing, plus concentration on speaking and comprehension. (DR:H)

6 units, Aut, Win, Spr (Mehrl, Staff)

90. Advanced Intensive German—Concentration on increasing the student's active vocabulary, including reading, essay writing, and limited grammar review. (DR:H)

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. (DR:X)

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, idiomactic expressions, grammar, and vocabulary. (DR:H)

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. (DR:A)

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. (DR:H)

3 units, Aut, Win, Spr (Thimig)

STANFORD PROGRAM IN PARIS

Marc A. Bertrand, Director

STANFORD PROGRAM AT THE FREE UNIVERSITY IN BERLIN

Karen Kramer, Acting Associate Director

STANFORD PROGRAM IN SALAMANCA

Isabel Criado, Director
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 Academic Council**—inquire at Academic Secretary's Office.
**Astronomy and Astrophysics at Stanford, Graduate Study in**—available at Graduate Admissions Office and Astronomy Course Program 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 of 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 Conference Office.
**Endowed Professorships at Stanford University**—limited quantity—inquire at the Office of Development.
**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.

**Founding Grant, The, with Amendments, Legislation and Court Decrees**—(limited quantity) inquire at the President's Office.
**Graduate Division, Stanford University, Application Booklet**—available at the Graduate Admissions Office.
**Graduate Opportunities for Minority Students at Stanford University**—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 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**
- **Selected Facts: Stanford University Libraries**
- **The Lively Arts at Stanford**—available at the Office of Public Events.
**Native Americans at Stanford**—available at Dean of Student Affairs Office
**People Should Feel Good: Stanford Health Services**—available at Cowell Student Health Center.
**Regulations Governing Student Conduct and Procedures for Their Enforcement**—available at the Office of the President.
**Rosters of the Senate, Advisory Board and various committees**—available at the Academic Secretary's Office.
**Rules for the Handling of Grievances Referred to the Advisory Board Under the Statement on Academic Freedom**—available at the Academic Secretary's Office.
**Rules for the Handling of Grievances Referred to the Advisory Board Under the Statement of Faculty Grievance Procedures at Stanford University**—contained in the Faculty Handbook available at the Academic Secretary's Office.
Seeing Stanford... A Walking or Bicycling Tour of the Inner Campus—on sale at the Visitor Information Office, Memorial Court.

Senate Rules—available at the Academic Secretary’s Office.


Staff Handbook—available at Benefits Section, Personnel Office.

Standing Rules of Procedure Governing the Filing and Appeal of Grievances in the Administrative Structure (Statement of Faculty Grievance Procedures at Stanford University, Article III, and Article IV, Section A.)—contained in the Faculty Handbook available at the Academic Secretary’s Office.

Stanford Associates Directory (limited quantity)—inquire at the Office of Development.

Stanford Campus Guide Map—on sale at Visitor Information Office, Memorial Court; and Bookstore.

Stanford from the Beginning—booklet on sale at Visitor Information Office, Memorial Court; Bookstore; and Tresidder Union Store.


Stanford Memorial Church—booklet on sale at Stanford Bookstore, Visitor Information Office, and Tresidder Union Store.

The Stanford Observer—University’s monthly alumni newspaper: available at News & Publications, free to alumni and parents.


Stanford Para Mi? ¡Seguro Que Sí!—available at the Admissions Office.

Stanford Residences: A Descriptive Guide to the Undergraduate Spring Housing Draw—available for consultation at the Residential Education Office.

Stanford Today—available at Admissions Office.

Stanford University Bulletins:
Available at the Registrar’s Office:
Information
Summer Session
Available at the School or Department:
Hopkins Marine Station
School of Law
Graduate School of Business
School of Medicine
Overseas Studies

STATEMENT OF NONDISCRIMINATORY POLICY

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, handicap, 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.

