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

Stanford, California
Courses and Degrees may be purchased from the Stanford Bookstore or by sending a $4.00 check or money order ($4.25 if a California resident; add $2.40 if domestic first class mail desired) to:

Catalog Mailing

Old Union, Stanford University
Stanford, California 94305-3005

Summer Session and Information may be obtained free from the above address or at the Registrar's Information Window, Old Union.
### ACADEMIC CALENDAR 1988-89

#### AUTUMN QUARTER, 1988

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep 26-27</td>
<td>Sign class lists; last days to arrange payment of University fees</td>
</tr>
<tr>
<td>28 (Wed)</td>
<td>Instruction begins</td>
</tr>
<tr>
<td>29 (Thu)</td>
<td>Conferral of degrees - Summer Quarter</td>
</tr>
<tr>
<td>Nov 24-27</td>
<td>Thanksgiving recess (no classes)</td>
</tr>
<tr>
<td>Dec 1 (Thu)</td>
<td>Last day for filing A.B., B.S., and B.A.S. applications for January</td>
</tr>
<tr>
<td>9 (Fri)</td>
<td>Last day for filing candidacy applications for Educational Specialist or Engineer degree for April (Winter Quarter) conferral</td>
</tr>
<tr>
<td>9 (Fri)</td>
<td>Last day for filing University theses, D.M.A. final project, Ph.D. dissertations, and Notice of Intention for conferral of January (Autumn Quarter) degree</td>
</tr>
<tr>
<td>12-16 (Mon-Fri)</td>
<td>End-Quarter examinations</td>
</tr>
</tbody>
</table>

#### WINTER QUARTER, 1989

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 9 (Mon)</td>
<td>Sign class lists; last day to arrange payment of University fees</td>
</tr>
<tr>
<td>10 (Tue)</td>
<td>Instruction begins</td>
</tr>
<tr>
<td>12 (Thu)</td>
<td>Conferral of degrees - Autumn Quarter</td>
</tr>
<tr>
<td>16 (Mon)</td>
<td>Observance of Martin Luther King Day (holiday, no classes)</td>
</tr>
<tr>
<td>31 (Tue)</td>
<td>Last day for filing graduate “Notice of Intention” for June commencement diploma</td>
</tr>
<tr>
<td>31 (Tue)</td>
<td>Last day for filing A.B., B.S., and B.A.S. application for April (Winter Quarter) and June (Spring Quarter) conferral</td>
</tr>
<tr>
<td>Feb 20 (Mon)</td>
<td>Observance of Presidents’ Day (holiday, no classes)</td>
</tr>
<tr>
<td>Mar 12 (Sun)</td>
<td>Observance of Founders’ Day</td>
</tr>
<tr>
<td>17 (Fri)</td>
<td>Last day for filing candidacy applications for Educational Specialist or Engineer degree for June (Spring Quarter) conferral</td>
</tr>
<tr>
<td>17 (Fri)</td>
<td>Last day for filing University theses, D.M.A. final project, Ph.D. dissertations, and Notice of Intention for conferral of April (Winter Quarter) degree</td>
</tr>
<tr>
<td>20-24 (Mon-Fri)</td>
<td>End-Quarter examinations</td>
</tr>
</tbody>
</table>

#### SPRING QUARTER, 1989

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apr 3 (Mon)</td>
<td>Sign class lists; last day to arrange payment of University fees</td>
</tr>
<tr>
<td>4 (Tue)</td>
<td>Instruction begins</td>
</tr>
<tr>
<td>6 (Thu)</td>
<td>Conferral of degrees - Winter Quarter</td>
</tr>
<tr>
<td>25 (Tue)</td>
<td>Last day for filing undergraduate scholarship applications for matriculated undergraduates</td>
</tr>
<tr>
<td>May 29 (Mon)</td>
<td>Memorial Day (holiday, no classes)</td>
</tr>
<tr>
<td>June 7 (Wed)</td>
<td>Last day for filing candidacy applications for Educational Specialist or Engineer degree for September (Summer Quarter) conferral</td>
</tr>
<tr>
<td>7 (Wed)</td>
<td>Last day for filing University theses, D.M.A. final projects, Ph.D. dissertations, and Notice of Intention for conferral of June (Spring Quarter) degree</td>
</tr>
<tr>
<td>9-14 (Fri-Wed)</td>
<td>End-Quarter examinations</td>
</tr>
<tr>
<td>17 (Sat)</td>
<td>Baccalaureate Saturday and Senior Class Day</td>
</tr>
<tr>
<td>18 (Sun)</td>
<td>Commencement</td>
</tr>
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#### SUMMER QUARTER, 1989

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>26 (Mon)</td>
<td>Sign class lists; last day to arrange payment of University fees</td>
</tr>
<tr>
<td>27 (Tue)</td>
<td>Instruction begins</td>
</tr>
<tr>
<td>July 4 (Tue)</td>
<td>Independence Day (holiday, no classes)</td>
</tr>
<tr>
<td>Aug 17 (Thu)</td>
<td>Last day for filing candidacy application for Educational Specialist or Engineer degree for January (Autumn Quarter) conferral</td>
</tr>
<tr>
<td>18-19 (Fri-Sat)</td>
<td>Eight-week term examinations</td>
</tr>
<tr>
<td>19 (Sat)</td>
<td>Eight-week term closes</td>
</tr>
<tr>
<td>Sep 5 (Tue)</td>
<td>Quarter closes</td>
</tr>
<tr>
<td>5 (Tue)</td>
<td>Last day for filing University theses, D.M.A. final project, Ph.D. dissertations, and Notice of Intention for conferral of October (Summer Quarter) degree</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>1989-90</th>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer (8-week term)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First day of classes</td>
<td>Sep 27</td>
<td>Jan 9</td>
<td>Apr 3</td>
<td>June 26</td>
</tr>
<tr>
<td>Last day of Finals</td>
<td>Dec 15</td>
<td>Mar 23</td>
<td>June 13</td>
<td>Aug 18</td>
</tr>
<tr>
<td>Commencement</td>
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HISTORY OF THE UNIVERSITY

Stanford University is now embarked upon its "Centennial Years," a period for celebration and for reflection upon its past, for a clearer understanding of its present, and for exceptional opportunities to plan its future.

On November 14, 1885, Senator and Mrs. Leland Stanford executed the Founding Grant of The Leland Stanford Junior University. Three days later they called together the 24 prominent men who had been chosen to become the University's first trustees and presented them this historic document, which Leland Stanford himself had dictated without notes. This document, with various amendments, legislative acts, and court decrees, remains as the University's charter. In bold, sweeping language it stipulates that the objectives of the University are "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 as derived from the inalienable rights of man to life, liberty, and the pursuit of happiness."

The University bears the name of the Stanford's only child (although it is usually referred to simply as "Stanford University"). Leland Junior died of typhoid fever in Florence, Italy in 1884 just before his 16th birthday. His parents had come to California in 1852 and, although he was schooled as a lawyer, Mr. Stanford entered the mercantile business with his brothers in the gold fields. They established large scale operations in Sacramento, where Mr. Stanford became a leader in business and politics. He was one of the "Big Four" who built the transcontinental railroad and was elected Governor of California and later United States Senator. One of the founders of the Republican Party in California, he was an ardent follower of Abraham Lincoln and is credited with keeping California in the Union during the Civil War.

Almost immediately after the death of their son, the Stanfords decided to found a university in his memory on their vast country estate on the San Francisco Peninsula. Although they consulted with several of the presidents of leading institutions, they were not content to model their university after eastern schools. "Of all the young men who come to me with letters of introduction from friends in the East, the most helpless are college young men," the Governor said. But, as the Stanfords' thoughts matured, their ideas of "practical education" enlarged until they arrived at the concept of producing cultured and useful citizens who were especially prepared for personal success in their chosen professions. In a statement of the case for liberal education that was remarkable for its time, Stanford wrote, "I attach great importance to general literature for the enlargement of the mind and for giving business capacity. I think I have noticed that technically educated boys do not make the most successful businessmen. The imagination needs to be cultivated and developed to assure success in life. A man will never construct anything he cannot conceive."

The cornerstone was laid May 14, 1887, and instruction began October 1, 1891. At the dedication ceremony David Starr Jordan, first president, stressed what has been the constant task of the University: to strengthen its students as individuals so that they are better fitted to serve a leading role in a free society. "We hope," Dr. Jordan said on the opening day, "to give our students the priceless legacy of the educated man, the power of knowing what really is. The higher education should . . . help to free them from the dead hands of old traditions and to enable them to form opinions worthy of the new evidence each new day brings before them."

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, 10-year job of organizing the departments into schools. Several regroupings occurred thereafter, but since 1948 the School organization has been as follows: Business, Earth Sciences, Education, Engineering, Humanities and Sciences, Law, and Medicine.

Within the seven Schools there are approximately 70 departments. In addition there are more than 30 institutes, centers, programs, and laboratories that are not organized within the schools. Some of the major ones are the Center for Integrated Systems; the Center for Research in International Studies; the Hoover Institution on War, Revolution, and Peace; the Stanford Linear Accelerator Center; and the W. W. Hansen Laboratories of Physics.

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 1986 it was 517.

The University does not use any racial, religious, ethnic, geographic, or sex-related quotas in admissions. It is committed to the principles of Affirmative Action in the admission of students and in the employment of faculty and staff. Enrollment in Autumn Quarter 1987 totaled 13,292, of whom 6,571 were undergraduates and 6,721 were graduate students. Blacks, Hispanics, Puerto Ricans and Native Americans numbered 1,198 undergraduates and 489 at the graduate level. Stanford awarded 4,287 degrees in 1986-87, of which 1,628 were baccalaureate and 2,659 were advanced degrees.

Among the 1,354 faculty members who make up the Academic Council there are 9 Nobel laureates, 81 members of the National Academy of Sciences, 130 members of the American Academy of Arts and Sciences, 54 members of the National Academy of Engineering, 12 members of the National Academy of Education, 12 winners of the National Medal of Science, 24 members of the American Philosophical Society, and 5 Pulitzer Prize winners.

On October 12, 1980, the University inaugurated Donald Kennedy as its eighth president. Like Stanford's first president, he too is a widely known biologist and an innovator in education. Dr. Kennedy succeeded Richard W. Lyman whose 10 years in office were as troubled as any since Jordan's time; and yet he presided during a period that not only brought Stanford spectacular growth, but its maturity.

Books on Stanford history that are easily obtained in libraries and some bookstores are:

Clark, G. T., *Leland Stanford*, 1931
Elliott, O. L., *Stanford University: The First Twenty-five Years*, 1937

Books about Stanford that are out of print or hard to find are available to scholars from the University Archives, Green Library. The Stanford University Archives manuscript and archival collections now number more than six million items.
This section describes academic degree requirements 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 graduate 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 March and available, without charge, from the Registrar's Information Window, Old Union Lobby or from Catalog Mailing, Old Union, Stanford University, Stanford, CA 94305-3005. *Information* details Stanford University policies and practices regarding matters such as registration, tuition and fees, leaves of absence, academic standing, the Fundamental Standard and Honor Code, and student services.

**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 those candidates recommended by the Subcommittee on Academic Standing, Petitions, and Exceptions who have applied in advance for graduation (see deadlines in the *Time Schedule* calendar) and who have fulfilled the following requirements:

1. Completed 180 (quarter) units of University work.
2. Completed Writing, Distribution, and Language Requirements.
3. Completed curricular requirements of at least one major department or program and received its recommendation. (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 all major requirements as well as the Writing, Distribution, and Language 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.) also is conferred upon students who are candidates recommended by the Subcommittee on Academic Standing, Petitions, and Exceptions, and 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.

A maximum of 90 quarter units of credit for work done elsewhere may be counted toward the bachelor's degree at Stanford. (See the section on Transfer Credit in the *Information* bulletin.)

Undergraduate students who entered Stanford prior to September 1986, are limited to a total of 12 units of Physical Education activity courses and 24 units of ensemble Music courses to count toward graduation. There is no limit for either of these per quarter.

Undergraduate students entering Stanford in September 1986, or thereafter, may apply a maximum of 12 units in activity courses (Physical Education or Music) to the 180 units required for graduation. There is, however, no limit on the number of activity courses or units which may be taken in any given quarter.

The courses considered Physical Education activity courses will be designated by the Curriculum Committee of D-APER and those considered Music activity courses will be designated by the Department of Music.

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 Registrar's Office.

The degree of Bachelor of Science is con-
ferred upon candidates who fulfill these requirements in the Schools of Earth Sciences or Engineering, or in the Departments of Biological Sciences, Chemistry, Mathematics, and Physics in the School of Humanities and Sciences. The B.S. degree is also conferred upon candidates in the Programs in Mathematical and Computational Science, Medical Microbiology in the School of Medicine, Symbolic Systems, and, when appropriate, in Values, Technology, Science, and Society, as well as in the Program for Individually Designed Majors. 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 requirements are met, but diplomas are issued and commencement exercises are held only in June.

SECOND BACHELOR’S DEGREE

Stanford does not award a second Bachelor of Arts degree to an individual who already holds a Bachelor of Arts, nor a Bachelor of Science degree to an individual who already holds a Bachelor of Science.

The holder of a Bachelor of Arts degree from Stanford may apply to the Subcommittee on Academic Standing, Petitions, and Exceptions for admission to pursue a Bachelor of Science degree, and the holder of a Bachelor of Science degree may apply to pursue 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.

DUAL 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 131, Old Union, during the student’s 10th or 11th quarter. This statement is submitted on a standard petition form and should have the favorable recommendations of appropriate representatives of the two departments in which the student expects to receive degrees.

In order to qualify for both degrees, a student must complete the stated University and departmental requirements for each degree, and complete 15 full-time quarters (225 units), 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 coterminus degree program provides the opportunity for Stanford undergraduates to study for the bachelor’s and master’s degrees simultaneously in the same or a different department. Undergraduates with strong academic records may apply for admission to a coterminous master’s program as early as the eighth quarter (or upon completion of 105 units) and no later than the end of the 11th quarter of undergraduate study. Students with advanced placement and transfer units must apply at least four quarters in advance of the anticipated date of conferral of the master’s degree.

The requirements for a coterminous bachelor’s/master’s program are: (1) 180 units for the bachelor’s degree plus 36 (or the higher departmental requirement) unduplicated units for the master’s degree; (2) 15 full-tuition quarters of residency or three quarters after the quarter in which 180 units are completed. The requirements for the coterminous program with two undergraduate degrees are 180 units for the first bachelor’s degree, 45 units for the second bachelor’s degree, 36 to 45 units for the masters degree, and residency of six full tuition quarters after the quarter in which 180 units were completed, or a total of 18 full tuition quarters.

Each degree is applied for separately by the deadlines given in the University Time Schedule and calendars. The master’s degree must be conferred simultaneously with or after the bachelor’s degree.

Information and applications for the coterminous degree program are available in the Graduate Program office, or the Undergraduate Advising Center. Applications that have been recommended by the undergraduate and graduate departments should be submitted to the Graduate Program office. Final offers of admission to graduate programs are made by the Dean of Graduate Studies through the Graduate Program office.
As do all distinguished universities, 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, which significantly deepens understanding of one or two of these areas, and which prepares him or her for a lifetime of continual learning and application of knowledge to career and personal life. The distinguishing mark of the University is that its faculty is engaged in the discovery and creation of knowledge as well as in its dissemination. 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 pursuit of 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 undergraduate study programs 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, the Language Requirement, 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 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 important, 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.

The Language Requirement ensures that every student will gain a basic familiarity with a foreign language. Foreign language study extends the student's range of knowledge and expression in significant ways, providing access to materials and cultures that otherwise would be out of reach.

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

THE FRESHMAN WRITING REQUIREMENT

All instructors expect that students will express themselves effectively in speech and writing. The Freshman Writing Requirement helps students meet that expectation.

All candidates for the bachelor's degree, regardless of the date of matriculation, should satisfy the requirement during their first year at Stanford. Transfer students are individually informed at matriculation of their status vis-a-vis the requirement.

The Writing Requirement can be satisfied in four ways:

1. English 1-2, a two-quarter sequence of composition courses (Note: A few students who demonstrate sufficient skill in the first quar-
ter of the English 1-2 sequence will be exempted from English 2 upon certification by the instructor);

2. English 3, an intensified one-quarter course open only to students with a score of 4 or 5 on the CEEB Advanced Placement Test;

3. Special writing instruction in connection with the Western Culture program in the Structured Liberal Education (SLE) track and the English 7-8-9 track, "Literature and the Arts;" and

4. Approved transfer credit.

A complete list of Freshman English courses is distributed to all entering undergraduates and is also available at the Freshman English office.

Courses available to fulfill the Freshman Writing Requirement are designated DR:W in this bulletin.

THE DISTRIBUTION REQUIREMENTS

PURPOSE

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. Fulfillment 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, (C-US) under the authority of the Senate of the Academic Council, certifies courses which will fulfill the Distribution Requirements in the required areas of study. Information regarding specific courses that satisfy the Distribution Requirements and regarding individual student distribution status is available at the Registrar's Office. Course planning and advising questions related to the Distribution Requirements should be directed to the Undergraduate Advising Center.

It is the responsibility of each student to ensure that he or she has fulfilled the requirements by checking with the Registrar's Office. This check should be made at least two or three quarters before graduation. Specific details about course options are available at the Undergraduate Advising Center 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. The date of undergraduate matriculation at Stanford determines what requirements apply to any individual student. Note that the requirements are measured in courses of at least 3 units each.

CURRENT SYSTEM

To fulfill the Distribution Requirements, undergraduates who entered Stanford in Autumn Quarter 1980, and thereafter must take 10 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 2 through 8);

At least one of the courses in Areas 2 through 8 must be designated as concentrating on a non-Western culture.

The subject areas, and corresponding notational symbols, of these Distribution Requirements are as follows:

Area 1: Western Culture (one three-course sequence) (DR:1)

Area 2: Literature and Fine Arts (DR:2)

Area 3: Philosophical, Social, and Religious Thought (DR:3)

Area 4: Human Development, Behavior, and Language (DR:4)

Area 5: Social Processes and Institutions (DR:5)

Area 6: Mathematical Sciences (DR:6)

Area 7: Natural Sciences (DR:7)

Area 8: Technology and Applied Sciences (DR:8)

Note: At least one course must be certified as concentrating on a non-Western culture. The non-Western requirement may be satisfied by completing one course from among those courses certified for Areas 2-8 and designated with an asterisk, e.g., (DR:3*) or by completing one course on a list of routine substitutes drawn up annually by the Dean of Undergraduate Studies,
based on information provided by the departments, and approved by the C-US Subcommittee on Distribution Requirements.

Courses certified as meeting the Distribution Requirements must carry a minimum of 3 units of credit. Normally, a single course will be certified as fulfilling only one area of the Distribution Requirements. 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 who entered Stanford in Autumn Quarter 1980, and thereafter, courses which have been certified as satisfying the Distribution Requirements are annotated according to the symbols above to show how they fulfill the Distribution Requirements. A complete list of courses appears as an Appendix at the back of this bulletin.

CREDIT TRANSFER

Where students propose to use work taken at another college or university to satisfy a Distribution Requirement, the Office of the Registrar's Credit Evaluation staff will determine, after appropriate faculty consultation, whether the work is comparable to any of the specifically certified courses or course sequences.

PETITION

Students who have reason to believe their undergraduate program objectives are served by using some course(s) other than those specifically certified as satisfying the Distribution Requirements may present petitions, endorsed by their academic advisors and the Registrar's Graduation Assistant, to the Academic Standing Office, room 131, Old Union.

UNDERGRADUATES WHO ENTERED PRIOR TO AUTUMN 1980

Stanford has a long tradition of assuring curricular breadth through some system of requirements, variously described as “distribution requirements,” “general studies requirements,” or “general education.” Students returning to Stanford to complete interrupted degree programs can satisfy either the distribution program in place at the time of their matriculation or the current program of requirements. Such students should consult the Stanford University Bulletin appropriate to their original entrance year or seek the advice of the Registrar's Graduation Assistant, room 142, Old Union.

THE LANGUAGE REQUIREMENT

Undergraduates who entered Stanford in September 1982, or thereafter, are required to complete at least one year of college level study in a single foreign language. Alternatively, students may demonstrate, by a Stanford departmental examination, competency at a level comparable to the completion of the third quarter of first year foreign language study at Stanford. Students whom the Office of Undergraduate Admissions determines to have completed the third year course of one foreign language in high school will have satisfied this requirement.

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 must select a major by the time they achieve junior status (85 units completed). All undergraduate major programs listed in Courses and Degrees are open to all students except for certain Honors degree programs which require application and admission in advance. Students may change their majors 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, may formally 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 the following conditions must be met:

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), or
   b) overlapping courses enable the student to meet school requirements (e.g., for two majors within the School of Engineering).

3. At the time the student applies to graduate, the major departments or programs must be cognizant of the courses the student proposes to satisfy the declared majors and of the limitation of (2) above, and they must attest to the student's satisfaction of the pertinent major requirements.

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

PURPOSE OF THE MAJOR

A primary purpose of the major is to enable a student to investigate a subject area in 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, and how it is shaped by time and circumstances.

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 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 "Individually Designed Majors" section of this bulletin.

UNDERGRADUATE ACADEMIC ADVISING

The objective of the advising program is to assist students in assuming maximum responsibility for their academic programs. The Undergraduate Advising Center (UAC) provides and coordinates information and services which help student and advisor work together toward the establishment and accomplishment of the student's goals.

Freshmen are assigned to general academic advisors according to their residence and their preliminary academic interest. Each residence where freshmen live offers them the services of a group of advisors representing the major aca-
academic disciplines. While freshmen are assigned to one specific advisor, they have easy access to all members of the advising group. Freshman advisors work with advisees each quarter to plan their academic programs; advisors must sign Study List cards for each quarter of the students’ freshman year.

Sophomores who are undecided about their majors continue to work with the advisors with whom they were associated as freshmen, and to seek out their advisors’ guidance and signatures on their Study Lists. Sophomores whose advisors are no longer advising use the advisors at the UAC until they declare a major. All transfer students are advised by the Transfer Advising Coordinator in the UAC until they declare a major and/or become acclimated to Stanford. 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.

At the UAC, located on the first floor of Sweet Hall, advisors and students are given answers, or assistance in finding them, to all questions relating to academic matters. The UAC answers questions concerning: course selection, choosing a major, and planning for an academic career; graduate school and funding for graduate study both at Stanford and at other institutions in the U.S.; sophomore and transfer advising; individually designed majors; and preparing for business, law, medical school, or other allied health fields. A complete collection of graduate and undergraduate catalogs from other institutions is available, as well as reference guides to graduate and professional schools. Special programs run by the UAC are the Women’s Science and Engineering Network, and The Majors’ Event.

ADVANCED DEGREES

GENERAL REQUIREMENTS

For each Stanford advanced degree, there is an approved course of study which meets University and departmental requirements. The minimum unit requirements for Stanford advanced degrees are described later in this section. Where more than one advanced degree is received, each degree must represent at least 36 unduplicated units. The final units of a degree program, whether coursework, directed reading, or research, are to be completed at Stanford as a registered student.

Residency for an advanced degree is the time devoted to graduate study measured in tuition payments. The minimum residency requirement for an advanced degree is three full-tuition quarters or the equivalent in partial tuition. A full-tuition quarter is payment for 11 or more units per quarter during the academic year and 15 units in the Summer Quarter.

Specific departmental degree requirements are provided in the “Graduate Programs” section of each departmental segment of this catalog. Opportunities for individually designed, interdisciplinary study at the doctoral level are described in “Graduate Division Special Program.” Additional information on University requirements and procedures for obtaining advanced degrees is available from the Graduate Program Office, Building 590, room 104.

REGISTRATION REQUIREMENTS

Graduate students must register for all three quarters of the academic year (Autumn, Winter, and Spring) until the degree is conferred. Coursework and research are expected to be done on campus unless the department gives prior approval for study in absentia. Leaves of absence may be requested, in advance of departure, for up to one year.

Registration is required in the current or immediately preceding quarter in which a departmental project, thesis, or dissertation is submitted and/or a Notice of Intention to Complete Advanced Degree Requirements is filed for conferral of a degree.

The following registration categories are available to graduate students who are in the final stages of their degree programs:

1. Advanced Graduate Registration (AGR)—Doctoral students who have been admitted to candidacy, registered for all required courses, and completed nine quarters of residency may request Advanced Graduate Registration status for 9-unit registration.

2. Terminal Graduate Registration (TGR)—Doctoral students who have been admitted to candidacy, completed all required coursework, accrued 10.5 quarters of residency, and submitted a Doctoral Dissertation Reading Committee form may use Terminal Graduate Registration status to complete their dissertation. Students enrolled in master’s programs may qualify for TGR status upon completion of all required coursework and three quarters of residency only if their program requires a thesis or departmental project. TGR status for the Engineer program may be obtained after admission to candidacy, completion of all required courses, and six quarters of residency.
A one quarter TGR authorization is available to graduate students who have completed all degree requirements, are returning after a leave of absence or reinstatement, and who must register only to take a University Oral Examination, submit a thesis or dissertation, or file a Notice of Intention to Complete Advanced Degree Requirements (the final request for conferral of a degree).

3. Graduate Final Requirement Registration
—Graduate students who have only a few remaining units to complete degree requirements or to qualify for AGR or TGR status may register for one quarter on a unit basis to cover the deficiency. This status may be used only once during a degree program.

Additional information on these registration categories is available from the Graduate Program office.

ADDITIONAL DEGREES AND CHANGES OF MAJOR OR DEGREE LEVEL

Graduate students who wish to obtain an additional degree or change to a new degree program must obtain departmental and graduate division approval on the Application for Additional Degree or to Change Major or Intended Degree Level. This form, available from offices in the Graduate Administrative Center, must be submitted to the Associate Dean of Graduate Studies, Building 590.

Students who seek a degree in a department in which they were not originally admitted may be required to provide additional information to the second department, such as advanced subject GRE scores, letters of recommendation, or a new statement of purpose. An additional graduate application fee is not required. Foreign students must file a new Verification of Financial Resources form available from the Graduate Awards Office before approval will be granted.

MASTER OF ARTS AND MASTER OF SCIENCE

Upon recommendation to the Senate of the Academic Council by the faculty of the major department and the Committee on Graduate Studies, the degrees of Master of Arts (A.M.) and Master of Science (M.S.) are conferred on students who have satisfactorily completed at least three full-tuition quarters of residency as graduate students in the University and have fulfilled other requirements prescribed by the school or department concerned. The University minimum unit requirement for the A.M. and M.S. degrees is 36 units earned at Stanford as a graduate student. Most departments require more. Up to 9 units of graduate work done at another university may be used to meet departmental requirements that exceed the 36 unit minimum. The residency requirement of three full-tuition quarters remains unchanged.

In the first quarter of enrollment in a master's program, students must submit a Program Proposal for a Master's Degree for approval by the department and the graduate division. Authorization to register for master's programs expire three years from the first quarter of enrollment in the program. Extensions beyond the third year require review of academic progress and approval by the department and the graduate division.

If a thesis is a degree requirement, three 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 in which the degree is to be conferred. Directions for the preparation and submission of theses are available in the Graduate Program Office, Building 590, room 104.

A second Stanford master's degree requires an additional 36 unduplicated units and an additional three quarters of residency.

MASTER OF ARTS IN TEACHING

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Education and the Committee on Graduate Studies, the Master of Arts in Teaching (M.A.T.) is conferred on candidates who have completed at least three full-tuition quarters of residency as a graduate student at the University and have fulfilled other requirements prescribed by the School of Education and one of the academic departments participating jointly in the program. The program is reserved for experienced teachers or for individuals who have previously completed a program of teacher preparation.

MASTER OF FINE ARTS

Upon recommendation to the Senate of the Academic Council by the faculty of the Art Department and the 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 full-tuition quarters of residency as a graduate student at the University and have fulfilled other requirements prescribed by the School of Education and one of the academic departments participating jointly in the program. The program is reserved for experienced teachers or for individuals who have previously completed a program of teacher preparation.

MASTER OF BUSINESS ADMINISTRATION

Upon recommendation to the Senate of the Academic Council by the faculty of the Graduate School of Business and the 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.) The requirements for unduplicated units and residency for an A.M. or M.S. degree pursued concurrently with the M.B.A. degree are determined by the department offering the master's degree.

**EDUCATIONAL SPECIALIST**

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Education and the Committee on Graduate Studies, the degree of Educational Specialist (Ed.S.) is conferred on candidates who have completed a minimum of three full-tuition quarters of residency and a program of study, as outlined on the Application for Candidacy, of 45 units of coursework at Stanford beyond a master's degree (or its equivalent). A field based project is also required.

**ENGINEER**

Upon recommendation to the Senate of the Academic Council by the faculty of the major department and the Committee on Graduate Studies, the degree of Engineer is conferred on candidates who have been admitted to candidacy, have satisfactorily completed six full-tuition quarters of residency as a graduate student (of which a minimum of three quarters and 36 units must be in residence at Stanford), have presented an acceptable thesis, and have fulfilled other requirements prescribed by the major school or department.

Three 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 in which the degree is to be conferred.

A fee is charged 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 study 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.

Upon recommendation to the Senate of the Academic Council by the Faculty of the School of Law and the Committee on Graduate Studies, the degree of Master of Legal Studies is conferred upon candidates 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**

Upon recommendation to the Senate of the Academic Council by the Faculty of the School of Law and the Committee on Graduate Studies, the Master of Jurisprudence is conferred upon candidates who have successfully completed the first year of the J.D. program plus an additional year of full-time law study. The J.M. degree is a non-professional degree which terminates a course of study at the School of Law. 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. Candidates may elect to take the degree in the early spring of their second year.

**DOCTOR OF EDUCATION**

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Education and the Committee on Graduate Studies, the degree of Doctor of Education (Ed.D.) is conferred on candidates who have satisfied the requirements of the School of Education and the University. See the “Doctor of Philosophy General Regulations” section in this bulletin.

**DOCTOR OF MUSICAL ARTS**

Upon recommendation to the Senate of the Academic Council by the faculty of the Department of Music and the 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 work and a final project appropriate to the area of concentration are required. See the "Doctor of Philosophy General Regulations" section in this bulletin.

DOCTOR OF JURISPRUDENCE

Upon recommendation to the Senate of the Academic Council by the faculty of the School of Law and the Committee on Graduate Studies, the degree of Doctor of Jurisprudence (J.D.) is conferred upon candidates 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 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.

The degree is primarily designed for those qualified students who hold a J.D. or its equivalent and 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 Stanford Law School Bulletin.)

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 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 Stanford Law School Bulletin.)

DOCTOR OF MEDICINE

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

DOCTOR OF PHILOSOPHY

GENERAL REGULATIONS

Upon recommendation to the Senate of the Academic Council by the faculty of the major department and the 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.

Candidates for the Ph.D. degree must satisfactorily complete a three year program of study that includes 72 units of graduate course work and research done at Stanford and nine full-tuition quarters of residency. To promote diversity and depth in the doctoral program, the graduate division requires that at least three units be taken with each of four Stanford faculty members. A doctoral program may include a master's or Engineer degree. However, the minimum requirements for a doctoral degree taken after another Stanford advanced degree are three quarters of residency and 36 units of unduplicated work.

A maximum of three quarters of residency and 36 units for graduate work done elsewhere may be applied to the Stanford doctoral program requirements following review by the department and the Graduate Program Office. Students can apply for credit for prior academic work only after the first quarter at Stanford. Students who wish to receive credit for graduate work done at another institution during the course of their Stanford program must receive prior approval.

CANDIDACY

Admission to candidacy for the doctoral degree is an acknowledgement of the student's potential to complete successfully the requirements for the Ph.D. Students are expected to complete departmental qualifying procedures and apply for candidacy by the end of the second year of doctoral study. The Application for Candidacy specifies a departmentally approved three year program of study to fulfill degree requirements. If the program includes a minor, approval by the department awarding the minor is also required. Applications for Candidacy are reviewed by the Graduate Program Office and
valid for five years unless terminated by the department for unsatisfactory progress. Extensions of candidacy require review of the student's progress by the department and the graduate division, and a timetable for completion of the dissertation.

**TEACHING REQUIREMENTS**

A number of departments require their students to teach for one or more quarters during their doctoral program. Detailed information is included in the departmental sections of this bulletin.

**FOREIGN LANGUAGE REQUIREMENT**

Some departments require doctoral candidates to have reading knowledge of one or more foreign languages as indicated in departmental sections of this bulletin. Fulfillment of language requirements is endorsed by the chair of the major department on the Foreign Language Report form which is submitted to the Graduate Program Office.

**DOCTORAL DISSERTATION READING COMMITTEE**

The Doctoral Dissertation Reading Committee consists of the principal dissertation adviser and two other readers. At least one member must be from the major department. All members must be on the Academic Council. (On occasion, permission for appointment of a reader who is not on the Academic Council may be approved by the Graduate Program Office if that person contributes an area of expertise that is not readily available from the faculty.) In addition, a chair of the examining committee is appointed by the Dean of Graduate Studies through the Graduate Program Office. The chair cannot be from the student's department or from any department represented by a committee member.

The University Oral Examination Schedule must be submitted to the Graduate Program Office at least three weeks prior to the proposed examination date. The official period for scheduling University oral examinations is from the third week to the last day of classes each quarter. The examination is conducted according to the major department's adopted practice, but it should not exceed three hours in length and it must include a period of private questioning.

The candidate passes the examination if the examining committee casts four favorable votes out of five or six, five votes out of seven, or six votes out of eight. Five members present and voting constitute a quorum. If the committee votes to fail a student, the committee chair sends within five days a written evaluation of the candidate's performance to the major department. Within 30 days and after discussion with the student, advisor, and appropriate faculty members, the chair of the student's major department must send the student a written statement indicating the final action of the department. Copies of the statement from the chair of the examining committee and the chair of the department should also be sent to the Dean of Graduate Studies and the Graduate Program Office.

**DISSERTATION**

The doctoral dissertation is expected to be an original contribution to scholarship or scientific knowledge and to exemplify the highest standards of the discipline. The dissertation is approved for the school or department by the Doctoral Dissertation Reading Committee. Each member of the reading committee signs the signature page of the dissertation to certify that the work is of acceptable scope and quality. One reading committee member reads the dissertation in its final form and certifies on the Certificate of Final Reading that departmental and University specifications have been met.
Dissertations must be in English. Exceptions are granted by the Graduate Dean only upon submission of a written request from the chair of the student's major department. Approval for writing the dissertation in another language is normally granted only in cases where the other language or literature in that language is also the subject of the discipline. Dissertations written in another language must include an extended summary in English.

Directions for preparation of the dissertation and abstract are available from the Graduate Program Office. Four copies of the dissertation and an abstract of less than 350 words must be submitted to the Graduate Program Office on or before the last day of classes in the quarter in which the degree is conferred. Two copies of the bound dissertation are sent to the Stanford University Library and one copy goes to the major department. A fourth copy is sent to University Microfilms in Ann Arbor, Michigan from whom microfilm copies may be ordered. Additional copies for personal use may be submitted for binding. A fee is charged for microfilming and binding copies of the dissertation as well as for publishing the abstract.

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. This status is granted for one academic year only. Any extension of enrollment privileges into the next academic year requires approval in writing from the Graduate Admissions Office. A nonmatriculated student who later applies for admission to a degree program must meet the standard admission requirements and should not anticipate special priority because of work completed as a nonmatriculated student. Students who are admitted to a degree program may apply a maximum of one quarter of nonmatriculated study toward a master's degree and two quarters toward an Engineer or Ph.D. degree.

Information and applications for nonmatriculated status during the academic year are available from the Graduate Admissions Office. Applicants interested in nonmatriculated status for only the Summer Quarter apply 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 met.
Note—Unless otherwise specified, courses numbered from 1 to 99 inclusive are primarily for first- and second-year undergraduates; courses numbered from 100 to 199 inclusive are for third- and fourth-year undergraduates; and those from 200 to 499 inclusive are for graduate students.

Courses in this bulletin are marked to indicate their availability to fulfill Writing and Distribution Requirements for undergraduates entering Autumn Quarter, 1980-81, and thereafter. The complete list of courses fulfilling the Requirements for the present academic year will be found in the section “Appendix” in this bulletin. Graduate students should ignore the various (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 10-week courses.

This bulletin includes, for the Summer Session, only those courses that can be tentatively scheduled at publication time by each department. For the complete list of courses and faculty, requests should be made for the Stanford University Bulletin, Summer Session, issued each February.

Dean: Robert K. Jaedicke

Associate Deans: Charles P. Bonini, Paul R. Johnson, Carol F. Marchick, James M. Patell, D. John Roberts

Assistant Dean: Jeffrey H. Moore


Professor (Teaching): George C. Parker


Courtesy Associate Professor: Timothy F. Bresnahan

Senior Lecturer: Steven C. Brandt


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 (M.B.A) 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 have two or more years managerial experience and to include some mathematics and economics in their undergraduate programs. Possible options within the M.B.A. Program include a specialty in Public Management, and a program leading to the joint J.D./M.B.A. degree.

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

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

For detailed information on programs, curricula, and faculty write to the Graduate School of Business, Stanford University, Stanford, California 94305-5015 for the current bulletin.
The School of Earth Sciences includes the Departments of Applied Earth Sciences, Geology, Geophysics, and Petroleum Engineering. The aims of the school are: (1) to prepare students for careers in the fields of geology, geochemistry, geophysics, petroleum engineering, petroleum geology, geomechanics hydrogeology, 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 Master of Science, Engineer, and Doctor of Philosophy as described below. Details of individual degree programs will be found in the section for each department.

UNDERGRADUATE PROGRAM

There are no special examinations or prerequisite course requirements for admission to the School of Earth Sciences. 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 assigned to an academic advisor who is 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 facilitate 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. 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. Each department offers an Honors program which involves research during the senior year.

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. A third option permits the students to earn the degrees in two different departments or even in different schools, e.g., a B.S. in Physics and an M.S. in Geology. 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 sections 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 departments. Applications should be filed by January 1 for awards which become effective in Autumn Quarter the following school year.

APPLIED EARTH SCIENCES

Emeriti: Evan Just, Konrad B. Krauskopf (Affiliated Faculty), Frederick C. Kruger, Charles F. Park, Jr.
Chairman: André G. Journel
Associate Chairman: George A. Parks
Associate Professors: Simon C. Brassell*, Steven M. Gorelick, Stephan A. Graham* (on leave, Autumn, Winter)
Affiliated Faculty: James O. Leckie** (Professor), Ken Belitz, Paul Hsieh, Warren K. Kourt, Jacob Rubin, Ward C. Smith, Eugene Thiers (Consulting Professors)
Senior Lecturer: George Mader

OFFERINGS

Undergraduate—The Department of Applied Earth Sciences offers an undergraduate major in Applied Earth Sciences in the following programs:

Earth Resources
Environmental Earth Sciences
Land Resources Planning

Graduate—The Department of Applied Earth Sciences offers a graduate major in Applied Earth Sciences in the following programs:

Applied Earth Sciences
Applied Hydrogeology
Geologic Remote Sensing
Geomathematics in Process Simulation and Petroleum Resource Analysis
Geomechanics
Geostatistics for Natural Resources Characterization

Financial Aid—Scholarships, fellowships, and research grants are available to students in the School of Earth Sciences. Detailed information is available from the departments. Applications should be filed by January 1 for awards which become effective in Autumn Quarter the following school year.

APPLIED EARTH SCIENCES

Low Temperature Aqueous Geochemistry
Ore Deposits and Exploration
Petroleum Geology

Students who enroll in one of these predefined programs may have the program designated on their diploma.

A general degree in Applied Earth Sciences (A.E.S.) is available for students with specialized objectives consistent with the scope of the department. The diploma will not list these "special" programs. At the graduate level, the department welcomes applicants from any scientific or engineering discipline who are interested in Applied Earth Sciences.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

EARTH RESOURCES

The Earth Resources program is intended for students whose career objectives include the business and management aspects of Earth Sciences commodities. The program consists of a basic core and an in-depth option dealing with one of four categories of Earth Resources commodities. The specializations available are (1) land, (2) mineral resources, (3) oil and gas, and (4) water. Students from this program have entered graduate work in business, management, and law, as well as the Earth Sciences.

BASIC CORE

Course No. | Subject | Qtr. & Units
--- | --- | ---
A.E.S. 190 | Fundamentals of Geostatistics | A 3
A.E.S. 192 | Computing in Geology I | W 3
A.E.S. 193 | Introduction to Probability and Statistics in Earth Sciences | W 3-4
Math. 41, 42, 43 | Calculus and Analytic Geometry | A,W,S 15
Op. Res. 50, 150, 152, A.E.S. 136 | or Engr. Econ. Syst. 105 | 3
Total | | 27-28

Business and Economics

Econ. 1 | Elementary Economics | A,W,S 5
Engr. 60 | Engineering Economics | A,W,S 3
Indust. Engr. 133 | Industrial Accounting | A,S 3
Total | | 11

Chemistry and Earth Sciences

Chem. 31 | Chemical Principles | A,W 4
Geol. 1 | Interpreting the Earth | A,W,S 5
Geol. 80 | Rocks and Minerals | S 5
Geol. 102 | Introduction to Field Geology | Sum 3
Geol. 110A | Structural Geology | W 3
Total | | 20
### Earth Sciences Commodity

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 1</td>
<td>Introduction to Earth Resources</td>
<td>W 3</td>
</tr>
<tr>
<td>A.E.S. 100</td>
<td>Management of Earth Resources</td>
<td>S 3</td>
</tr>
<tr>
<td>A.E.S. 145</td>
<td>Mineral Economics</td>
<td>S 3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Earth Sciences Commodity Land

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 130, 131, 132</td>
<td>Environmental Earth Sciences</td>
<td>A, W, S 15</td>
</tr>
<tr>
<td>A.E.S. 133</td>
<td>Measurement of the Environment</td>
<td>S 3</td>
</tr>
<tr>
<td>Civ. Engr. 139</td>
<td>Introduction to Urban Planning</td>
<td>W 3</td>
</tr>
<tr>
<td>Urban Studies 170</td>
<td>Introduction to Urban Design</td>
<td>W 5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>26</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Earth Sciences Commodity Mineral Resources

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 120</td>
<td>Introduction to Mineral Deposits</td>
<td>A 4</td>
</tr>
<tr>
<td>A.E.S. 124</td>
<td>Mineral Processing and Metal Extraction</td>
<td>A 2</td>
</tr>
<tr>
<td>Chem. 33</td>
<td>Structure and Reactivity or Chem. 135</td>
<td>Physical Chemical Principles</td>
</tr>
<tr>
<td>Geol. 170</td>
<td>Introduction to the Chemistry of the Earth</td>
<td>A 4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13-14</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Earth Sciences Commodity Oil and Gas

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 102</td>
<td>Decision Analysis in Resource Exploration</td>
<td>W 3</td>
</tr>
<tr>
<td>A.E.S. 251</td>
<td>Oil Field Exploration and Development</td>
<td>S 3</td>
</tr>
<tr>
<td>A.E.S. 252</td>
<td>Sedimentary Basins</td>
<td>A 3</td>
</tr>
<tr>
<td>A.E.S. 253</td>
<td>Petroleum Geology and Exploration</td>
<td>S 3</td>
</tr>
<tr>
<td>A.E.S. 258</td>
<td>Role of Fluids in Geologic Processes</td>
<td>W 2</td>
</tr>
<tr>
<td>Geol. 151</td>
<td>Sedimentary Geology and Petrography</td>
<td>W 4</td>
</tr>
<tr>
<td>Geophys. 180</td>
<td>Geologic Interpretation of Reflection Seismograms</td>
<td>W 3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Earth Sciences Commodity Water

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 135</td>
<td>Soil Science</td>
<td>A 4</td>
</tr>
<tr>
<td>A.E.S. 230</td>
<td>Hydrogeology</td>
<td>W 5</td>
</tr>
<tr>
<td>A.E.S. 258</td>
<td>Role of Fluids in Geologic Processes</td>
<td>W 2</td>
</tr>
<tr>
<td>Civ. Engr. 160</td>
<td>Water Resources</td>
<td>A 4</td>
</tr>
<tr>
<td>Civ. Engr. 270</td>
<td>Movement, Fate, and Effects of Contaminants in Surface Waters and Groundwater</td>
<td>A 3</td>
</tr>
<tr>
<td>Engr. 21</td>
<td>Mechanics of Fluids</td>
<td>A, S 4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Environmental Core

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 192</td>
<td>Introduction to Probability and Statistics in Earth Sciences</td>
<td>W 3-4</td>
</tr>
<tr>
<td>Geol. 102</td>
<td>Structural Geology</td>
<td>W 3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>47</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Environmental Programs

Two environmental programs are offered: Environmental Earth Sciences and Land Resources Planning. Both programs have a common core that provides a basic environmental and geological background and analytical tools. In addition, each of the programs has individual requirements consistent with the program objectives.

### COMMON ENVIRONMENTAL CORE

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 1</td>
<td>Introduction to Earth Resources</td>
<td>S 3</td>
</tr>
<tr>
<td>A.E.S. 130, 131, 132</td>
<td>Environmental Earth Sciences</td>
<td>A, W, S 15</td>
</tr>
<tr>
<td>A.E.S. 133</td>
<td>Measurement of the Environment</td>
<td>S 3</td>
</tr>
<tr>
<td>Chem. 135</td>
<td>Physical Chemical Principles</td>
<td>W, S 3</td>
</tr>
<tr>
<td>Geol. 1</td>
<td>Interpreting the Earth</td>
<td>A, W, S, Sum 5</td>
</tr>
<tr>
<td>Geol. 90</td>
<td>Rocks and Minerals</td>
<td>S 5</td>
</tr>
<tr>
<td>Geol. 102</td>
<td>Introduction to Field Geology</td>
<td>Sum 3</td>
</tr>
<tr>
<td>Math 19, 20</td>
<td>Analytic Geometry and Calculus or Math. 41</td>
<td>6</td>
</tr>
<tr>
<td><strong>Environmental Core Subtotal</strong></td>
<td><strong>47</strong></td>
<td></td>
</tr>
</tbody>
</table>

### ENVIRONMENTAL EARTH SCIENCES

The Environmental Earth Sciences program is for students primarily interested in the Earth Sciences aspects of the environment. Former students have entered graduate programs of study in city and regional planning, engineering, landscape architecture, law, and sciences.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 193</td>
<td>Introduction to Probability and Statistics in Earth Sciences</td>
<td>W 3-4</td>
</tr>
<tr>
<td>Geol. 110A</td>
<td>Structural Geology</td>
<td>W 3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>93-96</strong></td>
<td></td>
</tr>
</tbody>
</table>

### LAND RESOURCES PLANNING

The Land Resources Planning Program prepares 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.
Course No. | Subject | Qtr. & Units
--- | --- | ---
| Common Environmental Core | 47
A.E.S. 145. Mineral Economics | S 3
Civ. Engr. 130. Introduction to Urban Planning | W 3
Civ. Engr. 170. Environmental Science and Technology | A 3
Civ. Engr. 171. Environmental Planning | W 3
Econ. 1. Elementary Economics | A, W, S 5
Geol. 2. Earth History | A 3
Geol. 150. The Oceans: An Introduction to the Marine Environment | W 3
Stat. 60. Introduction to Statistical Methods I | A,W,S, 5
Urban Studies 170. Introduction to Urban Design | W 5
One Course From:
Urban Studies 171. Urban Design Studio | S 5
Urban Studies 183. Transportation Policy | S 3
Urban Studies 184. Facility Siting | S 3
One Course From:
Anthro. 146. Urban Problems in Anthropological Perspective | W 5
Soc. 150. Urban Sociology | A 5
One Course From:
Art 3. Introduction to the History of Architecture | S 4
Art 175A,B. Modern Architecture I or II | W,S 4
Art 176. American Architecture and Urbanism | W 4
Total | 92-94

HONORS PROGRAM

The department offers a program leading to the degree of Bachelor of Science in Applied Earth Sciences with Honors. The program is available to seniors having letter grade indicators of at least 3.5.

1. Students should find a research project, either theoretical, field, or experimental.
2. The student shall submit his or her proposal to the Honors Subcommittee, which will decide on its suitability as an Honors project.
3. Course credit for the project will be assigned by the advisor within the framework of A.E.S. 199.
4. A written report of the work at its completion will be required for Honors.
5. 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.
6. The decision as to whether a given independent study project does or does not merit an 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 entire academic record.

7. The work done on the Honors program should not be used as a substitute for regularly required courses.

GRADUATE PROGRAMS

The department's graduate programs prepare students for careers focused on application of the earth sciences in mineral, energy, and water resources, and environmental management. The programs lead to the degrees of 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.

Graduate students must maintain a letter grade indicator of "B" in the School of Earth Sciences and equivalent status in other schools.

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 are outlined in the "Advanced Degrees" section of this bulletin.

Applied Earth Sciences (A.E.S.) requires a minimum of 45 units of course work including the departmental Core Curriculum. A thesis or Master's Report is required, but no more than 15 units of thesis research may be used to satisfy the 45-unit basic requirement. Some students will be required to make up background deficiencies. No more than 9 units of deficiencies may be applied toward satisfaction of the basic 45-unit requirement.

Each student must take the Core Curriculum and one Specialization Core Curriculum.

REQUIRED BACKGROUND COURSES

Courses listed under this requirement are "deficiencies" if taken during the M.S. career at Stanford:

- Calculus and Analytic Geometry: the equivalent of Math. 41, 42, and 43.
- General Geology: the equivalent of Geology 1
- Mineralogy and Petrology: the equivalent of Geology 80.
- Skill in a computer programming language: the equivalent of, e.g., Comp. Sci. 3.
### REQUIRED M.S. CORE CURRICULUM

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-4 units: 1 course from:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 120.</td>
<td>Introduction to Mineral Deposits</td>
<td>3-4</td>
</tr>
<tr>
<td>Geol. 110A,B</td>
<td>Structural Geology</td>
<td>3 each</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-4 units: 1 course from:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 233.</td>
<td>Measurement of the Environment:</td>
<td>4</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>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3 units: 1 course from:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math. 103.</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6-7 units: 2 courses from:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 102.</td>
<td>Decision Analysis in Resource Exploration</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 190.</td>
<td>Fundamentals of Geostatistics</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 192.</td>
<td>Computing in Geology I</td>
<td>3</td>
</tr>
<tr>
<td>A.E.S. 193.</td>
<td>Introduction to Probability and Statistics in Earth Sciences</td>
<td>3-4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-5 units: 1 course from:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.E.S. 280.</td>
<td>Rock Mechanics and Advanced Structural Geology</td>
<td>4</td>
</tr>
<tr>
<td>Civ. Engr. 301.</td>
<td>The Creation and Solution of Environmental Models</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 62.</td>
<td>Introduction to Operations Research I</td>
<td>4</td>
</tr>
<tr>
<td>Engr. Eco. Syst. 208.</td>
<td>The Art of Mathematical Modeling</td>
<td>3</td>
</tr>
</tbody>
</table>

18-23 total units are to be in the Required Departmental Core.

### APPLIED HYDROGEOLOGY

All students in the Applied Hydrogeology Program are expected to have completed a prior degree in a science or engineering discipline, including courses in elementary chemistry and physics, fluid mechanics, analytic geometry and calculus, computer science, statistics, and geology.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 135.</td>
<td>Soil Science</td>
<td>alt. A 4</td>
</tr>
<tr>
<td>A.E.S. 193.</td>
<td>Introduction to Probability and Statistics in Earth Sciences</td>
<td>W 3-4</td>
</tr>
<tr>
<td>A.E.S. 230.</td>
<td>Hydrogeology</td>
<td>W 5</td>
</tr>
<tr>
<td>A.E.S. 255.</td>
<td>Introduction to Groundwater Solute Transport</td>
<td>A 3</td>
</tr>
<tr>
<td>A.E.S. 255.</td>
<td>Role of Fluids in Geologic Processes</td>
<td>W 2</td>
</tr>
<tr>
<td>Civ. Engr. 160.</td>
<td>Water Resources</td>
<td>A 4</td>
</tr>
<tr>
<td>Civ. Engr. 270.</td>
<td>Movement, Fate, and Effects of Contaminants in Natural Waters</td>
<td>A 3</td>
</tr>
<tr>
<td>Civ. Engr. 361.</td>
<td>Soil Moisture and Groundwater</td>
<td>S 4</td>
</tr>
</tbody>
</table>

Total ........................................ 31-32

Additional course units may be chosen to further particular interests. For example, students interested in groundwater chemistry should consider a course sequence in water chemistry (see the program in "Low Temperature Aqueous Geochemistry" in this department).

### GEOLOGIC REMOTE SENSING

Remote Sensing covers a wide range of interrelated topics, best understood when studied with a strong geologic background. Specializations may be taken in the following application areas, each with its own set of further requirements: Exploration/Ore Deposits, Exploration/Petroleum, Geomathematics, Hydrogeology, or Environmental Geoscience.

Students with non-geologic undergraduate degrees will be expected to correct their deficiencies.