TITLE IX OF THE EDUCATION AMENDMENTS OF 1972

It is the policy of Stanford University to comply with Title IX of the Education Amendments of 1972 and its Regulation, which prohibit discrimination on the basis of sex. Sally Mahoney, Associate Provost and Registrar, has been appointed to coordinate the University’s efforts to comply with the law. Anyone who believes that in some respect Stanford is not in compliance with Title IX and its Regulations should contact Ms. Mahoney at (415) 497-1550.

REHABILITATION ACT OF 1973

In its programs, activities and employment, Stanford University does not discriminate on the basis of handicap. Associate Provost Wayne Price has been appointed by President Lyman to coordinate the University’s efforts to comply with the Rehabilitation Act of 1973 and regulations promulgated thereunder prohibiting discrimination on the basis of handicap. Anyone who believes that in some respect Stanford is not in compliance with the Rehabilitation Act and its regulations should contact Mr. Price at (415) 497-2485.
APPENDIX

COURSES CERTIFIED AS FULFILLING THE DISTRIBUTION REQUIREMENTS FOR FRESHMEN ENTERING IN 1980

Information for freshmen entering Stanford in 1980 is to be found in the Degrees section of this book. The following courses have been certified in 1980-81 for the new 1980 Distribution Requirements.

PLEASE ALSO NOTE: Except where noted otherwise, no course may be applied to more than one Area of the Requirements by an individual student. In addition, certain sequences must be completed in their entirety for Distribution Requirement fulfillment, and those sequences are so noted below.

The symbol (*) indicates courses which also fulfill the non-Western culture requirement.

All questions regarding individual students' fulfillment of the Writing and Distribution Requirements should be referred to the Academic Information Center, Old Union 306 (497-2426).

AREA 1: WESTERN CULTURE

Comparative Literature 21, 22, 23; Major Texts in Western Culture (entire sequence must be completed)
Great Works of Western Culture 1, 2, 3 (entire sequence must be completed)
History 1, 2, 3; Europe: From the Middle Ages to the Present (entire sequence must be completed)
Humanites 61, 62, 63; Western Thought and Literature (entire sequence must be completed)
Philosophy/Religious Studies 5A, B, C; Ideas in Western Culture (entire sequence must be completed)
Program in Structured Liberal Education (entire sequence must be completed and thereby also satisfies Areas 2 and 3)
Values, Technology, and Society 1, 2, 3; Western Culture and Technology (entire sequence must be completed)

AREA 2: LITERATURE AND FINE ARTS

Art 001; Introduction to Art
Art 003; Introduction to the History of Architecture
Art 175A or B; Modern Architecture I or II
Art 176; American Architecture and Urbanism
*Asian Languages 042; Haiku
*Asian Languages 131; Chinese Poetry and Drama in Translation
*Asian Languages 132; Chinese Fiction in Translation
*Asian Languages 133; Modern Chinese Literature in Translation
*Asian Languages 136; Early Japanese Literature in Translation
*Asian Languages 137; Japanese Literature in Translation: The Middle Period
*Asian Languages 138; Modern Japanese Literature in Translation
*Asian Languages 176; Chinese Myths, Legends, and Folktales
*Asian Languages 178; Japanese Poetry from Manyōshū to Shin'okinshū
*Asian Languages 179; Classical Japanese Drama
*Asian Languages 182; Japanese Popular Religious Literature
*Asian Languages 184; Renga: Japanese Linked Verse
Classics 011; The Classical Epic
Classics 012; Greek Tragedy
Classics 018; Greek Mythology
Classics 112; Mycenaean Greece
Classics 135; Classical Conventions in European Lyric
Classics 185; Eros in Greece
Drama 001; Introduction to Drama
Drama 002; Introduction to Theatrical Style
Drama 059/English 073; Shakespeare
Drama 151; Greek Tragedy
Drama 152; Medieval and Renaissance Drama
Drama 153; Neoclassic Drama
Drama 154; Romantic and Early Realistic Drama
Drama 155; Modern Drama: 1870-1914
Drama 156; Contemporary Drama: 1918 to the Present
Drama 157; American Drama from 1920
Drama 160; History of Theater: Classical Greece to the 18th Century
Drama 161; History of Theater: 19th and 20th Centuries
English 025; Masterpieces of English Literature I: Chaucer, Shakespeare, Milton, and Their Contemporaries
English 030; Introduction to the Novel
English 035; Masterpieces of English Literature II: From the Enlightenment to the Modern Period
English 040; Introduction to Drama
English 045; Masterpieces of American Literature
English 050; Introduction to Poetry
English 063A or B; Women's Writing as Critique and Vision
English 079B; Faulkner