### CORE CURRICULUM

**Required:**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 192.</td>
<td>Computing in Geology I</td>
<td>W 3</td>
</tr>
<tr>
<td>A.E.S. 193.</td>
<td>Introduction to Probability and Statistics in Earth Sciences</td>
<td>W 3-4</td>
</tr>
<tr>
<td>A.E.S. 233.</td>
<td>Measurement of the Environment:</td>
<td>S 3-4</td>
</tr>
<tr>
<td>A.E.S. 280.</td>
<td>Rock Mechanics and Advanced Structural Geology</td>
<td>A 4</td>
</tr>
<tr>
<td>Geol. 110A.</td>
<td>Structural Geology</td>
<td>W 3</td>
</tr>
<tr>
<td>Geophys. 190.</td>
<td>General Geophysics</td>
<td>A 4</td>
</tr>
</tbody>
</table>

Total ........................................ 23-25

### SPECIALIZATION CURRICULUM

**Required:**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 120.</td>
<td>Introduction to Mineral Deposits</td>
<td>W 3-4</td>
</tr>
<tr>
<td>A.E.S. 190.</td>
<td>Fundamentals of Geostatistics</td>
<td>A 3</td>
</tr>
<tr>
<td>A.E.S. 256.</td>
<td>Photogeology and Radar</td>
<td>alt. A 3-4</td>
</tr>
<tr>
<td>A.E.S. 257.</td>
<td>Lithological Mapping</td>
<td>alt. A 3-4</td>
</tr>
<tr>
<td>Geophys. 180.</td>
<td>Reflection Seismograms</td>
<td>W 3</td>
</tr>
</tbody>
</table>

Total ........................................ 16-23

### OPTIONAL

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. Eco. Syst. 234.</td>
<td>Artificial Intelligence for Decision Analysis</td>
<td>A 4</td>
</tr>
<tr>
<td>Math. 130.</td>
<td>Differential Equations</td>
<td>A,W,S 3</td>
</tr>
</tbody>
</table>

Total ........................................ 7

### GEOMATHEMATICS IN PROCESS SIMULATION AND PETROLEUM RESOURCE ANALYSIS

This program focuses on the use of mathematics in exploration for petroleum and in analyzing petroleum resource potential. Stress is placed on analyzing and simulating petroleum-bearing sedimentary basins, including the use of detailed, dynamic three-dimensional computer simu-
lation models that represent interdependent geologic processes that create sedimentary basins.

The following courses form the general curriculum and include courses selected from the Applied Earth Sciences (A.E.S.) core curriculum. Substitutions in the program based on research needs may be approved by petition. A formal thesis is required for the M.S. degree.

**Course No.  Subject  Qtr. & Units**

- A.E.S. 102. Decision Analysis in Resource Exploration  W 3
- A.E.S. 192. Computing in Geology I  W 3
- A.E.S. 193. Introduction to Probability and Statistics in Earth Sciences  W 3-4
- A.E.S. 251. Oil Field Exploration and Development  S 3
- A.E.S. 252. Sedimentary Basins  A 3
- A.E.S. 253. Petroleum Geology and Exploration  S 3
- A.E.S. 258. Role of Fluids in Geologic Processes  W 2
- Geophys. 180. Geologic Interpretations of Reflection Seismograms  W 3

**Total 29-30**

Additional courses may be selected from other departments with choices influenced by the student's interests and relevance of the courses to the thesis topic. Students are expected to begin work on a thesis not later than the beginning of the third quarter of enrollment in the program. Relevant courses include those in computer science, decision analysis, engineering-economic systems, fluid mechanics, geology, geophysics, geostatistics, operations research, petroleum reservoir analysis, statistics, and well-log analysis. In addition, up to 12 credit units may be received for thesis research.

**GEOMECHANICS**

Graduate students may specialize in the Geomechanics Program by arranging a curriculum of courses and research, tailored to their specific needs, that is approved by petition to the faculty. This curriculum should include the Applied Earth Sciences Department M.S. Core Curriculum, A.E.S. 280, 281, 282, 283, and 386A,B,C. Courses are offered in the Departments of Geophysics and Geology, and from the School of Engineering to round out the curriculum. In particular, courses from the fields of tectonophysics, tectonics, and structural geology, as well as applied mechanics and materials science are recommended. A list of these courses is available upon request. A thesis is required for the M.S. degree. Correspondence with Professor Pollard before application is suggested to clarify the nature of the program.

Research opportunities in geomechanics involve problems related to earthquake and volcanic hazards, and to the recovery of natural resources. The focus is on rock fractures including faults, dikes, veins, joints, and solution surfaces. Students characterize fractures by detailed geologic mapping of ancient and active structures. Solid, fluid, and fracture mechanics are used to analyze the fracture processes, and experimental investigations include model studies of crack propagation and measurement of fracture toughness. Current fracture research ranges from investigations of microracks, to structural studies of faults and joints, and analyses of volcanic rift zones. Effective research projects combine field mapping, laboratory investigation, and theoretical analysis.

**GEOSTATISTICS FOR NATURAL RESOURCES CHARACTERIZATION**

All applicants to this program are expected to have an undergraduate background in earth sciences (geology, mining, petroleum, and civil engineering). The program is open to B.S. students in Math./Statistics provided that they make up for their Geology deficiency (Geol. 1-80).

The program focuses on modeling patterns of time and space dependence of attribute values (porosity-permeability-mineral grades). These models allow mapping of these attributes with assessment of uncertainty and generation of alternative, equiprobable, numerical models of the spatial distribution. These numerical models can be used to assess the need for additional information and plan production (mining, oil recovery, pollution control, etc.).

**SPECIALIZATION CURRICULUM**

**Course No.  Subject  Qtr. & Units**

- A.E.S. 290. Geostatistics for Exploration and Development  A 5
- A.E.S. 291. Practice of Geostatistics on Exhaustive Data Bases  W 5
- A.E.S. 293. Topics in Advanced Geostatistics  S 3

**Total ................................. 13**

**OTHER RECOMMENDED COURSES**

**Course No.  Subject  Qtr. & Units**

- Comp. Sci. 135. Numerical Methods  W 3
- Engr. 62. Introduction to Operations Research  A,W 4
- Engr. 102W. Technical and Professional Writing  A,W,S 3
- Stat. 201A,B. Data Analysis I-II  W,S 3-5

**Total ................................. 13-15**

A thesis is required for the M.S. degree. A Ph.D. program in Geostatistics is available for advanced research and/or applications.
LOW TEMPERATURE AQUEOUS GEOCHEMISTRY

Courses and research opportunities in low temperature aqueous geochemistry are available in the Departments of Applied Earth Sciences (A.E.S.), Civil Engineering (C.E.), and Geology. Programs in the three departments overlap, but differ in the emphasis placed on applications. A.E.S. students usually have a strong interest in exploration or environmental problems and approach them from a geochemical or hydrogeological perspective. The Environmental Engineering Program in C.E. stresses engineering science in problem solving; the Geology Department emphasizes fundamental mineral physics, petrology, and geochemistry. Students who wish to specialize in aqueous geochemistry must take the departmental Core Curriculum, and may design an individual Specialization Curriculum, subject to faculty approval. A strong background in chemistry and physical chemistry, or additional coursework in these areas, is required. Experimental or analytical experience is recommended. Geochemical research in A.E.S. is process oriented employing experimental or theoretical methods, rather than field methods, in order to examine the problem at the most fundamental level possible. Sample curricula, clarification of programs, and lists of recent publications are available on request from Professors Parks (A.E.S.), Bird (Geology), or Leckie (C.E.).

CURRENT RESEARCH IN A. E. S. is concerned with adsorption, partitioning, and dissolution reactions at mineral surfaces. Students are investigating the rate controlling mechanisms in weathering of silicates, the atomic-scale structure and composition of both aqueous and adsorption complexes of transition metals, and computer algorithms for simulating the synergistic effects of inorganic water chemistry on adsorption of organic solutes in groundwaters.

ORE DEPOSITS AND EXPLORATION

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

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 in addition to the departmental Core Curriculum.

SPECIALIZATION CURRICULUM

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 220</td>
<td>Geochemistry of Mineral Deposits</td>
<td>W 5</td>
</tr>
<tr>
<td>A.E.S. 277</td>
<td>Field Mapping Mineral Deposits</td>
<td>S 3</td>
</tr>
</tbody>
</table>

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

A.E.S. 120. Introduction to Mineral Deposits
A.E. 102, 103A, B. Field Geology
A.E. 152. Stratigraphic Geology
A.E. 161. Mineralogy
A.E. 170. Introduction to Geochemistry
A.E. 181, 182. Igneous and Metamorphic Petrology

PETROLEUM GEOLOGY

Petroleum Geology is a broad subject embracing aspects of many subdisciplines of the earth sciences. Students entering the Petroleum Geology M.S. Program may have diverse backgrounds and career interests, and the program is intended to provide flexibility to accommodate these differences. At the same time, the program includes required courses chosen to equip students with concepts and tools fundamental to petroleum geology and exploration.

In addition to taking required courses from the A.E.S. core curriculum, each student must fill the requirements of the following specialization curriculum in Petroleum Geology.

REQUERED COURSES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.E.S. 251</td>
<td>Oil Field Exploration and Development</td>
<td>S 3</td>
</tr>
<tr>
<td>A.E.S. 252</td>
<td>Sedimentary Basins</td>
<td>A 3</td>
</tr>
<tr>
<td>A.E.S. 253</td>
<td>Petroleum Geology</td>
<td>A 3</td>
</tr>
<tr>
<td>Pet. Engr. 150A</td>
<td>Well Log Analysis</td>
<td>A 4</td>
</tr>
<tr>
<td>Pet. Engr. 150B</td>
<td>Well Log Analysis</td>
<td>W 2</td>
</tr>
</tbody>
</table>

Total 15

ELECTIVE COURSES

Each student must take 3 courses for credit from the following:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 218</td>
<td>Seminar in Sedimentary Geology</td>
<td>S 3</td>
</tr>
<tr>
<td>Geol. 251</td>
<td>Continental Margins</td>
<td>A 4</td>
</tr>
<tr>
<td>Geol. 254</td>
<td>Sedimentary Facies</td>
<td>A 3</td>
</tr>
</tbody>
</table>

Total 15
Course No. | Subject | Units
--- | --- | ---
Geol. 278 | Organic Geochemistry | W 2
Total | 18

Substitutions in the program may be approved by petition. A thesis is required for the M.S. degree.

SPECIAL APPLIED EARTH SCIENCES PROGRAM

A program with 45 units of courses and research 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

Entry—Graduate students are admitted with a degree goal: M.S., Engineer, or Ph.D. Students who have not yet earned an M.S. are admitted with the M.S. goal. After initial registration they may petition to change to the Ph.D. goal, bypassing the M.S.

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.

There are three basic requirements to be met for the Ph.D.: (1) completion of the M.S. core course curriculum defined for the program with which the student is associated, (2) completion of the department’s qualification procedures outlined below, and (3) completion of a dissertation. The department qualifying procedure involves completion of core course sequence, faculty review, departmental oral examination and proposal of research project. All but the research proposal must be completed within the first 18 months after initial registration.

Courses—The student must pass the M.S. core courses required for his or her option with a letter grade indicator 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, by the end of the sixth quarter of graduate work. 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. After completion, the student should file his Ph.D. candidacy application.

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. A maximum of four years should be targeted. More time will be allowed if the department Curriculum Committee is satisfied with a candidate’s progress.

COURSES

UNDERGRADUATE

1. Introduction to Earth Resources—The occurrence, economics, history, and politics of earth resources including oil and gas, coal, water, radioactive fuels, metals, and non-metallic minerals. Topics: resources and reserves, environmental impacts of mining, nuclear waste disposal, metals from the sea, South Africa, strategic minerals, and the world resource situation. (DR:8)

3 units, Win (Gorelick, Harbaugh, Remson) TTh 1:15

100. Management of Earth Resources—Corporate strategies in the mineral and fuel resources sectors. The changes in the competitive position of resource suppliers in industrialized and developing countries, and their impact on corporate strategies. Success factors in resource
industries. Topics: project evaluation methods, production requirements, operating strategies, financing, and government policies (taxation).

3 units, Spr (Thiers) TTh 3:30

102. Decision Analysis in Resource Exploration—Use of formal procedures to make optimum financial decisions in resource exploration. Estimation of probabilities attached to exploration actions and their utilization in financial forecasts with a manual of problem sets and incorporating a computerized exploration game with competing teams. Examples are drawn from petroleum exploration, but concepts are broadly applicable.

3 units, Win (Harbaugh) MTW 11

110. Structural Geology—(Enroll in Geology 110A.)

120. Introduction to Mineral Deposits—A survey emphasizing the geological environment of metallic mineral deposits. Topics: processes that lead to cycling and concentration of metals in the earth's crust, and geological characteristics of different classes of mineral deposits in the context of petro-tectonic settings. Laboratory consists of hand lens inspection of rock suites from classic mining districts. Prerequisite: Geology 80.

4 units (Einaudi) given 1989-90

124. Mineral Processing and Metal Extraction—A survey emphasizing the technology involved in producing economically useful minerals and metals from mined ore and recycled solid waste. Offered only in a guided-reading format. Prerequisites: High School Chemistry and Physics, Geology 80.

2 units, Aut (Parks) by arrangement

130. Environmental Earth Sciences I—First of three-course sequence on the relationship of environmental earth sciences to city and regional planning. Major field project throughout sequence involves preparation of a land-use plan for a selected location. Topics: environmental data, introduction to city and regional planning, land use determinants, analysis for urban planning, land capability systems, optimization, and weather and climate. (DR:8)

5 units undergraduates, 3 units graduates

Aut (Mader, Remson) MWF 11; labs, seminars, and field trips by arrangement

132. Environmental Earth Sciences II—Topics: waste disposal and sanitary landfill, non-renewable resources and geologic hazards, planning responses to earthquakes, new towns, and visionary planners. Laboratories include use of air photos in planning, economics of mineral resources, and site selection for a new community. Prerequisite: 131 or consent of instructor.

5 units undergraduates, 3 units graduate,

Spr (Mader, Remson) MWF 11; lab, seminars, and field trips by arrangement

133. Measurement of the Environment: Remote Sensing—(Graduate students register for 233.) Survey covering the methods of rapid reconnaissance of the environment stressing techniques suited to change-detection. Emphasis on detection of vegetation as an indication of various types of pollution of water and air, potential landslide areas, and evaluating coastal wetland. "Hands-on" use of micro-computer to analyze LANDSAT satellite coverage of campus. Recommended: Introductory physics.

3 units (Lyon) given 1989-90

135. Soil Science—A survey of principal soil properties and processes, including properties of soil interfaces, physical, chemical, and micro-biological processes; soil genesis and classification. Designed for seniors and graduate students majoring in earth sciences and engineering. Prerequisites: Freshman calculus, chemistry, and physics.

4 units (Rubin) alternate years, given 1989-90

136. Environmental Earth Sciences Management—Applications of operations research to environmental problems.

3 units, Spr (Remson) MWF 9

145. Mineral Economics—Fundamentals of commodity analysis. The effects of demand and supply imbalances on price formation. Topics: methodologies for projecting demand; techno-economic factors determining supply and production economics; feasibility studies; pricing mechanisms; and international trade. Commodity reports are usually generated as part of the course.

3 units, Spr (Thiers) WF 3:30

190. Fundamentals of Geostatistics—An introduction for engineers focused towards immediate practice of geostatistics. Modeling spatial and temporal correlations. Kriging and cokrig-
Computing in Geology I—Introduction to computing stressing geological applications. Topics: FORTRAN programming, matrix algebra, surface fitting, contour mapping, numerical analysis, and simulation of dynamic systems. Applications include petroleum geology, ore deposits, hydrology, and geomorphology.

3 units, Aut (Journel) TTh 10-12

192 Computing in Geology II—Introduction to gridding and spatial interpolation. Criteria of optimality for an estimator. Optimal spatial sampling design. Practice using menu-driven, PC-based software. Case studies from the extractive industry and environmental sciences. Prerequisite: Introductory Calculus, MS-DOS.

3 units, Aut (Journel) TTh 10-12


3-4 units, Win (Switzer) MTTh 11

199. Special Problems in Applied Earth Sciences for Undergraduates—Guided research or reading on special problems.

any quarter (Staff) by arrangement

GRADUATE

220. Geochemistry of Mineral Deposits—Lectures integrating observational, theoretical, and experimental data on the origin of mineral deposits and application to exploration concepts. Laboratory introduction to the reflected light microscope, followed by advance study of rock suites from district collections. Individual projects. Prerequisites: 120, Geology 163, 171.

5 units, Spr (Einaudi) MWF 11

plus one lab by arrangement

224. Low Temperature Aqueous Geochemistry—(Same as Civil Engineering 273.) A systematic study of principles needed for solving quantitative problems in aqueous geochemistry. The use of thermodynamics in predicting 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 graphic representation of results. Prerequisite: Geology 171 or equivalent experience with thermodynamics.

3 units, Aut (Leckie) TTh 11 F 1:15

225. Surfaces and Interfaces—Introduction to the properties of surfaces and interfaces. Chemical reactions peculiar to surfaces, especially adsorption at mineral/water interfaces. Influence of surface chemistry and adsorption on geochemical processes. Prerequisites: Geology 161 and 171, Chemistry 171 or Material Science Engineering 181, or permission of instructor.

3 units, Spr (Parks) MWF 9

227. Workshop in Low Temperature Aqueous Geochemistry—Systematic self-study review of principles and strategies needed for solving quantitative problems in equilibrium aqueous geochemistry under earth-surface conditions. Introduction to the use of computer programs of the MINEQL family. Prerequisites: 224, Geology 161 and 175, and working knowledge of UNIX or DOS operating systems.

3-5 units, one quarter annually (Parks) by prior arrangement only.

230. Hydrogeology—(Same as Geology 230.) Theory of underground water, analysis of field data and pumping tests, geologic groundwater environments, solution of field problems, groundwater modeling. Prerequisite: Elementary calculus.

5 units, Win (Remson) MWF 10 seminar M 2:15-4:05, lab by arrangement


4 units (Lyon) given 1989-90

251. Oil Field Exploration and Development—Objective is to analyze an actual oil exploration venture and prepare a comprehensive analysis and recommendation that includes interpretation of the geology, well engineering specifications, lease acquisitions, and a financial forecast.

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

252. Sedimentary Basins—Analysis of the depositional framework and tectonic evolution of sedimentary basins. Topics: tectonic and environmental controls on facies relations, synthesis of basin development through time in terms of depositional systems and tectonic settings. Weekend field trip required. Prerequisites: Geology 110, 151. Recommended: Geology 154.

3 units (Graham) alternate years, given 1989-90

253. Petroleum Geology and Exploration—The basics of petroleum geology origin, and occurrence and exploration for hydrocarbons. Topics: 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. Prerequi-
sites: Geology 110, 151. Recommended: Geophysics 190.

3 units, Spr (Graham) TTh 1:15-3:05

255. Introduction to Groundwater Solute Transport—Processes influencing transport of solutes through porous media; mathematical equations describing transport of reacting solutes and numerical methods for their solution. Designed for earth scientists and for engineers interested in water and environmental problems. Prerequisites: 230, Geology 230, introductory computer programming.

3 units, Aut (Gorelick) T10 Th 9-11

257. Research Seminar in Aquifer Management Modeling—Introduction to the combined use of aquifer simulation models and optimization techniques. Reviews recent literature. Topics: introduction to selected methods in operations research, water quantity and quality simulation-optimization modeling methods, policy evaluation and allocation models, and conjunctive water use management models. Prerequisites: 230 or Geology 230, 255 or equivalent, introductory computer programming.

3 units, Spr (Gorelick) T 10 Th 9-11

258. Role of Fluids in Geologic Processes—Principles governing geologic processes in which fluids (groundwater) play an important role. Regional flow of groundwater; movement and entrapment of petroleum; development of anomalous fluid pressures; role of fluid in tectonic movements; hydraulic fracturing as a measure of in-situ stress; transport of chemical constituents by groundwater; flow in fractured rock; and transport of heat by groundwater. Prerequisite: Elementary calculus. Corequisite: 230 or Geology 230.

2 units, Win (Hsteh, Belitz) Th 3:15

276. Seminar: Sedimentary Geology—Discussion of current topics in sedimentary geology.

2 units, Win (Graham) by arrangement

277. Field Mapping of Mineral Deposits—A seven-day field trip to a specific mineral district in California or Nevada, emphasizing detailed mapping of outcrops, adits and (where possible) underground workings. Students in Spring Quarter prepare the maps and produce a report suitable for presentation to management or for publication. Register Spring Quarter. Prerequisite: 120.

3 units, Spr vacation (Einaudi)

280. Rock Mechanics and Advanced Structural Geology—Advanced concepts and theories of rock deformation with application to rock mechanics, structural geology, and tectono-
stochastic imaging of deposits and reservoirs. May be repeated for credit. Prerequisites: 290, advanced calculus.

3 units, Spr (Journal) by arrangement

295A,B,C,D,E. Research Seminar in Remote Sensing—Weekly two-hour discussion of recent advances covering aspects of remote sensing, especially those applied to mineral exploration. Participants cover some pertinent aspect of the field for review and presentation. Pass/No Credit grading. Sequence (A, B, C, D, E) varies by year.

295A. Pattern Recognition (Spatial and Spectral).
1 unit, Aut, Win, Spr (Lyon) F 12-2

295B. Geobotany.
1 unit, Aut, Win, Spr (Lyon) F 12-2

295C. Radiometry and Spectroradiometry.
1 unit, Aut, Win, Spr (Lyon) F 12-2

295D. Atmospheric Effects.
1 unit, Aut, Win, Spr (Lyon) F 12-2

295E. Statistical Aspects of Data-Experimental Design.
1 unit, Aut, Win, Spr (Lyon) alternate years, given 1989-90

296. Photogeology and Radar—Advanced interpretation of photographic and radar images of large-area features for regional reconnaissance. The effect of varying sun angles and radar look-directions of flight altitudes, scales and seasons. Includes laboratory analysis of imagery (satellite and aircraft) designed to extract the maximum structural information from an area. Field analysis. Prerequisite: 133/233. A photogeologic course is essential. Term paper for 4 units.

3-4 units (Lyon) alternate years, given 1989-90

297. Airborne Exploration: Lithologic Mapping—An advanced course covering the multispectral and multitemporal response of terrain from ultraviolet to infrared and microwave energy, principally for use as an exploration tool. Spectral and temporal signatures are stressed. Also, geobotanical and biogeobotanical aspects. Labs supported by field measurement, and data analysis. Prerequisites: 133, 233, and a photogeologic course. Term paper for 4 units.

3-4 units (Lyon) alternate years, given 1989-90

320A,B. Seminar and Field Trip: Ore Genesis—Research aimed at understanding the features and processes related to a particular class of mineral deposits. Topics are selected on basis of participant interest and timeliness. Field trip planning and guidebook prepared in Winter. Field trip (1-2 weeks) Winter or Spring Quarter. Students prepare papers and make oral presentations. Prerequisite: 220 or may be taken concurrently.

2 units, Win, Spr (Einaudi)

327. Topics in Low Temperature Aqueous Geochemistry—Lectures, student seminars, and an optimal team project on selected topics in aqueous geochemistry under earth-surface conditions. Illustrative topics: non-ideality models; measurement, evaluation, and estimation of thermodynamic data; trends in metal complex stability; heterogeneous reaction kinetics. Other topics may be requested. Prerequisites: 225, 227, or equivalent, Geology 261.

2-4 units, one quarter annually (Parks) by prior arrangement only

any quarter (Staff) by arrangement

386A,B,C. Research Seminar: Geomechanics—Selected topics. May be repeated for credit.
1 unit, Aut, Win, Spr (Pollard) by arrangement

390A,B,C. Seminar: Geostatistics—Discussion of classic results and current research in geostatistics. Topics selected on basis of interest and timeliness. May be repeated for credit.
1-2 units, Aut, Win, Spr (Journal) by arrangement

GEOLOGY

Emeriti: (Professors) Robert R. Compton, William R. Evitt, Konrad B. Krauskopf, Benjamin M. Page, Charles F. Park, Jr., Tjeerd van Andel; (Sr. Lecturer) Ernest I. Rich
Chairman: Gordon E. Brown, Jr.
Associate Chairman: Juhn G. Liou
Professors: Gordon E. Brown, Jr., Robert G. Coleman, Marco T. Einaudi†, James C. Ingle, Jr., Juhn G. Liou, George A. Parks†, David D. Pollard†, Irwin Remson†, Norman H. Sleep*, George A. Thompson*
Associate Professors: Simon Brassell, Stephan A. Graham†, Gall A. Mahood, Elizabeth L. Miller

* Joint appointment with Geophysics
† Joint appointment with Applied Earth Sciences
UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

The program leading to the degree of Bachelor of Science in Geology is designed to provide the background for a wide variety of careers within and outside of the earth sciences and provides students with an excellent background for graduate studies in the earth sciences, law, business administration, land use planning, environmental engineering public service, and other professions where an understanding of the earth and a background in science are often important. The field of geology is broad in scope, including the study of Earth's history and evolution of early life, earth materials, the ocean, and the internal and surface processes that shape the Earth's structure and landscape, concentrating on mineral and energy resources. Geology is also concerned with the present, particularly natural hazards (e.g. earthquakes, volcanic eruptions, landslides), the supply of water and other resources to society, and the interaction of man with Earth.

A major emphasis of the B.S. program in Geology is the field study of Earth processes, materials, and history. Each undergraduate major is thoroughly trained in the methods of field geology through a concentrated six-week summer course after the junior year. Stanford University's location near the Pacific continental margin, the Sierra Nevada mountain range, and the San Andreas fault system provides a nearly unparalleled setting for field studies. The San Francisco Bay area provides students a natural laboratory to study environmental and engineering geology problems that affect society in profound and complex ways.

Originally an observational and descriptive science, geology has evolved into a quantitative science dealing with the physics and chemistry of Earth and the interrelationships between the physical and biologic systems which characterize our planet. The study of geology requires significant course work in the related sciences of chemistry and physics, and in-depth laboratory studies of earth materials, fossils, and processes. Mathematics and computer science are important tools for the description and modeling of Earth processes, requiring significant course work in these areas. The diversity of course work and experience results in graduates with an unusual degree of versatility.

Some of the most difficult problems facing society, including safe disposal of hazardous wastes, land development, the location and environmentally safe extraction of mineral and energy resources require a quantitative knowledge of Earth processes and materials. The B.S. program in Geology is designed to provide this background.

CORE COURSE SEQUENCE

The geology courses that are required form an integrated core course sequence totaling a maximum of 75-78 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>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 1.</td>
<td>Interpreting the Earth</td>
<td>A,W,S,Su 4</td>
</tr>
<tr>
<td>Geol. 2.</td>
<td>Earth History</td>
<td>A 3</td>
</tr>
<tr>
<td>Geol. 3.</td>
<td>Earth History Lab</td>
<td>A 2</td>
</tr>
<tr>
<td>Geol. 80.</td>
<td>Rocks and Minerals</td>
<td>S 5</td>
</tr>
<tr>
<td>Geol. 102.</td>
<td>Introduction to Field Geology</td>
<td>Su 3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 100.</td>
<td>Undergraduate Seminar (3 quarters @ 1 unit/qtr.)</td>
<td>A,W,S,S 3</td>
</tr>
<tr>
<td>Geol. 103.</td>
<td>Advanced Field Geology</td>
<td>Sum 12</td>
</tr>
<tr>
<td>Geol. 110A.</td>
<td>Structural Geology I</td>
<td>W 3</td>
</tr>
<tr>
<td>Geol. 110B.</td>
<td>Structural Geology II</td>
<td>S 3</td>
</tr>
<tr>
<td>Geol. 151.</td>
<td>Sedimentary Geology and Petrography</td>
<td>W 4</td>
</tr>
<tr>
<td>Geol. 161.</td>
<td>Crystal Chemistry, Mineralogy, and Mineral Optics</td>
<td>A 5</td>
</tr>
<tr>
<td>Geol. 170.</td>
<td>Chemistry of the Earth</td>
<td>A 4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>34</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 152.</td>
<td>Stratigraphic Geology</td>
<td>S 4</td>
</tr>
<tr>
<td>Geol. 181.</td>
<td>Igneous Petrology and Petrography or</td>
<td>A 4</td>
</tr>
<tr>
<td>Geol. 182.</td>
<td>Metamorphic Petrology, and Petrography</td>
<td>S 4</td>
</tr>
<tr>
<td>Geol. 193.</td>
<td>Introduction to Probability and Statistics in Earth Sciences</td>
<td>W 4</td>
</tr>
<tr>
<td>Geol. 199.</td>
<td>Senior Research Project</td>
<td>A,W,S 3</td>
</tr>
<tr>
<td>Geophys. 190.</td>
<td>General Geophysics</td>
<td>A 3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>

ELECTIVE COURSES

A student entering Stanford with credit in high school algebra, trigonometry, and natural science normally will have 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. Choose 2 courses from the following list:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>App. Ear. Sci. 120. Introduction to Mineral Deposits</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>Geol. 143. Principles of Paleontology</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>Geophys. 180. Geological Interpretation of Reflection Seismograms</td>
<td>W</td>
<td>3</td>
</tr>
<tr>
<td>Math 130. Ordinary Differential Equations</td>
<td>A,W,S</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Required Elective Units: 6-9

Total units required for the B.S. degree in Geology: 112-115

Total Distribution, Language, Writing Requirements, Electives: 65-68

Total Units Required for the B.S. Degree Program in Geology: 180

REQUIRED COURSES IN SUPPORTING SCIENCES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31. Chemical Principles</td>
<td>A,W</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 171. Physical Chemistry (may be replaced by Geo. 171)</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>Math. 41, 42, 43, 44. Calculus and Analytical Geometry</td>
<td>A,W,S</td>
<td>18</td>
</tr>
<tr>
<td>Phys. 51. Mechanics</td>
<td>W</td>
<td>4</td>
</tr>
<tr>
<td>Phys. 53. Electricity and Magnetism</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>Phys. 55. Light and Heat</td>
<td>A</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Required Units in Supporting Sciences: 37

This schedule assumes entrance in the geology program no later than the Winter Quarter of the sophomore year. Students intending to declare a geology major later than the Winter Quarter of their sophomore years 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 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:

Mathematics —

1. For students who wish to complete the requirements for calculus and analytic geometry in four quarters: Mathematics 41, 42, 43, 44

Units: 18

2. For students who wish to cover the same subjects in six quarters: Mathematics 19, 20, 21, 22, 23, 24

Units: 18

Physics —

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)

Units: 12

2. For a student with exceptional interest in physics, higher physics sequences may be approved by the department provided the student has the required mathematics.

Chemistry —

1. For the majority of students majoring in geology: Chemistry 31 (Chemical Principles) and Chemistry 171 (Physical Chemistry)

Units: 7

2. In some instances the following sequence may be substituted for Chemistry 31 and 171 with consent of the advisor: Chemistry 31 (Chemical Principles) and Chemistry 33 (Structure and Reactivity; Organic Chemistry)

Units: 8

Required units in mathematics, physics, and chemistry: 37-38

HONORS PROGRAM

The Department of Geology offers a program leading to the degree of Bachelor of Science in Geology with Honors. The program provides an opportunity for students to undertake independent study and research on a topic of special interest culminating in an Honors report. The Honors program is open to seniors having a letter grade indicator (LCI) of at least 3.5 in their earth science courses and an LCI of at least 3.0 in all University course work. Financial
support is available to help defray laboratory and field expenses incurred in conjunction with Honors research.

Students intending to apply for the Honors program should register in the departmental office before the start of their senior year and follow the following guidelines for the program:

1. Potential Honors students should identify a research project, either theoretical, field, or experimental.
2. The student shall submit a written research proposal to the departmental Honors Subcommittee, which will decide on the suitability of the proposal as a project.
3. Course credit for the research project will be assigned by the project advisor within the framework of Geology 105.
4. A written report must be completed for Honors credit.
5. Before the end of the student's senior year, each Honor's candidate shall present a public seminar on the work proposed for credit.
6. The decision as to whether a given project and report does or does not merit award of Honors shall be made jointly by the Honors Subcommittee and the student's advisor.
7. The work completed for the Honors program cannot be used as a substitute for regularly required courses.

COTERMINAL B.S. AND M.S. PROGRAM

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

1. Students are encouraged to apply at the beginning of the Winter Quarter of their junior year, but applications will be accepted from students in their seventh, eighth, ninth, or tenth quarter of undergraduate work.
2. Admission is recommended by the school or department in which the student seeks a master's degree, that department applying the same standards for admission that it would to an applicant for the graduate division.

Both degrees may be granted simultaneously, provided:

1. The student completes 15 full-time quarters or the equivalent (or three full quarters after completing 180 units). Partial tuition registration is possible after the completion of 12 full quarters.
2. The student applies for each degree at the appropriate time and to the appropriate agency.
lems in mineralogy and mineral physics, igneous and metamorphic petrology, ore deposits, hydrothermal systems, mineral surface and colloid reactions, organic geochemistry, and the fundamental structure and properties of earth materials. Applications include field-oriented studies, detailed trace and major element analysis, computer prediction and modeling, X-ray scattering and spectroscopic studies of earth materials, and laboratory experimentation at high temperatures and pressures. The scale of problems studied ranges from global to atomic. Students with strong backgrounds in chemistry are especially urged to contact faculty in these fields, including Professors Bird, Brassell, Brown, Coleman, Einaudi, Hochella, Liou, Mahood, Parks, and Stebbins.

**Sedimentary Geology and Paleontology**—Sedimentary geology at Stanford emphasizes the relationships between the tectonic, depositional, and paleoceanographic development of continental margins and associated basins, including quaternary geology and neotectonics of coastal regions. Current studies include a full array of margin settings in North America, the Caribbean, the Mediterranean, Africa, and the Pacific rim. Our tools include sedimentary petrology, lithofacies, and biofacies analysis of depositional environments, micropaleontology, surface and subsurface analysis of sedimentary structure, application of organic geochemistry and ground water hydrology, and computer simulation of basin evolution. Faculty with special interests in these topics include Professors Brassell, Clifton, Graham, Ingle, Kvenvolden, Lowe, and Remson with a number of overlapping research interests shared with other faculty in the Departments of Applied Earth Sciences and Geophysics.

**Tectonic, Structural, and Regional Geology**—A wide spectrum of subdisciplines bearing on structural, tectonic, and regional geologic studies are represented among the faculty in the Geology Department including Professors Miller (structural geology and regional tectonics), Page (neotectonics), Pollard (physical processes), Sleep (thermal and mechanical models), Thompson (deep crustal structure), along with Nur (rock physics) in the Geophysics Department. Ongoing studies range from theoretical and laboratory analysis of stress, strain, and rock fracture to field-based studies of accreted terranes and tectonic evolution of the Cordillera. Integration of geologic and geophysical approaches to regional tectonic questions is encouraged in order to understand both surface and deep deformational processes.

For the typical well-qualified student with a background equivalent to that of a Stanford geology undergraduate, completion of the requirements for the M.S. normally takes at least six full-time quarters including both coursework and thesis research. Special programs in geochemistry and mineral physics are possible for students with strong backgrounds in chemistry and physics. Departmental financial assistance, if awarded, is limited to these terms.

**Admission**—For admission to graduate work in the department, the applicant must have taken the Aptitude Tests (Verbal, Quantitative, and Analytical) of the Graduate Record Examination. Previously admitted students who wish to change their degree objective from an M.S. to a Ph.D. must petition the Admissions and Awards Committee. A co-terminal B.S./M.S. program is open to Stanford undergraduates.

**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**—On the day(s) prior to the start of classes, students will be given a counseling test on material covered in those courses required of undergraduate geology majors at Stanford. The results will be used in the design of the student's course program. The Graduate Committee of the department will appoint a tentative academic advisor during registration with appropriate consideration of the student's background, interests, and professional goals. In consultation with his or her academic advisor, the student will plan a program of coursework for the first year. The student should select a thesis advisor within the first year of residence and submit to this advisor a proposal for thesis research as soon as possible. The academic advisor supervises completion of the departmental requirements for the M.S. program (as outlined below), until the research proposal has been accepted, when this responsibility passes to the thesis advisor. The student may change either thesis or academic advisors by mutual agreement and after approval from the Graduate Committee.

**Requirements**—The University's requirements for the Master of Science degree are stated in the "Advanced Degrees" section of this bulletin. The student must also be guided by the following departmental requirements:

1. The student must complete (for a grade) any remedial coursework required by the department on the basis of a counseling test (administered in the first quarter of residency) and recommendation of the student's advisor.
2. The student must complete a minimum of 36 units of coursework.
a) Not more than 15 units of the 36 shall normally consist of formal lecture courses, the remainder to be seminars, or special problem and research units.

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 or her academic advisor and must meet with approval of the latter.

3. The student must serve as a quarter-time teaching assistant for at least three quarters. Students who entered the department prior to Autumn Quarter of the academic year 1985-86 are required to serve as a quarter-time teaching assistant for one quarter.

4. The student must file a program proposal by the end of the first quarter of enrollment.

5. The student must complete a thesis describing his or her research. Thesis research should begin during the first year at Stanford and the thesis should be completed before the end of the sixth quarter here.

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

7. Once the thesis has been approved, the student will make a public presentation of his or her results at an appropriate forum, preferably at a meeting of a national geological society.

Schedule—The calendar of events of a typical M.S. program is as follows:

Quarter Procedure
1 Plan coursework for first year with academic advisor.
2-3 Planned coursework; selection of thesis advisor and thesis topic; submit short research proposal to thesis advisor; begin thesis research.
3-5 Select second reader and apply for M.S. degree candidacy to Graduate Studies Office.
5-6 Present a complete draft of thesis to thesis advisor and second reader at least three weeks prior to deadline for filing M.S. thesis with Graduate Studies Office; complete M.S. thesis; file thesis; present results publicly.

Time Limits—Students should note that University rules impose the following time limits: (1) for co-terminal students—3 calendar years after completion of 180 units; (2) for all other M.S. candidates—3 calendar years from the start of the first quarter of enrollment in the M.S. program. Extensions require approval of the department as well as the graduate division.

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—On the day(s) prior to the start of classes an advisor will be appointed by the Graduate Committee of the department, with appropriate consideration of the student’s background, interests, and professional goals. In consultation with his or her advisor the student will plan a program of coursework for the first year. The student should choose a research advisor within the first year of residence. The research advisor supervises completion of the departmental requirements for the Ph.D. program (as outlined below) until the student passes the research examination, at which time this responsibility passes to the doctoral committee. The student may change advisors with approval from the Graduate Committee.

Requirements—The University’s requirements for the Ph.D. are stated in the “Advanced Degrees” section of this bulletin. The student must also be guided by the following department requirements:

1. 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 3 units each from four different faculty members in the School of Earth Sciences at Stanford.

2. The student must serve as a quarter-time assistant for at least three quarters. Students who entered the department prior to Autumn Quarter of the academic year 1985-86 are required to serve as a quarter-time teaching assistant for one quarter.

3. The student must qualify for candidacy for the Ph.D. Departmental procedures require preparation of a research proposal, approval of this proposal by the research advisor, selection of a Committee for the Research Examination, and approval of the membership by the Graduate Committee of the department. The research examination consists of three parts: (1) oral presentation of a research proposal, (2) examination of the research proposal, and (3) examination on subject matter relevant to the proposed research. The research examination may be repeated once. For details regarding committee membership, examination requirements, and appeal procedures, see the Departmental Information sheet. Students are
expected to complete all procedures for qualification for candidacy by the end of their second academic year. Extensions may be petitioned in exceptional situations.

4. Annually, and preferably in the months of March or April, the candidate must organize a meeting with his/her research committee to present a brief progress report covering the past year. On a form provided by the department, the Research Committee shall note its impression of progress and, if desired, recommendations for further work. The report shall be signed by all committee members and by the student; a quorum must be present, and individual meetings with members are not an acceptable substitute. The report must be submitted to the department before May 1 of each year following that in which candidacy has been certified.

**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.

In accordance with University procedure, the department shall appoint the research advisor and two members of the candidate’s research committee to be readers of the draft dissertation. The readers are charged to read the draft and to certify in writing to the department that this draft is adequate to serve as a base for the University oral examination. Until such written and signed certification has been received by the department, the student is not permitted to begin arrangements for scheduling the University oral examination.

**Schedule**—The calendar of events in the Ph.D. program is normally as follows:

**Quarter Procedure**

1. Plan coursework for first year with advisor.

2-6 Preparation of research proposal; research examination, certification and petitions for Ph.D. candidacy; admission to candidacy for the Ph.D.

2-12 Ph.D. research; University oral examination; complete dissertation.

**COURSES**

Courses in the 300 to 400 series ordinarily are not open to undergraduates. Courses in the Summer Quarter are offered for a 10-week period unless otherwise noted.

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

1. **Interpreting the Earth**—Introduction to and survey of the physical and chemical processes, past and present, that shape the earth’s landforms, produce the minerals and rocks that comprise the earth’s crust, create the soils, deform the earth’s crust, and move the continents. Ways in which man interacts with the earth, constructively and destructively. Superficial processes involving water, water’s role in erosion, and in the production of rocks called sediment. Processes acting within the earth’s interior emphasizing global tectonics. Non-renewable resources, energy, earthquake prediction and environment problems. Field studies constitute a significant part of this course. Lectures, one three-hour laboratory period per week, and one or two field trips required. A transportation fee is charged for field trips. Recommended: High school chemistry and physics. (DR:7)

5 units, Aut (Staff) MWF 9
Win (Liou) MWF 9
Spr (Brown) MWF 9
Sum (Staff) MWF 9
lab and field trips by arrangement

2. **Earth History**—The earth is a dynamic planet, its surface continuously remolded by changing patterns of plate movements, climatic variation, the rise and fall of sea level, mountain building, volcanism, erosion, and sedimentation. It has hosted an evolutionary parade of organisms, from self-replicating molecules to man, that have interacted with and often strongly modified surrounding environments. The evolution of the earth and its biosphere, hydrosphere, and atmosphere represents active areas of current research and discussion including: the formation of the earth, origin of life, evolution of the continents, oxygenation of the atmosphere, development of metazoans, history of glaciations and climate, the role of extraterrestrial events of geological and biological evolution. Designed for non-majors and prospective geology majors. Enroll concurrently in Geology 3 to examine the materials and organisms discussed. Students intending to major in geology must take 3 either concurrently or in a subsequent year. (DR:7)

3 units, Aut (Lowe) MWF 11

3. **Earth History Laboratory**—An introduction in the methods and materials of historical geology. Laboratory sessions deal with the origin of the earth, early life forms, stratigraphic interpretation, geologic maps and cross sections, sedimentary environments, and metazoan evolution and fossils. Prerequisite: 2,
which may be taken concurrently. Recommended for students taking 2; required for Geology majors who took 2 in 1985-86 or later.

2 units, Aut (Low) 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 emphasizes use of hand lens in making observations, and field trips demonstrate rock structures and genetic associations. Prerequisite: 1. Recommended: Introductory chemistry.

5 units, Spr (Coleman, Liou) MWF 8; lab MW or TTh 1:15-4; field trips by arrangement

100. Undergraduate Seminar—Required during each quarter of the junior year to give majors a chance each week to meet with individual faculty members, or with a senior graduate student, to discuss topics in the earth sciences.

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

102. Introduction to Field Geology—Instruction and practice in the basic methods of geologic investigation and recording in the field. Emphasis on techniques of systematic observation on the outcrop and the construction of geologic maps and sections from the data obtained. The field area studied varies each year, but each site displays a variety of rock types and landforms related to clearly defined structures. Conducted from the White Mountains Research Station in Bishop, Ca. during the two-week interval between Labor Day and the beginning of the Autumn Quarter. See the bulletin, Summer Session for the schedule. Prerequisites: 1 and 80, or consent of instructor.

3 units, Sum (Ruetz)

103A,B. Advanced Field Geology—Provides an opportunity to junior- and senior-level students to become involved in a substantial field investigation of professional scope. Assumes familiarity with elementary techniques used in field mapping, stratigraphic, and structural studies concepts. Provides an in-depth exposure to independent analysis of relatively complex geologic problems in the field and the presentation of research results in a professional report. Conducted from a tent camp at one or more localities in the western states and involves coordinated field mapping, descriptions, and interpretation of a relatively unknown field area. Emphasis is 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. Prerequisites: 1, 2, 80, 102, 110, and 151; or consent of instructor(s).

103A. Field portion of 103 includes studies described above and short reports on this work written in the field. Credit for 103A requires completion of 103B.

8 units, Sum (Miller) June 16-Sept. 1

103B. Laboratory studies, compilation of maps, cross-sections, stratigraphic columns and structural data for the preparation of a comprehensive geologic report on field areas studies during 103A; work done in the field or on campus.

105. Geologic Problems—Supervised reading, field and/or laboratory work, written reports thereon.

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

110A. Structural Geology I—First of a two part series emphasizes the theoretical and experimental background required to practice structural geology. Mechanical principles useful for understanding rock deformation in the earth's crust. Topics: stress and strain analysis, physical properties of rock, brittle fracture, friction, buckling, flexure, and heat and mass transport. Field laboratory and computer exercises emphasize the techniques of data collection and interpretation of joints, sheet intrusions, faults, and folds. The roles of these structures in the evolution of the earth's crust, in natural resource recovery, and volcanic hazards. Prerequisites: 1, calculus, Macintosh skills.

3 units, Win (Pollard) MWF 11 labs and field trips by arrangement

110B. Structural Geology II—Emphasizes the use of structural geology in understanding the deformational history of the earth's crust and the evolution of mountain belts and ocean basins. The effects of composition, temperature, and time on rheology and deformation mechanisms in the crust. Characteristic largescale structures formed by crustal shortening, extension, and strike-slip faulting. Advanced techniques of structural analysis: the study and interpretation of maps and construction of balanced cross-sections, measurement of strain in deformed rocks, stereonet analysis of folds and multiple folding events, deformational fabrics in metamorphic rocks and preferred crystallographic orientation of minerals in metamorphic tectonites. Prerequisites: 1, 102, 110A, calculus, or consent of instructor.

3 units, Spr (Miller) MWF 9 lab and field trips by arrangement

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

5 units, Win (Staff) MWF 10; lab T 1:15-4:05
plus one lab by arrangement

150. The Oceans: An Introduction to the Marine Environment—An introduction to oceanography. Topics: topography and geology of the sea floor, the circulation of the ocean and atmosphere, the nature of sea water, waves, tides, and the history of the major ocean basins. The interface between continents and ocean basins emphasizing estuaries, beaches, and continental shelves with California margin examples. The biology of the ocean and the relationships between the distribution of inorganic constituents, ocean circulation, and biologic productivity. Marine resources and attendant legal conflicts. Individual marine environments from the deep sea to the coast. Lectures, occasional demonstrations, and a required one-day field trip to measure and analyze waves and currents. For non-majors and prospective geology majors. (DR:7)

3 units, Win (Ingle) MWF 11; demonstrations and field trips by arrangement

151. Sedimentary Geology and Petrography: Depositional systems—Topics: the origin, distribution, deposition, and diagenesis of sedimentary materials. Weathering, erosion and transportation, deposition, the origins of sedimentary structures and textures, diagenesis, sedimentary facies, tectonics and sedimentation, and the characteristics of the major siliciclastic and carbonate depositional environments. Laboratory: methods of analysis of sediments in hand specimen and thin section. Field trips required. Prerequisites: 1, 2.

4 units, Win (Lowe, Graham) MWF 9
lab and field trips by arrangement

152. Stratigraphic Geology— Rudiments of interpreting sedimentary sequences emphasizing integration of paleontologic and sedimentologic evidence to reconstruct depositional environments, basin history, and paleogeographic and paleoceanographic settings. Characteristic variations of modern and ancient biotaxies and lithofacies are traced in time and space. Biostratigraphy, magnetostratigraphy, and radiometric dating and correlation. Stratigraphic techniques include surface and subsurface examples. Individual investigation of a stratigraphic problem forms the basis for a required term paper. Lectures supplemented by classic and current scientific literature and take-home exercises. Prerequisites: 1, 2, 102, and 151.

4 units, Spr (Ingle) MWF 11; 3 required field trips; research conferences by arrangement

161. Crystal Chemistry, Mineralogy, and Mineral Optics—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. Examination of the structures, chemistry, physical properties and paragenesis of the major rock-forming minerals emphasizing silicates. The principles of optical mineralogy. Lab on determinative mineralogy; hand specimen, identification, and optical and x-ray methods. One field trip. Prerequisites: 1, 80, 102, and Chemistry 31 (may be taken concurrently).

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

170. Introduction to the Chemistry of the Earth—How chemical elements are distributed in the earth, oceans, and atmosphere, processes which cause this distribution, and conceptual and analytical tools needed to explore these questions. Lectures supplemented by laboratory experiments relating to aspects of aqueous chemistry, sedimentary, igneous, and metamorphic petrology. A field trip observes geochemical processes affecting ground water and mineral deposits.

4 units, Aut (Stebbins) MWF 11
lab by arrangement

171. Geochemical Thermodynamics—Introduction to the application of chemical principles and concepts to geologic systems. The chemical behavior of fluids, minerals, and gases using simple equilibrium approaches to modeling the geochemical consequences of diagenetic, hydrothermal, metamorphic, and igneous processes. Topics: reversible thermodynamics, solution chemistry, mineral-solution equilibria, reaction kinetics, and the distribution and transport of elements by geologic processes. Prerequisite: 161.

3 units, Aut (Bird) MWF 9

181. Igneous Petrology—Origin of igneous rocks, emphasizing magmatic differentiation processes displayed in the chemistry of volcanic rocks. Topics: the physical properties of magmas, roles of volatile components, applications of trace elements and isotopes to petrogenesis, modeling of crystal fractionation and partial melting, relevant experimental data and phase diagrams, relation of magma types to tectonic setting, and classification schemes. For seniors and new graduate students. May be taken without the lab for 3 units by students who are undergraduate geology majors. Prerequisite: 161.

4 units, Spr (Stebbins) MWF 10
lab T 1:15-4:05
182. Metamorphic Petrology—Genesis of metamorphic rocks and the imposed physico-chemical conditions for their formation. Topics: 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: 181.
4 units, Spr (Liou) TTh 11
lab T 1:15-4:05

185. Volcanology—Types of eruptions; eruptive mechanisms; models of emplacement of pyroclastic flows and characteristics of resulting deposits; volcanic landforms and their relation to the composition and physical properties of the magma; calderas; volcanic gases; eruptive histories of volcanic centers. One four-day field trip required. Prerequisite: 80 or its equivalent.
3 units, Aut (Mahood) MWF 10
alternate years, not given 1989-90

185L. Volcanology Laboratory—Hand sample and petrographic microscope examination of volcanic rocks. Labs are keyed to lectures in 185, which must be taken concurrently. Prerequisite: Some experience with a petrographic microscope.
1 unit, Aut (Mahood) W 1:15-4:05
alternate years, not given 1989-90

3-4 units, Win (Switzer) MTTh 11

199. Senior Research Project—An in-depth research project is required of each major during one quarter of the senior year. The results are presented in a written paper and in an oral presentation. Projects are chosen in consultation with a faculty member, who serves as project advisor.
3 units, Aut, Win, Spr (Staff)
by arrangement

215. Topics in Regional Geology and Tectonics—Seminar.
2 units, Win (Miller)

218. Seminar in Sedimentary Geology—The basis for and problems involved with compara-
tive sedimentology—the interpretation of sedimentary rocks on the basis of modern analogues. A wide range of issues in a combined lecture/discussion/seminar format. Three or four one-day field trips are required on weekends. Prerequisites: 151, 152, or equivalent background.
3 units, Spr (Clifton) M 11-12 T 11-1

2 units, Aut (Demaison) M 4:15-6:05

224. Biological Markers in Petroleum Exploration—The use of biological markers for correlation and as sensitive and selective indicators of the thermal history and environment of deposition of source rocks and petroleum; examples of the application from case histories in selected sedimentary basins. Recommended: 223.
2 units, Spr (Brassell) TTh 1:15

230. Hydrogeology—(Same as Applied Earth Sciences 230.) Theory of underground water, analysis of field data and pumping tests, geologic groundwater environments, solution of field problems, groundwater modeling. Prerequisite: Elementary calculus.
5 units, Win (Remson) MWF 10; seminar M 2:15-4:05, lab by arrangement

3 units, any quarter (Remson)
by arrangement

241. Introduction to Micropaleontology—Microscopic marine fossils including diatoms, ostracods, and radiolarians emphasizing foraminifera. The principles of classification, evolutionary trends, common genera, ecology, and environmental distribution of foraminifera. Application of planktonic and benthic foraminifera to interpretation of marine paleoenvironments, paleoceanographic and paleoclimatic analysis, and correlation of marine sequences. Paleo-environmental and age analysis of an unknown
244. Advanced Micropaleontology—The use of marine microfossils (mainly benthic and planktonic foraminifera) to solve fundamental geologic and oceanographic problems of geochronology, correlation, paleoecology, and paleoceanography. Individual analysis 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 on classic and current examples of research in this field. One week field trip. Prerequisite: 241.

3 units (Ingle) alternate years, given 1989-90

250. Sedimentation Mechanics—The mechanics of sediment transport and deposition and the origins of sedimentary structures and textures, particularly as applied to interpreting ancient rock sequences. Dimensional analysis, fluid flow, drag, boundary layers, open channel flow, particle settling, erosion, sediment transport, sediment flows, primary formation of fluid escape structures. Field trips required.

3 units, Spr (Lowe) TTh 8-9:30 alternate years, not given 1989-90

253. Sedimentary Petrology—Examination and interpretation of sediments and sedimentary rocks. Aspects of provenance, texture, composition, diagenesis, and incipient metamorphism. Lectures and readings stress research in sedimentary petrography over the last five years; less emphasis on classical petrography. Class is topical and varies yearly. Prerequisite: 151.

2 units, Spr (Staff) TTh 9

253L. Sedimentary Petrology Laboratory—Student defines a research problem and solves it using a combination of petrographic microscope, SEM, and/or microprobe techniques. Ten page write-up similar to publishable paper and oral presentation required.

2 units, Spr (Staff)

254. Sedimentary Facies and Environments—Recognition of sedimentary environments in the field; facies studies of alluvial, fluvial, beach, shelf, (siliciclastic and carbonate), deltaic, turbidite and pelagic environments. Origins of sequences in sedimentary rocks, geometric aspects of sedimentary rocks, analysis of bedforms. Lectures and readings stress research in sedimentology over the last five years.

3 units, Aut (Staff) MWF 2:15

3 field trips by arrangement

254L. Sedimentary Facies and Environments Laboratory—Student defines a research problem in sedimentology undertaken in the field, laboratory, or in theory, and solves it. Units depend on time available to student. Oral presentation with write-up required.

1 or 2 units, Aut (Staff)

260. Physics and Chemistry of Earth Materials—The interrelationships among structure, composition, and physical and thermochemical properties of the major rock-forming silicate minerals and of silicate melts and glasses. Topics: the response of minerals and melts to variations in temperature, pressure, and composition; the connections between atomic-scale structure and thermodynamic properties of earth materials; the derivation, interpretation, and use of phase diagrams in mineral-melt-vapor systems; the theory and limitations of geothermometry and geobarometry; and the mechanisms controlling trace element behavior. Characterization of earth materials using x-ray and spectroscopic methods in lectures and in laboratory exercises. Several labs are devoted to synthesis experiments of minerals and glasses.

4 units, Win (Brown, Stebbins) MWF 11 labs by arrangement

264. Techniques in X-ray Fluorescence—Modern fluorescence instrumentation and associated computing available to earth scientists at Stanford. Proper and efficient instrument use and accepted techniques in data interpretation. Use of the data collection and reduction software available, including wavelength scanning, qualitative to quantitative analysis, instrument calibration, matrix corrections, fundamental parameters, and the statistics of precision for counting and analysis.

2 units, Spr (Hochella) M 3 lab by arrangement

265. Quantitative Electron Microscopy—The capabilities of the scanning electron microscope and electron microprobe. Topics: theory, design, and function of electron microbeam instrumentation, sample preparation, practical procedures for imaging, qualitative and quantitative analysis, and data reduction.

2 units, Aut (Paque) TTh 9

265L. Quantitative Electron Microscopy Laboratory—Instruction in use of Stanford's Center for Materials Research scanning electron microscopes and electron microprobe. A research project allows quantitative analysis on materials of student's choice. Required for those who wish to independently use the facilities. Lab size limited. Prerequisites: 265 (may
be taken concurrently), consent of the instructor.
2 units, Aut, Win, Spr (Paque) by arrangement

275. Solution-Mineral Equilibria: Theory—
Procedures for calculating and evaluating the thermodynamic properties of reversible reactions among rock-forming minerals and aqueous solutions in geologic systems. The concepts and principles of chemical thermodynamics relevant to geochemical processes followed by a systematic investigation of the thermodynamic behavior of minerals, H₂O, CO₂ and electrolyte solutions at high temperatures and pressures. Emphasis on the generation and utility of phase diagrams depicting solution-mineral equilibria relevant to phase relations associated with diagenetic, hydrothermal and metamorphic processes, and the prediction of temperature, pressure, and the chemical potential of thermodynamic components compatible with observed mineralogic phase relations in geologic outcrops. Individual research topics. Prerequisite: 171.
3 units, Win (Bird) MWF 10:15

278. Organic Geochemistry—An introduction to the origins and geological fate of sedimentary organic matter and petroleum, emphasizing its molecular aspects. The geological significance of major compound classes are considered with the methods for their recognition. Principles are illustrated by reference to their application in petroleum exploration, palaeoenvironmental assessment, maturity evaluation, palaeoclimatology and pollution from fossil fuels. Recommended: Some prior knowledge of basic organic chemistry.
2 units, Win (Brassell) MWF 1:15

279. Analytical Methods in Organic Geochemistry—A combined lecture/laboratory linking the principles and applications of techniques for the extraction, fractionation and analysis of sedimentary organic matter with practical, hands-on experience in their use. The basis for interpretation of chromatographic and spectroscopic data is related to their geological application. A term project examines the organic characteristics of a sediment or petroleum of the students choice. Prerequisite: 224 or 278.
2 units, Spr (Brassell) M 1:15-3:05

280. Rock Sample Preparation—Practical instruction on the safe use of rock-crushing and mineral separation equipment and technique. For graduate students and advanced undergraduate students using these techniques for their research.
1 unit, Win (Mahood) F 1:15-4:05 alternate years, not given 1989-90

281. Advanced Metamorphic Petrogenesis—
For those who have had an introduction to metamorphic petrology and phase equilibria. The origin and evolution of metamorphic rocks emphasizing metamorphic processes and petrogenesis in the mid-to-lower continental crust. The evolution and maturation of continental crust from geochemical and geophysical points of view through the integration of information from heterogeneous phase equilibria, crystal chemistry, trace element and isotopic geochemistry, experimental geochemistry, and tectonics. The generation of crustal material and its modification by various processes in a tectono-thermal framework that allows a quantitative assessment of the evolution of metamorphic belts. Two lectures and one laboratory per week.
3 units, Win (Bohlan) by arrangement

289. Teaching Experience.
0-3 units, Aut, Win, Spr, Sum (Staff) by arrangement

310. Surface Analytic Chemistry—A practical, hands-on approach to surface analytic techniques including x-ray and ultraviolet photoelectron spectroscopy, Auger electron spectroscopy, scanning electron and Auger microscopy, and low energy electron diffraction. Instruction on a VG ESCALAB Mk II instrument. Lecture topics: design and function of surface analytic instrumentation, technique fundamentals and application, sample preparation, and general procedures in ultra-high vacuum equipment. A term project allows students to perform surface analytic experiments on materials of their choice. Required for those who wish to independently use the VG ESCALAB Mk II at Stanford’s Center for Materials Research. Class size limited. Prerequisite: Consent of instructor.
3 units, Win (Hochella) MW 10:15 lab by arrangement

317. Advanced Field Mapping—10-14 days mapping in a structurally complex region. Emphasis is on collected detailed microscopic structural data and stratigraphic and sedimentologic data to solve a topical problem in either regional and/or local geology. Prerequisite: Consent of instructor.
3 units (Miller) by arrangement

318. Seminar in Structural Geology.
1 unit, Aut, Win, Spr (Staff) by arrangement

358. Seminar in Sedimentary Geology.
1-3 units, Win, Spr (Staff) by arrangement

361. Seminar in Mineralogy.
1 unit, Win (Staff) by arrangement

371. Seminar in Geochemistry.
1 unit, Aut (Staff) by arrangement
381. Seminar in Igneous Petrology-Volcanology.
   1-3 units, Win, Spr (Mahood)
   by arrangement

382. Seminar in Metamorphic Petrology—Selected topics in tectonic and metamorphic processes, research problems and methods of study of metamorphic rocks on their origin and relationships in time and space. Prerequisite: Consent of instructor.
   1-2 units, Aut, Win, Spr (Liou, Coleman)
   by arrangement

386. Seminar in Experimental Geochemistry—For those interested in doing experiments and in using experimental data, and who wish to trace how experiments are planned and carried out, how usable data is extracted from results, how experimental errors propagate through calculations, and how models can be realistically constrained. Student projects concerning either the design of an experiment or the proper use of experimental data are presented.
   2 units, Win (Stebbins) by arrangement

Problems in Various Fields of Geology.
   units, quarter, and time by arrangement
   (Staff)

309. Problems in General Geology.
319. Problems in Structural Geology.
321. Problems in Organic Geochemistry.
339. Problems in Environmental Earth Sciences and Hydrogeology.
349. Problems in Paleontology, Palynology, and Paleocology.
355. Problems in Oceanography.
359. Problems in Sedimentary Geology.
369. Problems in Mineralogy.
379. Problems in Geochemistry.
389. Problems in Petrology and Volcanology.
399. Problems in Geomathematics.

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

409. Research in General Geology.
419. Research in Structural Geology.
421. Research in Organic Geochemistry.
439. Research in Environmental Earth Sciences and Hydrogeology.
449. Research in Paleontology, Palynology, and Paleocology.
455. Research in Oceanography.
469. Research in Mineralogy.
479. Research in Geochemistry.
489. Research in Petrology and Volcanology.
499. Research in Geomathematics.

GEOPHYSICS

Chairman: Amos M. Nur
Professors: John F. Claerbout, Robert L. Kovach, Amos M. Nur, Norman H. Sleep, George A. Thompson, Mark Zoback
Associate Professors: Jerry Harris, Michael O. McWilliams
Assistant Professor: Kiyoshi Yomogida
Courtesy Professors: Stephan A. Graham, David D. Pollard
Acting Assistant Professor: Richard Ottolini
Consulting Professors: Cecil Green, Walter Mooney, Francis Muir, Paul Segall

Geophysics is the branch of earth science concerned with exploration of the earth and its history by physical measurement. The undergraduate and graduate programs are designed to provide (1) a background of fundamentals in science and (2) courses in geophysics to coordinate the fundamentals with principles of geophysics. The program leading to the Bachelor of Science in Geophysics permits many electives and a high degree of flexibility for each individual student. Graduate programs give specialized training for professional work in exploration, research, and education. The Department of Geophysics is housed in the Ruth Wattis Mitchell Earth Sciences Building and the Salvatori Laboratory of Geophysics. The department has a number of research facilities among which are a rock-magnetism laboratory, several large scale microcomputers, a high pressure and temperature rock deformation laboratory, and various instruments for field measurements. Current research activities in the department include earthquake mechanics, geophysical well logging, application of seismology to the study of present-day tectonics, near field seismology, seismic studies of the continental lithosphere, paleomagnetic investigations of regional tectonics, behavior of the geomagnetic field, free oscillation and surface wave studies, and major research programs in reflection seismology and experimental and theoretical rock physics. Graduate programs lead to the degree of Master of Science and Doctor of Philosophy.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

Objectives—To provide a solid background in the essentials of physics and geology, while at the same time providing knowledge about the entire spectrum of geophysics (ranging from exploration geophysics to earthquake seismology and plate
tectonics). Students will be prepared for either an immediate professional career in the resources industry or graduate study.

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 or an Honor’s thesis is also required. Normally, this will be undertaken as part of the student’s participation in three quarters of Research Seminar (Geophysics 185A,C,D,E,F,G,H,J,K,L,M) 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**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<tbody>
<tr>
<td>Chem. 31</td>
<td>Chemical Principles</td>
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<tr>
<td>Chem. 135</td>
<td>Physical Chemical Principles, or Physics 170, 171. Thermodynamics</td>
</tr>
<tr>
<td>Elect. Engr. 141</td>
<td>Electromagnetic Fundamentals, or Physics 120. Electricity and Magnetism</td>
</tr>
<tr>
<td>Geol. 1</td>
<td>Interpreting the Earth</td>
</tr>
<tr>
<td>Geol. 80</td>
<td>Rocks and Minerals</td>
</tr>
<tr>
<td>Geol. 102</td>
<td>Introduction to Field Geology</td>
</tr>
<tr>
<td>Geol. 110</td>
<td>Structural Geology</td>
</tr>
<tr>
<td>Geophy. 185A,C,D,E,F,G,J,K,L,M</td>
<td>Research Seminar</td>
</tr>
<tr>
<td>Math. 21, 22, 23 and 44, or 41, 42, 43, and 44</td>
<td>Analytical Geometry and Calculus</td>
</tr>
<tr>
<td>Math 130</td>
<td>Ordinary Differential Equations</td>
</tr>
<tr>
<td>Physics 51, 53, 54, 55, and 56</td>
<td>Elementary Physics</td>
</tr>
<tr>
<td>Physics 110, 111</td>
<td>Mechanics</td>
</tr>
</tbody>
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The curriculum includes 9 units of Geophysics electives.

The following are particularly recommended to fill the 9-unit requirement: 150, 174, 190, 191. Other suggested Geophysics electives are: 102, 180, 195, 262, 276, 284, 285.

Elective courses which do not fill the 9-unit requirement, but are recommended are: Comp. Sci. 105 or 106, Geol. 103A and B, Geology 181, Physics 57, 58, 64A, 64B, 120, 121, 122, 210, 211, or Elect. Engr. 142, Math. 101, 106, 113, 114, 131, 132, Engr. 44, and Chem. Engr. 140, 150.

**HONORS PROGRAM**

The Department of Geophysics offers a program leading to the degree of Bachelor of Science in Geophysics with Honors. The guidelines are:

1. Find a research project, either theoretical, field, or experimental, that has the approval of an advisor.
2. Submit a proposal to the department, which will decide on its suitability as an Honors project. Necessary forms are in the department office.
3. Course credit for the project will be assigned by the advisor within the framework of Geophysics 205.
4. 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.
5. The decision as to whether a given independent study project does or does not merit an award of Honors shall be made jointly by the department and the student’s advisor. This decision shall be based on the quality of both the Honors work and the student’s other work in earth sciences.
6. The work done on the Honors program should not be used as a substitute for regularly required courses.

**GRADUATE PROGRAMS**

**MASTER OF SCIENCE**

Objectives—To round out the student’s training for professional work in geophysics through the completion of fundamental courses, both in the major field and in related sciences, and by obtaining a start on independent work and specialization.

Requirements for the Degree—The candidate must fulfill the following requirements:

1. Be registered in the graduate school for at least three quarters at full tuition.
2. Complete 45 units with at least a letter grade indicator of “B.” Engineering 102W is required. 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 385A,C,D,E,F,G,H,J,K,L,M).
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. A background in field geology should be at the level of Geology 103A and B.
4. Submit a Program Proposal for the Master’s Degree in the first quarter of enrollment.

Students who do not meet the standard course requirements (see the 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.

**M.S. IN EXPLORATION**

Objectives—To provide the theoretical background needed for a career in petroleum exploration or development geophysics. The program takes four quarters, beginning and ending in the
Autumn Quarter, and in addition includes, for students entering without an equivalent course, a 2-week field geology course (Geology 102) given just before registration for the Autumn Quarter. Separate tuition for this summer session must be paid by the student. A summer internship working in industry or in a government laboratory is an integral part of the program. A written report based on the summer internship is completed in the final Autumn Quarter.

Prerequisites: A B.S. degree in geophysics, geology, physics, engineering, or mathematics, a sequence of courses in mathematics at least through ordinary differential equations, and at least one course in introductory geology. The following additional undergraduate courses are recommended: linear algebra, computer science, complex variables, petrography, and structural geology.

Requirements for the Degree—The required courses for the degree are listed in the following model schedule. Students who have already taken the equivalent of some of the required courses are encouraged to take additional electives in geophysics, electrical engineering, geology, mathematics, or business administration, depending on their career objectives.

First Year

Autumn Quarter

Elect. Engr. 261. Fourier Transform and its Application
Geophys. 174. Seismology
Geophys. 190. General Geophysics
Geophys. 380A. Seminar: Exploration Geophysics
Geophys. 397. Contemporary Geophysics Seminar
Pet. Engr. 150A. Introductory Well Log Analysis

Winter Quarter

Geol. 151. Sedimentary Geology
Geophys. 180. Geologic Interpretation of Reflection Seismograms
Geophys. 180A. Seismic Data Processing Lab
Geophys. 262. Rock Physics
Geophys. 397. Contemporary Geophysics Seminar

One of the following 3 courses:
Elect. Engr. 263. Digital Signal Processing
FORTRAN Short Course
Geophys. 150. Plate Tectonics

Spring Quarter

Geol. 80. Rocks and Minerals
Geol. 110. Structural Geology
Geophys. 284. Reflection Seismology I

Second Year

Autumn Quarter

Geophys. 191A. Geophysical Field Techniques
Geophys. 285. Reflection Seismology II
Geophys. 380B. Seminar: Exploration Geophysics

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, computer science, industrial engineering, accounting, and management.

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 and the completion of 108 units graduate study at Stanford must be satisfactorily completed. At least two of these years, ordinarily the first, must be spent as a registered student at Stanford. During their first year, candidates will take three quarters of Research Seminar (Geophysics 385A,C,D,E,G,H,J,K,L,M). Ph.D. candidates in Geophysics are required to complete Physics 121 or Electrical Engineering 142, Electrical Engineering 261, Engineering 102W, and Physics 210, 211, or Mathematics 220A, 220B and four of the following: Geophysics 102, 174, 195, 262, 283, 294, or 295. Additional advanced courses are to be selected from the following topics: applied physics, astrophysics, atomic and nuclear physics, communications theory, computer sciences, civil engineering, chemical engineering, electromagnetic theory, engineering mechanics, geology, geophysics, materials science, physics of solids, and thermodynamics. Students who wish to waive any of the required courses must petition the department in writing prior to their admission to candidacy. Petitions must state a well-reasoned plan for the substitute requirements. Petitions submitted after admission to candidacy will be approved only in the event of extraordinary circumstances. 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 two academic quarters) is required for the Ph.D. degree. The student
must pass the departmental written qualifying examination (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; submit an Application for Candidacy to the Graduate Program Office; fulfill the requirements of the minor department, if a minor is elected; and prepare under faculty supervision a dissertation which is a contribution to knowledge and the result of independent work expressed in satisfactory form, and pass the University oral examination, which is essentially a defense of the dissertation.

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 department and the University oral examinations. They will be given one additional year in which to submit their dissertations.

University requirements regarding the M.S. and Ph.D. are described in the "Degrees" section of this bulletin.

COURSES

4. Natural Hazards and Man—Introduction to understanding natural and other hazards, earthquakes, volcanic eruptions, tsunamis, toxic waste disposal, nuclear power plant siting, their risk assessment, possible mitigation, and protective measures. For non-majors and potential earth scientists. (DR:8) 3 units, Win (Kovach) MWF 10

102. Paleomagnetism—The application of paleomagnetic methods to problems in tectonics, and stratigraphy. Origin and analysis of the geomagnetic field, origin of magnetization in geological materials, techniques of measurement, data analysis, apparent polar wandering and plate motion, analysis of terrane displacement. Students conduct a small-scale paleomagnetic study as a research project. Prerequisite: Geology 1 or 2. Recommended: 150, Geology 110, Physics 53. 3 units, Spr (McWilliams) by arrangement

111. Introduction to Computing in Earth Science—Computing tools for research in earth sciences. How to use existing hardware and software tools. Focuses on: UNIX operating system; computer networking; graphics software; text processing software; and management of programming projects. 1 unit, Aut (Farrell) TTh 10

150. Plate Tectonics—Description and evolution of movements between lithospheric plates as determined from geologic and geophysical data. Topics: relative velocities between plates; marine magnetic anomalies; interpretation of paleomagnetic data; seismicity at plate boundaries; geologic processes at rises, trenches, and transforms; causes of plate motions; the relationship of plate tectonic processes to the geology of California. Prerequisites: Knowledge of plane geometry, vectors, Geology 1 or 2, or consent of instructor. 3 units, Win (McWilliams) MWF 11

174. Seismology—Introduction to earthquakes and seismic wave propagation. Topics: 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 and its relation to tectonics, and engineering seismology. 3 units, Aut (Kovach) MWF 1

180. Geologic Interpretation of Reflection Seismograms—Elementary principles of reflection seismology, seismic data processing, and field operations, including a field trip to an operating crew (if available). Integration of seismic and other exploration data into exploration programs. Workshops and lectures in stratigraphic and structural interpretation of seismic sections and well logs, utilizing data from various oceans and continents. 3 units, Win (Graham, Ostrander, Zoback) TTh 11, lab W 1:15-4

181. Seismic Data Processing—Workshop experience in computer enhancement of reflection data. Prerequisites: Electrical Engineering 261, concurrent or previous registration in 180. 3 units, Spr (Zoback) WF 1:15-3:30

185A,C,D,E,G,HJ,K,L,M. Research Seminars—Provides the undergraduate an opportunity to participate directly in one of the ongoing research projects. Participation consists 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)

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 each 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. Emphasis on use of deep seismic reflection and refraction data.
2 units, Aut, Win, Spr (Thompson, Mooney) by arrangement

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

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

185L. Research Seminar: Seismotectonics—Research using seismic reflection and other types of geophysical data to understand structure and processes in seismically active areas.
2 units, Aut, Win, Spr (Zoback) by arrangement

185M. Research Seminar: Earthquake Seismology—Current research in 1-D and 3-D earth structures, and kinematic and dynamic processes of earthquakes, with use of global and local seismic data.
2 units, Aut, Win, Spr (Yomogida) by arrangement

190. General Geophysics—Elementary study of gravitational magnetic, seismic, and thermal properties of the earth. Measurements, interpretation, applications to earth structure and exploration. Lab includes field measurements of gravity anomalies magnetic anomalies, and seismic velocity. Prerequisites: Calculus, first-year college physics. Recommended: Geology 110.
4 units, Aut (Sleep) MWF 11 lab by arrangement

191. Geophysical Field Techniques—Geophysical field investigations in a region of geologic and economic interest using seismic refraction, gravity, magnetic, electromagnetic, and electrical field techniques. Introduction to techniques of geophysical prospecting (excluding seismic reflection). Students engage in all phases of the program, interpret the data, and prepare a final report. Suggested for non-geophysics majors in other earth science disciplines. Recommended: 190.
3 units, Aut (McWilliams) TTh 10-11:30 field trip by arrangement

191A. Geophysical Field Techniques—Field investigations as in 191 supplemented with lectures and classroom exercises on the quantitative interpretation and inversion of electrical and electromagnetic prospecting data. Suggested for geophysics majors. Prerequisites: 190 and Physics 120 or Electrical Engineering 141.
4 units, Aut (McWilliams) TTh 10-11:30 field trip by arrangement

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 on current unresolved problems, including the formation of the planets and their thermal histories.
3 units, Spr (Sleep) TTh 10-11:30

205. Honors Program—Experimental, observational, or theoretical Honors project and thesis in geophysics under supervision of a faculty member. Prerequisites: Superior work in the earth sciences and approval of the department. Students who elect to do an Honors thesis should begin planning of the project no later than Winter Quarter of the junior year.
1-3 units, Aut, Win, Spr, Sum (Staff) by arrangement

262. Rock Physics—Properties of and processes in rocks as related to geophysical exploration, crustal studies and tectonic processes. Emphasis on wave velocities and attenuation, hydraulic permeability; and electrical resistivity in rocks. Application to in situ problems, using laboratory data and theoretical results.
3 units, Win (Nur) TTh 11-12:15

276X. Advanced Seismology—Review of modern techniques in earthquake seismology. Elastic dynamic theory. Representation theorem of seismic sources; elastic waves in homogeneous, isotropic and unbounded media; propagation of plane waves, attenuation, elastic waves in...
two-layered or half-space media. Prerequisites: 174 and knowledge of complex variables.

3 units (Yomogida) alternate years, given 1989-90

276Y. Advanced Seismology—Body waves in vertically heterogenous media (generalized ray theory, reflective method, WKB method, full-wave theory), kinematics of seismic source processes. Introduction to dynamics of seismic source processes. Prerequisite: 276X.

3 units, Aut (Yomogida) TTh 1:15 alternate years, not given 1989-90


3 units, Spr (Yomogida) TTh 1:15


252. Rock Fracture—(Enroll in Applied Earth Sciences 282.)


3 units, Spr (Yomogida) TTh 1:15 alternate years, not given 1989-90

284. Reflection Seismology I—Imaging the earth’s interior. Extrapolation of wave fields through 2-D in homogeneous media by finite difference and Fourier methods. Acoustic reflection imaging. Migration. Velocity estimation. Prerequisites: Familiarity with convolution and Fourier transform. Also, Physics 120, 121, Physics 122 or 161 or Electrical Engineering 366.

3 units, Spr (Claerbout) MWF 10


3 units, Aut (Claerbout) MWF 10


3 units (Zoback, Nur) alternate years, given 1989-90

301. Problems in Geophysics.

any quarter (Staff) by arrangement

380A, B. Seminar: Exploration Geophysics—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. First year students register in 380A. Second year in 380B.

380A. 1 unit, Aut (Staff) by arrangement

380B. 1 or 3 units, Aut (Staff) by arrangement

385A, B, C, D, E, G, H, J, K, L, M. Research Seminars—An opportunity to frame and pursue research or thesis research within the context of one of the ongoing research projects in the department. It gives the advanced graduate student a regular opportunity to present thesis research progress reports 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)

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

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

385D. Research Seminar: Rock Physics—Research in areas of current interest in rock mechanics, reservoir geophysics, and related problems. Content varies each 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. Emphasis on use of deep seismic reflection and refraction data.

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


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


2 units, Aut, Win, Spr (McWilliams) by arrangement
385K. Research Seminar: Borehole Geo-
physics—Research in areas of petrophysics,
seismology, in situ stress, and other subjects
related to characterization of physical prop-
erties of rock in situ.
   2 units, Aut, Win, Spr (Zoback)
by arrangement

385L. Research Seminar: Seismotectonics
—Research using seismic reflection and
other geophysical data to understand struc-
ture and processes in seismically active areas.
   2 units, Aut, Win, Spr (Zoback)
by arrangement

385M. Research Seminar: Earthquake Seis-
mology—Current research in 1-D and 3-D
earth structures, and kinematic and dynamic
processes of earthquakes, with use of global
and local seismic data.
   2 units, Aut, Win, Spr (Yomogida)
by arrangement

397. Introduction to Contemporary Geophys-
ics—Seminar on current topics of interest in
geophysics emphasizing active research within
the department and at other institutions. Re-
quired of all first year graduate students.
   1 unit, Aut, Win, Spr (Yomogida) F 3:30

399. Teaching Experience in Geophysics —
On-the-job training in the teaching of geophys-
ics. Provides an opportunity to develop prob-
lem sets and laboratory exercises, grade papers,
and give occasional lectures under the super-
vision of the regular instructor of a geophysics
course. Regular conferences with the instructor
and with students in the class provide the stu-
dent-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

Emeriti: (Professors) Frank G. Miller, Marshall
B. Standing
Chairman: Khalid Aziz
Acting Chairman: Franklin M. Orr, Jr.
Associate Chairman: William E. Brigham
Professors: Khalid Aziz (on leave), William E.
   Brigham, George M. Homsy (by courtesy),
   Sullivan S. Marsden, Jr., Franklin M. Orr,
   Jr., Henry J. Ramey, Jr.
Associate Professor: Roland N. Horne
Acting Assistant Professor: Younes Jalali
Consulting Professors: William C. Harrington,
A. J. Horn, Warren K. Kourt, Robert G.
   Lindblom, James C. Melrose, Aziz S. Odeh,
   Oswaldo Pedrosa, William R. Voss

Petroleum engineers are concerned with the
optimization of hydrocarbon recovery from oil
and gas reservoirs. This involves drilling of
wells, design and operation of production facil-
ities, selection and implementation of schemes
for enhancing recovery, monitoring of reser-
voirs, and transportation of oil and gas to proc-
essing facilities and to markets. Because of the
complex and changing nature of the problems
involved, the Petroleum Engineering Depart-
ment curriculum attempts to develop a sound
background in relevant basic sciences and their
application to practical problems. This includes
fundamentals of physics, chemistry, mathemat-
ics, geology, geophysics, computer science, and
engineering. Applied courses in the depart-
ment cover virtually all aspects of petroleum
engineering and some related fields like ge-
othermal engineering.

Petroleum engineers are distinguished from
other engineers by their understanding of the
characteristics of reservoir rock and flow of
fluids in such systems. The broad training in this
field prepares the graduates for professional
assignments in areas such as:

Drilling and Production Technology
Enhanced Oil Recovery
Environmental Engineering
Geothermal Energy Production
Natural Gas Engineering
Pipeline Transportation
Reservoir Engineering
Reservoir Simulation
Water Production and Reclamation
Well and Property Economic Evaluation
Well Logging and Log Analysis
Well Test Analysis

Faculty and graduate students in the depart-
ment conduct research in a variety of areas
including: enhanced oil recovery by thermal
means, by gas injection, and by the use of
chemicals; reservoir simulation with computer
models; well test analysis; flow of fluids and fluid
mixtures in pipes; natural gas engineering;
properties of petroleum fluids; and geothermal
engineering. Undergraduate students are en-
couraged to participate in research projects.
Graduate programs lead to the degrees of
Master of Science, Engineer, Engineer with
Management Option, and Doctor of Philos-
ophy.

FACILITIES

The department occupies the Lloyd Noble
Laboratory of Petroleum Engineering and por-
tions of the Ruth Watts Mitchell Earth Sci-
ences Building and the Henry Salvatori Labora-
tory of Geophysics. The departmental office and
most of the faculty are housed in the Mitchell Earth Sciences Building. In addition, a research laboratory and student study space are provided in this building. The Lloyd Noble Building contains laboratories for high temperature fluid flow and geothermal energy research, oil recovery research, adsorption studies, and analytical work. It also houses the Stanford Petroleum Research Institute (SUPRI) main office as well as a classroom, small all-purpose shop, and offices for faculty, staff, and graduate students. The Salvatori Laboratory houses the department's VAX 11/750 computer, two laboratories for enhanced oil recovery research, and offices for faculty and students. Computer terminals are available in student and faculty offices in all three buildings, and several dial-in lines are available for off-campus use. In addition to the VAX 11/750, the department supports an on-campus Gould 9080 Computer System. All graduate and undergraduate students have easy access to the computer facilities and are required to use these in their course work.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

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 certified by the Accreditation Board for Engineering and Technology (ABET). The department undergoes accreditation inspections with the School of Engineering and further information may be found in the “School of Engineering” section of this bulletin. Basic sciences and engineering are stressed to provide depth sufficient for the wide spectrum of careers possible in this field.

COURSE PROGRAM

The requirements for the B.S. degree in Petroleum Engineering are similar to those described for any engineering degree in the “School of Engineering” section of this bulletin. Students must satisfy the University distribution, writing, and language requirements. The normal Petroleum Engineering undergraduate program will automatically satisfy the University distribution requirements in Area 6 (Mathematics), Area 7 (Natural Sciences) and Area 8 (Technology and Applied Science). Engineering fundamentals courses and petroleum engineering depth and elective courses should be taken for a letter grade. ABET accreditation requires that engineering students have one-half year (22½ credits) of engineering design. That requirement will normally be met on completion of the engineering fundamentals and petroleum engineering depth courses.

In brief, the credit and subject requirements are:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering fundamentals</td>
<td>19 (min)</td>
</tr>
<tr>
<td>Mathematics</td>
<td>20 (min)</td>
</tr>
<tr>
<td>Science</td>
<td>24 (min)</td>
</tr>
<tr>
<td>Petroleum engineering depth</td>
<td>45 (min)</td>
</tr>
<tr>
<td>Distribution, writing, language and electives</td>
<td>72</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
</tr>
</tbody>
</table>

The following courses constitute the normal program leading to a B.S. in Petroleum Engineering. The course program may be modified to meet a particular student's needs and interests, provided the degree requirements for engineering and ABET certification are met. Modified course programs must be approved by the student's advisor. Design units are indicated in brackets [ ].

MATHMATICS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 41.</td>
<td>Calculus and Analytical Geometry</td>
<td>5</td>
</tr>
<tr>
<td>Math. 42.</td>
<td>Calculus and Analytical Geometry</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

or

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 19.</td>
<td>Calculus and Analytical Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Math. 20.</td>
<td>Calculus and Analytical Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Math. 21.</td>
<td>Calculus and Analytical Geometry</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

In addition, the following courses are also required:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math. 43.</td>
<td>Calculus and Analytical Geometry</td>
<td>5</td>
</tr>
<tr>
<td>Math. 44.</td>
<td>Calculus</td>
<td>3</td>
</tr>
<tr>
<td>Math. 130.</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

SCIENCE

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 31.</td>
<td>Chemical Principles</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 33.</td>
<td>Structure and Reactivity</td>
<td>4</td>
</tr>
<tr>
<td>Chem. 135.</td>
<td>Physical Chemical Principles</td>
<td>3</td>
</tr>
<tr>
<td>or Chem. 171.</td>
<td>Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>Geology 1.</td>
<td>Interpreting the Earth</td>
<td>4-5</td>
</tr>
<tr>
<td>Physics 51.</td>
<td>Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>Physics 53.</td>
<td>Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>Physics 54.</td>
<td>Electricity and Magnetism</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>24-25</td>
</tr>
</tbody>
</table>

ENGINEERING FUNDAMENTALS

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr. 10.</td>
<td>Applied Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 11.</td>
<td>Mechanics of Materials I</td>
<td>4</td>
</tr>
</tbody>
</table>
**Course No.** | **Subject** | **Units**
--- | --- | ---

**Plus one course chosen from:**
- Comp. Sci. 3. Fortran* 2
- Engr. 50. Introduction to the Science of Materials 3
- Engr. 70. Introduction to Software Engineering [2] (same as Comp. Sci. 106A.) or Engr. 70X. Introduction to Software Engineering (Accelerated) (same as Comp. Sci. 106X.) 5

**Total** 19-23

*Students in junior- and senior-level petroleum engineering courses are assumed to have competence in Fortran. Students who do not have a Fortran background should take Comp. Sci. 3.*

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**PETROLEUM ENGINEERING DEPTH**

The following courses constitute the core program in Petroleum Engineering (45 units required):

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geol. 110A. Introduction to Earth Structures [1]</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geol. 151. Introduction to Sedimentary Facies [1]</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pet. Engr. 151D. Reservoir Fluids Laboratory [0]</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

**Total** 39

**Technical Electives:** Students must select a minimum of 6 additional units of courses from Applied Earth Sciences, Geology, Geophysics or Petroleum Engineering. Courses that may be used to satisfy this requirement are listed below. Other relevant courses may be substituted with the prior approval of the student's advisor.

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>App. Earth Sci. 192. Computing in Geology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Geophys. 190. General Geophysics [1]</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

---

Sample programs showing courses by year and quarter are available in the Petroleum Engineering office, room 360, Mitchell Earth Sciences Building. It is important to start mathematics courses in the first year and engineering and geology early in the second year. There is extensive use of computers in most petroleum engineering courses. Students must develop programming skills through self study and appropriate course work.

Several other requirements are: (1) engineering fundamentals, petroleum engineering depth courses and technical electives should be taken for letter grades, and (2) ABET accreditation requires engineering students to have one half year (22½ credits) of engineering design. The latter requirement will normally be met on completion of engineering fundamentals and petroleum engineering depth requirements.

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**HONORS PROGRAMS**

A limited number of undergraduates may be admitted to the Honors program at the beginning of the senior year. Those completing the program satisfactorily will receive the degree of
Bachelor of Science in Petroleum Engineering with Honors.

To be admitted in the program, the student must have a letter grade indicator (LGI) 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 6 units of advanced petroleum engineering courses and complete at least 3 units of undergraduate petroleum engineering research (Pet. Engr. 190). An overall 3.5 LGI is required in all petroleum engineering courses for graduation with Honors.

Students who wish to be admitted to the Honors program should register in the Petroleum Engineering Department office before the start of their senior year. Those who do not meet all of the above formal requirements, may petition the department for admission.

COTERMINAL B.S. AND M.S. PROGRAM

A Stanford undergraduate majoring in engineering or earth sciences may be admitted to the University Division for the purpose of working simultaneously toward both bachelor’s and master’s degrees under terms indicated in the introductory material for the School of Earth Sciences.

The applicant’s petition must provide strong evidence of academic performance as a graduate student. The petition will be evaluated and acted upon by the graduate admissions committee of the department. Typically, at least a 3.25 letter grade indicator in engineering, science, and mathematics is expected. Applicants should take the Graduate Record Examination (GRE) to be considered. Students seeking a Bachelor of Science in an engineering field other than petroleum engineering and a Master of Science in Petroleum Engineering, should plan to take petroleum engineering and geology undergraduate requirements as a portion of the School of Engineering engineering breadth requirement for their undergraduate degree.

GRADUATE PROGRAMS

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 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.

MASTER OF SCIENCE

The objective is to prepare the student for professional work in petroleum engineering through the completion of fundamental courses, both in the major field and in related sciences, and by obtaining a start on independent work and specialization.

The candidate must fulfill the following requirements:

1. Be registered in the graduate school for at least three full quarters at full tuition.
2. Submit a Program Proposal for the Masters Degree in the first quarter of enrollment.
3. Complete 45 units with at least a letter grade indicator of “B”; normally 6 of these units must be independent work on a research problem.
4. 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.

In making up deficiencies, some of the following courses may be considered as mezzanine courses: Pet. Engr. 150A, 150B, 170, 171, 172, and 175. That is, they may apply as either undergraduate or graduate credit. The 10 unit limitation applies to other deficiencies such as geology and other undergraduate petroleum engineering courses.

5. Demonstrate a knowledge of basic principles and research methods in the general field of study by preparing a report, to be submitted to the research advisor.

Usual research subjects include oil and gas recovery, reservoir engineering, reservoir simulation, 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.

RECOMMENDED COURSES

The following course list is recommended for most students. With the consent of the student's advisor, other courses may be substituted based on interest or prior background.
## MATHEMATICS SEQUENCE

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

## RESERVOIR ENGINEERING SEQUENCE

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pet. Engr. 175</td>
<td>Well Test Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Pet. Engr. 270A</td>
<td>Advanced Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td>Pet. Engr. 270B</td>
<td>Advanced Reservoir Engineering</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

## ENHANCED OIL RECOVERY SEQUENCE

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pet. Engr. 251</td>
<td>Thermodynamics of Phase Equilibria</td>
<td>3</td>
</tr>
<tr>
<td>Pet. Engr. 280A</td>
<td>Improved Recovery Methods</td>
<td>3</td>
</tr>
<tr>
<td>Pet. Engr. 280B</td>
<td>Improved Recovery Methods</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

## RESERVOIR SIMULATION SEQUENCE

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pet. Engr. 171</td>
<td>Reservoir Simulation</td>
<td>3</td>
</tr>
<tr>
<td>Pet. Engr. 271</td>
<td>Advanced Reservoir Simulation</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

## TECHNICAL ELECTIVES

Technical electives should consist of two courses from Pet. Engr. 167, 269, 273, 274, 284 or any advanced level course from other departments (with consent of advisor).

Electives 6

## RESEARCH

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>6</strong></td>
</tr>
</tbody>
</table>

## 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 full 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 (Petroleum Engineering 360). No more than 10 of the 90 required units can 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 (Petroleum Engineering 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 letter grade indicator (LGI) of "B" 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, another faculty member, and the University Committee on Graduate Studies.

## 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 full 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 15 units credit for research (Petroleum Engineering 360), and including all the course requirements of the department's master's degree (39 units, excluding research). If the candidate has received unit credit for research, this credit ordinarily would be transferable to the Engineer degree, in which case a total of 9 additional research units would be required. No more than 10 of the required 90 units may be applied to overcoming deficiencies in undergraduate training. In making up deficiencies, some of the following may be considered as mezzanine courses: 150A, 150B, 170, 171, 172, and 175. That is, they may apply as either undergraduate or graduate credit. The 10-unit limitation applies to the other deficiencies such as geology and other petroleum engineering courses. 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):
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 an LGI of "B." 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, another faculty member, 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 72 units beyond the 45 units required for the master's degree. Approximately 45 units of course work are generally required, exclusive of research units. The 45 units in question should represent graduate courses in petroleum engineering offered at Stanford, courses picked from the following list, and other courses approved by the department.

MATH AND APPLIED MATH

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
</table>

SCIENCE

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>App. Earth Sci. 225. Surfaces and Interfaces</td>
<td>3</td>
</tr>
<tr>
<td>App. Earth Sci. 251. Oil Field Geology and Exploration</td>
<td>3</td>
</tr>
<tr>
<td>App. Earth Sci. 255. Introduction to Solute Transport</td>
<td>2</td>
</tr>
<tr>
<td>Geol. 232. Numerical Methods in Hydrology</td>
<td>2</td>
</tr>
<tr>
<td>Geol. 278. Organic Geochemistry</td>
<td>2</td>
</tr>
<tr>
<td>Geophys. 190. Geologic Interpretation of Reflection Seismograms</td>
<td>3</td>
</tr>
<tr>
<td>Geophys. 190. General Geophysics</td>
<td>4</td>
</tr>
<tr>
<td>Geophys. 262. Rock Physics</td>
<td>3</td>
</tr>
</tbody>
</table>

ENGINEERING

<table>
<thead>
<tr>
<th>Subject</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Chem. Engr. 140. Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Engr. 295. Methods and Experiences in Engineering Education</td>
<td>3</td>
</tr>
<tr>
<td>Mech. Engr. 230. Introduction to Heat Transfer</td>
<td>4</td>
</tr>
<tr>
<td>Mech. Engr. 252A. Convective Heat and Mass Transfer</td>
<td>3</td>
</tr>
</tbody>
</table>

The Ph.D. program is normally a four-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 a minimum of 45 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 27 units of research. The student begins the research work by making a literature survey and by formalizing research objectives. In the fourth year, the student spends full time completing research and writing the dissertation.

The departmental qualifying examinations usually are taken at the beginning of the second year of graduate study, or at any time mutually agreed upon by the student and the faculty. Students are required to take the qualifying examination at the first opportunity after the completion of the requirements for the master's degree. Students who enter the program after obtaining the master's degree in another university will take the qualifying examination in their second year of graduate study at Stanford, but will be required to present a seminar on their master's research during their first year. The qualifying examinations extend over a period of about 10 days and consist of a written part and an oral part. The written part consists of three or four two-hour examinations on different sub-
jects. 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. The student must prepare a dissertation which is a significant 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.

Ph.D. MINOR

To be recommended for the degree of Doctor of Philosophy with Petroleum Engineering as a minor subject, a student must take 15 units of selected graduate-level lecture courses in the department. These should include 270A and B. The remaining courses must be selected from 170, 171, 271, 275, 280A and B.

COURSES

103. Survey of the Energy Industries—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 renewable resources. (DR:8)
3 units, Aut, Spr (Staff) MWF 9 and 11

150A. Well Log Analysis I—An interdisciplinary course for all earth scientists and engineers giving 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. First part of a two-part course concentrating on the fundamentals of all types of logs including electric and nonelectric logs.
3 units, Aut (Lindblom)
evenings, by arrangement

150B. Well Log Analysis II—Second part of the two-part course. Concentrates on quantitative, interpretive techniques of all types of logs.
2 units, Win (Lindblom) W 7-10

3 units, Aut (Staff) T 10-12 Th 11

151D. Reservoir Fluids Laboratory—Physical properties of petroleum and its products: gravity, viscosity, surface tension, distillation, etc.; computer prepared reports and literature search. Prerequisite: 151A (may be taken concurrently).
2 units, Win (Marsden) by arrangement

151E. Core Analysis—Laboratory and related lectures on porosity, permeability, capillary pressure, irreducible saturations, and the formation resistivity factor of porous media. Prerequisites: 151D, 155.
3 units, Spr (Marsden) T 1:15
lab TTh 2:15-5:05

152A. Drilling Technology—A comprehensive picture of modern drilling operations, practices, and equipment onshore and offshore. Lectures, field trips, problems.
3 units, Win (Staff) T 10-11:50 Th 11

152B. Production Technology—A survey of production operations, practices, and equipment. Lectures, demonstrations, field trips.
3 units, Spr (Staff) T 10-12 Th 11

155. Fundamentals of Transport Phenomena—Lectures, problems. An introduction to the description of fluid flow, mass and heat transfer, and energy. Hydrostatics and potential flow. Laminar and turbulent flow in tubes. Flow in porous media, capillary pressure, and relative permeability. Simultaneous flow and diffusion of heat or mass. Prerequisites: Engineering 21 or Mechanical Engineering 33; Math 30 (may be taken concurrently), or consent of instructor.
3 units, Win (Orr) TTh

160. Report on Energy Industry Training—Students are required to submit a report covering at least two consecutive months of industrial experience.
1 unit, any quarter (Staff) by arrangement

167. 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, taxation, fair market value. Prerequisite: Consent of instructor.

3 units, Win (Kourt, Voss) S 9-12

170. Elements of Reservoir Engineering—Lectures, problems. Description and classification of natural underground oil and gas reservoirs. Description and engineering calculations on fluid contents of natural underground oil and gas reservoirs. Prediction of recoveries from oil, water, and natural gas reservoirs as a function of pressure and time. Design of reservoir development. Prerequisites: 151A and B.

3 units, Spr (Brigham) MWF 1:15


3 units, Aut (Horne) TTh 8:30-9:50


3 units, Aut (Staff) MWF 8


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


3 units, Spr (Ramey) MWF 10

180. Undergraduate Teaching Experience—Leading field trips, preparing lecture notes, quizzes under supervision of the instructor. Maximum of 3 units allowed.

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

190. Undergraduate Research Problems—Original or guided research problems with comprehensive report.

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


3 units, Aut (Orr) TTh 2:30-4

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, taxation, fair market value; original or guided research problems on economic topics with report. Prerequisite: Consent of instructor.

3 units, Win (Kourt, Voss) S 9-12


1 unit, 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 (Staff) not given 1989-90


3 units, Win (Ramey) MWF 10


3 units, Win (Ramey) MWF 10


3-4 units, Win (Staff) MWF 11

any quarter (Staff) by arrangement


3 units, Aut (Marsden) MWF 10


3 units (Staff) not given 1988-89


3 units, Win (Orr, Jalali) TTh 8:30-9:50


3 units, Spr (Staff) alternate years, not given 1989-90


3 units, Spr (Horne)

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

3 units, Spr (Marsden) MWF 1:15

285A,B,C,E. Research Seminars—Pursues special, focused study in areas of research within the department. All graduate degree program students may 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 (Brigham) by arrangement


1 unit, Aut, Win, Spr (Horne, Ramey) by arrangement

285E. Research Seminar: Reservoir Simulation—Current research in SUPRI-B (Reservoir Simulation) program.

1 unit, any quarter (Aziz, Horne) by arrangement

359. Teaching Experience in Petroleum Engineering—On the job training in teaching petroleum engineering. The student prepares and presents several lectures, problem sets, grades problems, and prepares laboratory experiments under the supervision of a regular course instructor. Performance is evaluated by students and the regular instructor.

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


any quarter (Staff) by arrangement
Dean: Marshall S. Smith
Associate Deans: Carl E. Thorsen (Academic Affairs), Anne Gaddy (Administration)
Assistant Dean: Ralph Keller (Alumni Relations)

Associate Professors: Martin Ford, Edward Haertel, Jane Hannaway, Milbrey McLaughlin, Francisco O. Ramirez, David Rogosa, Myra H. Strober, Decker F. Walker
Assistant Professors: M. Beatriz Arias, Angelo Collins, Teresa D. LaFromboise

Lecturers: Margaret Azevedo, Raymond F. Bacchetti, David Fetterman, Donald B. Herring, Francis J. Method, Louise Spindler
Acting Associate Professor: Stephen Witte
Acting Assistant Professors: Herlinda Cancino, Rebecca Hawthorne, Margaret Korpi
Consulting Associate Professors: John Bachman, Dolores Gallagher, Donald M. Hill III
Visiting Professors: Philip G. Altbach, Jeremy Finn
Visiting Associate Professor: Richard Valencia
Visiting Assistant Professor: Linda Vavrus

The School of Education is organized into six Program Area Committees:
Administration and Policy Analysis (APA)
Curriculum and Teacher Education (CTE)
International Development Education (IDE)
Mathematical Methods in Education (MME)
Research (MME)
Psychological Studies in Education (PSE)
Social Sciences in Education (SSE)

These committees function as administrative units which act on admissions, plan course offerings, assign advisors, and set program requirements within their areas. Various subspecialties are offered in most program areas. Faculty members are primarily affiliated with one program, but normally participate in two to three of the area committees. While there is a great deal of overlap and interdisciplinary emphasis across program areas, students will be affiliated with one area committee and must meet the degree requirements set by that committee.

Detailed information about admission and degree requirements, faculty members, and specializations related to these area committees can be found in the School of Education Bulletin.

OFFERINGS

The School of Education prepares scholars, teachers, supervisors, guidance workers, administrators, and other educational specialists. Five graduate degrees with specialization in education are granted by the University: Doctor of Philosophy, Doctor of Education, Educational Specialist, Master of Arts, and Master of Arts Teaching (subject). While no undergraduate majors are offered, programs and courses are available to undergraduates. The school also provides appropriate coursework and programs to recommend candidates to the California Commission on Teacher Credentialing for the Single Subject (secondary) Teaching Credential and the Preliminary Administrative Services Credential. California credential requirements frequently satisfy or partially satisfy requirements in other states.

Students who have qualified for a preliminary teaching credential in California and need a fifth year of study and a University recommendation for the clear California teaching credential may satisfy this requirement in one of the University’s degree programs. The Stanford Teacher Education Program (STEP) offers a master’s degree along with the credential. Persons interested in becoming principals, central office administrators, or superintendents and who are seeking the Preliminary Administrative Services Credential must be admitted to a degree program in the school as well as to the program for the credential.
Students interested in credentials must contact the Degree Program Office in the School of Education during their first quarter of study. Requirements for credentials and degree program requirements do not necessarily coincide, and students seeking a credential along with a degree must make certain that they satisfy both types of requirements.

The School of Education offers an eight-week Summer Session. Those who pursue a full program of study (15 units) for eight weeks may earn a full quarter of residence toward the requirement for a degree. Summer course offerings are covered in the Summer Session Bulletin issued each year in February. The school offers no correspondence or extension courses.

**UNDERGRADUATE PROGRAM**

The School of Education does not offer an undergraduate education major. However, programs are available for students interested in the field of education. Undergraduate education is receiving increased attention in the school. Students are encouraged to take courses in many departments and to explore admission to co-terminal and master's degree programs. Several courses at the 100 level are especially designed for undergraduates. The Undergraduate Program in the School of Education, UPSE, offers a variety of tutoring opportunities for undergraduates interested in developing educationally oriented skills. A coterminal program offering a Master of Arts degree in Education and an undergraduate Honors program are available.

**HONORS PROGRAM**

This program, which during the first two years will be limited to 12 students, will permit interested and able undergraduates at Stanford to build upon the training they have received in their field of major study by pursuing additional courses and a research or practicum project in a related area of education. The connection between the School of Education and undergraduate education at Stanford has grown during recent years, the Undergraduate Program in the School of Education (UPSE), the Public Policy Program, the master’s programs that involve co-terminal enrollment, and the Honors program will systematize that connection.

The School of Education is a graduate school; it has earned its reputation in this field, but, at the same time, is committed to undergraduate education. The intention of the Honors program is not to develop an undergraduate major in education but to provide exposure to the field of education for undergraduates who may or may not decide on education as their ultimate career goal.

Students will apply for entry during their junior year; those applying or considering applying will take the UPSE seminar in the fall of the junior year. Approved coursework totaling 25 units must be taken, in addition to coursework in their major field of study. No more than 6 units can be taken for work on the Honors thesis; the thesis will be based upon a supervised research or practicum project. At least one course must be taken from each of the following:

1. Educational policy and history in the U.S. Courses include American Education and Public Policy; History of Education in the United States; History of School Reform; Issues in Education.
2. Contemporary problem areas. Courses include Psychology of Literacy; Sex and Education; The New Families: Implications for Education and Employment; Investing in the Education of the Disadvantaged.
3. Foundational disciplines. Courses include Psychological Foundations of Education; Sociology of Education; Models of the Child in Contemporary Educational Thought; Introduction to Philosophy of Education; History of Education.

One course or a directed reading with either a faculty member in Education or in the major department that relates the major to an education issue will also be required.

Near the end of Spring Quarter there will be a mini-conference at which successful candidates for Honors will orally present brief reports of their work and their findings. All students enrolled will be expected to attend this conference.

**MELLON PROGRAM IN TEACHER EDUCATION FOR STANFORD UNDERGRADUATES**

The Mellon Foundation Program in Teacher Education is a coterminal degree program leading to the bachelor's degree in one of five subject areas and the master's degree in education. It offers undergraduate students at Stanford the opportunity to begin preparing for careers in teaching two years before the normal fifth-year program. It also offers an enhanced pedagogical perspective on the student's major.

Students will be involved in educational coursework and/or fieldwork during the junior and senior academic years and summers, enroll in the Stanford Teacher Education Program (STEP) in the year following completion of the bachelor's degree, and attend several follow-up sessions at Stanford during the first year of teaching and the summers previous and subsequent to that year. These sessions will be de-
voted to assisting students as they enter the profession. Coursework and fieldwork during the junior and senior years will be planned in conjunction with students' major area and education advisors. It will be chosen to enrich and broaden the subsequent STEP experience.