* Indicates courses which also fulfill the non-Western Culture requirement.
English 111; Women in Later Medieval Literature
English 113; The Renaissance
English 115; The Neoclassic Period
English 119; Modern British Literature
English 120; The American Historical Novel
English 122; American Literature: 1855 to 1917
English 131A; The English Novel through the 18th Century
English 131B; The English Novel in the 19th Century
English 137; Development of the Short Story
English 140; American Drama; 1918 to the Present
English 161A; The Afro-American Novel
English 161D; The Afro-American Autobiography
English 161E; Recent Writing by Afro-American Women
English 162A; Contemporary Chicano Literature
*English 166; Modern Literature from Africa
English 169A; The Literature of Existentialism
English 171A; Chaucer: Canterbury Tales
English 171B; Chaucer: Minor Poems and Troilus
English 173A, B, or C; Shakespeare
English 176; Donne and Jonson
French 107; Sartre: Literature and Politics
French 114A; The 19th-century French Novel
French 130; French Literature I: Middle Ages and Renaissance
French 131; French Literature II: 17th and 18th Centuries
French 132; French Literature III; 19th and 20th Centuries
German Studies 032A/132; Culture and Civilization II
German Studies 083A; Faust and the Western Tradition
German Studies 101 or 102; Reading and Writing Modern German
German Studies 150; Introduction to German Literature
German Studies 154; Modern Short Prose
German Studies 157; Orpheus in Germany: Lyric Poetry from the Middle Ages to the Present
German Studies 161; The Classical Period
German Studies 162; Romanticism and Realism
German Studies 163; Naturalism to the Present
Medieval Studies 065; Introduction to Medieval Culture and Society
Music 001; Introduction to Music
Music 002; The Symphony
Music 004A; The Music of Bach
Music 005A; Music in America
Music 006C; Music in the History of Ideas
Music 019; Introduction to Music Theory
Music 021 or 022; Elements of Music
Music 023; Functional Harmony
Music 024; Elementary Tonal Counterpoint
Music 100; Music History: Medieval and Renaissance
Music 101; Music History: Baroque
Music 102; Music History and Theory: Classic
Music 103; Music History and Theory: Romantic
Music 104; Music History and Theory: Modern
Religious Studies 121; The Old Testament
Slavic Languages 111; Third-year Russian
Slavic Languages 145; Survey of Russian Literature in Translation I: The Rise of a Secular Literature
Slavic Languages 146; Survey of Russian Literature in Translation II: The 1860's and Their Aftermath
Slavic Languages 150; Romanticism Among the Slavs
Slavic Languages 151; Fyodor Dostoevsky
Slavic Languages 153; Leo Tolstoy
Slavic Languages 154; The Russian Drama
Slavic Languages 167, 168, or 169; Fourth-year Russian Seminars I, II, or III
Slavic Languages 187; Russian Poetry of the 19th Century
Spanish 122A; Spanish Literature in Translation
Spanish 151 or 152; Spanish Literature I or II
*Spanish 162; Introduction to Spanish-American Literature II: Contemporary Latin America: Poems and Songs
Structured Liberal Education (SLE) (entire sequence must be satisfied and thereby also satisfies Areas 1 and 3)
Values, Technology, and Society 165; Technology and Musical Expression