Eligibility—Students must have between five and seven remaining quarters to complete at Stanford at the time of their admission into the Mellon Program in September. Only students with appropriate majors will be considered for the Mellon Program: foreign languages (Spanish, German, French), History, English, science (Biology, Chemistry, Physics), and Mathematics, and five areas of teacher training in the Stanford Teacher Education Program (STEP).

Financial Aid—Limited fellowship support associated with tutoring activities will be available in varying amounts during the junior and senior years. Need-based tuition support and a stipend is anticipated for the STEP year.

Applications, available in the Admissions Office at the School of Education, are due May 1. Awards will be made by June 1.

COTERMINAL A.B./A.M. PROGRAM IN EDUCATION

The School of Education admits students from undergraduate departments within the University into a coterminal A.B. and A.M. program. Students in such a program receive an A.B. in their undergraduate major and an A.M. in Education. Approval of the student's undergraduate department and of the School of Education is required. Applications may be made upon completion of 105 units, but no later than the end of the 11th quarter of undergraduate work. Students study for both the bachelor's and master's degrees simultaneously and must complete 15 full-time quarters, or three full-time quarters after completing 180 units toward the undergraduate degree. The number of units required for the A.M. degree depends upon the program requirements within the School of Education; the minimum is 36 units.

Applicants may obtain coterminal degree application materials from the School of Education Admissions Office. The Graduate Record Examination (General Test) is required for all coterminal admissions. (Coterminal applicants should also consult with the University's Graduate Program Office regarding eligibility for coterminal study.)

GRADUATE PROGRAMS

Several advanced degree programs are offered by the School of Education and are described below. Requirements vary somewhat across programs. Both University and School of Education requirements must be met for each degree. The University requirements are detailed in the "Degrees" section of this bulletin, and are administered by the graduate division of the University. Students are urged to carefully read this section noting residence, tuition, and registration requirements. A student who wishes to enroll for graduate work in the School of Education must be qualified and admitted to graduate standing by the University and by one of the area committees within the school.

Complete information about admissions procedures and requirements is available by writing to the Office of Graduate Admissions, Building 590, Stanford University, Stanford, CA 94305-3052. The admissions packet includes: The Stanford University Bulletin, Information, which details University requirements, organization and facilities; The School of Education Bulletin, which outlines degrees, programs, admission, and graduation requirements, and interests of the faculty of the School; a reprint of the School of Education section of the Courses and Degrees bulletin, which describes courses and degrees offered; and application materials. Scores from the Graduate Record Examination General Test (verbal, quantitative, and analytical areas) must be submitted as well as TOEFL scores for those whose first language is not English.

MASTER OF ARTS

The Master of Arts degree is conferred by the University upon recommendation of the faculty of the School of Education and the University Committee on Graduate Studies. The University residence requirement is three full-tuition quarters as a graduate student at Stanford. The minimum unit requirement is 36 quarter units earned at Stanford as a graduate student. At least 12 units must be taken for a letter grade indicator of "B" or better, and a minimum of 18 quarter units of the program must be taken in the School of Education. Master's students should obtain detailed program requirements from their area committees, and University degree requirements and forms from the Degree Programs office in the School of Education during their first quarter of residence. Please note that some master's degree programs require more than the minimum of 36 quarter units of credit. No thesis is required to earn a master's degree. (Note: the IDE Area Committee does require an essay.) Additional detailed information regarding entrance requirements and degree requirements is available in the School of Education Bulletin. Upon admission, each student is assigned an advisor from the appropriate area committee, and students are
encouraged to see their advisor and begin planning a coherent program early.

The area committee programs with specializations available for Master of Arts degrees are as follows:

- Administration and Policy Analysis
  Joint Program with Graduate School of Business
- Prospective Principal's Program
- Curriculum and Teacher Education with specializations in:
  - Curriculum Areas (Art, Dance, Math, Science, Social Studies)
  - Design and Evaluation of Educational Programs (General Curriculum, Curriculum Evaluation, Elementary Education, Secondary Education, Teacher Education)
  - Language, Literacy and Culture (Bilingual/Bicultural Education; Second Language Education; Writing, Reading, and Language-English)
  - Stanford Teacher Education Program
  - International Development Education
  - International Educational Administration and Policy Analysis
  - Mathematical Methods in Educational Research
  - Psychological Studies in Education
  - Health Psychology/Education
  - Social Sciences in Education
  - Gender Studies

PROSPECTIVE PRINCIPALS PROGRAM

The Prospective Principals Program at Stanford offers the Master of Arts degree with a specialization in Administration and Policy Analysis which can be combined with the Preliminary Administrative Services Credential. It enables prospective principals to become leaders and to manage ideas, things, and self to achieve worthwhile educational results for a diverse student population. This is accomplished through three consecutive summers of full-time study and is, therefore, available to persons working in a school system during the academic year. Teaching experience is a prerequisite for admission to this program. The master's degree requires 45 quarter units. In order to qualify for the credential, a total of 47 quarter units, including internship units, will be necessary. Additional information regarding admission requirements, course work, and credential requirements is available in the School of Education Bulletin.

STANFORD TEACHER EDUCATION PROGRAM (INTERNSHIP)

The Stanford Teacher Education Program (STEP) is a 12-month, fifth-year program for persons seeking initial preparation for the California Single Subject (secondary) Teaching Credential along with a Master of Arts degree. It begins in June with a Summer Quarter of intensive academic preparation in the process of teaching and experience in summer programs in high school classrooms. During the academic year, students take courses in academic areas, and in education and also teach part-time in local schools. STEP offers an unusual opportunity to combine practical and theoretical preparation in an institution devoted to understanding teaching and learning. The following areas are available for credential training: English, foreign language (French, German, Spanish), Mathematics, science (Biology, Chemistry, Physics), and social science. The program requires 45 quarter units emphasizing educational theory, field experience, curriculum and instruction in academic areas, and specialized teaching needs. It has a definite course sequence and requires four quarters of consecutive residence at Stanford. Further information regarding admission requirements, course work, and credential requirements is available in the School of Education Bulletin.

MASTER OF ARTS, TEACHING (SUBJECT)

The degree of Master of Arts, Teaching (Subject) is reserved for experienced teachers or for individuals who have previously completed a program of teacher preparation. It is offered jointly by the School of Education and the following academic departments: Art, Biology, Chemistry, English, German, History, Latin American Studies, Mathematics, Political Science, Slavic Languages and Literatures, and Sociology. In addition to these fields, it is possible for candidates to work out special programs in areas such as the social sciences.

Applicants must have:

1. Completed a bachelor's degree with an acceptable letter grade indicator to qualify 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 by both the department of the teaching major and the School of Education.
2. Teaching experience.

General requirements for the degree are as follows:

1. Three quarters of full-tuition registration (or equivalent in partial tuition quarters). Only one quarter of non-matriculated study may be counted toward the residency requirement for this degree.
2. A minimum of 45 quarter units of graduate study. At least 36 of these units must be completed at Stanford.

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

4. At least 12 units of the M.A.T. degree 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.)

5. Requirements in the major teaching field are determined by the major department, and the program of professional courses by the School of Education. The program proposal for the degree must be signed by representatives of both the academic department and of the School of Education.

6. The candidate must achieve at least a "B" letter grade indicator 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.

7. 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.

8. Candidates for the M.A.T. degree must file a program proposal for the degree with the graduate division by the last day of class in the first quarter of residence.

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

EDUCATIONAL SPECIALIST IN EVALUATION

The degree of Educational Specialist (Ed.S.) is offered in the field of Evaluation for those students admitted to the School of Education's Evaluation Training Program. Evaluation of educational and social programs helps society to find programmatic methods of solving pressing problems. Evaluators must be familiar with a variety of disciplines and have expertise in at least one. A broad understanding is essential of the political, social, and organizational settings in which decisions are made and programs are carried out. Students take courses examining evaluation problems from theoretical, technical, and practical perspectives.

This program is especially designed for, but not limited to, applicants who: (1) hold a master's degree and wish to advance professionally; (2) are taking another course of study at Stanford and wish to obtain this degree concurrently; or (3) hold a doctorate degree but wish to specialize in evaluation in a post-doctoral year.

The Ed.S. degree requires 45 quarter units beyond the master's degree (or its equivalent) and includes field-based project work. The University requirement of three full-tuition quarters in residence at Stanford also applies. Additional information about admission and program requirements is available in The School of Education Bulletin.

DOCTORAL DEGREES

Two types of doctoral degrees are offered by the School of Education. The Doctor of Philosophy (Ph.D.) degree is offered by all program area committees. The Doctor of Education (Ed.D.) degree is offered only in the Administration and Policy Analysis Program. Both degrees are conferred by the University upon recommendation by the faculty of the School of Education and the University Committee on Graduate Studies. University residence requirements (nine full tuition quarters or the equivalent), amount of transfer credit applicable (no more than three full quarters), and the timetable for the stages of progress to completion are applicable to both degrees. Additionally, the School of Education unit requirement for both degrees is 108 quarter units beyond the baccalaureate degree (including a maximum of 36 relevant transfer units). Course work taken seven or more years ago will not ordinarily be counted.

Students should note carefully that admission to graduate standing by the University to work toward a doctoral degree does not in itself constitute admission to candidacy for the degree. Students must qualify and apply for candidacy by the end of their second year of study, and should obtain information about procedures and requirements during their first year.

Doctoral degrees are designed for students preparing to conduct research and teach as faculty members in a college or university, or to direct research in public school systems or in
specialized institutions. The Ph.D. degree is somewhat more oriented to theoretical research, while the Ed.D. degree can focus more on informed and critical applications of existing knowledge to educational practice. Ph.D. students must complete a formal minor in another discipline or hold an acceptable master's degree outside the field of education. A minor is not required for the Ed.D.

Doctoral students should plan to specialize in the field of their professional interest, preparing for some line of professional activity while mastering an organized body of knowledge. With the flexibility offered in programs, students are encouraged to design a course of study which is relevant and meaningful to their interests and professional objectives.

Upon admission, an advisor is assigned to the student from the admitting area committee who will work with the student to establish an appropriate course of study and project research plans. Other faculty members may also be consulted to aid in this process. All programs of study require approval of the relevant area committee, the Associate Dean for Academic and Student Affairs, and the University Committee on Graduate Studies. More details about the varying requirements for each area committee along with information regarding doctoral core courses and general timeframe expectations are given in the School of Education Bulletin, and complete guidelines may be obtained from the specific area committees.

The program areas for the doctorate are as follows:

- Administration Policy Analysis
  - Joint Program with Graduate School of Business

- Curriculum and Teacher Education with specializations in:
  - Curriculum Areas (Art, Math, Science, Social Studies)
  - Design and Evaluation of Educational Programs (General Curriculum, Curriculum Evaluation, Elementary Education, Secondary Education, Teacher Education)
  - Language, Literacy, and Culture (Bilingual/Bicultural Education; Second Language Education; Writing, Reading, and Language — English)

- International Development Education

- Mathematical Methods in Educational Research

- Psychological Studies in Education with specializations in:
  - Child and Adolescent Development
  - Counseling and Health Psychology
  - Educational Psychology

- Social Sciences in Education with specializations in:
  - Anthropology of Education
  - Economics of Education

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History of Education
Philosophy of Education
Politics of Education
Sociology of Education
Social Sciences in Education (interdisciplinary)

Ph.D. MINOR

Candidates for the Ph.D. degree in other departments or schools of the University may elect to minor in Education. Requirements include a minimum of 30 quarter units of graduate course work in education, and a clear field of concentration. Students choosing to minor in education should meet with the Associate Dean for Academic and Student Affairs to determine a suitable course of study early in their program.

COURSES

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.

EDUCATION

The numbering of courses in the School of Education identifies the level and the audience for which a given course is offered:

100-level—Courses primarily for undergraduates (graduates may enroll).

200 and 300-level—Courses for A.M., and 300-first-year, and second-year doctoral students.

400-level—Courses primarily for third-year doctoral students and beyond (typically research seminars or similar courses).

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 visiting faculty.

100A,B. Tutor Skills Training—For undergraduates who want to tutor or coach in local schools and educational programs. Oppor-
tunities for first-hand experience exist at all grade levels and in a wide variety of subjects. In class, students discuss experiences and learn relevant interpersonal, analytical, and instructional skills. Students must have concurrent tutoring placement. (Contact UPSE, Upward Bound or the Public Service Center, or attend the first class meeting.) (CTE)

100A. For elementary school tutoring.
2-3 units, Aut, Win, Spr (Staff)

100B. For secondary school tutoring.
2-3 units, Aut, Win, Spr (Lichenstein)

100C. Issues in Education Seminar—For students with continued interest in issues related to education. Individual research on topics covered in 100A or B. Particularly relevant to those considering teaching or research careers in education. Prerequisite: 100A or B. (CTE)
1-2 units, Aut, Win, Spr (Lichenstein)

105. American Education and Public Policy—(Same as History 158B, Political Science 186K.) Treats policy issues in education drawing on history and political science. Who influences schooling and how? How havon. Individual research on topics covered in 100A or B. Particularly relevant to those considering teaching or research careers in education. Prerequisite: 100A or B. (CTE)
1-2 units, Aut (Kirst, Tyack) MW 2:15
and by arrangement

116X. Anthropological Perspectives on American Culture—(Same as Anthropology 15.) Convergence and divergence in values, life styles, and psychocultural attributes are analyzed for mainstream, minority, and variant cultural patterns in U.S. society. Processes of boundary maintenance and identity reference. Current social movements in the perspective of counter-culturalism, marginality, and cultural change. Schooling in America as a process of cultural transmission, including the problems of cultural minorities in mainstream institutions. Field studies of relevant phenomena are encouraged. (SSE) (DR:5)
3-5 units, Spr (G. Spindler, L. Spindler)
MW 1:15-3:05

120X. Problems of Intelligence, Information, and Learning—(Same as Symbolic Systems 20.) Introduction to studies of intelligent reasoning, knowledge, understanding, representation, and meaning. Results of computational, linguistic, philosophical, and psychological research discussed and compared. Relevance of material to instruction and learning. (PSE)
3 units, Aut (Greeno) MWF 1:15

125. Issues in Education—The analysis of key topics and problems in the field of education, selected by seminar members. An introductory offering open to undergraduates. (CTE)
3 units (Gross) not given 1988-89

131. Economics of Women’s Education and Work—The determinants and effects of women’s employment in the U.S. using theoretical, empirical, and policy materials emphasizing relationships between education and employment. Topics: labor force participation and attachment, earnings, discrimination, occupational segregation, housework, child care, affirmative action and comparable worth. (SSE)
4 units, Sum (Strober) TTh 10-11:50

134. Career and Personal Counseling in Culturally Diverse Settings—(Same as Psychology 237.) Design and implementation of career counseling interventions based on cross-cultural perceptions and definitions of career competence, career development theories, and appropriate counselor behavior. Case studies of bicultural role conflict in work settings. (PSE)
3 units (LaFromboise, Krumbolz) alternate years, given 1989-90

155. Development of Measuring Instruments—For persons planning to develop achievement tests, reasoning tests, or questionnaires for research and evaluation, and for teachers wishing to improve classroom examinations. Planning tests, writing items, item tryout and criticism, qualities desired in tests and interview techniques. Lectures, case studies, and practical exercises. (PSE)
3 units (Haertel) alternate years, given 1989-90

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

163X. Technology Policy, Knowledge Formation, and Economic Development—The nature of national policies toward the economic development challenge of information technology, and the impact this technology, set in context of those policies, has on kinds of skills demanded in the labor force and the production of knowledge. (IDE)
4 units, Spr (Carnoy) M 7-10 p.m.
and by arrangement

170. Gender and Education—(Same as Sociology 112.) Gender as a critical variable in educational institutions and labor markets. Interdisciplinary approach to 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 primary disciplines are economics, and sociology, but historical, psychological, and legal materials are examined. Focus on the U.S. but some work on other countries. (SSE)

4 units (Strober, Cohen)
alternate years, given 1989-90

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

191S. Minorities in the Schooling Process—
(Same as Chicano Fellows 191.) Social foundations of education; analyzes themes, competing theories, and research findings concerning historical and contemporary minority schooling aspects. Focus is on Chicano and Black students, particularly the former. Emphasis on the construct of "minority school failure." Topics: schooling outcomes, ideology, structural considerations that shape schooling inequality (segregation; curriculum differentiation; testing), psychological and sociocultural considerations, and reform efforts. Lecture/seminar. (PSE, CTE)

3-5 units, Aut (Valencia) TTh 2:15-4:05

193S. Special Topics: Seminar on Minorities in the Schooling Process—(Same as Chicano Fellows 193.) For students interested in select topics of choice within the spectrum of minority schooling. Seminar forum for in-depth study, critical thinking, and debate. Under instructor's guidance, students investigate several areas (i.e., gifted minority students, minority drop-out issues, school reform), submit written work, orally present their work, and participate in seminar discussion. Recommended: 191S.

4 units, Spr (Valencia) W 3:15-6:05

196S. Educational Testing and Minority Students—(Same as Chicano Fellows 192.) The impact on Chicano and Black students of intelligence, achievement, and competency testing, particularly the former. Topics: overview of the "language" of educational testing, development and evolution of the intelligence testing movement, testing and curriculum differentiation, controversy of test bias, testing and special education issues (overrepresentation of Chicanos in educable mentally retarded classes), psychological and sociocultural correlates of test performance, contemporary testing issues (high school minimum competency tests; teacher competency tests). Lecture/seminar.

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

197X. Education and the Status of Women: An International Perspective—(Same as Sociology 117.) Theories and perspectives from the social sciences relevant to an understanding of the role of education in changing, modifying, or reproducing structures of gender differentiation and hierarchy. Cross-national research on the status of women and its uses to evaluate knowledge claims from varying perspectives. (IDE, SSE)

4 units, Win (Ramirez) MWF 10

199X. Undergraduate Honors Seminar—Required for all undergraduate seniors enrolled in the Honors program in the School of Education. Focusses upon doing research in education. Participants are expected to share ongoing work on their Honors thesis. (All Areas)

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

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 20th century. (SSE) (DR:5)

3-4 units (Gross) not given 1988-89

201. History of Education in the United States — (Same as History 158.) Analysis of selected turning points in education in relation to religion, political socialization, race relations, immigration, and urbanization. (SSE) (DR:5)

3 units, Spr (Tyack) MW 10
and by arrangement

202. Social Science: Teachers and Schools—Designed for the beginning secondary school teacher. Readings, lectures, and class activities involve the application of concepts and analytical techniques from the social sciences to problems of the beginning teacher. Interdisciplinary approach involves a team of two faculty members with differing social science specialties. (SSE, CTE)

4 units, Spr (Cohen, Arias, Kirst) MW 3:15-5:05

203. Models of the Child in Contemporary Educational Thought—Introductory focus on a number of influential views of the child formulated by psychologists, political theorists, and philosophers, and to place them in historical and philosophical perspective. (SSE)

4 units (Phillips) alternate years, given 1989-90

206A. Introduction to the Study of International Development Education—Theoretical orientations and the research agenda in international development education, and resources for study and research at Stanford.
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Required for all first-year students in SIDEC; others by consent of instructor. (IDE)
1 unit, Aut (Carnoy) M 12-1:15
and by arrangement

206B. Project Workshop in International Development Education—The conclusion of the 4-quarter A.M. program in SIDEC, required of all A.M. students. It is organized around the students' "Master Project", and provides in-depth reviews of draft project reports. The final version of the report is due at the end of the course. (IDE)
4 units, Sum (Ramirez) TTh 9:30-11

207. International Cooperation in Education Development—Critical review of current policies, priorities, and practices in international cooperation in education, emphasizing the role of international organizations (World Bank, Unesco, OECD), and of national development assistance agencies. (IDE)
5 units, Aut (Method) TTh 4:15-6:05 alternate years, not given 1989-90

208A. Introduction to Curriculum—Curriculum theory and the history of curriculum as a field of study. Aims and objectives; pre-active and interactive views; explicit and implicit curriculum; introduction to problems of program evaluation. (CTE)
4 units, Aut (Eisner) MW 1:15-3:05 alternate years, not given 1989-90

208B. Introduction to Curriculum—The practice of curriculum improvement including: planning, policy-making, development, implementation, and evaluation. Extensive, in-depth treatment of methods and approaches to curriculum improvement and their strengths and limitations. (CTE)
4 units, Win (Eisner) MW 3:15-5:05

208X. Introduction to Curriculum: Policy Focus—Curriculum studies for those concerned primarily with school policy and administration. Topics: curriculum theory; relation of theory and practice; schools and classrooms as contexts for curriculum; curricular policy making; leadership in school curricular issues; curriculum development; curriculum evaluation. (CTE)
3 units, Sum (Walker) TTh 1:15-3:05

210. Sociology of Education—(Same as Sociology 210.) Introduction to sociological approaches to educational phenomena. Topics: 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. Reading and evaluating social science research. Short written assignments and individual feedback. 210/310 meet together. (SSE)
4 units, Win (Cohen) MW 3:15-5:05

211. Introduction to Philosophy of Social Science—(Same as Philosophy 166.) Focuses on the differences writers have noted between the natural and social sciences, and 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. For upper division undergraduates majoring in one of the social sciences, and for beginning graduate students in related areas such as education. (SSE)
3 units (Phillips) alternate years, given 1989-90

212A. Practicum in Ethnographic Futures Research I—(Same as Anthropology 269A, VTSS 250A.) Instruction in the rationale and guidance in the practice of Ethnographic Futures Research (EFR), loosely structured, interactive, non-directive open-ended method for eliciting from a sample of interviewees their perceived and preferred middle-range sociocultural visions of alternative futures for their society or organization. EFR (1) complements other methods for studying extant values and on-going change processes; (2) augments conventional approaches to public and educational policy; and (3) provides an educational experience for interviewer and interviewee. The focus is on alternative futures enabled or driven by high technology, with reference to Stanford viewed as a sociocultural entity. (SSE)
3-5 units, Win (Textor) W 7-10 p.m.

212B. Practicum in Ethnographic Futures Research II—(Same as Anthropology 269B; Values, Technology, Science, and Society 250B.) Continuation of 212A for those who require additional time and guidance, especially in writing up research results for publication. (SSE)
3-5 units, Spr (Textor) W 7-10 p.m.

213. Aesthetic Foundations of Education—What is meant by "the art" of teaching. Major conceptions of art and their contribution to cognitive development, to human understanding, and to the role that the arts can play in education. (CTE)
4 units, Aut (Eisner) MW 3:15-5:05 alternate years, not given 1989-90

219. Artistic Development of the Child—Introduces research in the behavioral sciences having relevance for understanding of the child's artistic development. (CTE)
4 units (Eisner) alternate years, given 1989-90
220A, B, C, D. The Social Sciences and Educational Analysis—Relationships among economics, political science, and sociology and their applications to education in the U.S. Required of students in APA and open to all. Each quarter emphasizes the contribution of a particular social science, but 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. Topics: investment and consumption theories of education, the effects of education on earnings and employment, the effects of education on economic growth and distribution of income, and the financing of education. Students who lack training in elementary economics are required to enroll in a parallel course in economic analysis for one additional unit of credit. (APA, SSE)

4-5 units, Win (Strober) MW 10:10-12 and by arrangement

220B. The Social Sciences and Educational Analysis: Introduction to the Politics of Education—(Same as Political Science 187S.) The relationships between political analysis and policy formulation in education; focus is 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 policy analysis, implementation, and politics of reform emphasized. (APA, SSE)

3 units, Sum (Kirst) MWF 9

220C. Education and Society—(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 the schools. (APA, SSE)

5 units, Spr (Meyer) MWF 9

220D. History of School Reform: Origins, Policies, and Outcomes—School reform as an interaction between the broad context (social, economic, political, and ideological factors), schools as institutions, and the goals and behaviors of groups and individuals. Why and how some school reforms persist, why some fail or fade, and why some recur periodically. Focus is on early 1900's, 1950's and 60's, and current state-driven changes. Students investigate a particular reform: its sources, policy development and implementation, and the consequences, intended and unintended, using one or more of the analytic frameworks presented. (APA, SSE)

3-4 units, Aut (Cuban, Tyack)

MW 10-11:50

221. Issues in Policy Analysis—Major concepts associated with the development, enactment, and execution of social policy. Issues of policy implementation, agenda setting and problem formulation, coalition politics, and intergovernmental relations are examined through case materials and supplementary readings. Objective is to identify and understand factors that affect ways in which analysts and policymakers learn about the policy system and ways in which they can influence it. (APA)

4 units, Win (McLaughlin) MW 1:15-3:05

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

222A. Decision Analysis in Education I—Introduction to use of statistics to summarize data and make decisions in the face of uncertainty. Topics: elementary probability theory, sampling methods, descriptive statistics, inferences about populations, the value of uncertain outcomes, statistical decision theory, risk, and utility. Use of actual case data and computers. For educational administrators and policy analysts who must consider and act upon limited or uncertain information. (APA)

5 units, Win (Finn) MWF 8:20-9:50

222B. Decision Analysis in Education II—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. Attention to sensitivity of implications to model assumptions. (APA)

5 units, Spr (Levin) MW 1:15-3:05

223. Effective Schools: Research, Policy, and Practice—Examination of recent studies of schools that exceed expectations in producing high student achievement. Research methodologies, results of studies, and efforts to implement results. Components of effective schools analyzed: effective teaching, principal leadership, organizational processes, parent involvement, role of superintendent. Required project studies a school and determines effectiveness. (APA)

3-4 unit, Sum (Cuban) MW 10:30-12

224X. Computers in the Classroom—Basic computer operations and terminology: applica-
tasks including word processing, networking, instructional packages, teacher utility programs; uses in particular subject fields; economic, social, and ethical issues emphasizing equity. (CTE)

3 units, Aut (Rosenberg) MW 1:15-2:30
Win (Rosenberg) TTh 4:15-5:30

2255. Comparative Higher Education—A cross-cultural perspective on issues related to higher education. Growth and development of universities in Europe, the U.S., and the Third World. The key constituent elements of the academic system—faculty, students, and administration. Current issues facing higher education: university reform, university-state relations, the fiscal "crisis", student activism, etc. Examples from various national systems. (APA, IDE)

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

227. Educational Assessment of Linguistic and Culturally Diverse Populations—The major assessment issues in bilingual education including language proficiency testing program entry-exit or reclassification criteria, and program formative and summative evaluations. Problems related to the design and aggregation of data examined through an in-depth study of longitudinal and cross-sectional program evaluations. (CTE)

4 units (Arias) alternate years, given 1989-90

228. Psychology of Literacy—A beginning level course for graduate students which is part of the core curriculum for the Language, Literacy, and Culture program. Focuses on psychological principles in understanding the reading and writing process, and the acquisition of literacy. Required of LLC students, but open to others with approval of the instructor. (CTE)

3 units, not given 1988-89

229. The Development of Human Competence: Theory, Research, and Practice—Conceptions of effective personal and social functioning, and research on psychological and educational processes associated with the development of human competence. Introduces a conceptual framework for understanding humans as self-organizing, self-constructing living systems and provides a set of principles for intervening to enhance competent personal and social functioning in a variety of educational settings. (PSE)

4 units, Aut (Ford) TTh 12:15-2:05 alternate years, not given 1989-90

231. Social Structure of World Society—(Same as Sociology 152; VTSS 155.) Sociological analysis of human society on a world-wide basis. Competing models of the emerging world order and its dynamics. 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. (IDE, SSE) (DR:5)

3 units (Inkeles) given 1989-90


4 units, Spr (Thoresen) MW 9-10:50

233. Seminar in Cross-Cultural Counseling—(Same as Psychology 233.) How the New World experience has affected the adaptive strategies, acculturation patterns, family structure, and support systems of Afro-Americans, American Indians, Asian/Pacific Islanders, and Hispanic Americans. Intensive analyses conducted on: the theory and practice of cross-cultural counseling, the cultural appropriateness of present mental health service delivery approaches, alternatives to individual counseling interviews, and the process of culturally adapting counseling interventions. Emphasis on cross-cultural counseling competence with ethnic minorities. (PSE)

3 units, Spr (Thoresen) M 1:15-3:05 alternate years, not given 1989-90

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

3 units, Aut (J. Krumboltz) M 3:15-5:05 and by arrangement alternate years, not given 1989-90

235X. Counseling and Therapy in Groups—(Same as Psychology 229.) Introduction to using small groups in counseling and therapy. Different theoretical models are examined (psycho-dynamic, Gestalt, and cognitive-behavioral) along with existing empirical evidence of effectiveness. Rationale for using group approaches with couples, families, and problem-specific groups; the appropriateness of models for specific client problems. Opportunity to participate as a group member is provided. (PSE)

3 units (Krumboltz, Thoresen) alternate years, given 1989-90

237. Psychological Assessment—(Same as Psychology 233.) Administration and interpretation of commonly-used measures of interest, aptitude, achievement, intelligence, and personal-
ity for purposes of individual diagnosis and treatment. (PSE)

3 units, Spr (Krumboltz, Staff)
TTh 12:15-2:05, alternate years,
not given 1989-90

238A. Orientation to Counseling Psychology
—Overview of counseling psychology, common counseling theories, and procedures of the Stanford Counseling Institute. Individual client-counselor relationship development activities, conceptualization of client problems, counseling goal setting, process, and outcome evaluations. Procedures used in emergency situations and termination. (PSE)

3 units, Aut (LaFromboise) Th 8-9:50

238B.C. Counseling and Health Psychology: Supervised Applications —Supervised counseling interventions at Stanford Counseling Institute and in selected field settings. Sequence begins in Autumn Quarter. (Counseling Psychology majors only.) Consent of instructor. This course requirement may be waived at the discretion of the instructor. (PSE)

238B. 4 units, Win (Krumboltz, LaFromboise) by arrangement
238C. 4 units, Spr (Krumboltz, LaFromboise) by arrangement

240. Adolescence: Health and Special Needs
—Physiological and psychological problems of adolescence emphasizing health related issues and adolescent development, and special education problems for high school teachers. (CTE)

1 unit, Aut (Nichols) by arrangement

242X. First Year Proseminar in Language, Literacy and Culture—For master's and first year doctoral students in LLC program. Introduces basic concepts and pragmatics of the field; provides opportunities to meet faculty, respond to critical readings, and explore professional matters.

2 units, Aut (Cancino) Th 4:15-6:05

245X. Origin and Diffusion of Mass Education—(Same as Sociology 245.) Introduction to issues regarding the rise, organization, and expansion of mass education throughout the world. Interdisciplinary readings with a comparative/historical and cross-national research focus. Evaluation of functionalist, conflict, incorporation, and other theories of mass education. (CTE, CTE)

4 units, Spr (Ramirez) MWF 10

246A,B,C,D. Secondary School Teaching Practicum — Training and practice in specific skills in schools. Taken during each quarter of STEP year. Includes regular meetings with STEP staff. (16 units required for graduation from the program). (CTE)

246A. 1-13 units, Sum (Grant)
by arrangement

246B. 1-13 units, Aut (Grant)
by arrangement

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

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

247. Affective Education—Treats affect and emotion and emphasizes social, ethical, and intellectual aspects of affect and their relation to cognition. (SSE, CTE)

4 units, Win (Noddings) TTh 12:15-2:05
alternate years, not given 1989-90

250A,B. Statistical Analysis in Educational Research I—Two-quarter sequence for graduate students who expect to use statistical methods in their research. Analysis of variance and covariance; correlation and regression; analysis of categorical data. Proficiency with statistical computer packages. Prerequisite: Statistics 160. (MME)

250A. (Same as Psychology 152.)
4 units, Win (Rogosa) MWF 11-12:30
250B. 4 units, Spr (Finn) MWF 11-12:30


4 units, Aut (Finn) MWF 11-12:30

252. Introduction to Test Theory—(Same as Psychology 248.) Concepts of reliability and validity; derivation and use of test scales and norms; mathematical models and procedures for test validation, scoring, and interpretation. Prerequisite: Statistics 60 or Psychology 60, or equivalent (PSE).

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

254A. Ethnographic Monitoring of Rapid Change I—(Same as Anthropology 192A.) Seminar-practicum on the anthropological study of processes of rapid or sudden change: technological innovation (telemicrowave, biotechnical, materials-science), an ecological crisis, a precipitous economic downturn, or a fundamental shift in political or managerial control, where such change is likely to produce serious impacts on human well-being. Students, alone or with a team, receive training and frequent tutorial guidance in using appropriately adapted ethnographic techniques to carry out a fieldwork project in a local community or institution. The resulting paper assesses implications of findings for theory, public policy, and/or
educational programs. Open to all graduate students, and to undergraduates contemplating Honors theses. Recommended: 138/238. Previous social science interviewing background helpful. (IDE, SSE)

3-5 units (Textor) alternate years, given 1989-90

254B. Ethnographic Monitoring of Rapid Change II—(Same as Anthropology 192B.) Optional continuation of 254A for the student requiring additional time, training, or seminar participation to complete a paper, or undergraduate Honors thesis or prepare same for publication, or to develop a dissertation proposal. (IDE, SSE)

3-5 units (Textor) alternate years, given 1989-90

255. Human Abilities—(Same as Psychology 155.) Introductory survey of psychological theory and research on human cognitive abilities; their nature, development, and measurement; and their importance in society. Relation of education and intellectual abilities; examples relating to social institutions. Cognitive analysis of verbal reasoning and spatial abilities. Individual differences in relation to motivation, personality, gender, and ethnic differences. Prerequisites: Psychology 1 and Psychology 60 and Statistics 60, or equivalent. (PSE)

3 units, Win (Snow) MWF 10

260X. Investing in the Education of the Disadvantaged—The educationally disadvantaged represent a large rising portion of students in the American public schools. Failing then-conditions has wide repercussions for the future of the U.S. economy, society, and polity. The issue is addressed from a policy analytic perspective by exploring the nature of the problem, the inadequacy of past and present policies, and the formulation of approaches that promise greater success. Open to A.M. students and undergraduates. (APA, SSE)

4-5 units, Aut (Levin, Smith)

MW 3:15-5:05

262A. Curriculum and Instruction in English: Introduction—Approaches to teaching English in the secondary school, including goals for instruction, teaching techniques, and methods of evaluation. (CTE)

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

262B. Curriculum and Instruction in English: The Teaching of Writing—Practical approaches with an examination of alternative goals. (CTE)

2-3 units, Aut (Witte, Chin) M 3:15-6:05

262C. Curriculum and Instruction in English: Teaching of Literature—(CTE)

2-3 units, Win (Hauhorne, Athanases) TTh 2:15-4:05

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

263A. 3 units, Sum (Tyson) MW 3:15-5:05

263B. 2-3 units, Aut (Tyson) W 3:15-5:05

264A,B. Curriculum and Instruction in Foreign Languages—Methods, techniques of foreign language teaching, testing. Materials of foreign language teaching. (CTE)

264A. 2-3 units, Sum (Azevedo) MW 3:15-5:05

264B. 2-3 units, Aut (Azevedo) T 4:15-6:05

266X. Introduction to Foreign Language and Bilingual Education.

4 units, Aut (Cancino) TTh 2:15-4:05

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 (Atkin, Collins, Tamir) TTh 3:15-5:05

267B. 2-3 units, Aut (Atkin, Collins) T 4:15-6:05

268A,B. 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)

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

268B. 2-3 units, Aut (Bower) Th 4:15-6:05

269. Foundations of Learning for Teaching—The psychology of instruction and the epistemology of school subjects as related to the planning and implementation of teaching, the analysis of curriculum and the evaluation of performance and understanding. Readings and activities are coordinated with internship and student teaching activities of participants. (CTE)

4 units, Win (Phillips, Shulman) MW 3:15-5:05 and by arrangement

272. Literacy: Social and Historical Perspectives—Historical examination of writing systems, the impact of print, and links between social mobility and literacy to identify norms and practices which affect the teaching and learning of reading and writing today. Emphasis on the social functions of literacy in work, home, and school settings. Myths regarding literacy's
consequences for cognition, socioeconomic mobility, and predictability of citizen behaviors are examined with respect to recent social historical and other social science research. (CTE, SSE)

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

273. Education as a Social Science—Intended only for first year doctoral students in the Social Sciences in Education. Students meet with faculty of the area committee, are oriented to the range of intellectual and research strategies represented by the social science faculty, and interview faculty and plan with them the topic of discussion for the evening of their course session. Each session is planned with relevant readings. Assists the student in course planning and in strategies for developing a problem question for the doctoral thesis. Opportunity to develop sessions to meet orientation and adjustment needs, as they arise. (SSE)

1 unit, Aut (Cohen) T 4:15-6:05

276. Feminist Perspectives on Ethics and Education—(Same as Feminist Studies 127.) Ethical problems in education. After reading and discussing background material in ethics and feminism, concentrates on ethical problems in education of interest to feminists. Emphasis on the ethics of caring. (CTE, SSE)

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

278. Introduction to Issues in Evaluation—The basic literature and major theoretical and practical issues facing the emerging evaluation profession. Topics: 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, Korpi) TTh 12:15-2:05

250. Training Seminar: Ethnography of Schooling—(Same as Anthropology 280.) Ethnographic approaches to the study of schooling emerging from recent anthropological work. Topics: the development of such approaches in educational anthropology and the emerging criteria of good ethnography in schools; problems of ethnographic "evaluation," ethics and ethnography; and the potential relevance of school ethnography to educational policy. Focus: training participants to observe and record behavior, develop skills in the elicitation of cultural knowledge, and to develop an internally consistent conceptual structure that orients observation and elicitation productively. Selected techniques of ethnographic research applicable to the study of schooling are demonstrated. Application of such techniques in modest field research projects that can be carried out in settings accessible to students. Writing of one research report or proposal for research. (CTE)

4 units, Sum (G. Spindler, L. Spindler) W 2:15-5:05

282. Linguistics and the Teaching of English as a Foreign/Second Language—(Same as Linguistics 189/289.) 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)

4-5 units, Aut (Staff) MW 1:15-3:05


4 units, Win (Cancino) MW 1:15-3:05

288. Social Diversity and Educational Reform—Introduces key normative issues facing educators. The relation of social diversity (race, ethnicity, gender, and class) to equality in schooling. Alternative conceptions of the purposes of education in reform movements. (CTE, SSE)

3 units, Sum (Tyack) MW 1:15-3:05

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

2 units, Aut (Petig)

292. Methods of Teaching Spanish—(Same as Spanish 301.) A practical guide to the teaching of language. Analysis and discussion of classroom practices and instructional material. (CTE)

3-5 units, Spr (Haro) MWF 11

293. Methods of Teaching French—(Same as French 293.) Approaches, methods, and procedures in relation to foreign language acquisition theory; teaching practice regularly observed in a demonstration class. (CTE)

4 units, Spr (Hester) W 4:15-6:05

294. Language and Mental Development: Implications for Schooling—Language use and development as they relate to general issues in teaching and learning. Ways in which linguistics, philosophy, and psychology approach a shared problem-area are examined through a study of major works in a variety of disciplines. (CTE)

4 units, Spr (Witte) M 3:15-6:05 and by arrangement

295X. Psychology of Problem Solving and Reasoning—(Same as Psychology 261.) Introduction to results and methods of research on cognitive processes of solving problems and
reasoning. Focus is on accomplishments and limitations of research conducted since 1970. (PSE)

3 units, Spr (Greeno) MW 3:15-4:40

297. Language and Literacy in Secondary Schools—Emphasis on the development of literate thinkers in content area classrooms. Introduction to theories of reading instruction. Training in vocabulary and comprehension strategies, and techniques for text analysis, oral interaction, and creative assessment. Intended primarily for STEP interns, but open to all graduate students. (CTE)

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

299X. Adulthood—(Same as Human Biology 172.) The biological, psychological, and social perspectives on adulthood as a phase of life. Topics: the concept of adulthood, historical and cross-cultural views, stage theories and longitudinal studies, biological aspects of development to adulthood; consolidation of psycho-social and gender identity, interpersonal relationships, patterns of vocational choice, psychological changes, menopause, psychological stress, and aging. (PSE)

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

303X. Qualitative Inquiry in Education—The functions of qualitative thinking in the conduct of teaching and in educational research and evaluation. Do qualitative case studies generalize? Do qualitative forms of representation, e.g., literary narrative and figurative speech, convey unique forms of meaning? What can be learned from the use of such forms about educational practice? Students learn some of the techniques needed to do qualitative research in education. (CTE)

4 units, Win (Eisner) MW 9-11

304. The Philosophical and Educational Thought of John Dewey—(Same as Philosophy 304.) Analysis of important works of John Dewey: The School and Society, The Quest for Certainty, and Experience and Education. Attention to Democracy and Education, related essays, and critiques. (SSE)

4 units, Spr (Noddings, Phillips) MW 1:15-3:05, alternate years, not given 1989-90


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. Topics: different theoretical approaches to the study of education and politics, questions of legitimacy in educational policy, international factors in educational development, the politics of educational planning and reform, processes and conditions of political learning. (IDE, SSE)

5 units, Win (Altbach) MW 1:15-3:05 and by arrangement

306C. Education and Sociocultural Change—(Same as Anthropology 239.) Models of cultural change are developed that stress the impact of abrupt changes in the conditions of life on the personal adaptations of individuals and local communities brought about by modernization and urbanization. Education as an instrument of change and its intervention in the process of indigenous cultural transmission as an aspect of these processes. Case studies document and help build appropriate models. Students, in a seminar-like setting, apply the models developed to the analysis of third world and other relevant situations. (IDE, SSE)

3-5 units, Win (G. Spindler, L. Spindler) MW 1:15-3:05

306D. Sociology of Development and Education—(Same as Sociology 306.) The analysis of the relations between educational and societal developments from a comparative perspective. Readings on varying theoretical perspectives and empirical studies on the structural and cultural sources of educational expansion and differentiation, and on the cultural and structural consequences of educational institutionalization. Research topics: education and nation-building; education, mobility, and equality; education, international organizations, and world culture. (IDE, SSE)

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

307X. Knowledge and Legitimation: The Politics of Educational Research—(Same as Political Science 328.) Within the theoretical framework of legitimation theory, the notion of "compensatory legitimation" for the analysis of the national and international politics of educational research. Case studies on the work of agencies for research support, cooperation, and dissemination. Research seminar for doctoral students; consent of instructor required. (IDE, SSE)

5 units (Weller) alternate years, given 1989-90

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

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

311X. Topics in Educational Finance and Productivity—Focus is on a strong analytic approach to selected topics in educational finance and productivity policy at all levels of education. Topics: educational vouchers, determinants of educational expenditures, state funding, higher educational productivity, cost effectiveness analysis of educational alternatives. Prerequisites: Background in economics and statistics equivalent to the APA core requirements in 220A, and 222A and B. (APA)

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

312B. Interaction Processes in Education: Design and Evaluation—(Same as Sociology 242B.) Educational applications of sociological/social psychological theory and research to classroom processes, staff relations, teams, and task forces. The principles for design and evaluations of group work for students and teamwork for teaching staff. Topics: social processes of influence, role differentiation, and evaluation. Methods for systematic evaluation and observation are included; students receive practical experience in using these methods. (SSE)

4 units, Aut (Cohen) MW 1:15-3:05 alternate years, not given 1989-90

314. Seminar in Citizenship Education—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 (Cross) not given 1988-89

315. Cultural Transmission: Education in Cross-Cultural Perspective—(Same as Anthropology 266.) The transmission and communication of explicit and implicit cultural assumptions in a variety of formal and informal educational contexts. The patterning of education in a cross-cultural perspective, the sequence of culturally constructed experiences in life careers, cultural analysis, and sensitization. Attention to education in the U.S. and other complex societies, and in non-literate cultures. (SSE)

3-5 units, Win (G. Spindler, L. Spindler) T 7-10 p.m.

316. Cognitive Psychology of Education—Review of research on perception, learning, and memory processes. Emphasis on research procedures and analysis of problems of school learning. For doctoral students in Psychological Studies. Open to others with consent of instructor. (PSE)

3 units (Calfee) not given 1988-89

317. Psychological Research on Teaching—Introduction to theory, methodology, and substantive findings of research on teaching and teacher education. (PSE)

4 units, Spr (Shulman) MW 1:15-3:05 alternate years, not given 1989-90

318X. Understanding Cultural Differences—Gaining skills in self-other observation, inquiry, and interpretation through cultural mediation. How can culture affect behavior? How are situational cultures, e.g., classrooms and schools, generated, maintained, changed? Can cultural therapy help reduce self-other conflicts for educators? (APA)

3 units, Sum (G. Spindler, L. Spindler) Th 9-12

321A.B. Qualitative Methods of Educational Research: Issues in Design and Data Collection—Survey of types of qualitative research methods from a variety of disciplinary perspectives (anthropology, cognitive psychology, criticism, history, political science), with intensive experience in the collection, analysis and reporting of data. Prerequisites: At least in the second year of doctoral program, and have at least one graduate course in statistics. Students must enroll for both quarters. No auditors. (CTE, PSE)

321A. 4-5 units, Win (Staff) TTh 2:15-4:05
321B. 4-5 units, Spr (Staff) TTh 2:15-4:05

324. Managing Complex Organizations—Introduction to the nature of managerial work in various types of organizations including educational institutions. Topics examined from viewpoint of manager: leadership, change, decision-making, conflict resolution, and communication. Case studies from management oriented problems. (APA)

3-4 units, Sum (Cuban) MW 3:30-5

325A.B.C. Administration and Policy Analysis Research Seminar—Faculty and dissertation students present their research and proposals for research to other faculty and students in the APA program. Emphasis on presenting research ideas at an early stage of their formulation to conceptualize and critically review research designs and proposals. (APA)

325A. 1 unit, Aut (Hannaway) M 12-1:05
325B. 1 unit, Win (Strober) M 12-1:05
325C. 1 unit, Spr (Strober) M 12-1:05

330X. Research Seminar in Language, Literacy, and Culture—For second year students in the LLC program. Provides a forum within which students critically examine selected recent research, examine methodological and design issues, and prepare critical and integrated reviews of a research question. Increases familiarity with recent research, provides a forum for critical thinking and debate, integrates stu-
dents' work during the second year of the program, and aids planning dissertation topics. (CTE)

2 units, Win, Spr (Padilla) W 4:15-6:05

338A,B,C. Practicum in Counseling and Health Psychology—Intensive supervised field experience in local schools or social agencies. (For Counseling Psychology majors only.) (PSE)

338A. 1-6 units, Aut (Krumbolz, LaFromboise) by arrangement
338B. 1-6 units, Win (Krumbolz, LaFromboise) by arrangement
338C. 1-6 units, Spr (Krumbolz, LaFromboise) by arrangement

343. Motivational Processes in Education—Theory and research from the psychology and education literatures on three basic sets of motivational processes, and personal agency beliefs. Introduces a conceptual framework for integrating these processes into a comprehensive understanding of motivated behavior emphasizing the crucial role of these processes in the development and maintenance of effective patterns of academic and social functioning. Implications for classroom instruction, teacher training, and curriculum development. (PSE)

4 units, Spr (Ford) TTh 12:15-2:05

344S. SIDEC Research Seminar—(IDE)

3 units, Aut (Method) by arrangement

347. Problems of Teacher Education—Enables students to formulate researchable problems and promising methods for the study of teacher education. Compares teacher education with education in other professions and other issues in the preservice and inservice education of teacher professionals. (CTE)

4 units, Spr (Ford, Staff) Th 10-11:50 and by arrangement

350A. Psychological Studies in Education—Introduction to psychological studies in education. Required of first-year doctoral students in Psychological Studies. Others by consent of instructor. (PSE)

1 unit, Aut (Greeno, Snow) Th 2:15-4:05

350B,C,D. Research Practicum in Psychological Studies in Education—Three-quarter sequence provides students in PSE an opportunity to engage in all facets of the research process. Individual projects in a group context are designed to provide extensive opportunities for training and feedback concerning specific projects and the general enterprise of psychological research in education. Required of second-year students in PSE. (PSE)

3 units, Aut, Win, Spr (Ford, Staff) Th 10-11:50 and by arrangement

351A. Advanced Statistical Analysis in Educational Research: Design and Analysis of Longitudinal Research—The analysis of longitudinal data is central to much empirical research on learning and development. Covers growth models; measurements of change; repeated measures designs; analysis of quasi-experiments; structural regression models; analysis of reciprocal effects. Prerequisite: 250C or equivalent. (MME)

3 units, Spr (Rogosa) MW 1:15-3:05 alternate years, not given 1989-90

352. Psychology of Instruction—The implications of psychological research and theory for the development and evaluation of instruction. Emphasis is on a cognitive perspective, but ranges over other rubrics, including social, motivational, and affective dimensions. "Instruction" includes all activities for teaching students, with a focus on the pragmatics of the regular classroom. Required of second-year students in Educational Psychology; open to other students with the equivalent of 316 or 317. (PSE)

3 units (Calfee) not given 1988-89

353. Problems in Measurement—(Same as Psychology 249.) Models, methods, and applications of factor analysis. Models for factor analysis; estimation procedures; factor rotation; factor scores; using factor analysis in research; confirmatory factor analysis; methods for dichotomous variables. Prerequisites: Psychology 152 and 248, or equivalent. (MME, PSE)

3 units, Aut (Haertel) MW 3:15-4:30

355A,B. Policy and Research in Science Education I, II—Science education from pre-school through undergraduate years, outside and inside established educational institutions, emphasizing public primary and secondary schools. Oriented toward questions of science education policy: What science should be taught at different education levels? For what purpose? To whom? By whom? Where? By what methods? How is the effectiveness of science programs to be assessed? Overview of issue in 355A. Emphasis on school-based research on these topics in 355B. (CTE)

355A. Aut (Atkin) MW 3:15-5:05
355B. Win (Atkin) MW 1:15-3:05

366X. Literacy: Controversies and Developments—Historical examination of writing systems, the impact of print, and links between social mobility and literacy is used to identify norms and practices affecting teaching and learning of reading and writing. Emphasis on social functions of literacy in work, home, and school settings. (CTE)

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

369. Personnel Administration—Topics: selection and appraisal of personnel, collective bar-
gaining, work-related stress, and dismissal. Treats the legal, social science, and educational aspects of these topics. (APA)

3 units (Bridges) alternate years, not given 1988-89

376. Education and Theories of the State—Explores the relationship between political system structures and educational change by analyzing theories and interpretations of how political systems function and the implications of these theories for understanding education. Classical and Marxist interpretations discussed. (IDE, SSE)

4 units (Carnoy) alternate years, not given 1988-89

377. Organization and Style in Research Reports—Important considerations in preparing written reports of analyses and inquiry, including course papers, theses, and dissertations. Attention to structure, clarity of exposition, style, common conventions, and general practices in academia and among publishers. Private critique of manuscripts submitted by those enrolled is a major course procedure. (All Areas)

3 units, Spr (Coladarci) Th 10-11:30 and by arrangement

379X. Public Policy Toward Abused and Neglected Children—(Same as Law 337.) Standards that are, and should be, used in defining child abuse and neglect and evaluating means of state intervention to protect such children. Role of various professionals, doctors, lawyers, mental health workers, police and social workers in dealing with problems of child abuse and neglect. Types of research currently being done and identification of new research directions. Limited to 20 graduate and law students and meets for 15 weeks under Law School semester system. Permission of instructor required. (APA)

5 units total, Win and Spr (Wald)

W 3:15-5:45

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

4 units (Eisner) given 1988-90

382. Practicum in Cultural Pluralism—An intensive review of the curricular strategies which schools have utilized to address the cultural diversity of their student bodies. Visits to local schools for observation of desegregation, bilingual, and multicultural programs. Each student prepares a critical review of these programs as a class project. (CTE)

4 units, Spr (Arias) T 2:15-5:05 and by arrangement

388. Recent Research in Bilingual Education: A Critical Appraisal—Familiarizes the student with the body of research recently conducted in bilingual education settings. The research is examined for methodological soundness. Specific considerations in effectively conducting research with language minority populations are identified. Quantitative and qualitative research are critically evaluated. (CTE)

3 units, Win (Arias) TTh 2:15-4:05 and by arrangement

408A, B, C. Research Workshop in International Development Education—Continuing research workshop for the review of key issues in the methodology and epistemology of social research in education, and research proposals and findings by students and faculty. Prerequisite: 306A-D or equivalent. Limited enrollment; priority given to advanced doctoral students in SIDEC and SSE. (IDE, SSE)

408A. Research Workshop in IDE I.

2-5 units, Aut (Ramirez) MW 3:15-5:05

408B. Research Workshop in IDE II.

2-5 units, Win (Carnoy) M 3:15-6:05

408C. Research Workshop in IDE III.

2-5 units, Spr (Altbach) MW 1:15-3:05

415. Seminar in the Psychology of Reading—Topics for advanced students. Admission by consent of instructor. (PSE)

2-4 units (Calfee) alternate years, given 1989-90

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

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

422A. Practicum for Principals—The major tasks and related activities of principals. Uses a training approach that is problem rather than discipline based and provides for a substantial degree of self-directed learning by students under the guidance of professors and practicing principals. (APA)

4-6 units, Sum (Bridges, Staff) T 9-12
Th 1:15-4:05

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

1-3 units, Aut, Win, Spr, Sum (Bridges) by arrangement

423A. The Dissertation Proposal: Research on Educational Administration and Policy Anal-
ysis—An elaboration of the conceptual, ethical, political, and emotional problems in developing doctoral research proposals and ways of solving those. Students learn how to conduct a literature search using Stanford library resources. (APA)

3-5 units, Aut (Bridges) TTh 2:15-4:05

423B. The Dissertation Proposal: Research Design and Methodology—Conceptual and methodological issues in current research design. Students are expected to critically analyze and develop research proposals. (APA)

3-5 units, Win (Smith) MW 1:15-3:05

426. Theory and Practice in Criterion-Referenced Tests Interpretations—Definitions of criterion-reference tests, objective methods of domain definition and test construction, problems and methods of standard setting, statistical analysis of criterion-referenced test data, and applications to minimum competency testing. Prerequisite: 252 or equivalent course work, or consent of instructor. (PSE)

3 units, Win (Haertel) MW 10-11:30 alternate years, not given 1989-90

431. Doctoral Seminar: Counseling and Health Psychology—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 (Krumboltz, LaFromboise, Thoresen) T 4:15-6:05, biweekly

450. Seminar on Ethical Concerns in Research and Evaluation—Ethical obligations, issues, and dilemmas in planning, conducting, disseminating, and applying educational research emphasizing new problems raised by qualitative methods. Codes of ethics developed by relevant scientific and professional organizations are evaluated. (All Areas)

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

451X. Research in Mathematical Education—An overview of the major problems, controversies, and findings in current research in mathematics education. (MME)

2-4 units, Win (Greeno, Noddings, Olkin) W 7-9 p.m.

453. Doctoral Dissertation—(All Areas)

any quarter (Staff) by arrangement

460. Advanced Seminar in Evaluation Design—The major traditions in the design of evaluation research. The strengths and weaknesses of standard evaluation models in view of the different objectives for evaluation, emphasizing the constraints inherent in studying educational processes and institutions. Focus is on dilemmas central to the design and conduct of educational evaluations and will pursue alternative, “state-of-the-art” approaches. (CTE, SSE, MME)

3 units, Spr (Staff, Rogossa) T 12-2:05

465. Research Seminar on the Writing Process and Writing Instruction—State-of-the-art review of the contributions of various disciplines to the understanding of writing processes. Critical analysis of assumptions, methodologies, and results as they relate to teaching practice and to an understanding of cognitive and linguistic development. Studies from rhetoric, linguistics, anthropology, psychology, and education. May be taken more than once for credit. For advanced LLC students. (CTE)

4 units, Aut (Witte) M 3:15-5:05 and by arrangement

466. Doctoral Seminar in the Design and Evaluation of Educational Programs (DEEP)—Required of all doctoral students in DEEP to provide the opportunity to become acquainted with research in this field. Students learn about research activities in which they are engaged and the kinds of problems that they believe to be important in the field. Introduces 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. Seminar acquaints students with the major problems in this field and ways these are addressed by current investigators. (CTE)

1-5 units, Win (Staff)

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

any quarter (Staff) by arrangement

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

any quarter (Staff) by arrangement

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

any quarter (Staff) by arrangement

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

any quarter (Staff) by arrangement

493A,B. Seminar on Methodological Problems in Educational Research—Discussion of topics of current methodological interest. Practicum in consulting on actual projects being carried out by faculty and students. (MME)

1-3 units, Aut (Olkin) Th 12-2

Win (Olkin) Th 12-2
ADMINISTRATION AND POLICY ANALYSIS (APA)

105. American Education and Public Policy (Same as History 158B, Political Science 186K.)

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 Education Analysis: Introduction to the Sociology of Education (Same as Sociology 143.)

220D. History of School Reform: Origins, Policies, and Outcomes

221. Issues in Policy Analysis

222A. Decision Analysis in Education I

222B. Decision Analysis in Education II

223. Effective Schools: Research, Policy, and Practice

2255. Comparative Higher Education

260X. Investing in Education of the Disadvantaged

290. Leadership: Research, Policy, and Practice

311X. Topics in Educational Finance and Productivity

315X. Understanding Cultural Differences

324. Managing Complex Organizations

325A,B,C. Administration and Policy Analysis Research Seminar

369. Personnel Administration

379X. Public Policy Toward Abused and Neglected Children

422A. Practicum for Principals

422D. Internship in Educational Administration

423A. The Dissertation Proposal: Research on Educational Administration and Policy Analysis

423B. The Dissertation Proposal: Research Design and Methodology

CURRICULUM AND TEACHER EDUCATION (CTE)

100A,B. Tutor Skills Training

100C. Issues in Education Seminar

105. Issues in Education

191S. Minorities in the Schooling Process

193S. Special Topics: Seminar on Minorities in the Schooling Process

196S. Educational Testing and Minority Students

202. Social Science: Teachers and Schools

208A. Introduction to Curriculum

208X. Introduction to Curriculum: Policy Focus

213. Aesthetic Foundations of Education

219. Artistic Development of the Child

224X. Computers in the Classroom

227. Educational Assessment of Linguistic and Culturally Diverse Populations

228. Psychology of Literacy

240. Adolescence: Health and Special Needs

242X. First Year Proseminar on Language, Literacy and Culture

246A,B,C,D. Secondary School Teaching Practicum

247. Affective Education

269A. Curriculum and Instruction in English: Introduction

269B. Curriculum and Instruction in English: The Teaching of Literature

269C. Curriculum and Instruction in English: The Teaching of Literature

269A,B. Curriculum and Instruction in Mathematics

264A,B. Curriculum and Instruction in Foreign Languages

266X. Introduction to Foreign Language and Bilingual Education

267A,B. Curriculum and Instruction in Science

268A,B. Curriculum and Instruction in Science

269. Foundations of Learning for Teaching

272. Literacy: Social and Historical Perspectives

276. Feminist Perspectives on Ethics and Education

282. Linguistics and the Teaching of English as a Foreign/Second Language (Same as Linguistics 289.)

286. Second Language Acquisition

288. Social Diversity and Educational Reform

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

292. Methods of Teaching Spanish (Same as Spanish 301.)

293. Methods of Teaching French (Same as French 293.)

294. Language and Mental Development: Implications for Schooling

297. Language and Literacy in Secondary Schools

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

303X. Qualitative Inquiries in Education

314. Seminar in Citizenship Education

315A,B. Qualitative Methods of Educational Research: Issues in Design and Data Collection

330X. Research Seminar in Language, Literature, and Culture

342A,B. Curriculum Construction

347. Problems of Teacher Education

348. Educational Connoisseurship and Educational Criticism

355A,B. Policy and Research in Science Education

366X. Literacy: Controversies and Developments

380. Curriculum Development in the Visual Arts

382. Practicum in Cultural Pluralism

383. Recent Developments in Foreign Language Education

384. Recent Research in Bilingual Education: A Critical Appraisal

435X. Advanced Seminar in Language, Literacy, and Culture: Current Issues in Reading Research

460. Advanced Seminar in Evaluation Design

461. Seminar in Art Education for Doctoral Students

465. Research Seminar in the Writing Process and Writing Instruction
466. Doctoral Seminar in the Design and Evaluation of Educational Programs (DEEP)

INTERNATIONAL DEVELOPMENT EDUCATION (IDE) (SIDEC)

161. Introduction to Teaching and Learning in Asia

163X. Technology Policy, Knowledge Formation, and Economic Development

197X. Education and the Status of Women: An International Perspective

206A. Introduction to the Study of International Development Education

206B. Project Workshop in International Development Education

207. International Cooperation in Educational Development

225S. Comparative Higher Education

231. Social Structure of World Society (Same as Sociology 152; Values, Technology, Science and Society 155.)

245X. Origin and Diffusion of Mass Education (Same as Sociology 245.)

254A. Ethnographic Monitoring of Rapid Change I (Same as Anthropology 192A.)

254B. Ethnographic Monitoring of Rapid Change II (Same as Anthropology 192B.)

306A. Education and Economic Development

306B. Education and Political Change (Same as Political Science 221.)

306C. Education and Sociocultural Change

306D. Sociology of Development and Education

307X. Knowledge and Legitimation: The Politics of Educational Research (Same as Political Science 329.)

344S. SIDEC Research Seminar

376. Education and Theories of the State

405A,B,C. Research Workshop in International Development Education

MATHEMATICAL METHODS IN EDUCATIONAL RESEARCH (MME)

250A. Statistical Analysis in Education Research I (Same as Psychology 152.)

250B. Statistical Analysis in Education Research I

250C. Statistical Analysis in Educational Research II: Advanced Regression and Multivariate Analysis

351A. Advanced Statistical Analysis in Educational Research: Design and Analysis of Longitudinal Research

353. Problems in Measurement (Same as Psychology 249.)

451X. Research in Mathematical Education

460. Advanced Seminar in Evaluation Design

493A,B,C. Seminar on Methodological Problems in Educational Research

PSYCHOLOGICAL STUDIES IN EDUCATION (PSE)

120X. Problems of Intelligence, Information, and Learning (Same as Symbolic Systems 20.)

134. Career and Personal Counseling in Culturally Diverse Settings

155. Development of Measuring Instruments

191S. Special Topics: Seminar on Minorities in the Schooling Process

193S. Special Topics: Seminar on Minorities in the Schooling Process

196S. Educational Testing and Minority Students

229. The Development of Social Competence: Theory, Research, and Practice

232. Science and Research in Counseling Psychology (Same as Psychology 253.)

233. Seminar in Cross-Cultural Counseling (Same as Psychology 131.)

234. Applications of Counseling Theories (Same as Psychology 250.)

235X. Counseling and Therapy in Groups

237. Psychological Assessment

238A. Orientation to Counseling Psychology

238B,C. Counseling and Health Psychology: Supervised Applications

251. Experimental Methods in Educational Research

252. Introduction to Test Theory (Same as Psychology 248.)

255. Human Abilities (Same as Psychology 155.)

295X. Psychology of Problem Solving and Reasoning

299X. Adulthood

316. Cognitive Psychology of Education

317. Psychological Research on Teaching

321A,B. Qualitative Methods of Educational Research: Issues in Design and Data Collection

338A,B,C. Practicum in Counseling and Health Psychology

343. Motivational Processes in Education

350A. Psychological Studies in Education

350B,C,D. Research Practicum in Psychological Studies in Education

352. Psychology of Instruction

353. Problems in Measurement (Same as Psychology 249.)

415. Seminar in the Psychology of Reading

416. Seminar on Aptitude

426. Theory and Practice in Criterion-References Test Interpretations

431. Doctoral Seminar: Counseling and Health Psychology

SOCIAL SCIENCES IN EDUCATION (SSE)

105. American Education and Public Policy (Same as History 158B, Political Science 186K.)

116X. Anthropological Perspectives on American Culture (Same as Anthropology 15.)

131. Economics of Women's Education and Work

170. Gender and Education (Same as Feminist Studies 130, Sociology 112.)

197X. Education and the Status of Women: An International Perspective

200. History of Education

201. History of Education in the United States (Same as History 158, African and Afro-American Studies 201.)
SCHOOL OF EDUCATION

306A. Education and Economic Development
306B. Education and Political Change (Same as Political Science 221.)
306C. Education and Sociocultural Change
306D. Sociology of Development and Education
307X. Knowledge and Legitimation: The Politics of Educational Research (Same as Political Science 328.)
310. Sociology of Education (Same as Sociology 310.)
312B. Interaction Processes in Education (Same as Sociology 242B.)
315. Cultural Transmission: Education in Cross-Cultural Perspective (Same as Anthropology 266.)
327. Research Practicum: Social Sciences in Education
408A,B,C. Research Workshop in International Development Education
460. Advanced Seminar in Evaluation Design

DIRECTED READING AND RESEARCH, DISSERTATION AND PRACTICA (ALL AREA COURSES)

180. Directed Reading in Education—Master’s degree students.
190. Directed Research in Education—Master’s degree students.
199X. Undergraduate Honors Seminar
377. Organization and Style in Research Reports
450. Seminar on Ethical Concerns in Research and Evaluation
470. Practicum—For advanced graduate students. Not for STEP students.
470E. Practicum in Evaluation—For Evaluation Consortium members.
490. Directed Reading—For advanced graduate students.
490. Directed Research—For advanced graduate students.
SCHOOL OF ENGINEERING

Dean: James F. Gibbons
Associate Deans: Kenneth S. Down (Business Affairs), Dwain N. Fullerton (Development), Gordon Kino (Space Planning), Charles H. Kruger (Academic and Faculty Affairs), Elliott Levinthal (Research), Rick Reis (Professional Development)
Assistant Dean: Jane Johnston
Consulting Professor of Engineering: Jeffrey Wadsworth

Faculty Teaching General Engineering Courses
Associate Professors: John C. Bravman, Gerald G. Fuller, Lambertus Hesselink, H. Craig Howard, Bruce B. Lusignan, M. Elisabeth Paté-Cornell
Assistant Professors: Jeffrey R. Koseff, Sheri D. Sheppard
Lecturers: David Lougee, Gerd D. Wallenstein

School of Engineering Advisory Committee on Engineering in Biology and Medicine: Charles R. Steele (Mechanical Engineering) Chairman; Dennis Carter (Mechanical Engineering), I-Dee Chang (Aeronautics and Astronautics), Lambertus Hesselink (Aeronautics and Astronautics), Albert Macovski, Channing R. Robertson (Chemical Engineering), Gfio Wiederhold (Computer Science), Felix Zajac (Mechanical Engineering)

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 10 academic departments: Aeronautics and Astronautics, Chemical Engineering, Civil Engineering, Computer Science, 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 several inter-school activities, including the Microwave Laboratory, the Center for Materials Research, the Center for Space Science and Astrophysics, the Radio Astronomy Institute, the Joint Institute for Aerodynamics, the Institute for Electronics in Medicine, 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 and intend to major in engineering should take mathematics in high school to as high a level as is offered. (See the Mathematics Department, School of Humanities and Sciences, for information on advanced placement in mathematics.) High school courses in physics, chemistry, and computer science 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."
addition, students should complete the equivalent of Stanford's foreign language requirement and as many of the University's distribution requirements as possible before transferring. 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.

(3 + 2) DEGREE PROGRAMS

The School of Engineering cooperates with 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 in a field of engineering by Stanford. These programs comprise three years of study at 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 (3 + 2) program should request transfer application forms from the Stanford University Admissions Office. The (3 + 2) program applicants are given careful consideration for admission to Stanford, provided they meet the following three requirements: 1) the recommendation of the coordinator at the liberal arts college, 2) a letter grade indicator which is competitive with those of other transfer applicants, 3) a satisfactory scholastic aptitude test score. (3 + 2) transfer students may not receive the Stanford B.S. degree until the requirements for the particular program of study they have selected are completed.

UNDERGRADUATE PROGRAMS

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 sufficiently flexible that many decisions on individual courses are left to the student and the advisor. For a student with a well-defined educational goal, there is a great deal of latitude. In addition to the special requirements for engineering majors described below, all undergraduate engineering students are subject to the University distribution, writing, and foreign language requirements outlined in the first pages of this bulletin. Most engineering programs will automatically satisfy the University distribution requirements in Area 6 (Mathematical Sciences), Area 7 (Natural Sciences), and Area 8 (Technology and Applied Science). Depending on the program chosen, students will have the equivalent of from one to three quarters of free electives to bring the total number of units to 180.

BACHELOR OF SCIENCE

Departments within the School of Engineering offer programs leading to the degree of Bachelor of Science in the following fields: Chemical Engineering, Civil Engineering, Computer Science, Electrical Engineering, Industrial Engineering, Materials Science and Engineering, and Mechanical Engineering. The School of Engineering itself offers interdisciplinary programs leading to the Bachelor of Science degree in Engineering with specializations in Aeronautics and Astronautics, Computer Systems Engineering, and Product Design. In addition, students may elect an Individually Designed Major leading to the degree of Bachelor of Science in Engineering.

ACCREDITATION

The Accreditation Board for Engineering and Technology (ABET) accredits college engineering programs on a nationwide basis. At Stanford, the following undergraduate curricula are accredited: Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering, Mechanical Engineering, and Petroleum Engineering (School of Earth Sciences). The Department of Aeronautics and Astronautics offers an accredited program at the master's degree level. 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, Terman 208.

POLICY ON PASS/NO CREDIT GRADING AND MINIMUM GRADE INDICATOR

All courses taken to satisfy major requirements (including the requirements for mathematics; science; engineering fundamentals; Values, Technology, Science, and Society; and engineering depth) for all engineering students (including both departmental majors and School of Engineering majors) must be taken for a letter grade.

For departmental majors, the minimum aver-
age LGI (letter grade indicator) for all courses taken in fulfillment of the Engineering Fundamentals requirement and the Engineering Depth requirement is 2.0. For School of Engineering majors, the minimum average LGI on all engineering courses taken in fulfillment of the major requirements is 2.0.

DEPARTMENTAL MAJORS

Curricula for majors offered by the Departments of Chemical Engineering, Civil Engineering, Electrical Engineering, Industrial Engineering and Engineering Management, Materials Science and Engineering, and Mechanical Engineering have the following components: mathematics (21 units minimum, see Note 1); science (20 units minimum, see Note 2); engineering fundamentals (five courses minimum, see Note 3); Values, Technology, Science, and Society (VTSS) (one course minimum, see Note 4); engineering depth (45 units minimum, see course listings below). Included within the courses taken to fulfill the preceding curriculum components is a requirement for 8 units minimum of experimentation (see below).

Curricula offered by the School of Engineering and by the Department of Computer Science have separate requirements as described below.

EXPERIMENTATION

Departmental programs in Chemical, Civil, Electrical, Industrial, Materials, and Mechanical Engineering must include 8 units of experimentation. Laboratory courses taken in the sciences as well as experimental work taken in courses within the School of Engineering can be used in fulfillment of this requirement. By careful planning, the experimentation requirement should not necessitate additional course work beyond that required to meet the other components of an engineering major. A list of courses and their experimentation content (in units) can be found in the School of Engineering Undergraduate Handbook which can be obtained from the office of the Dean of Engineering, Terman 202.

CHEMICAL ENGINEERING

Mathematics: 21 units minimum (See Note 1)
Science: 20 units minimum* (See Note 2)
Engineering Fundamentals:
5 courses** (See Note 3)
Val., Tech., Sci., & Soc.: 1 course (See Note 4)
Engineering Depth:
Chem. 36. Chemical Separations 3
Chem. 130. Theory and Practice of Identification 4
Chem. 131. Organic Polyfunctional Compounds 3
Chem. 173. Physical Chemistry 3
Chem. 175. Physical Chemistry 3
Chem. Engr. 110. Equilibrium Thermodynamics 3
Chem. Engr. 120. Separations Processes 3
Chem. Engr. 140. Fluid Mechanics 3
Chem. Engr. 180. Chemical Engineering Laboratory 4
Engr. 21 or Mech. Engr. 33. Mechanics of Fluids 4
Restricted Elective† 3
45

* Science courses should include Chem. 31, 33, and 35.
** Chem. 171 may be substituted for Engr. 30 in Engineering Fundamentals.
† Courses from engineering or the sciences are applicable with the consent of the student’s academic advisor.

CIVIL ENGINEERING (C.E.)

Mathematics: 21 units minimum (See Note 1)
Science: 20 units minimum (See Note 2)
Engineering Fundamentals:
5 courses (See Note 3)
Val., Tech., Sci., & Soc.: 1 course (See Note 4)
Engineering Depth:
C.E. 130. Introduction to Urban Planning or C.E. 171. Environmental Planning 3
C.E. 150. Legal and Professional Aspects of C.E. 3
C.E. 160. Water Resources Engineering 4
C.E. 170. Environmental Science and Technology 3
C.E. 180. Elementary Structural Analysis 4
C.E. 190. Geotechnical Engineering 4
Engr. 11. Mechanics of Materials I 4
Engr. 21. Mechanics of Fluids 4
Additional Civil Engineering Courses* 16
45

* The additional units must be C.E. courses selected with the approval of the student’s advisor.

SPECIAL REQUIREMENTS: All candidates for the B.S. degree in Civil Engineering must take Engineering 10, Statics; Engineering 60, Engineering Economics; and Engineering 70, Introduction to Software Engineering. These courses may also be used in partial fulfillment of the Engineering Fundamentals requirement. In addition, students must have ex-
experience in drafting, either computer-aided or manual, as obtained in high school, through work experience, or by taking Mechanical Engineering 102.

**COMPUTER SCIENCE (C.S.)**

Mathematics: (28 units)
- Math 41, 42, 43. Calculus and Analytic Geometry 15
- Math 103 or 113. Linear Algebra 3
- C.S. 157. Logic and Automated Reasoning 4
- C.S. 160. Discrete Mathematics 3
- Math Elective* 3

Science: (12 units)
- Phys. 51. Mechanics 4
- Phys. 53. Electricity and Magnetism 4
- Other Science† 4

Engineering Basics: (10 units)
- C.S. 106X. Programming Methodology and Abstractions (Accelerated) or C.S. 106A and 106B 5
- Engr. 40. Basic Electronics 5
- Val., Tech., Sci., & Soc.: 1 course (See Note 4)

Computer Science Courses: (45-48 units)
- C.S. 106C. Theoretical Foundations for Computer Science 5-8
- or C.S. 109A, B. Introduction to Computer Science 5
- C.S. 107. Programming Paradigms 5
- C.S. 110. Introduction to Computer Systems and Assembly Language 4
- C.S. 140. Concurrent Programming 3
- C.S. 143A. Compilers 4
- C.S. 154. Introduction to Automata and Complexity Theory 4
- C.S. 161. Discrete Structures and Algorithms 4
- C.S. 221. Introduction to Artificial Intelligence 3
- C.S. 240A. Operating Systems 4
- Project Courses†† 6

* Any course of 3 or more units from the School of Engineering list (see Note 1) may be taken.
† Other science courses are to be taken from the School of Engineering list (see Note 2), plus Psych. 102, 106, 108. Physics 61 and 62 or Physics 21 and 23 may be taken instead of Physics 51 and 53, as long as a total of 12 science units are taken.
†† The following project courses are acceptable: a total of 6 units must be taken: C.S. 191 (3-6 units), 194 (3-6 units), 225A and 225B (6 units). Further details can be found in the School of Engineering Undergraduate Handbook.

**ELECTRICAL ENGINEERING (E.E.)**

Mathematics: 21 units minimum (See Note 1)
- Science: 20 units minimum (See Note 2)
- Engineering Fundamentals: 5 courses* (See Note 3)
- Val., Tech., Sci., & Soc.: 1 course (See Note 4)
- Engineering Depth:
  - Comp. Sci. 106B. Software Engineering 5
  - I.E. 100. Organizations: Theory and Management 4
  - I.E. 121. Statistics and Quality 4
  - I.E. 125. Work Design and Measurement 5
  - I.E. 133. Industrial Accounting 3
  - I.E. 235. Introduction to Financial Decisions 4
  - I.E. 260. Analysis of Production Systems 4
  - I.E. 180 or 183 or 186. Senior Project 4
  - Stat. 110. Statistical Methods 4

* Math courses should include Stat. 116 and Math 103.
** Engineering Fundamentals courses must include Engr. 40, 60, and 70A or 70X.

**INDUSTRIAL ENGINEERING (I.E.)**

Mathematics: 21 units minimum (See Note 1)
- Science: 20 units minimum (See Note 2)
- Engineering Fundamentals: 5 courses* (See Note 3)
- Val., Tech., Sci., & Soc.: 1 course (See Note 4)
- Engineering Depth:
  - Comp. Sci. 106B. Software Engineering 5
  - I.E. 100. Organizations: Theory and Management 4
  - I.E. 121. Statistics and Quality 4
  - I.E. 125. Work Design and Measurement 5
  - I.E. 133. Industrial Accounting 3
  - I.E. 235. Introduction to Financial Decisions 4
  - I.E. 260. Analysis of Production Systems 4
  - I.E. 180 or 183 or 186. Senior Project 4
  - Stat. 110. Statistical Methods 4

* Math courses should include Stat. 116 and Math 103.
** Engineering Fundamentals courses must include Engr. 40, 60, and 70A or 70X.

**MATERIALS SCIENCE AND ENGINEERING (M.S.E.)**

Mathematics: 21 units minimum (See Note 1)
- Science: 20 units minimum (See Note 2)
- Engineering Fundamentals: 5 courses (See Note 3)
- Val., Tech., Sci., & Soc.: 1 course (See Note 4)
- Engineering Depth:
  - Engr. 51. Materials Technology for Structural Applications 3
  - Engr. 52. Materials Engineering of Microelectronic Devices 3
  - M.S.E. 150. Atomic Arrangements in Solids 5
  - M.S.E. 151. Thermodynamics and Phase Equilibria 5
  - M.S.E. 152. Rate Processes in Materials 4
  - M.S.E. 155. Mechanical Behavior of Solids 4
M.S.E. 158. Electrical, Optical, and Magnetic Properties of Materials 5
M.S.E. 160, 161, 162. Experimental Methods 6
Restricted Electives* 10


MECHANICAL ENGINEERING (M.E.)
Mathematics: 21 units minimum (See Note 1)
Science: 20 units minimum (See Note 2)
Engineering Fundamentals: 5 courses (See Note 3)
Val., Tech., Sci., & Soc.: 1 course (See Note 4)
Engineering Depth:
Engr. 10. Applied Mechanics: Statics 3
Engr. 11. Mechanics of Materials I 4
M.E. 33. Introductory Fluids Engineering 4
M.E. 101. Visual Thinking 3
M.E. 103. Manufacturing Technology 4
M.E. 111. Stress, Strain, & Strength 3
M.E. 112. Mechanical Systems 3
M.E. 113. Engineering Design 3
M.E. 131A. Fluid Mechanics 4
M.E. 131B. Heat Transfer 5
M.E. 131C. Thermosciences 5
M.E. 161. Mechanical Vibrations 4

PETROLEUM ENGINEERING
Petroleum Engineering is offered by the School of Earth Sciences. Consult the appropriate sections of this bulletin for requirements.

AARONAUTICS AND ASTRONAUTICS (A.A.)
Mathematics: 21 units minimum (See Note 1)
Science: 20 units minimum (See Note 2)
Engineering Fundamentals: 5 courses (See Note 3)
Val., Tech., Sci., & Soc.: 1 course (See Note 4)
Engineering Depth:
A.A. 100. Introduction to Aero and Astro 3
A.A. 131. Experimentation in Aero/Astro 3
A.A. 192. Vector and Tensor Analysis 3
A.A. 200A. Applied Aerodynamics 3
A.A. 210A. Fundamentals of Compressible Flow 3
Engr. 10. Applied Mechanics: Statics 3
Engr. 11. Mechanics of Materials I 4
Engr. 104. Dynamic Response 3
Math 130. Differential Equations 3
Mech. Engr. 33. Introduction to Fluids Engineering 4
Mech. Engr. 131A. Fluid Mechanics 4
Restricted Electives* 6


COMPUTER SYSTEMS ENGINEERING (C.S.E.)
Mathematics: (21 units)
Math. 41, 42, 43, 44. Calculus 18
Math. 103 or 113. Linear Algebra 3
Science: (12 units)
Phys. 51. Mechanics 4
Phys. 53. Electricity and Magnetism 4
Phys. 55. Light and Heat 4
Basic Engineering: (10 units)
Engr. 40. Electronics 5
Engr. 70X. Programming Methodology and Abstractions 5
Depth: (47-50 units)
Comp. Sci. 106C. Theoretical Foundations for Computer Science 5
or
Comp. Sci. 109A.B. Introduction to Computer Science 5-8
Comp. Sci. 107. Programming Paradigms 5
Comp. Sci. 110. Introduction to Computer Systems and Assembly Language 4
Comp. Sci. 140. Concurrent Programming 3
Comp. Sci. 143A. Compilers 4
or
Comp. Sci. 240A. Operating Systems 4
Elect. Engr. 101. Circuits 3
Elect. Engr. 111, 112. Electronics 6
Elect. Engr. 121. Digital Laboratory 2
Elect. Engr. 152. Computer Organization 3
Elect. Engr. 183. Advanced Logic Laboratory 3
Elect. Engr. 271. Introduction to VLSI Systems 3
Senior Project* 6

Total Units: 90-93

* Senior projects can be either course-based or independent study. The courses Elect. Engr. 272A and B satisfy the requirement as does Comp. Sci. 194. Independent study projects require faculty sponsorship and must be approved by the C.S.E. program advisor. Further details can be found in the School of Engineering Undergraduate Handbook.
PRODUCT DESIGN

Mathematics: 21 units minimum  (See Note 1)
Science: 20 units minimum*  (See Note 2)
Technical Electives: 15 units minimum**
Val., Tech., Sci., & Soc.: 1 course  (See Note 4)

Engineering Depth:
Art 60. Basic Design  3
Art 160. Design I  3
Art 161. Design II: Type and Symbol Design  3
Art 164. Color  3
Engr. 11. Mechanics of Materials I  4
Mech. Engr. 105. Manufacturing Technology  4
Mech. Engr. 111. Stress, Strain, and Strength  3
Mech. Engr. 112. Mechanical Systems  3
Mech. Engr. 115A. Human Values in Design  3
Mech. Engr. 115B. Concept Presentation  3
Mech. Engr. 191. Engineering Problems  1  45

* From the approved list for departmental majors (see Note 2) plus up to 3 units of behavioral science.

** Engineering Fundamentals courses (see Note 3) plus Indust. Engr. 100, 133, and Mech. Engr. 102.

INDIVIDUALLY DESIGNED MAJORS (I.D.M.)

I.D.M.s are intended for undergraduates interested in pursuing engineering programs that fall outside the purview of departmental majors or the pre-approved School of Engineering majors. Programs are designed by students, with the assistance of two faculty advisors of their choice, and presented to the Undergraduate Council for approval. The degree will be designated Bachelor of Science in Engineering: (proposed title). This degree is not accredited by ABET.

Students should submit written proposals to the Undergraduate Council, Terman 208, detailing their programs. Programs must comply with the following requirements: Mathematics (21 units minimum, see Note 1 below), Science (17 units minimum, see Note 2), Engineering courses (40 units minimum) with additional courses to bring the total to at least 90 and not more than 107 units. (Students may take additional courses beyond the 107 units, but the I.D.M. proposal must be limited to a maximum of 107 units.) Each proposal should begin with a statement that 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. A proposed title for the major, to be included on the official University transcript, should be included.

The proposal statement should be followed by a list of courses to be counted toward the major: normally the courses selected should represent a well-coordinated sequence that provides mastery of the important principles and techniques in a well-defined field. In some circumstances, especially if the proposal indicates that the goal of the major is to prepare the student for graduate work outside of engineering, a more general engineering program may be appropriate. The proposal must be signed by two faculty members, at least one of whom must be from the School of Engineering, whose signatures certify that they endorse the major as described in the proposal and agree to serve as the student’s permanent advisors. One of the faculty members will act as primary advisor, and the proposal must be accompanied by a statement from that person giving his or her appraisal of the academic viability of the proposed major.

Students proposing I.D.M.s must have at least three quarters of undergraduate work remaining at Stanford after their proposals are submitted. Any changes in a previously approved major must be endorsed by the faculty advisors and reapproved by the Undergraduate Council. Proposals are reviewed and acted upon once per quarter. Proposals should be submitted to the Dean of Engineering, Terman 208.

Note 1 (Mathematics)—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 Math. 43. Knowledge of ordinary differential equations and matrices is important in many areas of engineering, and students are encouraged to select additional courses in these topics.


Note 2 (Science)—A strong background in the basic concepts and principles of physical science in such fields as physics, chemistry, geology, and biology is essential for engineering.

Courses which satisfy the science requirement are: Biology 31, 32, 33; Chem. 31, 33, 35, 36, 135 (and, by petition, Chem. 30); Geol. 1 or 2; Geol. 3; Phys. 51, 53, 54, 55, 56, 57, 58 (preferred sequence for engineers); Phys. 21, 22, 23, 24, 25, 26; Phys. 61, 62, 63.

Note 3 (Engineering Fundamentals)—The Engineering Fundamentals requirement is satisfied by a nucleus of technically rigorous, introductory courses chosen from the various engineering disciplines. It is intended to serve several purposes. First, it provides mastery of the important principles and techniques in a well-defined field. In some circumstances, especially if the proposal indicates that the goal of the major is to prepare the student for graduate work outside of engineering, a more general engineering program may be appropriate. The proposal must be signed by two faculty members, at least one of whom must be from the School of Engineering, whose signatures certify that they endorse the major as described in the proposal and agree to serve as the student’s permanent advisors. One of the faculty members will act as primary advisor, and the proposal must be accompanied by a statement from that person giving his or her appraisal of the academic viability of the proposed major.

Students proposing I.D.M.s must have at least three quarters of undergraduate work remaining at Stanford after their proposals are submitted. Any changes in a previously approved major must be endorsed by the faculty advisors and reapproved by the Undergraduate Council. Proposals are reviewed and acted upon once per quarter. Proposals should be submitted to the Dean of Engineering, Terman 208.
students with a breadth of knowledge concerning the
major fields of endeavor within engineering. Second,
it allows the incoming engineering student an oppor-
tunity to explore a number of courses before embark-
ing on a specific academic major. Third, the individual
classes each offer a reasonably deep insight into a
contemporary technological subject for the interested
non-engineer.

The requirement is met by taking five courses from
the following list:

Engr. 10. Applied Mechanics: Statics, or Engr. 12,
Intermediate Dynamics
Engr. 20. Introduction to Chemical Engineering
Engr. 30. Engineering Thermodynamics
Engr. 40. Electronics
Engr. 50. Introductory Science of Materials
Engr. 60. Engineering Economics, or, Engr. 62,
Introduction to Operations Research I
Engr. 70A or Engr. 70X. Introduction to
Software Engineering

Note 4 (Vol., Tech., Sci.,
6-
Soc.): It is important to
obtain a broad understanding of engineering in its
human, social, and cultural contexts. To introduce
this aspect of professional development, many engi-
eering majors require one course on the interaction
of technology with values and beliefs, social institu-
tions, or behavior.
The following courses satisfy this requirement:
Val., Tech., Sci., & Soc. 101, 106, 107, 112, 115, 116,
121, 124, 150, 157, 159, 162, 169, 170.

PROGRAMS IN
MANUFACTURING

Programs in manufacturing are available at
the undergraduate, master’s, and Ph.D. levels.
The undergraduate program of the Department
of Industrial Engineering and Engineering
Management provides general preparation for
any student interested in manufacturing. More
specific interests can be accommodated through
Individually Designed Majors (I.D.M.’s). To introduce
this aspect of professional development, many engi-
eering majors require one course on the interaction
of technology with values and beliefs, social institu-
tions, or behavior.
The following courses satisfy this requirement:
Val., Tech., Sci., & Soc. 101, 106, 107, 112, 115, 116,
121, 142, 150, 157, 159, 162, 169, 170.

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

This degree is available to students who com-
plete 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 bulletin.

COTERMINAL DEGREE
PROGRAMS

A Stanford undergraduate may work simul-
taneously toward bachelor’s and master’s de-
grees, 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 pro-
gram.

Dual A.B. and B.S. Degree Program — To
qualify for both degrees, a student must: (1)
complete the stated University requirements and
departmental requirements for each
degree, (2) complete 15 full-time quarters or 3
full-time quarters after completing 180 units and (3)
complete a total of 225 units (180 units
for the first bachelor's degree plus 45 units for
the second bachelor's degree.)

Coterminal Bachelor/Master Program — A
Stanford undergraduate may be admitted to the
University graduate division for the purpose of
working simultaneously toward a bachelor's de-
gree 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 re-
quired by his or her graduate department for the
master’s degree (not fewer than the University
minimum of 36 units); (3) complete the require-
ments for the bachelor's degree (department,
school, and University) and apply for the degree
at the appropriate time at the Office of the Regis-
trar, and (4) complete the department and Uni-
versity requirements for the master's degree.

Admission to the coterminal program re-
quires admission to graduate status by the perti-
nent department. Admission criteria vary from
department to department.

Procedure for Applying for Admission to the
Coterminal Degree Programs — A Stanford un-
dergraduate may apply (using the University
coterminal petition form) for admission to the
coterminal bachelor/master program after the
beginning of the eighth quarter of undergrad-
uate work and no later than before the end of the
11th quarter of undergraduate work. Students
seeking a graduate degree in engineering will
apply to the pertinent department.

GRADUATE ADMISSION

Application for admission with graduate
standing in the school should be made to the
Director of Graduate Admissions of the Uni-
versity; applications are reviewed by the appro-
priate department of the school before admis-
sion is authorized. Inquiries may be addressed
to the Dean of Engineering or to the chairman
of the department. While most graduate stu-
dents have undergraduate preparation in an
engineering curriculum, it is feasible to enter
from other programs including chemistry,
physics, or mathematics.
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 within the Schools of Humanities and Science and Earth Sciences also offer graduate degree programs under this plan. The majority of coursework taken in the HCP is done via the Stanford Instructional Television Network (SITN). A four-channel network 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) 723-3616.

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 CURRICULA

For further details about the below 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 her or his own.

Departments and divisions of the school offer graduate curricula, as follows:

AERONAUTICS AND ASTRONAUTICS

Acoustics
Aerodynamics
Aeroelasticity
Aerophysics and Experimental Space Science
Aerospace Structures
Aerospace Systems Synthesis and Design
Analytical and Experimental Methods in Solid and Fluid Mechanics
Biomedical Solid and Fluid Mechanics
Composite Materials
Computational Fluid Dynamics

Flights Mechanics
Gaskinetics
Guidance and Control
Hypersonic and Physical Gas Dynamics
Modern Optical Diagnostics in Fluid Mechanics
Physical Gasdynamics
Propulsion
Robotics
Waves and Vibrations

CHEMICAL ENGINEERING

Applied Statistical Mechanics
Bioengineering
Equilibrium and Transport Properties of Colloidal Dispersions
Hydrodynamic Stability
Kinetics and Catalysis
Newtonian and Non-Newtonian Fluid Mechanics
Rheo-optics of Polymeric Liquids and Colloidal Suspensions
Surface and Interface Science

CIVIL ENGINEERING

Computer-Aided Civil Engineering
Artificial Intelligence/Expert Systems
Computational Mechanics
Manufacturing/Construction Automation
Construction Engineering and Management
Environmental and Water Studies
Environmental Engineering and Science
Water Resources
Geotechnical Engineering
Resources Planning
Energy and Environmental Planning
Land Use Planning
Water Resources Planning
Structural Engineering
Earthquake Engineering
Reliability and Risk Analysis
Soil Mechanics and Foundations
Structural Analysis and Design
Structural Mechanics

ELECTRICAL ENGINEERING

Communications and Information Theory
Computer Systems and Applications
Control and System Theory
Electromagnetic Theory and Microwave Devices
Electronic Circuits and Devices
Information and Signal Processing
Integrated Circuits and Systems
Modern Optics and Optical Devices
Quantum Theory and Applications
Radioscience
Solid State Devices
Solid State Materials and Properties
Space Plasma Physics
VLSI

ENGINEERING
Interdisciplinary Programs
Interdepartmental Programs

ENGINEERING IN BIOLOGY AND MEDICINE
Biomaterials
Biostatistics
Design for Medical Applications
Information Processing in and for Biomedical Systems
Integrated Circuits for Medical Electronics
Mechanics of Hearing
Neuromuscular Biomechanics
Orthopedic Biomechanics
Rehabilitative Engineering
Transport Phenomena in Biological Systems

ENGINEERING-ECONOMIC SYSTEMS
Business Systems
Decision Analysis
Decision Systems
Economic Analysis
Energy Modeling and Analysis
Information Policy
Mathematical Systems Analysis
Social Analysis

INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT
Engineering Economy — Financial Analysis
Engineering Management
Manufacturing Systems Engineering
Organizational Design and Control
Production 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
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
Manufacturing Systems Engineering
Optimization
Product Design
Robotics
Solar Energy
Thermodynamics
Transport Processes
Turbulence

OPERATIONS RESEARCH
Applied Probability
Combinational Optimization
Dynamic Programming
Energy and Economic Modeling
Inventory Theory
Mathematical Programming
Networks
Queueing Theory
Reliability Theory
Simulation Methodology

SPACE SCIENCE
See the “Center for Space Science and Astrophysics" section in this bulletin.

ENGINEERING IN BIOLOGY AND MEDICINE
Though Stanford does not have a formal department of bioengineering, there are approximately 10 faculty in the School of Engineering whose primary research activities are in the general area of bioengineering. There are many opportunities in the medical and biological sciences for collaboration. 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. The program in bioengineering is open only to students who are admitted to, and enrolled in, a department in the

SCHOOL OF ENGINEERING
School of Engineering. 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, the mechanics of hearing, computer aided clinical neurology, bone mechanics, orthopedic biomechanics, and 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. Databases in medicine and planning, applications of artificial intelligence, and knowledge-based systems are being studied in Computer Science. 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 Rehabilitation Research and Development Center, a Veterans Administration sponsored cooperative program with the School of Engineering. (Contact Professors Carter, Leifer, or Zajac, Mechanical 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 in Biology and Medicine are available, there is no prescribed program and these degrees are not encouraged. An inter-departmental committee must approve these special programs for the rare case 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.

MANUFACTURING

Programs in manufacturing are available at the undergraduate, masters, and Ph.D. level. Masters-level programs are offered by the Industrial Engineering and Engineering Management (I.E.-E.M.) Department and as joint programs by I.E.-E.M. and Mechanical Engineering. The graduate program in computer-aided Civil Engineering (C.E.) includes an option for manufacturing/construction automation. The C.E. program in Construction is also a "manufacturing" program for students interested in facility and public works manufacturing. All of these programs take advantage of modern computer technology.

Doctoral programs related to manufacturing are available in a number of departments and involve research projects ranging from machine tool design to the integration of data bases into production software.

For detailed information about the master's and Ph.D. programs, see the sections in this bulletin pertaining to industrial, mechanical, and civil engineering. Also, a separate pamphlet, Manufacturing Programs at Stanford, is available in Terman 202.

GRADUATE PROGRAMS

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.

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. Each student’s program is administered by the particular department in which it is lodged and must meet the standard of quality of that department.

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 department sections following.

DOCTOR OF PHILOSOPHY

Programs leading to the degree of Doctor of Philosophy are offered in each of the departments of the school. Special Ph.D. programs, which may be interdepartmental in nature, (e.g., Bioengineering) can be arranged. See "Graduate Division Special Programs" section in this bulletin. University regulations for the Doctor of Philosophy are given in the section "Degrees" in this bulletin. Further information will be found in the departmental listings.

FELLOWSHIPS AND ASSISTANSHIPS

Departments and divisions of the School of Engineering award 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 below.

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, Science, and Society" section of this bulletin.

PRIMARILY FOR UNDERGRADUATES

5. The Microscopic World of Technology—An introduction to the microscopic world of technology through optical and electron microscopes. A discussion and participation in the application of various microscopes to study technological components. Experiments involve examination of silicon integrated circuits or broken metal parts at magnifications ranging from 10X to 1,000,000X. (Open to freshmen). 3 units (Sinclair) given 1989-90

6. Engineering at Stanford—Weekly seminar for freshman and undeclared sophomores interested in engineering. Provides information on the various engineering majors and the resources available for engineering undergraduates. Speakers include departmental representatives, faculty and industry researchers, and representatives from Overseas Studies, Career Planning and Placement, and the Undergraduate Advising Center. 1 unit, Aut (Masters) M 3:15-4:45
7. Professional Development for Minority Engineers—(Same as African and African American Studies 127.) Assists students in understanding the basic benefits and opportunities available to Blacks in the various fields of engineering. The emphasis is on diversity. Experts from various fields lecture on pre-college needs, the social obligations of students and engineers; problems faced by Black engineers, Black women in engineering; M.B.A., J.D., M.D., and sales options for engineers; small versus large companies, graduate versus industrial opportunities; consulting and starting one’s own business; opportunities for Black engineers and businesses in Third World countries; trips to industrial and academic laboratories. Students have weekly reading assignments with a short paper due each week; a final term paper is assigned.

3 units, Spr (Bates)

10. Applied Mechanics: Statics—Equilibrium of particles; moments, couples; equilibrium of rigid bodies; analysis of trusses, frames, machines, dry friction; hydrostatic forces. Vectors and vector algebra are introduced and used. Prerequisite: Physics 51. (DR:8)

3 units, Aut (Bershader) MWF 9

Win (Van Dyke) MWF 9

Spr (Howard) MWF 9

problem sessions by arrangement

11. Mechanics of Materials I—Introduction to the mechanics of deformable structures under tension, compression, shear, torsion, and bending. Analysis of stresses, strains, and deformations. Also, Mohr’s circle, pressure vessels, and columns. Prerequisite: 10.

4 units, Win (Steele) MWF 9

Spr (Shah) MWF 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; gyrosopes; 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. (DR:8)

4 units, Aut (Bryson) MWF 9

Spr (Ashley) MWF 10

problem sessions by arrangement

20. Introduction to Chemical Engineering—An overview of chemical engineering through discussion and engineering analysis of physical and chemical processes. Topics: overall material and energy balance, concepts of rate processes, heat and mass transport, and kinetics of chemical reactions. Applications of these concepts to areas of current technological importance: control, biotechnology, large scale production of chemicals and materials processing. Prerequisite: Chemistry 31.

3 units, Spr (Robertson, Madix) MWF 10

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; laminar and turbulent flows; specific engineering applications. Laboratory exercises. Prerequisites: 10, Physics 51, and Math 23 or 43. Recommended: 12.

4 units, Aut (McCarty) MWF 10; lab M 2:15

Spr (Koseff) MWF 9; lab M 1:15

and one hour by arrangement

30. Engineering Thermodynamics—Introduction to the concepts of energy and entropy from elementary considerations of the microscopic nature of matter. Use of basic thermodynamic concepts in the solution of engineering problems. Methods and problems in the socially responsible economic generation and utilization of energy in central power stations, solar systems, gas turbine engines, refrigeration devices, automobile engines, etc. Prerequisites: Freshman calculus and physics. (DR:8)

3 units, Aut (Kays) MWF 10

Win (Eustis) MWF 10

35. Automotive Technology—An engineering description of today’s automobile, how it works and why its designed the way it is. How the auto affects air pollution and aspects of engine design for improving exhaust emissions. Alternate power plants and fuels and their options for the long term. Aimed at non-scientists. (DR:8)

3 units, Aut (DeBra) MWF 2:15

40. Introductory Electronics—Overview of electronic engineering. Electrical quantities, and their measurement including the operation of the oscilloscope. Digital logic circuits and their functions including the elementary microprocessor. Basic function of electronic components including ideal diodes and transistors; tuned circuits. Laboratory assignments complement the lecture. Prerequisites: Physics 53 or equivalent, one course of calculus, and elementary competence on personal computers. (DR:8)

5 units, Aut (Pease) MWF 11-12:15

Win (Masters) MWF 11-12:15

Spr (Helliwett) MWF 11-12:15

one 3-hour lab weekly by arrangement

50. Introductory Science of Materials—Crystalline structure and the microstructures that determine the important physical properties of engineering materials. Introduction to phase

3 units, Win (Bravman) MWF 11
Spr (Sinclair) MWF 11

51. Materials Technology for Structural Applications—Metals, alloys, ceramics, glass, materials used primarily for their mechanical properties. Description of materials processing techniques, e.g., heat treatment used to develop optimum properties. Materials selection and processing for engineering applications. Prerequisite: 50.

3 units, Win (Weis, Baker) MWF 1:15

52. Semiconductor Processing Materials Technology—The materials parameters required of integrated circuit and other components of microelectronic structures, and their physical basis. Unit processes utilized in the synthesis and fabrication of desired microstructures in silicon-based integrated circuits and selected other devices used in modern electronic and magnetic systems. Preparation of high purity materials, crystal growth, deposition of epitaxial layers and thin films. Diffusion, ion implantation, oxidation, chemical and plasma-assisted etching, organic and inorganic photoresist materials and techniques. Assembly and packaging technology. Prerequisite: 50.

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

60. Engineering Economics—Economic analysis for choice among alternatives. Use of compound interest calculations. Selection of appropriate minimum attractive rates of return. Analysis of decision under uncertainty. Effects of depreciation and income tax. May be taken by freshmen, but recommended for second year or higher students. Prerequisite: Math 41 or equivalent. Recommended: Previous knowledge of elementary probability.

3 units, Aut, Sum (Staff) MWF 10
Win (Sweeney) TTh 9:30-10:50

62. 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 from problems in pricing resources, production planning, inventory control, transportation, pollution control, personnel assignment, construction management. Prerequisite: Math 43 or consent of instructor.

4 units, Aut (Staff) MWF 1-2:05

70A. Programming Methodology—(Enroll in Computer Science 106A.)

70X. Programming Methodology and Abstractions (Accelerated)—(Enroll in Computer Science 106X.)

75. Introduction to Small Computer Hardware and Interfacing—(Enroll in Mechanical Engineering 75.)

100. Teaching Public Speaking—Theory and practice of teaching public speaking and presentation development. Lectures and discussions on developing an instructional plan, using audio-visual equipment for instruction, devising tutoring techniques, and teaching delivery, organization, audience analysis, visual aids, and unique speaking situations. Weekly practice speaking. Students serve as apprentice speech tutors. Those completing course may become paid speech instructors in the Technical Communications Program. Admission by consent of instructor.

3 units, Aut, Spr (Lougee, Staff)
M 7:30-10 p.m. Th 12:15

102E. Technical/Professional Writing for Electrical Engineers—Required of Electrical Engineering majors. Examines process of writing technical/professional documents. Lectures, writing assignments, individual conferences. Prerequisite or corequisite: Electrical Engineering 121, or consent of instructor.

1 unit, Win, Spr (Lougee) W 1:15

102S. Writing: Special Projects—Structured writing instruction for students working on non-course-related materials (theses, dissertations, journal articles). Weekly individual conferences.

1-5 units, Aut, Win, Spr (Staff)

102W. Technical and Professional Writing—Explores systematically the process of writing technical and professional documents; lectures and discussions on analyzing audiences, defining purpose, generating and selecting appropriate report materials, structuring clear and convincing reports, designing and drafting effective reports, and editing reports that are clear, concise, emphatic, and mechanically and grammatically "clean." Weekly writing assignments and individual conferences. Recommended especially for upperclassmen or graduate students who have worked or will soon work as professionals.

3 units, Aut, Win, Spr (Lougee) TTh 11

103. Public Speaking/Presentation Development—Introduction to the full range of speaking activities, from impromptu talks to carefully
rehearsed formal professional presentations. Teaches how to organize and write speeches for a variety of occasions, to analyze audiences, to create and use appropriate visual aids, to combat nervousness, to deliver informative and persuasive speeches effectively. Develops confidence in one's speaking ability through weekly practice in class, rehearsals in one-on-one tutorials, and videotaped feedback. Open to all, but priority given to engineering students.

3 units, Aut, Win, Spr (Staff)


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


3 units, Aut (Franklin) MWF 9
Win (Cannon) MW 11-12:15


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

190. Problem Solving—(Same as Industrial Engineering 201, Values, Technology, Science and Society 181.) Problem solving emphasizing problem definition, creativity, and interpersonal and organizational factors that influence thinking. Common blocks to problem solving and methods of dealing with them. The advantages of integrating various problem solving strategies is stressed through use of reading, abstracted problem situations, and projects. Open to all undergraduates and graduates.

3 units, Spr (Adams) MW 2:15-4:05

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.

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

PRIMARILY FOR GRADUATE STUDENTS


4 units, Win (Staff) MWF 1:15
lab by arrangement

207. Digital Control I—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 personal computer with interface with an analog system. Limited enrollment. Prerequisite: 105.

4 units, Aut (Staff) TTh 11-12:15
Win (Franklin) MWF 9
Spr (Parkinson) TTh 8-9:15
lab by arrangement


3 units, Aut (Rock) TTh 9:30-10:45
Spr (Staff) TTh 11-12:15
lab by arrangement


3 units, Spr (Staff) MW 8-9:15

213. Current Progress in Worldwide Telecommunications—(Same as Communication 232.)
Seminar on trends in worldwide standardized services. Topics: Integrated Services Digital Networks (ISDN), use of fiber optics for broadband services, broadcasting satellites in competition with video cable. Based on ITU (International Telecommunications Union) documents. Focus is on interaction of technology, entrepreneurship, and governmental regulation for divergent national markets. Individual study of technical standardization and related cases may be continued under Engineering-Economic Systems 292.

3 units, Sum (Wallenstein)


3 units, Aut (Levine)

200B. Methods of Mathematical Physics— (Enroll in Mathematics 220B.) Continuation of 220A.

3 units, Win (Ward)

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

3 units, Spr (Keller)

221. The Nature of Technology in Modern Society— (Same as VTSS 106.) Development of unified consideration of technology, science, and human values. Basic patterns underlying the physical bases of human societies. Systems covering areas of major human concern and the disciplines that study them. The world views of technology, science, and other disciplines and the problems and advantages associated with combining them. Necessary routes to better connect science and technology with society and values, and suggested agenda for clarification of unresolved conflicts and for the provision of a better basis for cooperative interdisciplinary work. The bases of cooperation in groups.