AREA 3: PHILOSOPHICAL, SOCIAL, AND RELIGIOUS THOUGHT

Anthropology 005; Symbol, Myth, and Ritual
*Anthropology 013; Culture and History
*Anthropology 153; The Anthropology of Religion
*Asian Languages/Philosophy 046; Philosophical Chinese
*Asian Languages 151; Chinese History in Translation
*Asian Languages 176; Chinese Myths, Legends, and Folktales
Biology 051; Scientific Philosophy and Bioethics
Classics 003; Democracy and Imperialism
Classics 008; Classical Politics
Classics 018; Greek Mythology

* Indicates courses which also fulfill the non-Western culture requirement.
Classics 019; Socrates and the Socratic Tradition
Classics 115; Historiography
Classics 117; Greek Religion and Society
Classics 165; Hellenistic Philosophy
Economics 100; Economic Theory in Historical Perspective
Economics 120; The Marxist and Radical Tradition
English 128; Reflections on the American Condition
English 165; Culture and Society in 19th-century England
English 166; Modern Literature from Africa
English 169A; The Existential Hero in Modern Literature
English 174; Milton, Marvell, and God’s Ways to England
French 115; Introduction to Existentialism
German Studies 033A; Culture and Civilization III
*History 091 or 092; Traditional East Asian Civilization
History 105A; The History of Socialisms and Marxism
History 136; The Age of Reason and Enlightenment: European Thought in the 17th and 18th Centuries
History 136A; European Thought in the 19th Century
History 136B; European Thought in the 20th Century
History/Latin American Studies 177; Modern Latin America: 1970 to the Present
History of Science 138A and B; Introduction to Exact Sciences: Cosmology (entire sequence must be completed and thereby also satisfies Area 6)
Medieval Studies 065; Introduction to Medieval Culture and Society
Philosophy 001; God, Self, and World
Philosophy 002; Introduction to Ethics
Philosophy 004; Philosophies of the Good Life: East and West
Philosophy 006; The Growth of Scientific Knowledge
Philosophy 080; Mind, Matter, and Meaning
Political Science 150; Ancient and Classical Political Thought
Political Science 151; Roman, Christian, and Medieval Political Thought
Political Science 152; Political Thought from Machiavelli to Rousseau
Political Science 153; Political Thought: The Modern Period
*Religious Studies 001C; Comparative Religious Thought
*Religious Studies 013; Hinduism
*Religious Studies 014; Buddhism
Religious Studies 023; Judaism
Religious Studies 042; Philosophy of Religion
Sociology 170; Introduction to Social Theory
Structured Liberal Education (SLE) (entire sequence must be completed and thereby also satisfies Areas 1 and 2)
Values, Technology, and Society 105; Ethics and Human Values in Technological Society
Values, Technology, and Society 128; Ideas and Technology in Western Culture
Values, Technology, and Society 145; Man, Molecules, and Society: Chemical Revolution to Biological Revolution

AREA 4 HUMAN DEVELOPMENT, BEHAVIOR, AND LANGUAGE

*Anthropology 001; The Individual and Society: Cross-cultural Perspectives
Anthropology 004; Language and Culture
*Anthropology 012; Sex and Gender
*Anthropology 151; Ritual and Mind
*Anthropology 165; Psychological Anthropology
Communication 170; Communication and Children
English 101; Structure of the English Language
English 102; History of the English Language
German Studies 118/Linguistics 182; Introduction to German Dialects
Human Biology 002B, Human Evolution: Genetics and Culture; 003B, Properties of Society; and 004B, The Social Process (entire sequence must be completed and thereby also satisfies Area 5)
Linguistics 010; Introduction to Linguistics
*Philosophy/Asian Languages 046; Philosophical Chinese
Psychology 001; General Psychology
Psychology 102; Perception
Psychology 111; Developmental Psychology
Psychology 115; Social Development
Psychology 132; Theories of Personality
Psychology 146; Language and Thought
*Religious Studies 040; Eastern and Western Conceptions of the Self
Religious Studies 049; Approaches to the Study of Religion
Slavic Languages 001, 002, and 003; Beginning Russian (entire sequence must be completed)
Sociology 120; Interpersonal Relations
Sociology 122; Physiological Correlates of Social Behavior
Sociology 149; Youth in Modern Society