(DR:5)

4 units, Spr (Kline) TTh 1:15

section by arrangement

235A,B. Space Systems Engineering— 40-50 students, mostly from engineering and science, but also from business, form a team to prepare a preliminary design study of a space system. Systems designed in previous years include a Mars Exploration System, International Weather Systems, and Shuttle-Launched Science Platform System. About 20 invited speakers from government and industry give the necessary background information. At the end of the second quarter, the class gives a verbal briefing to government and industry representatives and publishes a final report on the system. Prerequisite: Electrical Engineering 235A or 244B, or consent of instructor.

235A. 3 units, Win (Lusignan) TTh 1:15-3:05 and two hours by arrangement

235B. 3 units, Spr (Lusignan) TTh 1:15-3:05 and two hours by arrangement

297A,B,C. Ethics of Development in a Global Environment (EDGE) — (Same as Anthropology 133A,B,C, Political Science 140A,B,C.) The EDGE seminars present a series of speakers on current development issues emphasizing the problems of the poorer nations. Autumn Quarter: world resources — energy, food, housing, population and environment. Winter Quarter: the role of institutions affecting the transfer of technology, e.g., political systems, world bank, transnationals. Spring Quarter: the role and responsibilities of the individual who wants to affect development. Speakers present widely differing case studies from their own experience. One unit credit for attendance of the speaker series; 3 additional units for optional workshops treating selected issues in more depth and writing a term paper. (Sequential registration is not required.)

1 unit (lecture only) or 4 units (lecture plus workshop), Aut, Win, Spr (Fagen, Lusignan, McWhorter, Siegel) lecture W 7:30-9:30 p.m., workshops by arrangement

298. Seminar in Fluid Mechanics— Interdepartmental seminar on problems in all branches of fluid mechanics, with talks by visitors, faculty, and students. Graduate students may register for 1 unit, without letter grade; a letter grade is given for 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
Emeriti: (Professors) John V. Breakwell, Chi-Chang Chao, Nicholas J. Hoff, Krishnamurty Karamcheti, Erastus H. Lee, Jean Mayers, Richard S. Shevell, Walter G. Vincenti
Chairman: Robert H. Cannon, Jr.
Associate Chairman: Daniel Bershader
Professors (Research): Dean R. Chapman, Bradford W. Parkinson, Leonard Roberts
Professor (Teaching): Richard S. Shevell
Associate Professors: Brian J. Cantwell, Lambertus Hesselink, Stephen Rock
Assistant Professors: Fu-Kuo Chang, Ilan Kroo
Consulting Professors: David Altman, Robert T. Jones, Harvard Lomax, Emery Reeves, Vincent Salmon, Fredric H. Schmitz, Clarence A. Syvertson
Visiting Professor: Nicholas Rott

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
- Aerodynamics
- Aeroelasticity
- Aerophysics and Experimental Space Science
- Aerospace Structures
- Aerospace Systems Synthesis and Design

AERONAUTICS AND ASTRONAUTICS AND

Analytical and Experimental Methods in Solid and Fluid Mechanics
Biomedical Solid and Fluid Mechanics
Composite Materials
Computational Fluid Dynamics
Flight Mechanics
Gaskinetics
Guidance and Control
Hypersonic and Physical Gas Dynamics
Modern Optical Diagnostics in Fluid Mechanics
Propulsion
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
- Aircraft Performance and Control
- Astrodynamics
- Bio-Fluid Mechanics and Physiological Acoustics
- Computational Fluid Dynamics
- Control of Flexible Spacecraft
- Control of Robots, including Space Robots
- Conventional and Composite Structures/Materials Systems Optimization
- Differential Games
- Experimental Space Sciences
- Geophysics
- Hypersonic Aerophysics and Trans-Atmospheric Flight
- Hypersonic Flow
- Inertial Instruments
- Laser Methodology for Fluid Flow Studies
- Multiphase Flows
- Nonequilibrium Flow
- Nonlinear Structural Mechanics
- Optical Diagnostics in Fluid Dynamics
- Optimal Control and Estimation
- Plasticity and Viscoelasticity
- Propulsion
- Shock Tube Studies of Vortex Interactions
- Structural Aeroacoustics
- Wave Propagation

INSTRUCTION AND RESEARCH FACILITIES

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 organizations allied in space exploration and aerospace technology.

The Guidance and Control Laboratories include a wide spectrum of specialized facilities for making and testing novel instruments of extremely high precision. The facilities include active table-leveling (0.1 arc sec); low-level accelerometer evaluation chamber (10^{-4} to 10^{-6} g); spaceflight 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. A new facility provides for testing systems for controlling flexible spacecraft on laboratory models. Dedicated high-capacity digital-control computers are part of this facility. Cryogenic gyro test facilities are available in the nearby Varian Physics Building, and Electrical Engineering's Integrated Circuit Fabrication Facility is adjacent. Active flutter suppression research is performed in 0.5m x 0.5m low speed wind tunnel. 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 Aerospace Robotics Lab (ARL) contains experimental facilities for testing controls for advanced robot designs with applications to industrial automation and to free-flying space robots. Current facilities include: very-flexible-beam manipulators, Scara configured manipulators with flexible drive trains, quick mini-manipulators, and pairs of cooperating manipulators. Several large granite tables provide for air-cushion-vehicle-mounted robots that move freely to simulate free-flying space robots. The ARL Computing Facilities include a family of realtime control computers that are especially suitable for robotics and controls research: These systems are multiprocessors based on 32 bit microprocessor single board computers. A realtime, multiprocessor operating system facilitates coordination of processor time and data resources. Our software development environment consists primarily of SUN-3 workstations running UNIX.

The ARL, together with the Computer Science Robotics Lab, are the partners for Stanford's Center for Automation and Manufacturing Science (CAMS). An ultra-precision machining laboratory is also part of the center.

Research in hypervelocity fluid dynamics, aerophysics, and vortex interactions makes use of the Stanford high-pressure shock tube, a device that can produce gas motion at very high Mach numbers, but which can also be used as a transonic wind tunnel. The shock tube can also generate high density, partially ionized plasmas under well-defined conditions. The associated instrumentation stresses modern optical diagnostics, especially holographic interferometry and other laser techniques.

Research in turbulent reacting flows is carried out in the Turbulence/Combustion Laboratory. This laboratory is centered around a recently completed variable pressure flow facility which permits studies of reacting flows under pressure conditions ranging from vacuum to 10 atmospheres. The apparatus is fully instrumented for two-point, two-color laser anemometry with fast local data acquisition. Current research includes a study of the break-up of a pulsed methane-air diffusion flame, investigation of the effects of turbulence on droplet evaporation and visualization of the small scale structure of turbulent wakes.

Diagnostics of shock-wave phenomena emphasize modern optical methods, including resonant interferometry and holography. Other recently outfitted laboratories deal with holography, tomography, optical data processing, and related problems involving Fourier optics. 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 and free-correction flow fields with interferometer equipment, shock-wave interaction by use of a shock tube, gyroscoptic behavior, vibration modes of a simulated wing, blunt-body flow with ballistic freelflight 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.

Excellent facilities exist in the Fourier Optics and Optical Diagnostics Laboratory for the development and evaluation of new techniques, including stable continuous wave and pulsed laser sources, extensive optical and electronic equipment, and a complete stand-alone digital image processing computer, linked to a Sun 3-260 and several Sun work stations.

The Experimental Fluid Dynamics group has developed an extensive capability in modern
optical diagnostics methods for fluids studies, including several applications of laser techniques, interferometry, and Fourier optics. Special opportunities exist for students with overlapping interests in fluid dynamics and experimental physics.

Included among the facilities in the Durand Building are the Structures and Composites Laboratories for studying and testing the behavior of small scale structures made of metal and fiber reinforced composites. Equipment is also available to fabricate composite material structural elements made by autoclave curing and by filament winding. A static/dynamic testing bed for large scale structural tests is provided in the Central Structures Laboratory of the School of Engineering.

Service facilities in the building include a full machine shop, chemistry laboratory, an aeronautics library, several conference rooms, and 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, complemented by a "satellite" computer facility in the adjacent Terman Engineering Center, 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 minicomputers 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 Engineering 206, 207, and 208 are closely integrated with the equipment used for research activities.

In connection with the consortium arrangement between Stanford and the nearby NASA-Ames Research Center, students and faculty have access to one of the best and most extensive collections of experimental aeronautical research facilities in the world, as well as the latest generation of super-computers.

INSTITUTES AND RESEARCH PROGRAMS

Several faculty of the Department of Aeronautics and Astronautics (A.A.) participate in the Center for Space Science and Astrophysics (CSAA). Graduate students in the department have the opportunity to arrange a program which emphasizes astronautics, planetary, and space sciences, and to work with faculty associated with CSSA.

At the master's level, a program in Computational Fluid Mechanics (CFD) is an option within the general structure of the master's requirements. At this level, students interested in a still greater emphasis on CFD may register for the M.S. in Engineering or Engineering Science (see below) and design a program in consultation with 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 (A.A. 214A-C and A.A. 215A-B) by planning an M.S. program strong in mathematics and numerical analysis (Mechanical Engineering—M.E. 200A-C or the equivalent) and in advanced fluid mechanics (e.g., A.A. 200A-B, M.E. 251A-B, A.A. 210A-B, M.E. 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 both the Department of Mechanical Engineering and of Aeronautics and Astronautics. Students undertaking theses in CFD generally utilize the large computer facilities of the NASA-Ames Research Center through a cooperative program with the University.

The Joint Institute for Aeronautics and Acoustics, co-sponsored by Stanford University and NASA-Ames Research Center, was originated in 1973. Its purpose is to provide long-term cooperative research in conjunction with graduate education. Specializations encompassed by the institute include: aerodynamics, fluid mechanics, flight dynamics, systems analysis, guidance and navigation. The Stanford University faculty and staff interface with the center staff, utilizing unique research facilities and experiencing leadership in long-term complex research, as well as in resolving problems facing the aeronautics industry. The institute uses several specially designed laboratories: a blow-down facility to study the mixing and acoustic characteristics of jets issuing from different nozzle configurations at both subsonic and supersonic speeds, and an instrument lab equipped with data acquisition and analysis equipment with modern mini-computers. A large anechoic chamber and several wind tunnels at NASA are actively used by the JIAA's faculty, staff, and students.

GENERAL INFORMATION

The department sponsors a very active student branch of the American Institute of Aeronautics and Astronautics which sponsors weekly films covering aerospace topics and monthly socials. It also conducts visits to nearby re-
search, government, and industrial facilities, and special events like Shuttle landings.

A brochure describing and illustrating the facilities and programs of the Department of Aeronautics and Astronautics is available on request to the academic secretary of the department.

ADMISSION

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 letter grade indicator (LGI) 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., A.A. 129, 295, 297, and 298). Insufficient grade points upon which to base the LGI may delay expected degree award or, if appropriate, result in refusal of permission from the Candidacy Committee to take the qualifying examinations. In any event, candidates with LGI's 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 instructor 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 format memo (approved by the course instructor and advisor) to the Candidacy Committee via the Academic Secretary indicating (1) the Stanford University course number and title, and (2) the institution, 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 this bulletin.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

An interdisciplinary program in Aeronautics and Astronautics leading to the Bachelor of Science degree in Engineering is available. For further information on this program, see the "School of Engineering" section of this bulletin and the Freshman Handbook available from the Office of the Dean of Engineering.

COTERMINAL PROGRAM

This special program allows Stanford undergraduate students an opportunity to get a Bachelor of Science in one field and simultaneously, in the fifth year, obtain a Master of Science degree in Aeronautical and Astronautical Engineering. Admission to the program is requested by special forms and procedures available through the department academic secretary, which are submitted through the Graduate Program Office. Admission is granted or denied through the departmental faculty Admissions and Awards Committee. As a graduate level department, Aeronautics and Astronautics has no other undergraduate component, although General Engineering students may obtain a Bachelor of Science in Engineering with an Aeronautics and Astronautics specialization through the School of Engineering.

GRADUATE PROGRAMS

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 (A.A.)

(45 Quarter Units)

All candidates for this degree 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.

1. A.A. 200A
2. A.A. 210A or A.A. 206A (Mech. Engr. 258A)
3. A.A. 240A and (A.A. 240B or A.A. 246, or A.A. 247 or A.A. 256)
   or
   A.A. 245A and (A.A. 245B or A.A. 246 or A.A. 247 or A.A. 249A)
5. A.A. 242
6. A.A. 271A or A.A. 279A
7. A.A. 280 or A.A. 283A
8. A.A. 131

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 6 units in applied mathematics taken from Mech. Engr. 200A or Math 113 (linear algebra), Mech. Engr. 200B or Math 131 and Math 132 (partial differential equations), Mech. Engr. 201 or Math 106 (complex variables), Comp. Sci. 135 (computer science), and Statistics 116E (probability); or (2) informally through matriculation in those basic (breadth) and technical electives (depth) courses which strongly emphasize methods of applied mathematics. Courses being used for informal fulfillment of the Category B requirements must be approved in advance by 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, 6 units of additional course work must appear in Category C, technical electives. Students may also elect the "science degree option", which consists of taking 9 mathematics units. In this case, 3 less units of technical electives are required.

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) 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; no more than 18 units used for the proposed program may have been completed previously. The proposed program must include at least 12 units of graduate level work in the Department of Aeronautics and Astronautics and meet rigorous standards of technical breadth and depth comparable to the regular Aero/Astro master of science program. 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 in this bulletin. The following are department requirements. The candidate's study program must fulfill the department's requirements for the master's degree or their substantial equivalent. Beyond the master's degree, a total of 45 units of work is required, including a minimum of 30 units of courses 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) computational fluid mechanics, (i) flight mechanics, (j) gas kinematics, (k) guidance and control, (l) physical gas dynamics, (m) propulsion, and (n) waves and vibrations.

2. 6 units of free electives.

Candidates for the degree of Engineer will be expected to have a minimum letter grade indicator of 3.0 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:

1. The student's having fulfilled the department's requirements for the master's degree or its substantial equivalent.
2. The student's maintaining a high scholastic record for graduate course work at Stanford.
3. The student's having completed 3 units of a directed research problem (A.A. 290).
4. 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 the dissertation draft in writing) but before final approval of his dissertation. The examination consists of a public seminar presentation of dissertation research, followed by substantive private questioning on the dissertation and related fields by the University Oral Committee (four 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 three weeks prior to the date approved for the oral by the student's advisor.

Ph.D. MINOR

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 $20,745 or more for the nine-month academic year to cover tuition and living expenses. Students who have demon-
strated 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 $850-$1030 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

100. Introduction to Aeronautics and Astronautics—The principles of fluid flow, flight and propulsion; 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, elementary physics, or consent of instructor. (DR:8)

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

104. Dynamic Response—(Enroll in Engineering 104.)

105. Control System Analysis and Design—(Enroll in Engineering 105.)

129. Life in Space — A sequence of lectures describing chemical evolution, the origin and evolution of life, the search for extraterrestrial intelligence: physiological changes in animals, plants and man in space; life support systems; biological experimentation in space; and life sciences aspects of future space settlements: given by investigators from the NASA-Ames Research Center.

3 units, Win (I. Chang, Billingham, Ballard, Clearwater, Cohen, Daunton, Foushee, Goldwater, Holton, MacElroy, Wydeven) 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, Win (Cantwell, Staff) Spr (Staff)

lec. first week Th 1:15-4:05;
lab T or Th 1:15-4:05

132. Introduction to Modern Optics — (Enroll in Engineering 170.)


3 units, Aut (Unal) MWF 10


3 units, Aut (Salmon) TTh 1:15-2:30


3 units, Aut (I. Chang) TTh 9:30-10:45

200A. Applied Aerodynamics — Atmospheric flight vehicles, the reasons for their configuration, and the nature of airflows associated with their operation. Vehicle equations of motion, their applications to performance and dynamic response, and the forms of aerodynamic data needed for their solution. Review of mathematical formulations for the fluid dynamic laws, leading to statements useful in theoretical aerodynamics. Discussion of the paneling and finite-difference approaches to airload prediction; Green's theorem and source-doublet superposition. Two-dimensional airfoils incompressible flow, analyzed by superposition methods and by conformal transformation. Estimation of pressure distributions and resultant airloads. Aerodynamics of subsonic finite wings by various methods. Slender wings and bodies. Introductory treatment of boundary layers, viscous drag, displacement effects, and separation. Prerequisites: 100 and 210A, or equivalents.

3 units, Win (Ashley) MWF 10

201A. Fundamentals of Acoustics—Acoustic equations for a stationary homogeneous fluid; wave equation; 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; Kirchhoff integral representation; scattering and diffraction of sound; propagation through ducts—dispersion, attenuation, group velocity; sound in enclosed regions—reverberation; absorption and dispersion; radiation from moving sources; propagation in the atmosphere and underwater. Prerequisites: First year graduate standing in engineering, mathematics, sciences, or consent of instructor.

3 units, Win (Staff) MWF 10 alternate years, not given 1989-90

204. Classical Aerodynamics — Selected topics emphasizing important results of classical wing theory. Early theories of Lanchester, Kutta and Joukowski. Adaptation of Joukowski theory to modern airfoils and the home computer. Munk's thin airfoil theory. Reverse flow and reciprocal theorems. Slender wing theory, swept wings, oblique wings. Material for outside reading (NASA RP 1050) and computer program available. Prerequisites: Knowledge of elementary aerodynamics and complex variables.

2 units, Win (Jones) F 3:15-4:15

205. Current Topics in Aerodynamic Design —Fundamental theory and simple computational methods are employed in a survey of recent aerodynamic design developments. Topics: airfoil developments (natural laminar flow, low Reynolds number airfoils, supercritical sections), wing design (optimization, winglets, swept forward and oblique wings), unconventional configurations (canard, 3-surface, tailless designs), propulsion (prop-fans, propellers, flapping flight), and applications of CFD in aircraft design. Hands-on experience with aerodynamic design problems using back-of-the-envelope analyses, micro-computer based programs, and super-computer results. Prerequisite: 200A, preferably 241A.

3 units, Spr (Kroo) MWF 3:15

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

207. Introduction to Turbulence — (Enroll in Mechanical Engineering 261A.)


3 units, Win (Ashley) MWF 8


3 units (L. Chang) alternate years, given 1989-90

210A. Fundamentals of Compressible Flow — Emphasis on the development of full three-dimensional nonsteady field equations and the associated constitutive relations representing the working fluid. Examples 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. Prerequisites: 192 (may be taken concurrently) and Mechanical Engineering 131A or equivalent.

3 units, Aut, Spr (Bershader) MWF 1:15

210B. Fundamentals of Compressible Flow—Continuation of 210A emphasizing on more general flow geometry. Use of exact solutions to explore the hypersonic limit. Identification of similarity parameters. Review of solution methods for the linearized potential equation with applications to wings and bodies in steady flow; relation to physical acoustics and wave motion in nonsteady flow. Nonlinear solutions for nonsteady constant area flow and introduction to the Riemann invariants. Elements of the theory of characteristics; nozzle design; extension to nonisentropic flow. Real gas effects in compressible flow. Flows in various gas dynamic testing facilities. Prerequisite: 210A.

3 units, Win (Bershader) MWF 1:15

211. Physical Gas Dynamics—(Enroll in Mechanical Engineering 262A.)
212. Introductory Hypersonic Aerophysics—Characterization of planetary atmospheres in the context of hypervelocity vehicle flight and energy exchange. Dynamic and thermal fluid flow features of the vehicle environment over a wide range of velocities and altitudes. Thermochernical equilibrium behavior is normally assumed. Additional material deals with finite rate processes, e.g., vibrational relaxation. Topics: The thermostatistical basis for the calculation of energies, specific heats, and shock strengths in dissociated and ionized gases. Combined effects of viscosity, heat conductivity and dissociation on thermal posture of the boundary layer, surface heat transfer and drag, with application to stagnation-point heat transfer. Block-body radiation and introduction to radiative vs. convective heating of hypervelocity vehicles. Recommended: Familiarity with the elementary concepts of compressible flow.

3 units, Win (Bershader) TTh 8-9:15

213. Atmospheric Entry—High-speed atmospheric entry subjects vehicles to intense heating, decelerations, and structural loads. Formulated and their intensity determined for a variety of flight paths. The trajectories range from nonlifting (ballistic) to constant lift and variable lift paths. Different heat shielding methods and their effectiveness are compared. Applications: the Space Shuttle, aerospace plane, Mars return missions, and atmospheric probe vehicles. Comprehension of fundamental physical principles is emphasized. Recommended: Understanding of compressible, equilibrium, real gas flows (210A and/or 212).

3 units, Spr (Tauber) TTh 8-9:15

214A. Numerical Methods in Fluid Mechanics—The basic principles underlying the Navier-Stokes equations. Relations between time-accurate and relaxation methods. Implicit and explicit methods combined with flux splitting and space factorization. Considerations of accuracy, stability of numerical methods, and programming complexity. Prerequisites: A knowledge of linear algebra and Mechanical Engineering 200A, 200B, or equivalent approved by instructor.

3 units, Aut (Lomax) MWF 8


3 units, Win (MacCormack) MWF 11


3 units, Spr (MacCormack) MWF 11


3 units, Win (Warning) TTh 9:30-10:45

216. Computational Fluid Dynamics Applications—Elements of computational fluid dynamics. Methods of solution for the nonlinear potential; Euler and Navier-Stokes equations emphasizing aerodynamic application. Topics: independent-variable transformation procedures, regeneration techniques, metric differencing algorithms, special differencing algorithms and iteration schemes. Selected theoretical concepts are numerically tested with student generated computer programs. Prerequisite: 214A or consent of instructor.

3 units, Spr (Holst) TTh 9-10:15

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

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


220. Optical Methods in Engineering Science—The design and understanding of modern optical systems. Topics: geometrical optics, aberration theory, systems layout, applications such as microscopes, telescopes, optical processors. Computer ray tracing program is used for class demonstrations and as a design tool. Prerequisite: Engineering 170, or Electrical Engineering 366, or equivalent.

3 units, Win (Hesselink) MW 2:15-3:30 alternate years, not given 1989-90

221. Hypervelocity Flight—Flowfields about advanced aeromaneuvering vehicles at mod-
erate to very high altitudes (around 100 km). The Navier-Stokes equations and the macroscopic gradient vector applied to real gas flowfields include the transport of mass, momentum, energy, chemical species, and surface charge for dissociating and ionizing gases. The effects of chemical concentration, thermal, pressure and forced diffusion; radiative transfer; and ablation. Consideration of chemical equilibrium, and chemical and thermodynamic nonequilibrium (for flight at high altitude). Recommended: 212 or equivalent material.

3 units, Aut (Howe) WF 4:15-5:30

222. Modern Developments in Reacting Flows—An advanced treatise on the principles of chemical kinetics at high temperatures and low densities and their effects on the flows around the hypersonic vehicles. Collision processes leading to rotational, vibrational, and electronic excitation; master equation; vibration-dissociation coupling; conservation equations; CFD techniques for reacting flows; effects of chemical reactions for aerodynamic forces and heat transfer rates; and comparison between the calculations and the experimental data from laboratory measurements and flights. Prerequisite: 212 or equivalent.

3 units, Win (Park) MW 2:15-3:30

225. Stochastic Processes in Aeronautics—Applications of probability theory to problems in aeronautics, emphasizing random behavior in fluid, thermodynamic, chemical, structural, and control systems of aerospace interest. The random-walk model introduces basic concepts and provides the common thread connecting the various topics. The time evolution of probability distributions, linking problems in chemical kinetics, rarefied gas flows, thermodynamic nonequilibrium, and finite difference methods in fluid mechanics. Statistical variables; power spectra, correlation functions, transform techniques, the response of a linear system to a random forcing function, and to the statistical theory of turbulence. Stochastic models on computer are part of homework assignments.

3 units, Win (Cantwell) MWF 9

alternate years, not given 1989-90

226. Modern Photodiagnostic in Gasdynamic Research—An introduction to laser-based optical measurement techniques and their applications to aerodynamic and combustion flows. Topics: the measurement requirements and methods in modern gasdynamic research; sources of uncertainty and noise in photometric measurements; laser velocimetry, linear and nonlinear laser spectroscopic methods includ-
VTOL aircraft as a dynamic body using linearization techniques. Laplace transform-root locus techniques deduce the vehicle's dynamic stability and open loop response characteristics. These are related to ease of control by a human operator with and without feedback compensation. Emphasis on basic understanding of principles involved. Prerequisite: 230 or equivalent.

3 units (Schmitz, Lebacqz)
alternate years, given 1989-90

232. Structural Dynamics and Aeroelasticity of Rotary Wing Aircraft—Handling the aeroelastic problems of rotating blades. The kinematics of finite rotation describe nonlinear deflections in the blade. The principle of virtual work obtains equations of motion including the contributions of simple aerodynamic models. Model and finite element solution techniques compared. Effects of aeroelastic couplings on the stability of rotating blades. Ground and air resonance problems of the helicopter. Emphasis on a basic understanding of the principles involved. Prerequisites: 230, 231. Recommended: 244A, and either 242 or Mechanical Engineering 231A.

3 units (Hodges)
alternate years, given 1989-90

233. Preliminary Design and Experimental Methods for Rotary Wing Aircraft—The preliminary design procedures for rotary wing aircraft using graphical and modern computational methods. The important scaling parameters of rotorcraft and procedures for flight testing, wind-tunnel testing, and ground based simulation. A model helicopter is designed, constructed, and flown. Some wind tunnel testing and ground based simulation of a model helicopter is performed. Prerequisite: 230, 231. Recommended: 244A, and either 242 or Mechanical Engineering 231A.

3 units (Hodges)
alternate years, given 1989-90

234. Dynamics, Control, and Flying Qualities of V/STOL Aircraft—The effects of airframe and propulsion system design on manual control of V/STOL aircraft. Topics: influence of mission requirements on pilot control strategy; examples of analytical models of the pilot for use in closed-loop control analysis and synthesis; decoupled longitudinal and lateral-directional control during hover and forward flight as an extension of conventional aircraft stability and control, emphasizing the unique features of V/STOL configurations; and coupled six-degree-of-freedom control situations pertinent to specific mission applications of the helicopter. Examples of the influence of coupled airframe-rotor system dynamics for these aircraft. Improvement of control characteristics of the basic aircraft through use of control augmentation systems and the influence of digital systems on the design of these control augmentation modes. Prerequisites: 230, 231. Recommended: 232.

3 units, Aut (Schmitz, Franklin) MWF 3:15 alternate years, not given 1989-90

235A,B. Space Systems Engineering—(Enroll in Engineering 235A,B.)

237. Compressible Aerodynamics and Noise of Rotary Wing Aircraft—Potential methods for the aerodynamic analysis of rotary-wing aircraft, generalized to develop the classical vortex analyses, and applied to the incompressible flow problem. Acceleration potential methods are extended to the linear compressible flow problem and to a nonlinear compressible aerodynamic formulation. These techniques are used to formulate the discrete frequency noise of rotary-wing aircraft and horizontal axis windmills. Linear and nonlinear formulations predict rotor impulsive noise. Other sources of rotor noise surveyed as to their relative importance commercially. Prerequisite: 230. Recommended: 231.

3 units, Win (Schmitz, Yu) MWF 3:15 alternate years, not given 1989-90

240A. Analysis of Structures — Elements of one- and two-dimensional elasticity theory. Boundary value problems; energy methods; analyses of solid and thin walled section beams, trusses, frames, rings, semimonocoque structures. Prerequisite: Civil Engineering 114 or equivalent.

3 units, Aut (Springer) MWF 9

240B. Analysis of Structures—Material behavior. Failure theorems; buckling; plastic behavior of solids; thermal effects. Dynamics of structures. Introduction of finite element analysis. Prerequisite: 240A or consent of instructor.

3 units, Win (F. Chang) MWF 9

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

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


3 units, Aut (Staff) MWF 2:15

243A. Spacecraft Attitude Dynamics I—(Enroll in Mechanical Engineering 232A.)
243B. Spacecraft Attitude Dynamics II—(Enroll in Mechanical Engineering 232B.)


3 units, Aut (Ashley) MWF 2:15

244B. Structural Dynamics and Aeroelasticity—Continuation of the 244A treatments of finite-element methods and vibration of continuous, two-dimensional structures. Introduction to aeroelasticity from a unified viewpoint applicable to flight vehicles, rotating machinery and other elastic systems, and 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 8 alternate years, not given 1989-90

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. Topics: optimization, coupling between aeroelastic phenomena and automatic controls systems, and problems of power machinery, windmills, etc. Prerequisite: 244B.

3 units, Spr (Ashley) MWF 9 alternate years, not given 1989-90

245A. Theory of Elasticity—(Enroll in Mechanical Engineering 238A.)
245B. Theory of Elasticity—(Enroll in Mechanical Engineering 238B.)
245C. Theory of Elasticity—(Enroll in Mechanical Engineering 238C.)

246. Theory of Plates—(Enroll in Mechanical Engineering 241A.)
247. Theory of Shells—(Enroll in Mechanical Engineering 241B.)
248. Theory of Shells—(Enroll in Mechanical Engineering 241C.)

249A. Introduction to Nonlinear Continuum Mechanics—(Enroll in Mechanical Engineering 242A.)
249B. Nonlinear Continuum Mechanics—(Enroll in Mechanical Engineering 242B.)


3 units (F. Chang) not given 1988-89

253A. Waves and Vibrations—(Enroll in Mechanical Engineering 236A.)
253B. Wave Propagation—(Enroll in Mechanical Engineering 236B.)


3 units, Spr (F. Chang) MWF 9

257. Design of Composite Structures—Analyses and design of composite beams and
columns. Analysis of composite plates; bending-shear coupling effect, interlaminar stresses, and structural stability. Application of finite element methods (FEM) to composite structures. Failure criteria and fracture mechanics of composite materials. Prediction of matrix and fiber failure, microbuckling, and edge stability-induced delamination. Delamination buckling. Design of composite structures with application to helicopter blades, aircraft wing, bolted and bonded joints; experimental methods of characterizing the materials. Prerequisites: 256 or consent of instructor.

3 units, Aut (F. Chang) TTh 1:15-2:30

261A. Introduction to Turbulence—(Enroll in Mechanical Engineering 261A.)

268. Digital Image Processing—Topics: physical descriptions of continuous images; properties of the human visual system; sampling and quantization of image; matrix representation of image forming and image processing systems; unitary transforms; image enhancement and restoration; scene matching and recognition, and applications. Demonstrations. Students are asked to write image processing algorithms. Prerequisites: Electrical Engineering 261 or equivalent, Mathematics 113S or 363. 3 units, Spr (Hesselink) MWF 9

270. Introduction to Linear System Theory—(Enroll in Electrical Engineering 363.)

271A. Dynamics and Control of Spacecraft and Aircraft—The dynamic behavior of spacecraft and aircraft, and the design of automatic control systems for them. For spacecraft in orbit: natural longitudinal and lateral dynamic behavior and the design of attitude control systems using combinations of gravity gradient, reaction thrusting and reaction wheels or control moment gyros. For aircraft: natural longitudinal and lateral dynamic behavior and the design of autopilots for flight path control, automatic landing, etc. Prerequisites: 200A or 208, 242, Engineering 105, or equivalents. 3 units, Spr (Cannon) MW 11-12:15

271B. Advanced Stability and Control of Flight Vehicles—Greater depth of control system synthesis methods for systems introduced in 271A. Linear-quadratic synthesis of aircraft autopilots and spacecraft attitude-control systems using computer programs. Nonzero set points, integral control. Random disturbance models and estimators. Prerequisites: 271A, 278A, 278B. 3 units (Bryson) alternate years, given 1989-90


273A. Digital Control I—(Enroll in Engineering 207.)

273B. Digital Control II—(Enroll in Engineering 208.)

275. Fluid Power Control—(Enroll in Mechanical Engineering 229.)

276. Control System Design and Simulation—(Enroll in Engineering 206.)

277. Nonlinear Control—(Enroll in Engineering 209.)

278A. Optimal Control of Dynamic Systems—Optimization problems for dynamic systems with terminal and path constraints (calculus of variations). Optimal feedback control (dynamic programming). Feedback control for linear systems with quadratic cost; regulator synthesis. Neighboring extremal paths and the second variation. Iterative methods for solving nonlinear control problems. Prerequisites: Engineering 105, Mathematics 130, and Mathematics 113 or Electrical Engineering 363. 3 units, Win (Bryson) TTh 2:45-4

278B. Optimal Estimation and Control Logic in the Presence of Noise—Probability theory and Gaussian Markov random processes. Estimation based on weighted least squares. Recursive filtering, smoothing, and interpolation for linear systems with additive Gaussian noise. Synthesis of optimal feedback controllers in the presence of uncertainty. Prerequisites: 278A and Statistics 116E (or equivalent). 3 units, Spr (Bryson) TTh 2:45-4

zero sum and many-player games. Prerequisite: 278A or equivalent.

3 units, Win (Breakwell) MWF 11
alternate years, not given 1989-90

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) MWF 11
alternate years, not given 1989-90

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 nonlinear oscillations and orbital analysis; nonlinear resonances. Prerequisite: 279A.

3 units, Spr (Breakwell) MWF 10
alternate years, given 1989-90

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; elements of electric propulsion; recent developments in space transportation systems. Prerequisite: Thermodynamics or elementary gas dynamics.

3 units, Win (Chang) TTh 2:15-3:30
alternate years, not given 1989-90

283A. Aircraft Propulsion I—Design and performance of airbreathing engines. Topics: an introduction to 1-D gas dynamics; physical parameters and cycle analysis of ramjets, turbojets, turbofans and turboprops; design of supersonic inlets and nozzles, compressor maps, component matching, fuel injection, ignition and combustion systems; equilibrium combustion calculations.

3 units, Aut (Cantwell) TTh 1:15-2:30
alternate years, not given 1989-90

283B. Aircraft Propulsion II—The off-design and dynamic behavior of airbreathing engines. Topics: compressor and turbine aerodynamics, boundary layer flows, models for cascade efficiency, transonic compressors, turbine cooling and turbine materials, multiple jet exhausts, nonequilibrium combustion, detonations and deflagrations, dynamic models and transfer function relations for ramjets and turbojets. Application to the design of a small aircraft gas turbine engine. Prerequisite: 283A or consent of instructor.

3 units (Cantwell)
alternate years, given 1989-90

286. Advanced Space Propulsion—Topics from recent developments in rocket propulsion, solid-fueled ramjet, ducted rocket, hybrid rockets, dual-fuel and mixed-mode rockets, composite engine and trans-atmospheric space propulsion systems, advanced space propulsion concepts, combustion, electric propulsion and applications to satellite control and station-keeping.

3 units, Spr (I. Chang, Altman) TTh 11-12:15

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.

1-5 units, any quarter (Staff)

291 A. Linear Transforms and Their Applications to Engineering Problems I—Introduction to Laplace and Fourier transforms. Applications to boundary and initial value problems in acoustics, fluid mechanics. Waves in elastic medium, random vibration, heat and mass transfer. Inverse transformation, contour integration. Method of steepest descent, stationary phase and other asymptotic analysis. Fast Fourier transforms. Prerequisite: Math 106 or its equivalent (may be taken concurrently).

3 units, Aut (Chang) TTh 2:15-3:30
alternate years, not given 1989-90

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 (Chang) TTh 2:15-3:30
alternate years, not given 1989-90

297. Seminar in Mechanics and Control of Flight—Problems in all branches of vehicle control, guidance, and instrumentation presented by researchers on and off campus. Graduate students with an interest in automatic control applications in flight mechanics, guidance, navigation, and mechanical design of control systems normally attend. Others 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.)

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

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

CHEMICAL ENGINEERING*

Emeriti: (Professors) Andreas Acrivos, David M. Mason
Chairman: George M. Homsy
Professors: Michel Boudart, Curtis W. Frank, George M. Homsy, Robert J. Madix, Channing R. Robertson, John Ross (by courtesy)
Associate Professor: Gerald G. Fuller
Assistant Professor: Alice P. Cast
Senior Lecturer: Robert H. Schwaar
Lecturer: James C. Schlatter
Consulting Professors: C. Richard Brundle, Ralph Dalla Betta, Georges Hadziioannou, Ralph Landau, Helmut Poppa, John F. Rabolt

UNDERGRADUATE PROGRAM

BACHELOR OF SCIENCE

The B.S. Chemical Engineering program consists of the basic 45-unit engineering depth requirement (described in the "School of Engineering" section in this bulletin) which provides a broad background in the fundamentals of chemistry as well as basic training in separation processes, engineering thermodynamics, transport phenomena, process analysis and control, plant design, and applied chemical kinetics. In addition, this program include courses in physics, mathematics, chemistry, and basic engineering. With the exception of these basic courses and the engineering depth sequence, there is no set program which all undergraduate students follow.

A sample B.S. program is available from 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.

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

GRADUATE PROGRAMS

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 after 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, Computer Science, Electrical Engineering, Materials Science and Engineering, Mechanical Engineering, Operations Research, Applied Physics, Biological Sciences, Chemistry, Mathematics, Physics, Statistics, and the School of Earth Sciences, and (b) all upper-division undergraduate courses in Biological Sciences, Computer Science (108 and above), Mathematics, Physics, and Statistics. (2) Undergraduate courses in chemical engineering excluding 110, 120, 130, 180A,B may be included as part of the 45-unit master’s program. Departures must be approved 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 270-278, or for the colloquium, 300. Note, however, that the student must register for 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; 290, however, may not be substituted for any of the required four lecture courses in the Chemical Engineering 200-lecture series. A written report describing the results of this research must be submitted to and approved by the research advisor.

To ensure 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 program proposal for the master's degree 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 average letter grade indicator of 3.0 for students enrolled in this 45-unit master's program in chemical engineering.

ENGINEER

The degree of Engineer is awarded after completion of 6 quarters of study plus the requirements listed below. This degree is not required to enter the Ph.D. program.

Unit and Course Requirements—A total of 45 units of course work (excluding chemical engineering courses numbered 270-300) is required, including 220, 221, 222, 230, 231, 232. 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 average letter grade indicator of 3.0 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—After completing all the requirements for the Engineer's degree, a student may request to be allowed to choose research topics as the basis for deciding whether or not these students will be allowed to choose research advisors and begin their thesis research in the first quarter of the second year. Students passing the examination described above will take a qualifying examination consisting of an oral defense of their research work before the faculty early in the Autumn Quarter of their second year.

DOCTOR OF PHILOSOPHY

The Ph.D. degree is awarded after 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 220, 221, 222, 230, 231, 232. 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 6 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 6 units of chemical engineering research. This research need not be the same as the student's ultimate Ph.D. research. These research units may be applied toward the 36-unit requirement for the M.S. but may not be applied toward 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 indicator of a 3.00 average must be maintained.

Teaching Requirement—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 in the Department of Chemical Engineering.

Qualifying Examination—To be advanced to candidacy for the Ph.D. degree, the student must pass a preliminary qualifying examination. First-year students 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 in the Spring Quarter of their first year. Failure of this examination will lead to termination of the student's study with an M.S. degree and precludes financial aid beyond that already promised. Students passing the examination described above will take a qualifying examination consisting of an oral defense of their research work before the faculty early in the Autumn Quarter of their second year.

Dissertation 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 four calendar years after enrolling in the department the student will have fulfilled all the require-
ments for the Ph. D. including submission of a completed dissertation, 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 dissertation research, is in the form of a public seminar followed by private questioning by an examining faculty committee. After 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, applied statistical mechanics, equilibrium and transport properties of colloidal dispersions, polymer adsorption, rheo-optics of polymeric liquids and colloidal suspensions, hydrodynamic stability, polymer science, surface and interface science, kinetics and catalysis, and bioengineering. A brochure describing research projects currently being pursued in these areas is available from the department upon request.

FELLOWSHIPS AND ASSISTANTSHIPS
A number of fellowships and assistantships are awarded each year to incoming students. Application forms may be obtained upon request to the department. The completed application should be received no later than January 1 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—(Enroll in Engineering 20.)
3 units, Spr (Madix, Robertson)
110. Equilibrium Thermodynamics—Thermodynamic properties; equations of state; properties of nonideal systems including mixtures; phase equilibria and chemical equilibria. Prerequisite: Chemistry 171.
3 units, Win (Schlatter) MWF 8
120. Separation 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, field flow fractionation. Prerequisite: 110 or equivalent.
3 units, Spr (Gast) MWF 10
130. Principles of Design of Chemical Reactions and Reactors—Chemical kinetics, elementary steps, mechanisms, rate-limiting steps and the quasi-steady state approximations. Ideal isothermal and nonisothermal reactors; design principles. Multiplicity, ignition, and extinction in stirred tank reactors; limitations of thermodynamic equilibrium. Departures from ideality; residence time distributions, dispersion in fixed beds, mass transfer limitations. Prerequisites: 110, 140, 150, Chemistry 171, 173.
3 units, Win (Boudart) MWF 10
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; free-surface phenomena; porous media flows. Prerequisites: Junior standing in chemical engineering or consent of instructor; Mechanical Engineering 33 or Engineering 21; Mathematics 130 or equivalent.
3 units, Aut (Robertson) MWF 9
150. Energy and Mass Transport—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.
3 units, Win (Homsy) MWF 9
3 units, Win (Homsy) MWF 9
160. Chemical Engineering Plant Design—Application of chemical engineering principles to design of practical plants for manufacture of chemicals and related materials. Topics: equipment design for distillation, chemical reactions, heat transfer, pumping, and compression; estimation of capital expenditures and production costs; plant construction. Open to seniors in chemical engineering or by advance consent of instructor.
3 units, Spr (Schaar) TTh 3:15-5:05
180. Chemical Engineering Laboratory — Investigation of a number of experimental aspects of chemical engineering science emphasizing development of communications skills. Experiments illustrating subjects covered in the lecture courses 110, 120, 130, 140, 150, 155 have been developed. Six experiments must be performed.

4 units, Win, Spr (Frank, Gast) 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. Research in one of the graduate research groups or other special projects in the undergraduate chemical engineering laboratory. Students should consult their advisors for information on available projects.

(Staff) by arrangement

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.


3 units, Aut (Homsy) TTh 9:30-10:45


3 units, Win (Fuller) TTh 9:30-10:45

222. Transport Phenomena II—Continuation of 221 emphasizing boundary layer phenomena, heat and mass transport, transport with chemical reaction, and reaction-diffusion systems. High Reynolds number flows; boundary layers, vorticity layers. Transport for low and high Peclet numbers in unbounded flows; transport in tubes, Leveque approximations; applications in membrane transport; transport in flows with closed streamlines, drops, bubbles, and interphase transport. Prerequisite: 221.

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

223. Microrheology — Flow phenomena of polymeric and colloidal liquids; fundamental concepts of rheology; measurement techniques in rheometry; molecular models of dilute and concentrated polymer solution dynamics (both flexible and rigid macromolecules); prediction of rheo-optical properties from molecular models; dynamics of colloidal suspensions.

3 units (Fuller) alternate years, given 1989-90


3 units, Spr (Fuller) Th 10:45-12 alternate years, not given 1989-90

230. Molecular Thermodynamics—Review of classical thermodynamics. Introduction to statistical thermodynamics; microcanonical, canonical, and grand canonical ensemble; partition function. Application to phase equilibria of polymer solutions; liquid lattice theory; phase diagrams; phase stability. Intermolecular forces and introduction to distribution functions; and perturbation theory.

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


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

232. Bioengineering—Structure and function of biological macromolecules; enzyme kinetics; reaction and diffusion in immobilized enzyme
systems; microbial behavior—growth and production formation; batch and continuous cultures; techniques of genetic engineering; metabolic regulation; structured models of microbial metabolism; immobilized cell systems; animal and plant cell culture; separation processes in biochemical engineering; special topics.

3 units, Spr (Robertson) TTh 1:15-2:30

233. **Polymer Physics**—Emphasis on statistical analysis of the molecular structure of high polymers. Topics: spatial configuration of the isolated polymer chain, morphology in amorphous and semicrystalline polymers, and spectroscopic and scattering methods for studying polymers.

3 units (Frank) alternate years, given 1989-90

234. **Polymer Chemistry**—The principal methods of polymer synthesis, emphasizing polymerization mechanisms and reaction kinetics, and their role in influencing polymer composition, structure, and ultimate properties. Topics: condensation; radical- and ion- initiated-chain polymerizations; heterogeneous and stereo-regulated polymerizations; copolymerization; microstructure of polymer chains governed by the synthesis, bulk, solution, emulsion, and suspension polymerizations.

3 units, Spr (Frank) MWF 2:15-3:30 alternate years, not given 1989-90

271-278. **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.

Aut, Win, Spr (Staff) by arrangement

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

273A,B,C. Bioengineering.
(Robertson)

274A,B,C. Microrheology.
(Fuller)

275A,B,C. Surface and Interface Science.
(Madix)

276A,B,C. Polymer Physics.
(Frank)

(Homsy)

(Gast)

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. Credit is not given until the student has satisfied the specific report or dissertation requirement.

(Staff) by arrangement

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

300. **Colloquium**—Students attend the colloquia of the Department of Chemical Engineering. Must be taken every quarter by candidates for advanced degrees in Chemical Engineering.

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

**CIVIL ENGINEERING**


Chairman: Haresh C. Shah

Associate Chairman: Paul V. Roberts


Associate Professors: David Freyberg, Anne S. Kiremidjian, Peter K. Kitanidis, Clyde B. Tatum

Assistant Professors: Ronaldo I. Borja, Andre Filiatrault, Dunja Grbic-Galić, H. Craig Howard, Jeffrey R. Koseff, Kincho H. Law, Stephen G. Monismith, Peter M. Pinsky

Professor (Research): C. Allin Cornell

Associate Professor (Research): Martin Reinhard

Professor (Teaching): Gilbert M. Masters

Courtesy Professors: Thomas J. Hughes, George S. Springer

Lecturer: John F. Cory III

Acting Associate Professor: Weimin Dong

Acting Assistant Professor: M. Fouad Bendimerad


Consulting Associate Professors: Robert E. Clark, Angelo N. Findikakis, Martin W. McCann, Piotr D. Moncarz, David Morell, Shishir K. Mukherjee, Poulicos P. Prastacos, Michael W. Walton, Felix S. Wong

Consulting Assistant Professors: Auguste C. Boissonnade, Tim E. J. Campbell, Viorica
OFFERINGS AND FACILITIES

The undergraduate curriculum 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 mathematics, science, and engineering fundamentals, permit students to obtain either a broad general civil engineering education or a more specialized education in a specific branch, such as construction, environmental engineering, water resources, structures, or a great variety of other branches. Laboratory facilities are available to students in construction, fluid mechanics, environmental engineering and science, structural and earthquake engineering, and experimental stress analysis.

At least one year of graduate study is strongly recommended for the professional practice of civil engineering. Students who contemplate advanced study at Stanford should discuss their plans with their advisors in their junior or senior years. The coterminus B.S.-M.S. program should be considered by students desiring an integrated five-year program.

The Civil Engineering Department, in collaboration with other departments of the University, offers graduate degree programs in:

- Computer-Aided Civil Engineering
- Artificial Intelligence/Expert Systems
- Computational Mechanics
- Manufacturing/Construction Automation
- Construction Engineering and Management
- Environmental and Water Studies
- Structural and Geotechnical Engineering
- Geotechnical Engineering
- Reliability and Risk Analysis
- Structural Engineering
- Structural Mechanics

Research work and instruction under these programs is carried out in the following facilities: the building energy laboratory, the concrete laboratory, the environmental fluid mechanics laboratory, the Stanford Construction Research Laboratory (SCRL), the structural engineering laboratory, and the water quality control research and teaching laboratories. Research in earthquake engineering is conducted in the John A. Blume Earthquake Engineering Center. Office space is provided for most of the graduate students who are research or teaching assistants.

In addition to these departmental centers and laboratories, a new center has been formed in collaboration with the Department of Computer Science. The major thrust of the Center for Integrated Facilities Engineering (CIFE) is to employ advanced CAD database, artificial intelligence, and communications concepts to integrate the presently fragmented participants in the facility development process and to facilitate construction automation. CIFE was launched in the Autumn Quarter of 1987 and is stimulating significant new research and educational activities in the two departments.

PROGRAMS OF STUDY

COMPUTER-AIDED CIVIL ENGINEERING

Computer-Aided Civil Engineering (CACE) is an umbrella for three specialized programs: Artificial Intelligence/Expert Systems, Computational Mechanics, and Manufacturing/Construction Automation. These interdisciplinary fields are becoming increasingly important to research and practice in civil engineering as computers penetrate every aspect of the field. The three degree programs blend courses in traditional civil engineering disciplines, computer-aided civil engineering, computer science, robotics, manufacturing, and engineering mechanics. These educational programs are closely tied with our research efforts in the Center for Integrated Facility Engineering. All CACE students take a common core of courses including C.E. 210, 212A, 212B, and 214.

The degree program in Artificial Intelligence/Expert Systems combines coursework in artificial intelligence and computer-aided engineering with an emphasis in one of the five traditional civil engineering educational programs at Stanford: Structures, Construction, Resources Planning, Water Studies, and Environmental Studies. The program is aimed at students who want to apply the exciting new technologies of artificial intelligence to solve civil engineering problems.

The degree program in Manufacturing/Construction Automation is oriented toward the student who sees the construction profession as the manufacturing arm of civil engineering and who wants to learn about the computer technologies that provide the potential for rapid change in the construction industry. The program emphasizes techniques in robotics, computer-aided engineering, and artificial intelli-
gence in conjunction with a solid grounding in construction engineering and management.

The degree program in Computational Mechanics is aimed at students who wish to pursue the applications of modern computing methods to structural and geotechnical analysis and design. The program topics encompass: the mechanics of solids and structures, numerical methods in structural analysis, computer graphics, artificial intelligence, and applications to design. The program, which brings together the disciplines of mechanics, mathematics, and computer science, is designed to reflect the rapid evolution of the field of computational mechanics.

The program leads to the degrees of Master of Science, Engineer, and Ph.D. Incoming students are expected to have advanced training or experience in engineering computer applications.

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 as well as 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 a program for their needs.

Subjects offered within the program include: estimating; 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 program leads to the degrees of Master of Science, Engineer, and Ph.D. Students with undergraduate degrees in chemical, electrical, mechanical, mining, or petroleum engineering who do not wish to satisfy the undergraduate prerequisite courses for the Master of Science in Civil Engineering-Construction Engineering and Management degree, have the option of meeting the same graduate course requirements as the above and obtaining the Master of Science in Engineering-Construction Engineering and Management degree. Opportunities are available to support a limited number of graduate students each year through the sponsored research activities of the Stanford Construction Research Laboratory.

The Construction Program faculty and students are active participants in the new Center for Integrated Facilities Engineering (CIFE), launched in 1987. Several current post-M.S. students are working on problems involving design-construction interface issues and are obtaining second M.S. degrees in Computer Science or Artificial Intelligence.

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.

ENVIRONMENTAL AND WATER STUDIES

This program covers a broad spectrum of specialties, including environmental engineering and science, water resources, and water resources and environmental planning. Course offerings are scheduled to permit either intensive study in a single area or interrelated study between areas. Seminars provide a broad coverage of water problems.

Students with backgrounds in all areas of engineering and science who are interested in applying their specialized abilities to the solution of water problems are welcome. Comprehensive introductory courses in each major area of study are given to provide a common basis of understanding among those with dissimilar backgrounds. The major areas of specialization in the graduate program are environmental engineering and science, and water resources.

Within the Environmental Engineering and Science program the major focus is on water, but much broader aspects of environmental concern and planning activities are covered as well. Thus, the chemical, biological, and engineering aspects of water supply and water pollution control, and the fate and effects of pollutants in surface and ground waters can be covered in depth through the environmental engineering and science courses. Additional study is available in air pollution, noise pollution, and environmental planning and impact assessment.

The Water Resources program focuses on developing an understanding of the physical processes controlling the movement of mass,
energy, and momentum in the water environment. Environmental fluid mechanics courses address fluid transport and mixing processes, turbulence and its modeling, the fluid mechanics of stratified flows, natural flows in coastal waters, estuaries, lakes and open channels, and experimental methods. Hydrology courses consider stochastic methods in both surface and subsurface hydrology, watershed hydrology and modeling, and flow and transport in porous media. Courses from many other programs and departments both complement and supplement the Water Resources program offerings. Some examples include: Environmental Engineering and Science (chemical and microbiological processes), Mechanical Engineering (applied math, fluid mechanics, heat transfer, experimental methods), Applied Earth Sciences (hydrogeology, geostatistics), Computer Science (numerical methods), Petroleum Engineering (reservoir engineering, well-test analysis), Statistics (probability and statistics).

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 and environmental fluid mechanics are well-equipped and instrumented for advanced research and instruction.

**RESOURCES PLANNING**

This program prepares 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, include water resources and water quality projects, energy facilities, land use controls, urban forms, and hazardous waste disposal facilities. The planning and management of these facilities and systems requires the integration of a variety of technical, social, economic, institutional, and environmental considerations, all of which are incorporated into the curriculum of the Resources Planning Program.