* Indicates courses which also fulfill the non-Western culture requirement.
**AREA 5: SOCIAL PROCESSES AND INSTITUTIONS**

*Anthropology 001; The Individual and Society: Cross-cultural Perspectives
Anthropology 002; Biology and Culture in Human Evolution
*Anthropology 003; Human Prehistory
*Anthropology 006; Problems in Anthropology
*Anthropology 011; Sex Roles in Society
Anthropology 102; Natives of North America
*Anthropology 103; Peoples of Mesoamerica
*Anthropology 105A or B; Peoples of Latin America
*Anthropology 107; Cultures and Societies of Sub-Saharan Africa
*Anthropology 113; Peoples of the Pacific
*Anthropology 117; Chinese Culture and Society
*Anthropology 121; Japanese Culture and Society
*Asian Languages 152; Nomad Empires of Inner Asia
Classics 101; History of Greece
Classics 102; Early Rome and the Hellenistic World
Classics 103; History of the Roman Empire
Communication 001; Mass Communication
Society
Economics 001; Elementary Economics
Economics 051 or 052; Economic Analysis I or II
German Studies 031A; German Culture and Civilization
*History/Latin American Studies 080; Culture and Society in Latin America
History 107; The 12th-century Renaissance: European Society and Culture, c 1050-1220
*History 120A,B, or C; Russian History (862 to 1930)
History 123A; The Soviet Union Since 1917
History 128B; Europe in the Age of the French Revolution and of Napoleon
History 129A or B; Modern Germany
History 141; Yorkist and Tudor England: 1460 to 1603
History 142; Stuart England: 1603 to 1688
History 144; Britain: 1851 to the Present
*History 146A; The United States and Africa
History 165A,B, or C; United States History
History 173A or B; American Women’s History
*History 192A,B, or C; Chinese History
*History 194A,B, or C; Japanese History
Human Biology 002B; Human Evolution: Genetics and Culture; 003B, Properties of Society; and 004B, The Social Process (entire sequence must be completed and thereby also satisfies Area 4)
Political Science 001; Major Issues in American Public Policy
Political Science 010; American National Government

Political Science 035; How Nations Deal With Each Other
Political Science 080/180C; Introduction to Public Policy Analysis
Political Science 113A; Politics of Development in Latin America
*Political Science 114; Government and Politics in Japan
*Political Science 115; Government and Politics in China
*Political Science 118A; Political Change in Tropical Africa
Psychology 080; Applications of Social Psychology
Psychology 121; Social Psychology
Religious Studies 001A; Varieties of Religious Communities
Religious Studies 024; Christianity
*Religious Studies 027; Islam
Sociology 001; Introduction to Sociology
Sociology 120; Interpersonal Relations
Sociology 121; Introduction to Social Psychology
Sociology 135; Social Change in Western Societies
Sociology 141; Politics and Society
Sociology 142; The Family
Sociology 144; Class, Status, and Power
Sociology 160; Introduction to Formal Organizations
Values, Technology, and Society 101; Contemporary Technological Society
Values, Technology, and Society 107; Technology and Modern Industrial Societies
Values, Technology, and Society 121; Technology in Society: Historical Perspectives

**AREA 6: MATHEMATICAL SCIENCES**

History of Science 138A and B; Introduction to Exact Sciences: Cosmology (entire sequence must be completed and thereby also satisfies Area 3)
Mathematics 019, 020, 021, 022, 023, 041, 042, or 043; Calculus and Analytic Geometry
Mathematics 053; Honors Calculus
Mathematics 113 or 113S; Linear Algebra
Operations Research 050; Models and Applications of Operations Research in Society
Philosophy 017; From Philosophy to Mathematics
Philosophy 057; Introduction to Logic
Psychology 060; Statistical Methods
Statistics 040; Chance and Strategy

* Indicates courses which also fulfill the non-Western culture requirement.
Statistics 060; Introduction to Statistical Methods I

AREA 7: NATURAL SCIENCES

Anthropology 002; Biology and Culture in Human Evolution
Applied Physics 015; The Nature of the Universe
Biology 040; Evolutionary Biology
Biology 041; Biochemistry and Molecular Biology
Biology 042; Cell and Developmental Biology
Biology 043; Organismal Biology
Biology 128; Systematics and Ecology of Vascular Plants
Biology 165; Animal Behavior
Biology 030H; Introduction to Marine Biology (Hopkins Marine Station)
Biology 113H; Introduction to Oceanic Biology (Hopkins Marine Station)
Biology 123H; Invertebrate Biology (Hopkins Marine Station)
Chemistry 031 or 031H; Chemical Principles
Chemistry 033; Structure and Reactivity
Chemistry 035; Organic Monofunctional Compounds
Engineering 050; Introductory Science of Materials
Geology 001; Interpreting the Earth
Geology 002; Earth History
Geology 150; The Oceans: An Introduction to the Marine Environment
Human Biology 002A; Human Evolution: Genetics and Culture
Human Biology 003A; Properties of the Individual
Human Biology 004A; The Human Organism
Physics 011 or 011S; The World of Physics: Nuclei and Particles
Physics 015; Cosmic Evolution
Physics 019 or 019S; An Introduction to Physics ("Physics for Poets")
Physics 021 or 021W; Mechanics and Heat
Physics 021H; Honors Mechanics and Heat
Physics 023 or 023W; Electricity and Optics
Physics 029 or 029W; Modern Physics
Physics 051; Mechanics
Physics 053; Electricity
Physics 055; Light and Heat
Physics 057; Atomic Physics
Physics 061, 062, or 063; Advanced Freshman Physics

AREA 8: TECHNOLOGY AND APPLIED SCIENCE

Applied Physics 010; Physics and Technology
Chemical Engineering 020; Introduction to Chemical Engineering
Civil Engineering 170; Man and His Environment
Civil Engineering 176; Small Scale Energy Systems
Computer Science 101; Computers: Their Nature, Use, and Impact
Engineering 001; Introduction to Engineering
Engineering 003; Applied Mechanics
Engineering 032; Introduction to the Thermosciences
Engineering 041; Circuits
Engineering 044; Basic Electronics
Engineering 050; Introductory Science of Materials
Engineering 090; Energy in the United States
Engineering 095; Automotive Technology
Geophysics 003; Earthquakes and Man
Operations Research 050; Models and Applications of Operations Research in Society
Operations Research 152; Introduction to Operations Research I
Petroleum Engineering 103; Survey of the Energy Industries
Values, Technology, and Society 121; Technology in Society: Historical Perspectives
Values, Technology, and Society 122; Ideas and Technology in Western Culture
Values, Technology, and Society 142; The Communications Revolution
Values, Technology, and Society 165; Technology and Musical Expression
Values, Technology, and Society/Mechanical Engineering 180; Energy and Society

* Indicates courses which also fulfill the non-Western culture requirement.
General Engineering, 83, 86
Genetics, 568
Geology, 34
Geomathematics, Applied, 25
Geophysics, 44
Geostatistics for Natural Resources Evaluation, 26
Geotechnical Engineering, 116
German Studies, 374
Germany, Stanford Program in, 636, 644
Graduate Division Special Programs, 589
Graduate Program Office, 14
Graduate School of Business, 21
Graduate Studies and Research, Dean of, 588
Greece, Stanford in, 269
Greek, see Classics