The program includes graduate curricula in three speciality areas: water resources planning, energy and environmental planning, and land use planning. Within these frameworks each student is encouraged, with the assistance of his or her faculty advisor, to design a course sequence meeting his or her interest. Students who did not major in Civil Engineering as undergraduates are eligible for admission, provided they have completed at least one year of calculus.

Faculty members in the Resources Planning 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 programs.

**STRUCTURAL AND GEOTECHNICAL ENGINEERING**

Structural and geotechnical engineering encompasses programs in earthquake engineering and structural dynamics, risk and reliability analysis, structural analysis and design, computational mechanics, and geotechnical engineering. The programs are designed to provide a broad knowledge in these fields and to prepare students for industrial or academic careers. Academic programs can be designed to meet the needs of students wishing to launch careers as structural analysts, designers, and consultants on large and small scale projects. Students have the opportunity to balance strong engineering fundamentals with modern computational methods.

Coursework in earthquake engineering and structural dynamics provides an understanding of the earthquake phenomenon, the resulting ground shaking, and in-depth knowledge on the behavior, analysis, and design of various types of structures under seismic or other dynamic forces. Advanced analytical and experimental research in earthquake engineering is conducted at the John A. Blume Earthquake Engineering Center which houses static and dynamic testing equipment, including a shaking table. The VAX 8350 computer facility and the microcomputer clusters at the center are available for instruction and research work by students and faculty.

The reliability and risk analysis program focuses on instruction and research in advanced methods for structural safety evaluation and design, and methods for loss estimation from damage and failures of structures. Coursework in this program combines strong background in structural analysis and design with probability theory and statistics. An integral part of the research in this program is seismic risk and reliability of large structural systems.

The structural analysis and design program focuses on conceptual and detailed design of structural systems and on computational methods for predicting the static and dynamic response of structures. Included in this program are courses that emphasize earthquake resistant design and computer-aided design. Related coursework is available from other departments such as mechanical engineering, materials science and engineering, and computer science. The computational mechanics program, which exists in conjunction with the computer-
aided civil engineering program, emphasizes the application of modern computing methods to structural and geotechnical engineering. The program, which draws on the disciplines of mechanics, mathematics, and computer science, encompasses numerical structural and geotechnical analysis, including finite element analysis.

The geotechnical program focuses on instruction and research in theoretical soil mechanics, computational methods, and analysis and design of foundations and earth structures. In addition to the courses offered under this program, courses are available in earth sciences, water resources, and construction engineering.

Structural and geotechnical engineering faculty and students also work at the Center for Integrated Facility Engineering utilizing modern CAD and CAE facilities.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

Students who major in Civil Engineering must complete the requirements for the B.S. degree listed under the School of Engineering, "Undergraduate Programs." Suggested courses to be taken in satisfaction of the requirements in mathematics, science, and engineering fundamentals are available from the Civil Engineering office. 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 should obtain their professional education at the graduate level.

HONORS PROGRAM

This program leads to a Bachelor of Science with Honors in Civil Engineering. The program is designed to encourage highly qualified students to undertake a more intensive study of civil engineering than is required for the normal major, with course and research work of high distinction.

The Honors program involves an in-depth research study in an area proposed to and agreed to by a Civil Engineering Department faculty advisor, and completion of a thesis of high quality. A written proposal for the research to be undertaken must be submitted and approved in the fourth quarter prior to graduation. At the time of application the student must have a letter grade indicator of at least 3.5 for coursework at Stanford, and this grade record must be maintained to graduation. The thesis will be supervised by a Civil Engineering Department faculty advisor, and must involve input from the School of Engineering Writing Program via Engineering 102S or equivalent. Students are encouraged to present their results in a seminar for faculty and other students. Up to 10 units of C.E. 199, Directed Reading and Special Studies in Civil Engineering, may be taken to support the research and writing (not to duplicate Engineering 102S). These units are beyond the normal civil engineering program requirements.

GRADUATE PROGRAMS

Admission—Apply to the Office of Graduate Admissions. Applications normally require submission of the application form, statement of purpose, three letters of recommendation, results of the Graduate Record Examination, and transcripts of courses taken at all colleges and universities attended. Policies for each of the department's programs are available from the Graduate Admissions Office or the Department of Civil Engineering. Successful applicants will be advised as to the degree and program for which they are admitted. If students wish to shift from one program to another after being accepted, an application for transfer must be filed with the department, and they will be advised if the transfer is possible. If, after enrollment at Stanford, students wish to continue toward a degree beyond the one for which they were originally admitted, a written application must be made to the Department of Civil Engineering.

MASTER OF SCIENCE

The University requirements governing degrees of Master of Science, Engineer, and Doctor of Philosophy are described in the "Degrees" section of this bulletin.

Programs are available leading to the degree of M.S. in Civil Engineering with the following special field designation on the diploma: Artificial Intelligence and Expert Systems, Computational Mechanics, Computer-Aided Civil Engineering, Construction Engineering and Management, Earthquake Engineering, Energy and Environmental Planning, Environmental Engineering and Science, Geotechnical Engineering, Land Use Planning, Manufacturing/Construction Automation, Reliability and Risk Analysis, Resources Planning, Structural Engineering, Structural Mechanics, Water Resource, and Water Resources Planning. 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 admitted to graduate study with a Bachelor's Degree in Civil Engineering (or its
equivalent) from an accredited curriculum can satisfy the requirements for the degree of Master of Science in Civil Engineering by completing a minimum of three quarters of full-tuition registration and a minimum of 45 units of study beyond the Bachelor's Degree. At least 36 of these units must be taken at Stanford. A minimum 2.75 letter grade indicator (LGI) is required for candidates to be recommended for the M.S. Degree. No thesis is required.

The program of study must be approved by the faculty of the department and should include at least 45 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.

Candidates for the M.S. Degree in Civil Engineering who do not have a Bachelor's Degree in Civil Engineering may, in addition to the above, be required to complete those undergraduate courses that are deemed important to their graduate programs. In such cases, more than three quarters of residence is usually required to obtain the degree.

ENGINEER

A student with a Master's Degree in Civil Engineering may satisfy the requirements of the Degree of Engineer in Civil Engineering by completing, in residence, 45 or more units of work (3 quarters minimum) including an acceptable thesis (12 to 15 units) and maintaining an "B" LGI average (3.0) or higher. The program of study must be approved by the member(s) of the faculty of the department.

This degree is recommended for those desiring additional graduate education, especially those planning a career in professional practice. The thesis normally should be started in the first quarter of graduate study after the M.S. degree. Programs are offered in the fields of specialization mentioned for the M.S. degree.

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 complete the equivalent of one 50 percent time teaching assistantship for one quarter. 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.

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 faculty has agreed to direct the dissertation research. Insofar as possible, the program of study is adapted to the interests and needs of the student within the framework of the requirements of the department and the University. In the second year of graduate study the student is expected to pass the Departmental General Qualifying Examination to be admitted to candidacy.

FINANCIAL ASSISTANCE

The department maintains a large and continuing program of financial aid for graduate students. Fellowship or scholarship awards for the academic year range from $2,000 to $20,000. A generous student loan program is available. Applications for financial aid and assistantships should be filed by January 1; 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-half time work as teaching aides during the academic year. Research assistantships also are available. Engineer and Ph.D. candidates may be able to use research results as a basis for the thesis or dissertation. 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, availability of research funds, and requisite staffing of current projects. Detailed information may be obtained by writing to the Department of Civil Engineering.
COURSES
UNDERGRADUATE

  3 units, Spr (Staff) MWF 10

125. Computers in Civil Engineering—The changing role of microcomputers and large computers in civil engineering practice. Applications of computers in several fields of civil engineering. Comparative analysis of alternative equation solving procedures and how they are applied in a civil engineering context. Software programs studied: spreadsheets, equation solvers, linear programming routines and computer-aided drafting packages. Enrollment limited, priority given to seniors in civil engineering. Prerequisite: Computer Science 106A or equivalent.
  4 units, Spr (Staff) MWF 12:45-2

130. Introduction to Urban Planning—The nature of urbanization and evolution of urban forms; conceptual modeling of urban growth and decay; the rationale for planning; steps in the planning process and basic studies of plan formulation; estimating requirements for commercial, industrial, and residential land uses; zoning, growth control, and other techniques of plan implementation; and the application of the planning process to typical problems of community growth and development.
  3 units, Win (Staff) alternate years, not given 1989-90

  3 units, Spr (Staff)

140. Surveying—Care and use of instruments; leveling; topographic surveying; triangulation; horizontal and vertical curves; engineering astronomy. Enrollment limited to 27, with priority given to seniors in civil engineering.
  4 units, Spr (Cory) TTh 11 lab TTh 1:15-5:30

144. Construction Engineering and Management—Techniques for coordinating decisions and actions of the participants involved in the design and construction of civil engineering projects. Legal, contractual, and behavioral determinants of company and project organization; 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. This is appropriate for GSB or other non-CE majors who wish to become "informed buyers" of construction services.
  3 or 4 units, Win (Levitt) MW 11-12:15

145. Construction Equipment and Methods—Construction engineering fundamentals; equipment economics; selection and efficient application of equipment; analysis of production output and costs. Prerequisites: Engineering 10 and 60.
  3 units, Spr (Paulson) MWF 9; one or more field trips by arrangement

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

  4 units, Aut (Freyberg) MWF 9 plus one hour by arrangement

161. Fluid Mechanics II—Dimensional analysis and principles of similarity, including application to hydraulic modeling. The fundamentals of open channel flow. Introduction to potential flows with application to natural and hydraulic flows, including groundwater flows. Lectures and laboratory experiments. Prerequisite: Engineering 21.
  4 units, Win (Monismith) TTh 8:30-9:50 F 2:15, plus one hour by arrangement

  3 units, Aut (Koseff) MWF 1:15

170. Environmental Science and Technology—(Same as VTSS 182.) An introduction to the causes, effects, and methods of controlling en-
Environmental degradation. Stress on problems associated with water resource development and water pollution; air pollution; population; and environmental effects of energy consumption. For both science and nonscience majors. (DR:8)

3 units, Aut (Masters) MWF 8

171. Environmental Planning—(Same as VTSS 183; graduate students register for 226.) Alternative strategies for air and water quality management; environmental impact assessment requirements; interactions between land use, physical infrastructure and environmental quality; forecasting and evaluating environmental effects; survey of techniques for assessing visual, biological, noise air quality and water quality impacts. Open to all students. Recommended: 170 and one year of college mathematics.

4 units, Win (Ortolano) TTh 1:15-2:30 alternate years, not given 1989-90

174. Noise Pollution—(Enroll in Aeronautics and Astronautics 138.)

176. Small Scale Energy Systems—(Graduate students register for 236.) Theoretical and practical considerations involved in the design of small scale energy systems emphasizing renewable energy systems and energy conservation. Passive solar heating, building energy requirements, photovoltaics, and active solar water heating. Open to all students. (DR:8)

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

177. Building Energy Laboratory—Measurement of building heat losses, infiltration, indoor air pollution, use of thermal mass. Efficiency measurements of renewable energy sources. Use of the microcomputer as a lab instrument. Enrollment is limited. Prerequisites: 176 and computer experience.

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

180. Elementary Structural Analysis — Analysis of beams, trusses, frames; influence line 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 and computer methods of structural analysis. Prerequisites: Engineering 11 and a year of calculus.

4 units, Aut (Law) MWF 10 W 2:15-4:05

181. Design of Steel Structures—Concepts of elastic design of structures; types of loading; structural systems; 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. Prerequisites: Engineering 11 and Civil Engineering 180, or equivalent.

3 units, Win (Law) TTh 10 W 2:15-4:05

182. Design of Reinforced Concrete Structures—Properties of concrete and reinforcing steel; behavior of structural elements subject to bending moments, shear forces, torsion, axial loads, and combined actions; design of beams, slabs, columns and footings; strength design and serviceability requirements; design of simple structural systems for buildings. Prerequisites: Engineering 11 and Civil Engineering 180, or equivalent.

3 units, Spr (Staff) TTh 10 M 2:15-4:05

190. Geotechnical Engineering — An introduction to basic principles of soil mechanics. Soil classification; site exploration; shear strength and stress-strain behavior of soils; consolidation theory; analysis and design of earth retaining structures, introduction to shallow and deep foundation design; slope stability. Includes laboratory projects. Prerequisite: Engineering 11.

4 units, Aut (Staff) MWF 11 laboratory by arrangement

197A,B,C. Professional Development Seminar—Weekly presentations by practicing engineers on topics relevant to students planning to enter the civil engineering profession. 197B puts students in the role of project managers, designing and building a concrete canoe for national competition. Normally taken by juniors and seniors.

197A. 1 unit, Aut (Staff) by arrangement

197B. 1 unit, Win (Staff) by arrangement

197C. 1 unit, Spr (Staff) by arrangement

199. Directed Reading or Special Studies in Civil Engineering—Practice in execution of an engineering investigation; preparation of a written report on the investigation. Student must obtain a faculty sponsor.

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

PRIMARILY FOR GRADUATE STUDENTS

203. Statistical Models in Civil Engineering—Applications of probability and statistical analysis to civil engineering; model construction from probability theory; descriptive statistics; estimation with small samples; recognition of variation including professional elements; models for reliability studies of civil engineering designs; construction of complex models. Prerequisites: Graduate standing, Mathematics 43.

4 units, Aut (Kiremidjian) TTh 1:15-3:05
212B implements and tests student designs on provides hands-on experience with a variety of ware; the operating systems for the hardware; ware and software tools in civil engineering stochastic processes; application of Poisson and discussion of previous development efforts.

concepts from Artificial Intelligence and Expert gence to civil engineering problems: relevant Introduction to applications of Artificial Intel ligence.

214. Expert Systems in Civil Engineering— Overview of advanced computer tools for civil engineering applications. Topics: software engineering, data structures, user interfaces, database management systems, and computer graphics. 212A provides hands-on experience with a variety of software tools and work in groups to plan and design medium-size computer applications. 212B implem ents and tests student designs on engineering workstations. Prerequisite: 210 or equivalent.

4 units, Spr (Kiremidjian) TTh 10-11:50

205. Stochastic Processes and Decision Statistics for Civil Engineers — Description of stochastic processes; application of Poisson and Markov processes to civil engineering problems; representatives of structural loads and response; introduction to statistical decision theory, Bayes theorem; prior and pre-posterior analysis; posterior analysis, utility functions; applications to civil engineering problems. Prerequisite: 203 or equivalent.

4 units (Kiremidjian) not given 1988-89

210. Introduction to Computer-Aided Civil Engineering—Introduction to computer hardware and software tools in civil engineering practice and research. Survey of: computer-aided engineering (CAE) and computer hardware; the operating systems for the hardware; the software available on those systems (e.g., text editors, word processors, spreadsheets, interpreters, compilers, communications packages, etc.) Weekly, one-hour lecture on general hardware/software/CAE principles and 2-hour interactive lab presenting hardware/software basics with hands-on practice. Restricted to entering Civil Engineering graduate students. Pre/co-requisite: Computer Science 106A, or equivalent course in structured programming.

1-3 units, Aut (Howard) Th 3:15-4:05, plus two-hour lab by arrangement

212A, B. Advanced Topics in Computer-Aided Civil Engineering—The use and development of advanced computer tools for civil engineering applications. Topics: software engineering, data structures, user interfaces, database management systems, and computer graphics. 212A provides hands-on experience with a variety of software tools and work in groups to plan and design medium-size computer applications. 212B implements and tests student designs on engineering workstations. Prerequisite: 210 or equivalent.

4 units, Win (Howard) Th 1:15-2:30

212B. 3 units, Spr (Howard) by arrangement

214. Expert Systems in Civil Engineering— Introduction to applications of Artificial Intelligence to civil engineering problems: relevant concepts from Artificial Intelligence and Expert Systems; illustrations of these concepts through discussion of previous development efforts. Projects involve development of microcomputer-based expert systems that capture knowledge in civil engineering. Instructor guidance and critique of the applications at all stages of development. Class size limited by permission of the instructor. Prerequisite: 210 or equivalent.

4 units, Spr (Levitt) MW 9:30-10:50 plus one hour by arrangement

215A, B, C. Seminar in Computer-Aided Civil Engineering—Seminars on ongoing research in the department and elsewhere on advanced computer applications in civil engineering. Each CACE student presents one or more seminars in the series. Strongly recommended for CACE students; others admitted by permission of instructor.

1 unit, Aut, Win, Spr (Howard, Levitt) M 4:15

225. Microcomputers in Urban and Environmental Planning—Current applications of microcomputer technology in the design professions and other business and agencies concerned with the built environment and urban services. Software programs include decision analysis, spreadsheets, Land Management Systems (LMS), and statistical mapping as they pertain to architecture, construction, urban design, environmental planning and urban planning. Organizational changes which occur in response to technological innovations and future directions in the field. Prerequisite: Computer Science 105A or consent of instructor.

4 units, Win (Staff) MWF 10 alternate years, not given 1989-90

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 (Ortolano) by arrangement

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

4 units, Win (Ortolano) TTh 1:15-2:30 alternate years, not given 1989-90

231. 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 (Staff) by arrangement
234. Land Use Planning and Control—
(Undergraduates enroll in Urban Studies 182.)
Theory and practice of contemporary and newly emerging methods for the planning and control of development, and the protection of the environment. Current practices, their origin and evolution, and the relation between land use planning and environmental protection. Emphasis on the regulatory and permitting process with examples of actual projects in urban and suburban/rural settings. Guest speakers from public, private, and conservation organizations bring different perspectives to in-class discussions. Students carry out case studies or investigations commensurate with standing.
3 units, Aut (Rossi) TTh by arrangement

236. Small Scale Energy Systems—Same as 176 with additional assignments for students who desire graduate credit.
3 units, Win (Masters) TTh 11-12:15

239. Facility Siting—The underlying reasons for inherent conflicts in facilities needed by society but which are locally unwanted: landfills, hazardous waste sites, energy facilities. Siting techniques: constraint mapping, optimization procedures, and decision analysis. Study of appropriate public and private roles, new planning strategies including environmental dispute resolution, and the relationship between regional and site-specific concerns.
3 units, Aut (Morell) M 3:15-6:05

240. Analysis and Design of Construction Operations — Understanding, analyzing, designing, and improving work at the site. Data acquisition, analysis, simulation, modeling, and design. Emphasis on work methods development, productivity, and safety. Corequisite: 241 or equivalent experience.
4 units, Aut (Paulson) TTh 9-11

241. Techniques of Project Planning and Control—Analytical techniques for planning and controlling the design and construction of projects. Concepts of networking techniques including treatment of uncertainty, subnetworks, resource allocation and leveling, time/cost tradeoffs and specification requirements. Also, basic techniques for scope determination, cost engineering, materials management, and quality control.
4 units, Win (Fondahl, Tatum, Levitt) TTh 8-9:50

242. Cases and Special Topics in Managing Construction—Integration and application of techniques for managing individual construction projects and construction companies. Case studies for application of techniques covered in the prerequisite courses. Techniques for strategic planning in construction companies. Requires individual and group efforts on problems and case studies. Prerequisites: 240, 241, or instructor's permission.
3 units, Spr (Tatum) TTh 9-10:50

243. Computer Applications in Construction —Analysis, design, development, and implementation of computer-based systems for construction engineering and management. Supporting topics cover computer hardware and software technology. This seminar-laboratory requires individual and group projects, building upon construction knowledge and experience. Enrollment limited to 20; priority given to students in graduate construction program. Prerequisites: 210, 240, and a computer course equivalent to Engineering 70A.
5 units, Win (Paulson, Katz) MWF 10-12

3 units, (Fondahl) not given 1988-89

247. Construction Finance—An in-depth look at the problems of a chief financial officer for a medium size construction company. Banking relationships, lines of credit, letters of credit, loans, dealing with bankrupt or insolvent suppliers and subcontractors, and examination of investment policies and procedures.
3 units, Win (Medearis) MWF 8

248. Construction Financing in Real Estate and Land Development Problems—The interrelationships between all of the variables that make up a successful real estate project. Emphasis is on the financial aspects involved in land acquisition, land development, construction, permanent lending, and project management. Also, aspects of joint venturing, including the control of functions and equity financing. Enrollment limited to 20; priority given to students in the graduate construction program. Prerequisites: Engineering 60, Industrial Engineering 133 or equivalent.
3 units, Spr (Medearis) TTh 8 plus one hour by arrangement

249. Labor and Industrial Relations in Construction—The history, laws, institutions, and social and economic forces affecting labor and industrial relations in construction; covers union and open-shop sectors.
2 units, Spr (Clark, Walton) W 3:15-5:05
250. Organization and Management of Human Resources in Construction—A theoretical framework and group problem solving exercises to understand the behavior of people in the workplace: individually, in small groups, and in organizational units. A systematic approach for the analysis of a project or company’s coordination requirements, and for the design of a system of market, hierarchial, and social coordination devices to facilitate the work of interdependent teams of specialists in project-oriented activities. Students work in small groups to develop solutions to case study problems assigned weekly.

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


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

255. Concrete Construction—Technical and management aspects of the methods and operations involved in concrete construction. Concrete production, formwork, field operations and special techniques. Requires student group preparation of a plan for a concrete construction project.

3 units, Aut (Tatum) MW 9 F 9-10:50

257. Building Systems and Industrial Construction—The basic design concepts, major components and standard materials, and construction operations for major building systems. Fundamental construction methods for mechanical and electrical construction on building and industrial construction projects. The mechanical systems for buildings include: heating, ventilating, and air conditioning; domestic water; drainage; and fire protection. Electrical and instrumentation systems for buildings focus on power distribution, environmental control, lighting, security, and data transmission. For industrial construction, an introduction to welding and rigging, and the differences between industrial and building projects regarding design requirements and construction methods for process piping, valves and instrumentation, large rotating equipment, and major heat exchange equipment.

3 units, Win (Tatum) MWF 9

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.

258A. 1 unit, Aut (Staff) M,T,W, or Th 7:30-10 p.m.
258B. 1 unit, Win (Staff) M,T,W, or Th 7:30-10 p.m.
258C. 1 unit, Spr (Staff) M,T,W, or Th 7:30-10 p.m.

259A,B,C. Construction Problems—Analysis of group selected problems in construction techniques, equipment, or management, followed by preparation of oral and/or written reports. Students consult specialists from the construction industry and use of University facilities. Prerequisites: Graduate standing in construction and consent of instructor. See 299 for alternative for individual studies.

259A. 1-3 units, Aut (Staff) by arrangement
259B. 1-3 units, Win (Staff) by arrangement
259C. 1-3 units, Spr (Staff) by arrangement


4 units, Win (Kitanidis) MTWF 1:15
264. Hydrodynamics—The flow of incompressible, viscous fluids, emphasis on developing an understanding of fluid dynamics that can be applied to environmental flows. Topics: kinematics of fluid flow; equations of mass and momentum conservation (including density variations); some exact solutions to the Navier-Stokes equations; approximate analysis of fluid flows including Stokes flows, potential flows, and laminar boundary layers; and, an introduction to the effects of rotation and stratification through scaling analysis of fluid flows. Prerequisites: Engineering 21 or equivalent; and some knowledge of vector calculus.

3 units, Aut (Kitanidis) MWF 10

265. Water Resources Economics and Institutions—Elements of economics commonly used in water resources planning and management. Applications of consumer demand theory, production economics, and public welfare economics. A survey of the institutional context of water resources planning in the U.S., emphasizing the role of the Corps of Engineers, the Bureau of Reclamation, and the Environmental Protection Agency.

4 units, Aut (Ortolano) TTh 1:15-2:30

266. Water Resources Systems Analysis—Application of mathematical optimization techniques (e.g., linear programming) to the analysis and design of water systems, both the quantity and quality of water. Topics: reservoir and conduit sizing, time phasing of capacity expansions, and reservoir operations. Water quality issues in the context of waste water treatment plant design and alternative schemes for the attainment of water quality standards. An introduction to multi-objective programming and the combined use of simulation and optimization. Use of LOTS to solve selected problems. Prerequisites: Experience with spreadsheets and communications software.

4 units, Win (Ortolano) TW 3:45-5


3 units, Spr (Kitanidis) MWF 10

268. Seminar: Topics in Optimization Under Uncertainty—Optimization when some parameters or inputs are modeled as random variables or stochastic processes. Emphasis on sequential decision processes and dynamic programming. Small-perturbation and numerical methods of solution. Applications from water resources: reservoir operation, optimal sampling from and control of a contaminant plume, determining pumping schedules and patterns. Prerequisite: Permission of instructor.

3 units, Aut (Kitanidis) MWF 11 alternate years, not given 1989-90

269. 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 1 unit, without letter grade; a letter grade is given for students presenting talks.

1 unit, Aut, Win, Spr (Staff)

270. Movement, Fate, and Effects of Contaminants in Surface Waters and Groundwater—Transport of chemical constituents in surface and groundwater, including advection, dispersion, sorption, interphase mass transfer, and transformation; water quality requirements for various beneficial uses. Emphasis on the behavior of hazardous waste contaminants. Prerequisites: Undergraduate chemistry, calculus, and basic fluid mechanics.

3 units, Aut (Roberts) MWF 8

271A. Water Quality Control I—Physical and chemical unit operations for water and wastewater treatment emphasizing 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, disinfection, and adsorption. Prerequisites: 270 and Engineering 21 or equivalents; or consent of instructor. Recommended: 273.

3 units, Win (Roberts) MWF 9

271B. Water Quality Control II—Biological processes for transformation of environmental contaminants. Unit processes for biological treatment including dispersed growth and fixed-film systems. Aerobic and anaerobic process microbial ecology and kinetics, with applications to the treatment of municipal and industrial wastewaters, hazardous chemicals and groundwater. Prerequisites: 270 and 274.

3 units, Win (McCarty) MWF 8

271C. Water Quality Control III—Analysis of advanced or specialized wastewater treatment processes, such as adsorption and air stripping. Emphasis on physical and chemical processes in
treatment of hazardous wastes, especially contaminated groundwater. Definitions of problems and objectives, evaluation of alternatives for example cases and use of these concepts in preliminary process design. Design-oriented class project and field trips. Prerequisites: 270 and 271A.

3 units, Spr (Roberts) MWF 9
field trips to be arranged
alternate years, not given 1989-90

272. Environmental Health Risk Assessment—(Enroll in Engineering-Economic Systems 288, Industrial Engineering 244.) Principles of quantitative health risk assessment applicable to routine and catastrophic pollution problems. Integration of dispersion, exposure and dose-response models. Use of decision analysis and probabilistic methods. Illustration by case studies. Prerequisites: Industrial Engineering 240 or Engineering-Economic Systems 231 or Chemical Engineering 205 or equivalent; or Statistics 116 and Engineering 60 and permission of instructor.

2 units, given 1989-90

273. Aquatic Chemistry—Chemical principles and application of those principles to the analysis and solution of problems in aqueous geochemistry (temperatures near 25°C and atmospheric pressure). Emphasis 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: precipitation/dissolution, hydrolysis, complex formation and oxidation—reduction. Prerequisites: Chemistry 31 and 33, or equivalent.

3 units, Aut (Leckie) TTh 11 F 1:15

273A. Water Chemistry Laboratory—Laboratory application of techniques for the analysis of natural waters and wastewaters; emphasizing instrumental techniques.

2 units, Win (Leckie) T 1:15-5:05

274. Environmental Microbiology — Fundamental aspects of microbiology and biochemistry; microbial physiology, metabolism and growth, genetics, taxonomy and ecology as related to water and soil environments. The role of major groups of microorganisms as pollutants, as purifying agents, and as agents of biogeochemical change. Connections with environmental pollution and water quality processes.

2-3 units, Aut (Grbić-Galić) TTh 10 M 2:15

274A. Environmental Microbiology Laboratory—Experimental approach to understanding fundamentals of microbiology; topics include morphology, physiology, metabolism, ecology, growth, microbial interactions, and water quality parameters.

2 units, Aut (Grbić-Galić) W 2:15-5:05
plus 3 hours by arrangement

275A. Water Quality Control Processes I—Laboratory and pilot plant studies of physical and chemical processes for the treatment of water and wastewaters. Prerequisites: 271A, 273, and 273A.

3 units, Spr (Leckie) by arrangement, alternate years, not given 1989-90

275B. Water Quality Control Processes II—Laboratory and pilot plant studies of aerobic and anaerobic biological processes for the treatment of water and waste waters. Prerequisites: 271B and 273A (or equivalent) and 274.

3 units (McCarty) alternate years, given 1989-90


3 units (Grbić-Galić) alternate years, given 1989-90


1 unit, Spr (Leckie) W 4:15


4 units, Aut (Pinsky) TTh 9:30-10:45
computer problem session F 2:15-3:15

4 units, Win (Krawinkler) MWF 11 computer problems session F 3:15-4:15

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, Aut (Kiremidjian) MWF 10

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: 282A or consent of instructor.

3 units, Spr (Shah) MWF 8

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; design of two-way slab systems; yield line analysis of slabs. Prerequisites: Basic courses in design of steel and reinforced concrete structures.

4 units, Aut (Krawinkler) TTh 11 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; analysis and design of tier buildings for gravity loads and lateral loads; earthquake resistant design; effects of dynamic loading on strength and ductility of structural elements. Prerequisites: Basic courses in design of steel and reinforced concrete structures.

4 units, Win (Krawinkler) TTh 10 W 2:15-4:05

287. Structural Performance and Failures—Basic concepts in definition of satisfactory structural performance; key elements in structural performance; types of failures, ranging from reduced serviceability to total collapse; failure sources and their root cause allocation; failure prevention mechanisms; illustration with real life examples.

2 units, Spr (Moncarz) M 3:15-5:05

288. Computer-Aided Design in Structural Engineering—Computer graphics; design representations; expert systems and artificial intelligence in structural engineering. 3 units, Spr (Law) TTh 8:30-9:50


2 units (Staff) not given 1988-89

291. Foundation Engineering—Types, characteristics, analysis, and design of foundations and earth retaining systems. Analysis and design of shallow and deep foundations including shallow footings, mat and raft foundations, piles and piers; foundation bearing capacity and displacement considerations; lateral earth pressures; design of retaining structures; excavation bracing; seismic considerations. Prerequisite: 190 or equivalent.

3 units, Win (Staff) MWF 9

292. Earth Structures — Static and dynamic slope stability; principles of earth and rockfill dam design including failure modes, foundation preparation, construction considerations, seismic safety, etc.; finite element analyses of earth masses and soil-structure interaction. Prerequisite: 190 or equivalents.

3 units, Spr (Staff) MWF 1:15

296A. Structural Dynamics I—Vibrations and dynamic response of simple structures to periodic and arbitrary loadings; support motion; response spectra; two-degree-of-freedom systems. Prerequisites: 190 and Engineering 12.

3 units, Win (Staff) MWF 10

296B. Structural Dynamics II—Introduction to the methods of structural dynamics for framed structures and continuous systems discretized by the finite element method; mode-superposition method; numerical solution of
eigenvalue problems; direct integration methods including the Newmark family of algorithms; reduction and dynamic substructuring methods; introduction to nonlinear analysis; analytical solutions and wave propagation for simple elements. Programming procedures for the implementation of the mode-superposition and direct integration methods in computer programs for structural analysis. Prerequisite: 296A.

3 units, Spr (Staff) MWF 11

298. Structural Engineering Seminar — Lectures on topics of current interest. Recommended for all graduate students.
1 unit, Win (Staff) W 4:15

299. Independent Study in Civil Engineering — Directed study for graduate students on subjects of mutual interest to students and faculty. Student must obtain faculty sponsor.
1-3 units, any quarter, by arrangement

300. Thesis — Investigation of an engineering problem; required of candidates for degree of Engineer.
Aut, Win, Spr (Staff) by arrangement

310. Post-Master’s Seminar — For post-master’s students to serve as orientation to the selection of a research topic.
1 unit, Aut, Win, Spr (Staff) by arrangement

4 units, Spr (Freyberg) MWF 8:30-9:50

3 units (Kitanidis) alternate years, given 1989-90

3 units, Spr (Monismith) TTh 11-12:15 alternate years, not given 1989-90

364. Natural Flows — Stratified and homogenous flows in the environment. Mixing in lakes and reservoirs, estuary dynamics including salinity intrusion mechanisms, upwelling in the coastal ocean. Unsteady flow in open channels and rivers. Prerequisites: 263, 363, Mechanical Engineering 200B.
3 units (Monismith) alternate years, given 1989-90

2 units (Roberts) alternate years, given 1989-90

373. Hydrogeochemical Cycles — The processes and mechanisms responsible for the natural circulation of major, minor, and trace elements through the hydrosphere, atmosphere, lithosphere, and biosphere. Emphasis on a mechanistic interpretation of global cycling of elements and man’s influence on accelerating or intercepting the normal processes. Chemical weathering processes, biotransformations of elements, residence times in various environmental compartments, and fluxes between environmental compartments. Prerequisites: 273 and 274.
2 units (Leckie) alternate years, given 1989-90

374. Microbial Degradation of Organic Pollutants — Analysis of mechanisms, biochemistry and enzymology, and of microbial degradation of various synthetic organic compounds as influenced by environmental factors, chemical structure, and concentration of substrates. Evolutionary and genetic explanations for existing metabolic pathways; the role of degradative plasmids and genetic manipulation in decomposition of pollutants. The phenomena of biodegradability and recalcitrance, detoxification and production of more toxic compounds, activation and biomagnification; the use of microorganisms in detecting mutagenic and carcinogenic compounds, and comparisons of metabolic pathways of hazardous organics in microorganisms and man. Estimations of biodegradation potential of xenobiotic compounds and predictions about their decomposition.
3 units, Spr (Grbić-Galić) TTh 9 F 1:15 alternate years, not given 1989-90

2 units, Win (McCarty) TTh 9

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. Prerequisite: Post-M.S. standing.

2 units (Shah) not given 1988-89

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 obtain faculty sponsor. A written report is usually required.

1-5 units, any quarter (Staff) by arrangement


Aut, Win, Spr (Staff) by arrangement

COMPUTER SCIENCE

Emeriti: (Professors) George B. Dantzig, John G. Herriot, (Professor, Research) Arthur Samuel

Chairman: Nils J. Nilsson

Associate Chairman: George S. Wheaton

Assistant Chairman for Education: to be announced

Assistant Chair for External Relations: Carolyn E. Tajnai


Associate Professors: David Cheriton, Michael Genesereth, Jean-Claude Latombe, Terry Winograd

Assistant Professors: David Dill, Andrew Goldberg, Anoop Gupta, John Mitchell, Ernst Mayr (on leave 1988-89), Paul Rosenbloom (on leave 1988-89), Yoav Shoham

Professors (Research): Thomas Binford, Bruce G. Buchanan

Associate Professor (Research): Gio Wiederhold

Associate Professor (Teaching): Charles A. Bigelow

Courtesy Professors: Michael J. Flynn (Electrical Engineering), David E. Rumelhart (Psychology)

Courtesy Associate Professors: John T. Gill, III (Electrical Engineering), Edward H. Shortliffe (Medicine), Fouad A. Tobagi (Electrical Engineering)

Courtesy Assistant Professors: Giovanni De Micheli (Electrical Engineering), Mark A. Horowitz (Electrical Engineering), Mark A. Linton (Electrical Engineering), Brian K. Reid (Electrical Engineering), David M. Ungar (Electrical Engineering), Daniel Weise (Electrical Engineering)

Affiliated Professor (Research): David Luckham (Electrical Engineering)

Senior Lecturers: Stuart Reges, Jean Rogers

Lecturers: Stephen Fisher, Roy Jones


Consulting Associate Professors: Richard P. Gabriel, Joseph Y. Halpern, Keith A. Lantz, Robert C. Moore, Moshe Vardi

Consulting Assistant Professor: Fernando C. N. Pereira

Visiting Assistant Professor: Arthur M. Keller

Industrial Lectureships: Whitfield Diffie, Witold Litwin, Frances Yao

FACILITIES

Five large computer systems are available to all students in the University. Most courses, including courses given by the Computer Science Department, use the systems available at the Low Overhead Timesharing System (LOTS) computer facility.

There are several large systems available to students of Computer Science. Each of these systems is a host on the nation-wide ARPAnet computer research network; each is also a host on SUNET, the University-wide ethernet system.

Score is a DECsystem-2065 running the TOPS-20 operating system. It includes 3.5 million words of main memory and 2.2 billion bytes of disk storage. Score is predominantly used for departmental research.

SAIL is a DECsystem-1080 running the WAITS operating system. SAIL supports 64 local display consoles with full graphics capability, plus other local and remote terminals. It has 2.3 million words of main memory and 1.6 billion bytes of disk storage.
SUMEX is a large DECsystem 2060 that supports research on knowledge-based systems and applications of artificial intelligences to biomedicine. Students doing research in appropriate areas may be granted access to SUMEX.

Gang-of-four is an Alliant FX/8 multiprocessor system running a parallel version of Berkeley Unix. It is used for research in parallel computation.

Polya is a VAX 8700 running ULTRIX 2.2. It is used for departmental research. Polya is also available to all C.S. graduate students for unsponsored work. There are 11 other VAX computers running UNIX associated with specific research projects.

The Computer Science (C.S.) Department also operates approximately 70 SUN workstations, 20 Symbolics workstations, 20 TI Explorers, and 20 laser printers of various types, linked together by the ethernet. In addition to these, there are a number of DEC Microvax I and VaxStation II systems.

At present, Ph.D. students are generally offered accounts on SAIL or Polya; unsupported Master's students are offered Polya accounts with access to other systems as needed.

A lecture series (C.S. 300) is offered during Autumn Quarter and presented for new students, at which time members of the department speak informally on their research interests and their views on the nature of computer science.

UNDERGRADUATE PROGRAMS

The department offers a degree in Computer Science (C.S.), as outlined in the School of Engineering section that appears earlier. In addition, there are several inter-disciplinary degrees with a substantial computer science component that might be of interest to undergraduates. The Computer Systems Engineering major (also in Engineering) allows students to study issues of both computer hardware and computer software, bridging the gap between traditional C.S. and Electrical Engineering majors. The Symbolic Systems major (in the School of Humanities and Sciences) offers students a chance to explore computer science and its relation to philosophy, linguistics, and psychology. Finally, the Mathematical and Computational Sciences major (also Humanities and Sciences) allows students to explore computer science along with more mathematics, statistics, and operations research.

GRADUATE PROGRAMS

MASTER OF SCIENCE

The University's basic requirements for the Master of Science degree are discussed in the "Degrees" section in this bulletin. The department offers two programs, the M.S. in Computer Science (M.S.C.S.) and the M.S. in Computer Science: Artificial Intelligence (M.S.A.I.). The M.S.A.I. program differs from the standard M.S.C.S. program (in particular from Specialization 5—Symbolic and Heuristic Computation) in that it is a program emphasizing practical system-building experience. Applicants need to indicate which program they wish to pursue; it is not possible to apply to both at the same time. The M.S.A.I. program will not be accepting applications for 1989-90 academic year.

MASTER OF SCIENCE IN COMPUTER SCIENCE

The degree "Master of Science in Computer Science" (M.S.C.S.) is intended as a terminal professional degree and does not lead to the Ph.D. degree. Students planning to obtain the Ph.D. degree should apply directly for admission to the Ph.D. program.

Applications for admission to the Master of Science program must be received by January 1. Exceptions are made for applicants to the M.S.C.S. program who are either Honors Co-op applicants or who are already students at Stanford. Information on deadlines is available from the department.

REQUIREMENTS

A candidate is required to complete a program of 45 units. At least 36 of these must be graded units, passed with an average 3.0 ("B") letter grade indicator or better. The 45 units may include no more than 21 units of courses from those listed in Requirements 1 and 2. Thus, students needing to take more than seven of the courses listed in Requirements 1 and 2 will actually complete more than 45 units of course work in this program. Only extremely well-prepared students should expect to finish the program in one year; most students complete the program in six quarters. It is expected that an adequately prepared student admitted to the M.S.C.S. program will have taken a number of the core courses as an undergraduate. Students hoping to complete the program with 45 units should already have a good background in computer science, including course work or experience equivalent to all of Requirement 1 and some of the courses listed in Requirement 2.

1. The following courses may need to be scheduled as they are prerequisites for other courses in the program: C.S. 22 (for specialization 5 only), 107, 109A, 109B, 110, 112, 140, 160, Math 109 or 120.
2. The following core courses or their equivalents must be completed: C.S. 137 or 237A, 134, 137, 161, 212, 221, 240A, Stat. 115 or 116. Courses will be waived only if evidence is provided that a similar course has been taken elsewhere. Courses that are waived rather than taken may not be counted toward the M.S.C.S. degree. Core courses may be taken on a P/NC basis provided that a minimum of 36 graded units is presented within the 45-unit program.

3. At least 1, but no more than 3 units of 500-level seminars must be taken.

A program of 21 units in an area of specialization must be completed. All courses in this area must be taken for letter grades. Six approved programs are listed below. Students may propose to the M.S. program committee other coherent programs that meet their goals and satisfy the basic requirements. Students desiring to include a substantial research project as part of their degree program can arrange with their advisor to replace units in their specialization with a C.S. 393 (Computer Laboratory) project.

1. Numerical Analysis/Scientific Computation
   a) The following courses: C.S. 237A, 237B, 237C.

2. Systems
   b) At least three of the following courses: C.S. 211, 243, 244, 245, 312, Elect. Engr. 271.

3. Software Theory
   a) The following courses: C.S. 242, 243, 260, 262.
   b) At least one course from the following: C.S. 244, 245, 342, 343, 345, 441, 442.
   c) At least one course from the following: C.S. 254, 263, 360, 364, 367A, 367B.
   d) At least one additional course from (b) or (c).

4. Theoretical Computer Science
   a) The following courses: C.S. 257, 260, 262.

5. Symbolic and Heuristic Computation
   a) The following courses: C.S. 257, 322, 323.
   b) At least 12 units from the following courses: C.S. 225A, 225B, 227, 254, 275, 276, 306, 324, 325, 326, 327A, 327B, 327C, 329; including no more than one of C.S. 328A, 328B, 328C.

6. Database (23 units)
   a) The following courses: C.S. 245, 345, 395.
   b) At least two of the following courses: C.S. 225A, 244, 262, 347.

MASTER OF SCIENCE IN COMPUTER SCIENCE:
ARTIFICIAL INTELLIGENCE (M.S.A.I.)
(The M.S.A.I. program will not be accepting applications for the 1989-90 academic year.)

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 Thomas Binford, William Clancey, Edward Feigenbaum, Michael Genesereth, and Paul Rosenbloom.

The M.S.A.I. program will begin in Autumn Quarter each year. Normally, a student will spend two years in the program. 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 application.

A student should indicate preference for this degree at the time of application for admission. (Coterminal applications from Stanford undergraduates are discouraged, because of the two-year research training required.) Admission to the M.S.A.I. program will be limited by available computing resources, research supervision, and financial support.

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 the M.S.A.I. program may negatively affect a sub-
sequent Ph.D. application. Students planning to obtain the Ph.D. degree are strongly advised to apply directly for admission to the Ph.D. program.

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. Familiarity with LISP is strongly advised.

REQUIREMENTS

Programs of at least 54 quarter units that meet the following guidelines will normally be approved:

1. Core AI. At least 9 units:
   a) C.S. 223 or 224.
   b) C.S. 225A or 271B.
   c) At least one of C.S. 225B, 275, 276, 326, 327A,B, 520 or 524.

2. Classical hardware and software (6 units):
   a) C.S. 161.
   b) C.S. 242.
   Students with prior equivalent courses may choose from the following: C.S. 211, 212, 240A, 243, 245, 312.


4. Practicum (27 units):
   C.S. 393. A substantial AI system is implemented and documented in the second year. This is an application that makes significant use of AI concepts and methods in a working program, demonstrating the student’s understanding of the field.

5. Additional units must be in courses relevant to the project. Acceptable courses will be determined by the project supervisor, depending upon the application area of the project. Examples of courses taken by the Computer Science Department include physical science, social science, or mathematics.

Courses taken to satisfy guidelines (1) through (5) will normally be taken for a letter grade. As in the M.S. program in the Computer Science Department, a 3.00 letter grade indicator must be maintained in these courses. Students in this program must also demonstrate satisfactory quarterly progress on an AI research project.

M.S.A.I. 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 M.S.A.I. 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.

DOCTOR OF PHILOSOPHY

The University’s basic requirements for the doctorate (residence, dissertation, examination, etc.), are discussed in the “Degrees” section in this bulletin. To be considered for this program, an application should reach the Office of Graduate Admissions by January 1. 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 Ph.D. Program Committee.

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. Once a student passes the examination, he or she will 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 Ph.D. program administrator has further details.

3. As part of the training for the Ph.D., each student is required to complete one of the following options of teaching service. These exact requirements are subject to revision for class entering 1988-89:
   a) Two units (a unit is 10 hours per week for one quarter) as a teaching assistant for courses numbered 300 or above.
   b) Four units as a teaching assistant for courses numbered between 108 and 299.
   c) Two units as a teaching assistant for a course numbered below 300, and 2 units as a teaching fellow for the same course.
   d) One unit as a teaching assistant for a course numbered 300 or above, and 2 units as a teaching assistant for courses numbered between 108 and 299.

For students with a special interest in teaching, there is an additional specialization: “with Distinction in Teaching.” This certifies significant experience in teaching upon conferral of the degree. For the designation “with Distinction in Teaching” a student must do the equivalent of 10 units of TA/TF (a unit is 10 hours per week for one quarter), with the following restrictions:
   a) The units must include at least one quarter as a TF with primary responsibility for organizing and teaching a course (tutored video does not qualify).
b) The units must include at least one course at each of the 100, 200 and 300-plus levels. 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.) An oral and written dissertation proposal will be required.

5. Each student must pass a University oral examination in the form of a defense of his or her dissertation. It will usually be held after all or a substantial portion of the dissertation research has been completed.

6. The student is expected to demonstrate the ability to present scholarly material orally, both in the dissertation defense and by a lecture in a departmental seminar.

7. The dissertation must be accepted by a reading committee, composed of the principal dissertation advisor, a second member from within the department, and a third member chosen from within the University. The principal advisor and at least one of the other committee members must be Academic Council members.

Ph.D. MINOR

For a minor in Computer Science, a candidate must complete 15 units of computer science coursework, numbered 200 or above, including at least three of the master's core courses, to provide breadth and one course numbered 300 to provide depth. One of the courses taken must include a significant programming project to demonstrate programming proficiency. A letter grade indicator of 3.0 or better must be maintained.

TEACHING AND RESEARCH ASSISTANTSHIPS

Graduate student assistantships are available. Assistants receive a tuition scholarship for up to 9 units of study per quarter during the academic year, and in addition receive stipends of at least $8,730 for the nine-month year. Some may work full time in the summer for approximately $1,940 per month.

Duties in the academic year involve 20 hours of work per week. Teaching assistants (TAs) help an instructor teach a course by conducting discussion sections, consulting with students, grading examinations, etc. Research assistants (RAs) 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. If there is an insufficient number of Ph.D. students to staff teaching and research assistantships, then such positions are open to a limited number of master's students in the department. However, master's program students (except for those in the M.S.A.I. program) should not plan on being appointed to an assistantship.

Students with fellowships may have the opportunity to supplement their stipends by serving as graduate student assistants.

COURSES

GUIDE TO SELECTING INTRODUCTORY COURSES

Students arriving at Stanford have widely differing backgrounds and widely differing goals, but most of them will find that the ability to use computers effectively will be beneficial to their education. The Computer Science Department offers a large collection of introductory courses to help meet the needs of many different students. This guide provides the information to help you select the course or courses that best meet your needs.

Students who expect to major in Computer Science, or to learn a substantial amount of introductory computer science in preparation for computer-intensive majors in engineering, should take C.S. 106X, 107, 109A,B, and 110. 106X is a fast-paced course for students who have had a certain amount of prior exposure to computer programming and have a degree of mathematical maturity. It covers the principles of software engineering—the construction and evaluation of computer programs—and spends a relatively small amount of time teaching elementary programming skills. C.S. 107 broadens the depth established in 106X by introducing several programming languages that exemplify different programming paradigms. The 109A/109B sequence constitutes a broad introduction to the field of computer science, and is appropriate both for students who expect to become computer professionals, students who need a deep understanding of computer science fundamentals, and students who plan academic or research careers in computer science. C.S. 106C provides a one-quarter alternative for students who want a more concise and practical presentation of the major topics from the 109 sequence. C.S. 110 completes the set of computer science fundamental courses by exposing students to machine-level issues, giving them a practical knowledge of assembly language and basic architecture.
Students with little prior experience or who wish to take more time to study the fundamentals of programming should take 106A or 106H, then 106B. Students in 106A are not expected to have any prior experience, but are expected to have a reasonable degree of mathematical ability. Students in 106H are expected to have a good working knowledge of calculus.

Students in engineering and science disciplines who expect to make limited use of computers in their fields should take 106A or 106H. These courses provide training adequate for the occasional use of computer programming to solve engineering and science problems and provide an introduction to the principles of software engineering and computer programming.

Students in non-technical disciplines who expect to make use of computers in their fields should take C.S. 105A. This course covers a certain amount of the material in 106A, but without a technical orientation.

Students who would like to learn basic computer skills for tasks unrelated to programming should take C.S. 1. Various sections of C.S. 1 are oriented towards different styles and brands of computers.

To summarize the options for introductory Computer Science courses:

To learn Computer Science—106X, 106C, 107 or both 109A and 109B, 110.
For significant use—(106A or 106H), 106B.
For scientific use—106A or 106H.
For nontechnical use—105A.
For exposure—1.

NUMBERING SYSTEM
The first digit of a C.S. course number indicates its general level of difficulty:

0-99 service courses for non-technical majors
100-199 other service courses, basic undergraduate
200-299 advanced undergraduate/beginning graduate
300-399 advanced graduate
400-499 experimental
500-599 graduate seminars

The ten’s digit indicates the area of Computer Science it addresses:

00-09 Introductory, miscellaneous
10-19 Hardware Systems
20-29 Artificial Language
30-39 Numerical Analysis
40-49 Software Systems
50-59 Mathematical Foundations of Computing
60-69 Analysis of Algorithms
70-79 Typography and Computational Models of Language
90-99 Independent Study and Practicum

NONMAJOR

1. Using Computers—A practical course in the use of specific computer systems. Pass/No Credit introduction to the basic functions of a computer system: word processor, communications facilities, spreadsheets and other software packages. Approximately one hour per week in lecture/demonstration and up to two hours per week doing an assignment with the demonstrated software package. There are no exams or problem sets. This is not a programming course. Section A examines the DEC Rainbow microcomputer. Section C examines the Apple Macintosh microcomputer. Section D examines the IBM PC. Students may take more than one section for credit, but cannot repeat the same section. Sections are offered when appropriate staff are available to teach them, see the Time Schedule.

1C. 1 unit, any quarter (Zelenski)
1D. 1 unit, any quarter (Jones)
contact arrangement

3. Programming in FORTRAN—Introduction to FORTRAN for students with experience in programming in a high-level programming language other than BASIC. Available any quarter as a self-paced course providing students videotapes, a textbook, and TA support to complete a specific set of programming problems. Prerequisite: 106A, or equivalent.

2 units, Aut, Win, Spr (Fisher)

21. Programming in Prolog—Introduction to the Prolog programming language and the declarative programming paradigm for students with programming experience in a high-level language. Prerequisite: 106B, 106X, or equivalent.

3 units, Aut (Rogers) MWF 9

22. Programming in LISP—Introduction to the LISP language and the techniques of manipulating symbolic data, algebraic and logical expressions, graphs, and computer programs. Progressive exercises develop programming skills and familiarity with a wide range of programming tools. Prerequisite: 106B, 106X, or equivalent.

*4 units, Win (Staff) MWF 3:15

40. Introduction to UNIX and C—Introduction to the UNIX operating system and C programming language. Covers UNIX commands, shell interface, shell programming, file system, processes, signals, interprocess communication.

*May be taken for 3 units by graduate students.
tion, and writing UNIX programs in the C programming language. C programming language issues include data types, control structures, pointers, dynamic memory allocation, libraries, performance, bit operations, and the interface to the UNIX shell. Previous experience in a high-level language other than BASIC required. Prerequisite: 106B, 106X, or equivalent.

3 units, Aut (Wilson) MWF 3:15

75. Computers and Language—(Same as Linguistics 35.) A basis for understanding computer use dealing with language and implications of computer systems in everyday life situations. Introduces basic principles of computing and linguistics through lectures, films, discussions and demonstrations of existing systems. Term paper required. Students assumed not to have prior computer background. Enrollment limited. (DR:4) or (DR:8)

5 units, Spr (Staff) MWF 11

UNDERGRADUATE

101. Computers: Their Nature, Use, and Impact—For nonspecialists from all departments surveying a variety of concepts and issues relating to computers. Topics: basic concepts and vocabulary of computers and information processing; current applications of computers in education, business, music, art, medicine, science, entertainment, communications, consumer products, manufacturing, defense, transportation, law, law enforcement, and government; future trends in the economies of computing, technological advances, artificial intelligence; impact of computers on issues of privacy, employment, leisure, obsolescence, political and economic power, and man's image of himself. Programming is not taught. Alternatives: 105A, 106A. (DR:8; student must also have completed 106 as taught before 9/1/85.)