Health Policy, Engineering-Economic Systems, 151
Health Services Research, 569
Hearing and Speech Sciences, Program in, 571
History, 396
History and Humanities, Joint Ph.D. Program in, 390
History of Science, Program in the, 398
History of the University, 6
Honors Cooperative Program, 88
Hoover Institution on War, Revolution and Peace, 612
Hopkins Marine Station, 245, 256
Human Biology, Program in, 399
Human Language, 413, 425, 427
Humanities and Sciences, School of, 190
Humanities, Graduate Program in, 409
Humanities, Honors Program in, 407
Humanities, Master of Arts Program in, 409
Humanities Special Programs, 407
Hydrogeology, Applied, 25
Hydrology, Committee on, 590
Individually Designed Majors, Dean's Advisory Committee, 599
Individually Designed Majors, Program for, 12, 599
Indo-European Studies, Graduate Program in, 271
Industrial Engineering and Engineering Management, 158
Information Bulletin, 8
Information Policy, Engineering-Economic Systems, 151
Information Services, Libraries and, 612
Information Systems, Electrical Engineering, 133
Infrastructure Planning and Management, 116
Institute for Communication Research, 281
Institute for Energy Studies, 594
Institute for Plasma Research, 595
Integrated Circuits, 133

International Relations, 413
International Relations, Political Science Courses in, 496, 491
International Studies, Center for Research in, 592
Inter-Personal and Small Group Communication, 314
Inter-University Center for Japanese Studies in Tokyo, 593
Inter-University Program for Chinese Language Studies in Taipei, 593
Intramural Sports, 626
Italian and English Literatures, 367
Italian and French Literatures, 367
Italian, Stanford in, 367

Japanese, Programs of Study in, 233, 234
Japanese Studies in Tokyo, Inter-University Center for, 233, 235, 593
Jasper Ridge Biological Preserve, 245
J.D. Degree, 17
J.M. Degree, 17
Jordan, David Starr, 6
Journalism, 278, 279, 281
Journalism, Professional Fellowship Program, 278
J.S.D. Degree, 17
J.S.M. Degree, 18

LAC, 13, 608
Land Resources Planning, 24
Language Laboratory, 423
Language, Special Program, 427
Latin, see Classics
Latin American Literature, Courses in, 543
Latin American Studies, Center for, 423
Law, School of, 559
Learning Assistance Center, 13, 608
Libraries, 613
Libraries and Information Services, 612
Lima, Peru, Stanford Program in, 537

Linguistics, 425
Literature in Translation, 434
Logic and Computer Systems, 33
Logic of Formal Systems, Philosophy and, 459
LOTS Computer Facility, 615

Maison Francaise, 364
Major, the Undergraduate, Individually Designed, 12
Limits on Requirements of, 12
Purpose of, 11
Structure of, 12
Management, M.S. Degree in, 21
Management Option, Applied Earth Sciences, 26
Marine Biology Hopkins Marine Station, Division of, 256
Mass and Energy Transfer, 83
Mass Media Institute, 281
Summer Session, 20
SWOPSI, 609

Table of Contents, 4
Taipei, Inter-University Program for Chinese Language Studies in, 593
Teaching Credentials, 61
Teaching, Master of Arts in, 58
Technology and Society, 83
Technology Policy and Resource Strategy, 152
Terminal Graduate Registration, 15

TGR, 15
Thermodynamics, 82
Thermosciences, 171
Tokyo, Inter-University Center for Japanese Studies in, 593
Tours, Stanford Program in, 642
Translation, Literature in, 434
Undergraduate Academic Advising, 12
Undergraduate Degrees, 13
Undergraduate Special Program, 611
Undergraduate Studies Special Programs, Dean of, 599
Undergraduate Study at Stanford, 8

Unit Basis Registration, 15
University Publications, 646
Urban Studies, Program on, 600
Values, Technology, and Society, Program in, 602
Vienna, Stanford Program in, 644
VTS, 600, 602

Western Culture and Technology, Courses in, 558, 604
Western Culture Program, 557
Women's Studies, see Center for Research on Women
World Religions, 508
Writing Requirement, 8, 9