3 units, alternate years, given 1989-90

105A. Introduction to Computers—Designed for non-technical majors to develop a working knowledge of computers as they are utilized in our society. Two major components: programming and issues. Karel the Robot and Pascal are used to expose students to the concepts of structured programming. Topics: artificial intelligence, databases, spreadsheets, graphics, security and privacy, computer systems, human factors, hardware, and networks. 105A requires considerable interaction between student and computer, but is oriented toward students without a strong math and/or technical background, and assumes no previous computer experience. Students in technical fields and students looking to acquire programming skills are encouraged to take 106A or 106X. (DR:8)

*5 units, Aut (Jones) MWF 2:15
Win (Jones) MWF 1:15
Spr (Jones) MWF 10

106A. Programming Methodology—Broad introduction to the engineering of computer applications using Pascal. Software engineering principles are stressed: design, decomposition, information hiding, procedural abstraction, testing, and reusable software components. Alternatives: 105A, 106H, 106X. Intended for students in technical disciplines, but no prior experience is assumed. (DR:8)

*5 units, Aut (Fisher) MWF 2:15
Win (Staff) MWF 1:15
Spr (Staff) MWF 1:15

106B. Programming Abstractions—Abstraction and its relation to programming. Software engineering principles of data abstraction, opaque types, modules, highly reusable types (e.g., stacks and queues), and data-directed design. Recursion and recursive data structures (linked lists and binary trees). Analysis of running time and space requirements for arbitrary programs including an introduction to elementary recurrence relations. Overview of machine-level representation of data, basic computer architecture, and simple assembly language. Students complete several large programs in Pascal. Prerequisite: 106A or 106H.

*5 units, Aut (Fisher) MWF 11
Win (Staff) MWF 2:15
Spr (Staff) MWF 1:15

106C. Theoretical Foundations for Computer Science—An overview of the basic theory underlying the various computer science disciplines. Possible topics: logic, models of computation (finite state machines, pushdown automata, and Turing machines), analysis of algorithms, program verification, computer organization, and graph theory. A number of Pascal programming projects explore the ramifications of these concepts on some practical problems. 106C need not (and probably in some cases should not) be taken immediately after 106B. Prerequisite: 106B or 106X. Alternate: 109A,B.

*5 units, Aut (Staff) MWF 10
Win (Staff) MWF 1:15
Spr (Staff) MWF 11

106H. Introduction to Computer Programming (Honors)—Programming as an intellectual discipline. Systematic design, verification, and testing of programs. Common paradigms of programming. Recursion, dynamic programming, iterative improvement, divide-and-conquer methods. Numerical convergence and precision. No prior programming experience is assumed; knowledge of calculus and tolerance for abstraction are essential.
Alternatives: 106A, 106X. Prerequisite: Mathematics 22 or 42.

*5 units, Spr (Floyd) MWF 10

106X. Programming Methodology and Abstractions (Accelerated)—Covers 70% of the material in 106A, B. Intended as a one-quarter preparation for 106C, 107, and 109 for students whose previous programming experience is sufficient to help them cover this fundamental material more rapidly. Prerequisite: Mathematics 3 or equivalent.

*5 units, Win (Staff) MWF 9
Win (Staff) MWF 1:15
Spr (Staff) MWF 10

106X. Programming Methodology and Abstractions (Accelerated)—Covers 70% of the material in 106A, B. Intended as a one-quarter preparation for 106C, 107, and 109 for students whose previous programming experience is sufficient to help them cover this fundamental material more rapidly. Prerequisite: Mathematics 3 or equivalent.

*5 units, Autumn (Staff) MWF 10

107. Programming Paradigms—Different programming paradigms are explored by introducing different programming languages. Possible programming languages: Prolog, Lisp, Smalltalk, C, and Ada. A number of small programming projects are assigned. Prerequisite: 106C or 106B.

*5 units, Win (Cleron) MWF 10
Spr (Cleron) MWF 1:15

108B. Fundamentals of Computer Science—108A, B is replaced by new courses. 106C is the nominal replacement for 108A. 107 is the replacement for 108B. 109A,B provides an alternative to 106C for more advanced students. 108B will be taught one last time for students who took 108A previously. Prerequisite: 108A.

5 units, Autumn (Staff) MWF 2:15

109A,B. Introduction to Computer Science—Two-quarter introduction to the science that underlies computer programming, accompanied by substantial programming problems. Theoretical focus: the concepts of automata, formal languages, data types, recursion, logic, algorithms, and proof; these form a mathematical basis for engineering good computer programs. Substantial written computer programs explore or exemplify these concepts. 109A: models of data and control, and written computer programs in Pascal that explore the use of those models. Topics: finite state machines, regular expressions, control constructs in programming languages, formal specification of control, program verification and proof techniques, efficiency analysis techniques, mathematical models of data, axiomatic descriptions, data types in programming languages, abstract data types, and non-elementary data structures, i.e., lists and trees. 109B: models of computation, i.e., Turing machines, recursion and recursive algorithms, proof techniques involving recursion, efficiency analyses of recursive algorithms, and an introduction to the semantics of programming languages. 109B also involves a substantial amount of programming work. Prerequisite for 109A: 106B or 106X. Prerequisite for 109B 109A.

4 units, Autumn (Reid) MWF 10
Win (Gorin) MWF 2:15

109B. 4 units, Win (Reid) MWF 10
Spr (Gorin) MWF 2:15


4 units, Autumn (Chou) MW 12:50-2:05
Win (Gill) TTh 9:30-10:45
Spr (Chou) MW 12:50-2:05


3 units, Autumn (Gupta) Win (Weise)

123. Artificial Intelligence: Concepts and Applications—Artificial Intelligence (AI) is the science and technology of building computer programs that reason about problems using knowledge, interact with people in natural language, and perceive images and speech. Survey of work in AI, addressing economic, social, and scientific importance: knowledge representation; problem solving methods; expert systems; natural language and speech understanding; computer vision; machine learning, software tools, and other current research areas. No programming. Prerequisite: 105A or equivalent computer exposure (by permission of instructor).

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

131. Applied Linear Algebra—Basic theory of linear algebra from a concrete point of view. Constructive methods emphasized. Applications from many disciplines. Computational tools, e.g., MATHLAB, are used to illustrate central ideas.

3 units, Win (Golub) MW 11-12:15
135. Numerical Methods—Acquaints students in science and engineering with methods and techniques for solving scientific problems of a mathematical type on digital computers. Emphasis on practical problems and pragmatics. Program libraries are studied and used. Problems discussed: interpolation and approximation of data, solution of differential equations, numerical integration, solution of linear and nonlinear systems of equations, fast Fourier transforms. Pitfalls in automatic computation and their remedies. Not intended for students with further interests in Numerical Analysis. Alternate: 137. Prerequisites: Knowledge of FORTRAN; Mathematics 103 or 113 and 130; or equivalents.

3 units, Sum (Staff)

137. Fundamentals of Numerical Computation—Introduction to the fundamental issues of numerical computation for the mathematical, computational and physical sciences, and engineering. Problems of accurately computing algebraically exact solutions in the presence of rounding errors and of computing discrete approximations of solutions which are defined on the continuum. The taxonomy of problem classes with methods for their solution and principles useful for analysis of performance and algorithmic development. Topics: error analysis, the solution of linear and nonlinear equations, interpolation and numerical differentiation, the approximation of integrals, and the solution of differential equations. Prerequisites: 3 and/or 106A; Math. 103 or 113, and 130; or equivalents.

*4 units, Aut, Spr (Staff) MWF 3:15

140. Concurrent Programming—Principles of concurrent programming, including processes, mutual exclusion and synchronization, message-passing and monitors. Emphasis on principles and algorithms, rather than on implementation. Prerequisites: 107 and 110.

3 units, Aut (Rogers) MWF 2:15
Spr (Staff) MWF 9

143A. Compilers—Principles and practices in the design of programming language compilers. Emphasis is on the design of "front end" processing: lexical, syntactic and semantic analysis, choices of data representations, and runtime support. Simple code generation is discussed. Attention to automatic compiler-generation tools. Occasional week-long programming assignments, but no programming project. Prerequisite: 107 and 110.

*4 units, Aut (Dill) MWF 10
Spr (Dill) MWF 2:15

143B. Compiler Project—(See 194.)

145. Introduction to Databases—Data models, relational database concepts, relational algebra and SQL, Boyce-Codd normal form, interactive database interfaces, programmed interfaces to database systems, transaction management, role of databases and computers in application environments. Involves a substantial database system project. Prerequisites: 107 and 110.

*4 units, Aut (Keller) MWF 1:15

154. Introduction to Automata and Complexity Theory—Regular sets: finite automata, regular expressions, equivalences among notation, methods of proving a language not to be regular; context free languages: grammars, pushdown automata, normal forms for grammars, proving languages non-context-free; Turing machines: equivalent forms, undecidability. Nondeterministic Turing machines: properties, the class NP, complete problems for NP. Prerequisites: 106C or 109B, and 160.

*4 units, Win (Ullman) MWF 3:15
Spr (Staff) MWF 10

154N. Introduction to NP Completeness—Turing machines. Reducibilities among problems; Cook's theorem; examples of NP-complete problems. Students participate in approximately the last half of 154. Prerequisite: A knowledge of formal languages and automata as in the first part of 154.

2 units, Win (Ullman) MWF 3:15
Spr (Staff) MWF 10


*4 units, Aut (Staff) TTh 1:15-2:30
Win (Staff) MWF 2:15

160. Discrete Mathematics—Introduction to the mathematics used in computer science. Possible topics: symbolic logic, induction, relations, permutation, set theory, trees, graphs, groups, boolean algebras, and lattices.

3 units, Aut (Staff) MWF 9

161. Discrete Structures and Algorithms—Efficient data structures: balanced trees, partially ordered tree. Graph properties and algorithms: depth-first search, shortest paths, connected components, matching, coloring. Storage management: garbage collection, structures for efficient allocation and deallocation of storage. Analysis of programs: recurrence relations, recursive programs, solution techniques; effi-
cient sorting algorithms; efficient search techniques; counting and generation of combinatorial objects, e.g., permutations, trees, Boolean algebras, lattices. Prerequisite: 106C or 109B, and 160.

*4 units, Win (Staff) MWF 1:15
Spr (Goldberg) TTh 2:45-4

191. Senior Project—Group projects under faculty direction. Register using the section number associated with the instructor.
3-6 units, any quarter (Staff) by arrangement

192. Programming Service Project—Appropriate academic credit (without financial support) is given for volunteer computer programming work of public benefit and educational value. Restricted to Computer Science students.
1-3 units, any quarter (Staff) by arrangement

194. Software Project Laboratory—Experience in designing and implementing large-scale software systems. Working in teams, students complete modest-sized projects through specification, coding, and testing. Topics: design methodologies, object-oriented design, problems of team programming, examples of good software, debugging techniques, and approaches to testing. May be taken multiple quarters for credit to complete a large project. Prerequisite: 140 or 143A, or consent of instructor.
3-6 units, Win (Ungar) W 1:15-3:05
Spr (Linton) T 1:15-3:05

196. Microcomputer Consulting—How to consult for a microcomputer cluster on campus with Apple Macintosh and IBM PC computers. Biweekly lectures on available software. Work as the on-duty consultant. Contact the manager of the Engineering microcomputer cluster or other microcomputer cluster manager on campus.
2-3 units, any quarter (Jones) TTh 7 p.m.

197A,B,C. LOTS Consulting—Three-quarter introduction to consulting on LOTS computing services. 197A: weekly lectures, short homework assignments, and begin consulting with an experienced LOTS consultant. 197B: fewer lecture hours on more advanced topics, more emphasis on consulting. 197C: for those interested in working on a special project supervised by Student Coordinators; emphasize on consulting and special project work, supplemented with several class meetings throughout the quarter. Lectures emphasize skills on LOTS mainframe services (TOPS-20, UNIX, VM/CMS); also material on computer workstations and personal computers. All interested students attend an orientation meeting the first Wednesday of the quarter; enrollment limited. Prerequisite: Consent of LOTS Student Coordinator.
197A. 2 units, Aut, Win, Spr (Jones)
MW 7-8:45 p.m.

197B. 2 units, Aut, Win, Spr (Jones)
TTh 7-8 p.m.

197C. 2 units, Aut, Win, Spr (Jones)
by arrangement

198. Teaching of Computer Science—How to teach other students by on-duty help at the computing center and by running a small discussion section for a 106 course. Attend three weekly meetings to discuss introductory courses in general, the specific course in particular, and techniques of teaching. Application and interview required; see the receptionist in Computer Science/Tresidder for information. Prerequisite: 106B or 106X.
4 units, any quarter (Reges, Purcell, Tysen) TTh 4:15

199. Independent Work—Special study under faculty direction, usually leading to a written report. Letter grade given; if this is not appropriate, enroll in 199P. Register using the section number associated with the instructor.
any quarter (Staff) by arrangement

199P. Independent Work—Like 199, but graded either Pass or No Credit.
any quarter (Staff) by arrangement

UNDERGRADUATE AND GRADUATE

211. Logic Design—(Enroll in Electrical Engineering 381.) Principles and techniques of logic design. Topics: combinational circuit analysis, including hazard detection; combinatorial circuit design including PLA, VLSI, and MSI techniques as well as testing techniques; IC logic families, flip-flop properties, sequential circuit analysis and synthesis for fundamental and pulse mode circuits; design for testability techniques. Prerequisite: 112 or equivalent.
3 units, Aut (Staff)

212. Computer Architecture and Organization—(Enroll in Electrical Engineering 282.) Structure of systems using processors, memories input/output (I/O) devices, and I/O interfaces as building blocks. Computer system instruction set design and implementation, including memory hierarchies and pipelining. Issues and tradeoffs involved in the design of computer system architectures, with respect to the design of instruction sets. Prerequisite: 112.
3 units, Aut (Hennessey)
Spr (Staff)

221. Introduction to Artificial Intelligence—A broad technical introduction to the core concepts of Artificial Intelligence. Topics: knowledge representation, search, deduction, planning, constraint propagation, learning, expert
systems, natural language understanding, vision, and connectionism. General problems, critiques, and fundamental assumptions. Prerequisites: 106C or 109B, or equivalent.

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

225A. Declarative Programming—Introduction to the technology of expert systems and the associated programming methodology. Emphasis on functional and logic programming (using various interpreters), metalevel control and partial programming (generalized condition-action rules). Some discussion of knowledge acquisition and validation techniques. Course work is done in teams. Prerequisites: 221, 157, and Lisp.

2-3 units, Spr (Genesereth) TTh 9:30-10:45

225B. AI Programming Laboratory—Companion project course for 225A. Corerequisite: 225A.

3 units, Spr (Staff) T 7-9 p.m.

226. Expert System Applications—Expert Systems are the most important of the applications of Artificial Intelligence in the commercial and defense sectors. Topics: the rapid transition of the Expert System technology from laboratories to societal use; what is in an Expert System; what is Knowledge Engineering. Case studies of commercial application in: diagnosis and repair; interpretation of data; manufacturing planning and control; financial services; engineering design, etc. The sources of benefit from Expert Systems. The magnitude of these benefits. What an organization needs to do to realize the benefits. A "what" rather than a "how to build systems" orientation aimed for a broad interdisciplinary audience.

3 units, Spr (Feigenbaum) TTh 1:15-2:30

227. AI Programming in Prolog—The programming language Prolog introduced. After the fundamentals, advanced techniques are used to solve problems predominantly from the domain of artificial intelligence. Prerequisites: 106C or 109B, and some acquaintance with AI.

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

237A,B,C. Advanced Numerical Analysis—Three-quarter graduate sequence to acquaint students of the mathematical and physical sciences with the derivation and analysis of methods for solving mathematical problems on digital computers. Organized so students may take the first quarter and then either the second or third according to their interests.

237A: Fundamental concepts of numerical computation. Topics: linear systems of equations, interpolation, numerical differentiation and integration, and the solution of nonlinear equations. 237B: The analysis of structures and data. Topics: the approximation of functions, the matrix eigenvalue problem, least squares approximation and statistical computations. 237C: The simulation of systems governed by ordinary and partial differential equations. Topics: methods for the solution of initial and boundary value problems. Finite difference, finite element, and collocation methods. These courses include analysis of convergence and estimation of truncation and round-off errors. Assigned work includes analytical problems and problems to be solved with the aid of a computer. 237A is prerequisite for 237B and C. Prerequisites: 3 and/or 106A; Math. 103 or 113 (CS 237C has the additional prerequisite of Math. 130); or equivalents.

237A. 3 units, Aut (Staff) MWF 11
237B. 3 units, Win (Staff) MWF 11
237C. 3 units, Spr (Staff) MWF 11

240A,B. Operating Systems—Two-quarter sequence in operating systems design and implementation. 240A: Fundamentals of operating system implementation: basic structure; multiprogramming, processes, and scheduling; synchronization and communication mechanisms; I/O device management; memory management, segmentation, paging; file systems, directory management, disk allocation. 240B: Deeper coverage of issues that arise in all subsystems of an operating system; naming and I/O protocols; protection; reliability; performance; user interfaces; and networking. Prerequisite for 240A: 140 or equivalent. Prerequisite for 240B: 240A.

240A. *4 units, Aut (Linton) MWF 11
240B. 3 units, Win (Staff) TTh 2:45-4

242. Programming Languages—Survey of old and new programming languages: CLU, Prolog, C++, Smalltalk-80, and Fortran. Emphasis on understanding language design goals: expressiveness, readability, and security, and on how a language may be designed to achieve or sacrifice these goals. Wherever possible, course material is from the original papers. Assignments include analysis of the relationships between goals and language designs. Prerequisite: 107.

3 units, Spr (Ungar) MWF 3:15

243. Advanced Compiling Techniques—Theoretical and practical aspects of building modern compilers. Topics: machine code generation, optimization techniques, type analysis and checking, language and machine descriptions, compiler-compilers. Three hours lecture, one hour discussion session lead by a TA. Prerequisite: 143A or equivalent.

*4 units, Win (Weise) TTh 1:15-2:30

244. Computer Networks: Architecture and Implementation—Motivations and objectives
of computer networks; overview of network architectures; layered architectures and the ISO Reference Model; network functions. Circuit-switching and packet-switching; physical level protocols; data link protocols including HDLC, and multiaccess link control. Network control, transport, and session protocols including routing, flow control; end-to-end communication and internetworking. Presentation layer protocols including virtual terminal and file transfer protocols, cryptography, and text compression. Specific examples and standards are cited for point-to-point, satellite, packet radio, and local networks. Prerequisite: 240A or equivalent; may be taken as corequisite.

3 units, Aut (Cheriton) TTh 2:45-4
Win (Staff) (Enroll in Electrical Engineering 384.)


3 units, Win (Wiederhold) MWF 11

247. Software Engineering Laboratory—(See 194.)

248A. Computer Graphics — Introductory computer graphics emphasizing raster techniques. Topics: fundamentals of display and printing devices, transformations, clipping and windowing, representation and rendering of curves and surfaces, and scan-convension of geometric shapes; the rudiments of input techniques and those of hidden-surface elimination, shading, color, and other image synthesis methods. The architecture of raster graphics systems and the use of specialized instructions for raster manipulation. Presupposes knowledge of linear algebra and data-structures, and requires programming assignments that make use of raster display system. Prerequisites: 107 and Math 113.

3 units, Win (Guibas) TTh 9:30-10:45


3 units, Spr (Staff) TTh 1:15-2:30 alternate years, not given 1989-90

254. Automata, Languages, and Computability—An enriched version of 154, recommended for graduate students and for undergraduates strong in mathematics. Prerequisites: 106C or 109B, and 160.

*4 units, Aut (Floyd) MWF 10


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

258. Introduction to Programming Language Theory—Syntactic, operational, and semantic issues in the mathematical analysis of programming languages. Type systems and non-context-free syntax. Operational semantics given by rewrite rules; confluence and termination. General framework and goals of semantic models; Scott-style domain constructions for simple languages with higher-type functions and recursion. Treatment of side-effects. Polymorphism, data abstraction and inheritance. Prerequisites: 157, Philosophy 160A, or consent of instructor.

3 units, Aut (Mitchell) TTh 9:30-10:45

260. 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 recurrence relations; asymptotic expansions; analysis of algorithms. An emphasis on obtaining simple closed-form answers to problems when it is possible. Prerequisites: 160 and Mathematics 22, 42, or equivalent.

3 units, Aut (Knuth) MWF 9


3 units, Win (Floyd) MWF 3:15


3 units (Staff) alternate years, given 1989-90

264. Introduction to Combinatorial Theory—An elementary first course in combinatorics. Topics: permutations, combinations, partitions; the principle of inclusion and exclusion; Ramsey's theorem; Burnside's lemma; Polya's counting theorem; the elementary theory of graphs and trees; flow in networks; matching problems; an introduction to matroids. Prerequisite: 160 and Mathematics 44 or equivalent.

3 units, Win (Staff) TTh 9:30-10:45
265. Basic Tools in Computer Systems Modeling—(Enroll in Electrical Engineering 284.)
Basic tools for the analysis and performance evaluation of computer systems. Topics: review of probability theory; Poisson distribution; exponential distribution; transforms; Poisson process; discrete-parameter Markov chains; birth-death processes; queueing theory; networks of markovian queues; elements of graph theory; graph algorithms. Examples from computer systems area. Prerequisite: Statistics 115 or 116.
3 units, Win (Tobagi)

270. Computer Applications in Medicine—(Same as Medical Information Sciences 210.)
Medical computer science activities in research and applied environments. Topics: office systems, hospital information systems, medical databases, pharmacy systems, laboratory systems, image analysis, EKG analysis, history taking, library systems, multiphasic health testing, medical computer-aided instruction, decision support systems.
3 units, Aut (Fagan, Shortliffe) TTh 3:15-4:15

271A. Computer-Based Medical Decision Making—(Same as Medical Information Sciences 211A.)
Medical decision making techniques and methods for their implementation in decision support systems. Bayesian statistics, decision analysis, and artificial intelligence (expert systems).
3 units, Win (Shortliffe) TTh 3:15-4:15

271B. Computer-Based Medical Decision Making—(Same as Medical Information Sciences 211B.)
For students who have completed 271A and wish to implement some of those ideas in a computer project. Computer programming is required in most projects. Prerequisite: 271A.
3 units, Spr (Cooper, Fagan, Shortliffe) TTh 3:15-4:15

273 Concepts of Text—(Same as Art 281.)
What every literate person should know about the basic principles of the visual organization of text. Subjects include handwriting, typewriting, typography, and computerized documents, perceptual, linguistic, and semiological issues. Consists primarily of visual exercises.
3 units, Spr (Bigelow) TTh 9:30-10:45

275. Computational Linguistics II—(Same as Linguistics 227.)
Computational methods in the linguistics (phonology, morphology, syntax, semantics, etc.) and applications (translation, expert systems, question answering, etc.). Individually, or in small groups, students complete a programming project involving substantial linguistic theory. The programming language is Lisp or Prolog (Lisp in 1988-89). Prerequisites: 21 (or 22, depending on the programming language being used), and Linguistics 120.
4 units, Spr (Kay)

276. Computational Models for the Semantics of Natural Language—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 (Staff) MWF 10 alternate years, not given 1989-90

277. Computational Models of Discourse—(Same as Linguistics 236.)
Text and conversation structure. Computational theories of anaphora, focus, and information structure. Plans and speech acts. Use of world knowledge and reasoning in computer analysis and generation of discourse.
*4 units, not given 1988-89

PRIMARILY FOR GRADUATE STUDENTS

300. Departmental Lecture Series—Weekly presentations by members of the department faculty, 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 (Staff) Th 4:15-5:30

304. Programming and Problem Solving Seminar—Solution of various problems, numeric and symbolic, on computers. Emphasis on the research paradigms of computer science and the development of algorithms that are "beautiful" from various points of view. Limited to and recommended for Ph.D. degree candidates in computer science.
3 units, Win (Knuth) TTh 2:45-4

306. Recursive Programming and Proving—Recursive programming using the LISP language and techniques for providing 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: 106B or 106X.
3 units, Aut (Shankar) TTh 2:45-4

309. Industrial Lectureships in Computer Science—Each quarter the department invites outstanding computer scientists to give a course in his/her specialty. Lecturers and topics change yearly; courses may be taken repeatedly. This year's lecturers are: Frances Yao, a
research scientist with Xerox Palo Alto Research Center where her current field of interest is computational geometry; Whitfield Diffie, manager of secure-systems research for Bell-Northern Research, and inventor of public key cryptography; Witold Litwin, a senior researcher at the French INRIA Institute, has contributed to the design and management of their distributed database systems.

309A. Topics in Computational Geometry
—Discussion of selected topics of current research interest in computational geometry. Topics: range search problems, geometric optimization problems, and finite-precision computational geometry. Familiarity with analysis of algorithms is assumed.

3 units, Aut (Yao)


3 units, Win (Diffie)

309C. Federated Databases—Multiple autonomous databases, usually distributed, including implementation. Top-down distributed database design, bottom-up integration, local autonomy, interoperability, federated databases, and a multidatabase system. Heterogeneous and autonomous data management: new capabilities for database languages for cooperative data definition and manipulation, multidatabase views, static and dynamic homogenization of data values and models, query decomposition, transaction processing. Survey of research prototypes. Future directions including use of high-speed networks and personal workstations, Open System Architecture, European public videotex systems, especially the French Teletel system.

3 units, Spr (Litwin)

312. Processor Design—(Enroll in Electrical Engineering 382.) Computer arithmetic, bounds on arithmetic speed, high speed algorithms. Pipelined machines, timing templates and design issues. Memory system design for high speed processors. Prerequisite: 212 or equivalent.

3 units, Win (Flynn)


3 units, alternate years, given 1989-90


3 units, Spr (McCluskey) alternate years, not given 1989-90

319. Topics in Digital Systems—Advanced material is often taught for the first time as a "topics" course, perhaps by a faculty member visiting from another institution. Students may therefore enroll repeatedly in a course with this number. See the Time Schedule for topics currently being offered.

by arrangement

322. Autonomous Agent Architecture—A rigorous treatment of the problems involved in building intelligent agents that interact with the physical world. Topics: the representation of knowledge about states, actions, and procedures, simulation and planning, and knowledge level agents. Prerequisites: 157, 221.

3 units, Win (Genesereth, Nilsson) MWF 1:15

323. Nonmonotonic Reasoning—(Same as Philosophy 326.) Formalisms for representing nonmonotonic reasoning and their applications to AI. Nonmonotonic aspects of commonsense knowledge and reasoning. Default logic, autoepistemic logic and circumscription. Computational nonmonotonic reasoning. Applications of nonmonotonic formalisms to inheritance systems, to logic programming, and to reasoning about action using the situation calculus. Prerequisite: A basic knowledge of logic.

3 units, Win (McCarthy) TTh 2:45-4

324. Knowledge and Change—A formal treatment of reasoning about time, action, knowledge, and uncertainty; emphasis on epistemological questions and their relevance to AI. Topics: the situational calculus, dynamic logic,
temporal logics, modal logics of knowledge and belief, fuzzy logic, and probabilistic logic. Prerequisites: An understanding of logic and basic model theory. Recommended: 323.

3 units, Spr (Shoham) TTh 11:15-12:30

325. Planning Methods in Artificial Intelligence—Introduction to AI methods for planning courses of actions in order to achieve a specified goal from an initial state of the world. Methods linear planning (means-ends analysis, goal regression), non-linear planning, hierarchical planning, and compromise-based planning. Underlying problems—frame, qualification, prediction, and persistence, and notions, such as interdependent subgoals, are reviewed and analyzed. Two parts: the basics illustrated with simple examples; and applications in various domains (robotics, process planning, etc.) Prerequisite: 221.

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

327A. Introduction to Robotic Manipulation—(Enroll in Mechanical Engineering 219A.) Introduction to the basics of robot manipulations and a review of current applications. Topics: kinematic structure, coordinate transformations, manipulator solutions, workspace, path selection, control, dynamics, and programming. Recommended: Knowledge of matrix algebra and some familiarity with basic control theory and rigid body mechanics.

3 units, Aut (Roth)

327B. Introduction to Computer Vision—Visual perception by computer: formation of the image of a surface patch; surface reflectivity; cameras and range sensors; statistical estimation. Three-dimensional vision: local geometry of a surface patch; global surface geometry; segmentation of surface data; stereo vision and motion perception. Image segmentation: edge operators and extended curves; texture. Interpretation: shape representation and geometric modeling; interpretation of line drawings; structural matching. Comparisons are made with psychophysics. Prerequisites: 106A, Statistics 115 or 116, Math. 103, or 113 and orthogonal polynomials.

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

327C. Robot Reasoning—Advanced robot programming. Representing the robot workspace, reasoning about spatial occupancy and motion, and reasoning about and under uncertainty. Programming a robot, path planning, generating trajectories for objects moving among obstacles; the high computational cost of general solutions; alternatives—hypothesize and test, potential field, configuration space, and free ways; gross motions and fine motions. Dealing with uncertainties in model, control, and sensing; automatically generating motion strategies that guarantee success despite uncertainties; approaches—program refining, inductive learning, and pre-image backchaining Grasp planning, multiple-moving-objects path planning, inference of geometrical positions from spatial relations, and integrated architectures for advanced robot programming systems. Prerequisites: 221 and 327A.

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

328A. Computational Models of Cognition—(Enroll in Psychology 187.) Computational models of information processing covering relevant current research in Artificial Intelligence (AI) and Cognitive Psychology. Use of computer simulations to test psychological theories. Applications of psychological research to building AI systems. Topics include, but not limited to, knowledge representation, machine learning, natural language understanding, and parallel processing models. Students give presentations in class on weekly readings and submit, as a final paper, a proposal for a research project. Enrollment by permission of instructor and limited to 15. Prerequisites: Advanced undergraduate standing and either 221, Psychology 106, or equivalent experience.

2-3 units (Pavel)
alternate years, given 1989-90

328B. Applying Cognitive Psychology to Computer Systems—(Enroll in Psychology 286.) Broad issues in applying psychology to various domains emphasizing computer-user interaction, using models of human abilities and limitations in solving real problems. Methodology including model building and testing. Computer-related topics: model-based approaches to design, computer-user interfaces, software psychology, and knowledge representation. Prerequisite: Consent of the instructor.

1-3 units, Win (Pavel) by arrangement
alternate years, not given 1989-90

328C. Advanced Seminar in Perception, Cognition, and Human Performance—(Enroll in Psychology 289.) Research-oriented course; in-depth analyses of selected current topics emphasizing on problems related to computer systems, artificial intelligence, and human information processing. Special topics to be announced. Prerequisite: Consent of the instructor.

1-3 units, Spr (Pavel) by arrangement

329. Topics in Artificial Intelligence—Advanced material is often taught for the first time as a "topics" course, perhaps by a faculty member visiting from another institution. Students may therefore enroll repeatedly in a course with this number. See the Time Schedule for topics currently being offered.

1-3 units
335. 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 relevant to practical statistical problems. Prerequisites: Statistics at the level of 219-220, matrix algebra, knowledge of a programming language.

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

339. Topics in Numerical Analysis—Advanced material is often taught for the first time as a "topics" course, perhaps by a faculty member visiting from another institution. Students may therefore enroll repeatedly in a course with this number. See the Time Schedule for topics currently being offered.

by arrangement

340. Distributed Systems—Overview of distributed systems, primarily as an extension of uniprocessor operating systems to span networks. The approach is to present the impact of networking on each of the subsystems and issues discussed in 240A, B, including basic architectural models; network-transparent message-passing and remote procedure call; network-wide virtual memory; distributed file systems; encryption; and multi-site concurrency control, replication, and error recovery. Prerequisites: 240B and 244.

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


3 units, Spr (Cheriton)

342. Programming Language Design — Exposure to the problems of programming language design and their known solutions. Topics may include formal semantics, implementation considerations, extensibility, very high level languages, evaluation of language designs, the innovative features of a variety of modern programming languages. Prerequisites: 242, 243.

3 units, Aut (Weise) MWF 3:15

343. Topics in Compilers — Lectures and discussions explore implementation issues in depth. Major focus on optimization techniques and advanced code generation. A significant project is included. Prerequisite: 243.

3-6 units

344. Computer Networks: Modeling and Analysis—(Enroll in Electrical Engineering 484.) Network functions, architectures and protocols; computer traffic characterization; resource sharing; packet-switched store-and-forward networks (e.g., ARPA net): delay analysis, network design and optimization including capacity assignment, routing and topological design; analysis of multi-access/broadcast protocols (used in packet-switched satellite, ground radio, and local networks): fixed assignment, random access, demand assignment, adaptive strategies, stability considerations and dynamic control. Prerequisites: 244, 265.

3 units, Spr (Tobagi)

345. Theory of Database and Knowledge-Base Systems—Logic as a data model: horn-clause logic, rules and negated subgoals, relational algebra and calculus, query languages based on logic; object-oriented data models and systems; relational design theory: functional and multi-valued dependencies, normal forms; database query optimization: algebraic laws, strategy search algorithms, semijoin-based algorithms, optimization of massive joins; optimization of logic queries: conjunctive queries, "magic sets", counting, and other methods for restricting inference. Prerequisites: 145, 245 or equivalent and 157, Philosophy 160A or equivalent.

3 units, Spr (Ullman) MWF 2:15


3 units, Sum (Ceri, Gottlob) MW 3:15-4:30

349. Topics in Programming Systems—Advanced material is often taught for the first time as a "topics" course, perhaps by a faculty member visiting from another institution. Students may therefore enroll repeatedly in a course with this number. See the Time Schedule for topics currently being offered.

by arrangement

350. Mathematical Theory of Computation—Abstract syntax and formal semantics of programming languages. Recursively defined and algolic programs. Proving assertions about computer programs using formalisms of Boyer and Moore, Burstall, Cartwright, Floyd, Manna, McCarthy, and Scott. Emphasis on functional programs rather than sequential. Use of proof-
checking programs including EKL and the Boyer-Moore theorem prover. Prerequisite: 257. Recommended: 306.

3 units (McCarthy) not given 1988-89

351. Introduction to Complexity Theory—Basic machine models and complexity measures, their properties and relationships. Diagonalization; reduction; complete problems. Concrete representative problems for the most important complexity classes (logspace, nlogspace, P, NP, Pspace). Properties of complexity classes.

3 units


3 units, Aut (Pratt) TTh 9:30-10:45

356. Reasoning About Knowledge—Knowledge plays a crucial role in distributed systems, cryptography, and artificial intelligence. Material examines formalizing reasoning about knowledge and the extent to which knowledge is applicable to the areas above. Issues: common knowledge, probabilistic knowledge, applying knowledge to analyzing distributed systems, attainable states of knowledge, and modeling resource-bounded reasoning. Prerequisites: Mathematical maturity and an acquaintance with propositional logic.

1-3 units, Win (Halpern) F 2:15-4:05

357. Analysis of Concurrent Programs—Concurrent systems; modeling real concurrency; fair transition systems; mechanisms for synchronization and communication; weak and strong fairness; language and system of temporal logic; past and future formulae; specification of properties by temporal logic and predicate automata; a hierarchy of temporal properties; temporal proof principles for safety and precedence properties; temporal proof principles for responsiveness and general liveness properties; assertional proof methods. Prerequisite: 257.

3 units, alternate years, given 1989-90


3 units (Floyd) alternate years, given 1989-90

359. Topics in Theory of Computation—Advanced material is often taught for the first time as a "topics" course, perhaps by a faculty member visiting from another institution. Students may therefore enroll repeatedly in a course with this number. See the Time Schedule for topics currently being offered.

by arrangement

360. Analysis of Algorithms — An advanced course primarily for students doing specialized work in the analysis of algorithms. Presents each of the important paradigms used to analyze algorithms exactly. Combinatorial approaches, generating functions, techniques for exact solution of recurrences, functional operators, and asymptotic methods are studied in connection with important algorithms for sorting and searching.

3 units, alternate years, given 1989-90

361. Probabilistic Methods in Combinatorics — Examples based on expected values. Modified random constructions and their uses. The second moment method. Random graphs, thresholds, and 0-1 laws. Discrepancy phenomena in hypergraphs and geometry. The Lovasz local lemma and its applications. Martingales as a tool to prove concentration of measure. Prerequisites: Some previous exposure to combinatorics, (e.g. 161, 363) and probability, or consent of instructor.

3 units, Win (Linial) TTh 9:30-10:45

363A. Combinatorial Algorithms — Advanced data structures and algorithms for priority queues, path compression, minimum spanning trees, searching in graphs, strongly connected components, lowest common ancestors, planarity testing, graph isomorphism, pattern matching, shortest paths, transitive closure, boolean matrix multiplication, maximum matching and maximum network flow. Prerequisites: 262, 263, or equivalents.

3 units

363B. Combinatorial Algorithms — Scheduling, flow analysis, graph separators and applications, concentrators, boolean networks, sorting networks, computation in groups, lattices, linear and integer programming, vertex elimination and sparse systems, approximation algorithms for NP-complete problems. Prerequisite: 363A.

3 units

364. Combinatorial Optimization— (Same as Operations Research 349.) Algorithms for optimization of combinatorial structures. Topics:
shortest paths, maximum flows, minimum-cost flows, bipartite matching and assignment problem, general matching, stable marriage, and linear programming and may include approximation algorithms for NP-hard problems and integer programming. Prerequisites: 151 and 161 or 264, or equivalent.

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


3 units


3 units

367A. Parallel Computation — Parallel machine models, parallel computation thesis, interconnection networks, properties of VLSI layouts, area-time tradeoffs and lower bounds; sorting, routing, and other basic algorithms and their efficient implementation in VLSI and other models of parallel computation. Prerequisites: 161, 264, and 351, or equivalents.

3 units (Staff) alternate years, given 1989-90

367B. Parallel Computation—Principles for the design of parallel algorithms, systolic architectures and algorithms, shared memory management; complexity bounds for parallel computations; P-complete problems and algorithms. Prerequisite: 367A or equivalent.

3 units (Staff) alternate years, given 1989-90

368. Computational Geometry—An advanced course on the design and analysis of geometric algorithms. Emphasizes the data structures of general usefulness in geometric computing and the conceptual primitives appropriate for manipulating them. Basic topics: convexity, intersection and range query problems, point location in subdivisions, and sweep-line methods. Additional topics vary yearly: visibility and decomposition problems, collision avoidance and shortest path questions, the use of geometric duality, etc. Prerequisite: 261.

3 units

369. Topics in Analysis of Algorithms — Advanced material is often taught for the first time as a "topics" course, perhaps by a faculty member visiting from another institution. Students may therefore enroll repeatedly in a course with this number. See the Time Schedule for topics currently being offered.

by arrangement

371. Medical Decision Analysis—(Same as Engineering Economic Systems 235, Medical Information Sciences 235.) The use of decision analysis in medical practice. Student teams analyze specific clinical decision problems as a term project. Topics: the decision making role of patients and physicians, medical preference models, assessing decision models in a clinical context, medical ethics, and designing and using automated medical decision tools. Prerequisites: Engineering Economics Systems 31 or 231, or equivalent. No formal medical background is required.

4 units, Spr (Holtzman, Matheson) MWF 3:15-4:30


3 units, Aut (Winograd) not given 1989-90

379. Interdisciplinary Topics—Advanced material that relates computer science to other disciplines is often taught for the first time as a "topics" course, perhaps by a faculty member visiting from another institution. Students may therefore enroll repeatedly in a course with this number. See the Time Schedule for topics currently being offered.

by arrangement

393. Computer Laboratory—A substantial computer program is designed and implemented. A detailed written report is required. Recommended as a preparation for dissertation research. Intended for graduate students of Computer Science; consent of instructor required. Register using the section number associated with the instructor.

any quarter (Staff) by arrangement

395. Database Project—Use of database management or file systems for a substantial application. A detailed written analysis and evaluation is required. For graduate students of Computer Science; consent of instructor required. Register using the section number associated with the instructor.

any quarter (Staff) by arrangement
399. Independent Project.
any quarter (Staff) by arrangement

EXPERIMENTAL

409. Topics in Knowledge-Based Software Environments—Knowledge-based environments for the production and evolution of software. Topics: wide-spectrum and very-high-level languages, formal specifications, correctness-preserving transformation rules, strategies for designing algorithms, data and control structure refinement, program optimization and finite differencing, knowledge-based support for project management, synthesis of concurrent programs and architectures. Individual projects included. Prerequisites: 22, 257A, 243, 261.
3 units, Aut (Green, Smith) TTh 9:30-10:45

411. Parallel Computer Architectures and Programming—Part 1 (parallel computer hardware); general principles and design space; and research and commercial parallel machines including shared-memory, message-passing, dataflow, systolic, and massively parallel architectures. Part 2 (parallel programming models and languages); brief survey of parallel programming models and languages, and study of techniques for communication and synchronization. Part 3 (applications); implementation trade-offs dealing with granularity, communication, data access patterns, and load balancing, using example programs corresponding to real applications. Programming to be done on one or more commercial multiprocessors. Prerequisites: 213, programming experience, and some familiarity with operating systems.
3 units, Win (Gupta) TTh 11-12:15

3 units, Aut (Rivin) TTh 1:15-2:30

426. Genetic Algorithms and Their Applications—Genetic algorithms are mathematical algorithms for search, optimization, and machine learning patterned after the evolutionary processes of reproduction and survival of the fittest. Topics: mathematical justification for genetic algorithms; applications to game-playing, function optimization, pattern recognition, self-programming computers, and permutation-type problems such as the Traveling Salesperson Problem; parallel implementations; and Holland Classifier systems.
3 units, Aut (Koza) TTh 1:15-2:30

441. Topics in Ada Programming—The Ada language is used for discussing current research in high level languages for programming large systems and distributed systems. Related developments are discussed. Part 1 (the Ada language design and programming techniques): multi-task programming, compilation algorithms for tasking, runtime supervisors for distributed systems in Ada, detection of concurrency errors; comparison of Ada with other high level concurrent languages. Part 2: design of specification languages related to Ada, specification, validation and verification methods for multi-task programs; environments for programming with specifications. Prerequisite: 107.
3 or 4 units, Aut (Luckham) TTh 1:15-2:30

3 units, Win (Hoffman)

499. Advanced Reading and Research—For graduate students in Computer Science; consent of instructor required. Register using the section number associated with the instructor.
any quarter (Staff) by arrangement

GRADUATE SEMINARS

510. Digital Systems Reliability Seminar—(Enroll in Electrical Engineering 385A.) Student-faculty discussions of research problems in the design of reliable digital systems. Specific areas include fault-tolerant systems, design for testability and system reliability. Emphasis on student presentations and Ph.D. thesis research.
1-4 units, Aut (Staff)
Win, Spr (McCluskey)

520. Survey of Research Topics in Artificial Intelligence—(Same as Psychology 224.) A survey of current research in AI. Topics vary yearly. Some current research topics: machine learning and discovery, speech or image or language understanding, automatic programming, formal reasoning, nonmonotonic logic, game playing, intelligent computer assisted instruction, knowledge representation and expert systems. The course often involves distinguished outside lecturers who are specialists in these research topics. Prerequisite: 123 or 221, or equivalent.
1 unit, Spr (Staff) T 11-12:15

1-3 units, any quarter (Staff) F 12:05-1:30 by arrangement
523. 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 AI qualifying exam. Prerequisite: 221. 
3 units, Win (Shoham)

524. Seminar on Rule-Based Expert Systems—(Same as Medical Information Science 229.) Graduate seminar for students wishing to gain historical perspective and a technical understanding of the last decade’s research on rule-based expert systems in the Knowledge Systems Laboratory. Past work is related to expert systems research directions for the 1980’s. Emphasis on an analysis of the research lessons of MYCIN and related projects of the KSL, the strengths and limitations of the rule-based approach to knowledge representation, and the way in which AI research evolves as new ideas and concepts are discovered. Prerequisites: 22, 221, or equivalents. Enrollment limited to 20. 
2 units, Spr (Shortliffe, Musen) W 3:30-5

527. Robotics Seminar—Recent research in the areas of computer vision, manipulation, and mobility; geometric modeling and CAD/CAM. Invited speakers present recent results and summaries of articles from the current literature. 
1 unit, Aut, Win, Spr (Binford) M 4:15

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

540. 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)

545. Database Research Seminar—Presentations of current research and industrial innovation. Emphasis on discussion and evaluation. Topics: database models, high performance algorithms, and application of artificial intelligence techniques to large and distributed databases. 
1-3 units, Aut, Win, Spr, Sum (Wiederhold) F 3:15

548. Distributed Systems Research Seminar—Recent research in the areas of distributed operating systems, computer communications, parallel machines, parallel programming, and distributed applications. Invited speakers from Stanford and elsewhere present topics and results of current interest. Primarily appropriate for Ph.D. students and other researchers in these areas. 
1 unit, Aut, Win, Spr (Cheriton) Th 4:15

801. TGR-M.S. Project. 
any quarter (Staff) by arrangement

802. TGR-Ph.D. Dissertation. 
any quarter (Staff) by arrangement
Students desiring to specialize in Electrical Engineering (E.E.) during their undergraduate period may do so by following the depth sequence given earlier in the general discussion of the School of Engineering.

Majors must receive at least a 2.0 average letter grade indicator (LGI) in courses taken for the E.E. depth requirement.

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 coterminal section in this bulletin.

GRADUATE PROGRAMS

The practice of the profession of Electrical Engineering demands a strong foundation in physical science and mathematics, a broad knowledge of engineering techniques, and an understanding of the relation between technology and man. Curricula at Stanford are planned to offer the breadth of education and depth of training necessary for leadership in the profession. For those who wish to engage in this profession with competence, four years of undergraduate study and at least one year of postgraduate study are strongly recommended. For those who plan to work in highly technical development or in fundamental research, additional graduate study is desirable.

A one-year program of graduate study in electrical engineering may lead to the degree of Master of Science. A two-year program, offering wider selection of engineering course work, more opportunity for study in the related fields of physics, mathematics, and engineering, and in particular more independent work and individual guidance, may lead to the degree of Engineer.

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

APPLICATION FOR ADMISSION

Applications for admission with graduate standing in Electrical Engineering are made to the Graduate Admissions Office, Building 590, 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.

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. The master’s program proposal must be turned into the department office during the first quarter of graduate study (modifications may be made later). Supplementary information sheets which provide the detailed requirements, instructions, and a worksheet are available from the department office.

Programs of at least 42 quarter units that meet the following guidelines will normally be approved:

UNDERGRADUATE PROGRAMS

Students desiring to specialize in Electrical Engineering (E.E.) during their undergraduate period may do so by following the depth sequence given earlier in the general discussion of the School of Engineering.

Majors must receive at least a 2.0 average letter grade indicator (LGI) in courses taken for the E.E. depth requirement.

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 coterminal section in this bulletin.

*On leave one or more quarters
1. A sequence of three or more graded electrical engineering courses numbered above 200, to provide depth in one area. The student must maintain an average 3.0 letter grade indicator or better in both the depth area and overall.

2. At least one electrical engineering course numbered above 200 in each of three additional course areas, outside of the area selected under (1) to provide breadth.

3. Enough additional units of electrical engineering courses so that items 1 through 3 total at least 21 units of graded electrical engineering courses numbered above 200, including at least 9 units of such courses numbered in the 300's or 400's. Some 600 or 700 level summer courses may also be considered for inclusion in the M.S. program.

4. At least three courses (9 units minimum) outside the depth area to increase the breadth of the degree program.

5. At least three quarters of 200, 201 seminar. (In case of time conflict, tapes of these classes can be checked out in the Terman Library.)

6. Additional courses, such as undergraduate electrical engineering courses, to bring the total to 45 or more quarter units, at least 36 units of which must be courses in which letter grades are given.

Capable students without formal undergraduate preparation in electrical engineering may also be admitted for graduate study. Such students may have graduated in any field and may hold either the B.S. or A.B. degree. Each student, with the help of an advisor, prepares a program of study to meet his or her particular needs and submits it to the faculty for approval. A student with adequate preparation in mathematics through calculus and college physics including electricity can usually complete the M.S. degree requirements within two academic years. A student with some additional preparation in electrical engineering may be able to complete the M.S. requirements in only one academic year.

Graduate study in electrical engineering is demanding, and it is essential that students be adequately prepared in physics, mathematics, circuits, fields, electronics, digital systems, and laboratory work. The ability to take advantage of modern computing facilities is an essential skill for electrical engineers, and an increasing number of our courses routinely require it. Every student should acquire this skill early in the program, either by taking one of the regular computer science courses or one of the special “short courses” given by the Computation Center, or by self-study.

It is the student’s responsibility, in consultation with an advisor, to determine whether the prerequisites for advanced courses have been met. Prerequisite courses ordinarily taken by undergraduates may be included as part of the graduate program of study. However, if the number of these is large, the proposed program should contain more than the typical 42 to 45 units, and the time required to meet the degree requirements may by 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, potential for advanced study, and on the ability of the faculty to supervise such study.

Admission to 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.

**ELECTRICAL ENGINEERING ADMINISTRATION**

The master's degree carrying the distinction “Electrical Engineering: Administration” on the diploma is conferred upon students who combine not fewer 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.

**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.) including six full-time quarters of approved work as a graduate (of which a minimum of three quarters and 36 quarter units must be in residence at Stanford).

Work toward the degree of Engineer in Electrical Engineering normally includes the re-
requirements for work toward the master's degree in Electrical Engineering, including qualifications for admission.

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 differs 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 M.S. degree in Electrical Engineering, 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 M.S. degree in Electrical Engineering, apply for admission to the Electrical Engineering Department as a candidate for the degree of Engineer.

During the first quarter of work beyond the M.S. degree, formal application for the degree of Engineer is made using the form that can be obtained from the department office. The program of study is prepared by the student with the help of the thesis advisor and submitted to academic secretary for approval. The form should contain a list of all graduate courses completed at Stanford and elsewhere and all courses yet to be completed.

**DOCTOR OF PHILOSOPHY**

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

Admission to the graduate division 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 Electrical Engineering 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 and University 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, two years 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 approved topic of research and a written dissertation, based on research, which must be a contribution to knowledge; (5) an oral examination near the completion of the doctoral program.

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's program must fulfill the M.S. depth requirement, comprise a total of at least 15 units of course work in electrical engineering and be approved by the electrical engineering Ph.D. Degree Committee. A letter grade indicator of at least 3.0 is required.

**FINANCIAL ASSISTANCE**

The department annually awards fellowships and teaching and research assistantships to graduate students. The fellowships are usually awarded only to first-year graduate students. Most of the awards to Engineer and Ph.D. candidates are research assistantships. 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 or Ph.D. thesis work and write their thesis as an integral part of their assistantships.

Applicants for all three forms of financial assistance should obtain the necessary applica-
tion forms from the Office of Graduate Admis-
sion, Old Union, Stanford, CA 94305.

THE HONORS COOPERATIVE PROGRAM

Many of the department's graduate students are supported by the Honors Cooperative Pro-
gram, which makes it possible for academically qualified engineers and scientists in nearby
companies to be part-time graduate students in Electrical Engineering while continuing nearly
time full-time professional employment (see the "School of Engineering" section of this bul-
letin).

AREAS OF RESEARCH

Candidates for advanced degrees participate in the research activities of the department as
paid research assistants or as students of indi-
vidual faculty members. At any one time, cer-
tain 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.

COMPUTER SYSTEMS

Compilers
Computer Aided Design
Computer Architecture
Computer Networks
Computer Organization
Computer Reliability
Concurrent Languages
Concurrent Processes and Processors
Distributed Systems
Local Area Networks
Operating Systems
Performance Measurement and Modeling
Programming Environments
Programming Languages
Program Verification
Software Engineering
User Interfaces
VLSI

INFORMATION SYSTEMS

Adaptive Control and Signal Processing
Adaptive Neural Networks
Biomedical Signal Analysis
CAD and Analysis of Systems
Cryptography and Data Security
Data Communications
Digital Signal Processing
Estimation Theory and Applications
Fourier and Statistical Optics
Information and Coding Theory
Medical Imaging
Multivariable Control
Pattern Recognition and Complexity
Quantization and Data Compression
Real-Time Computer Applications
Signal Processing Algorithms and Architectures
Speech and Image Coding

INTEGRATED CIRCUITS

Application Specific Integrated Circuit Design
Bipolar, MOS, and Other Devices and Circuit Technologies
Computer-Aided Analysis and Design
Custom Integrated Circuits for Computers and Telecommunications
Digital Integrated Circuits
Integrated Sensors and Transducers
Linear Integrated Circuits
Optoelectronic Integrated Circuits
Process, Device, and Circuit Modeling
Semiconductor Manufacturing
VLSI Device Structures and Physics
VLSI Fabrication Technology

LASERS AND QUANTUM ELECTRONICS

Coherent UV and X-Ray Sources
Fiber Optics
Laser Applications in Aeronautics, Biology, Chemistry, Electronics, and Physics
Laser Devices and Laser Physics
Nonlinear Optical Devices
Photoacoustic Phenomena
Picosecond Laser Pulses
Ultra-fast Optical Electronics

MICRO WAVES, ACOUSTICS, AND OPTICS

Acoustic Microscopy
Acousto-optic Devices
Fiber Optics
Holography
Microwave Integrated Circuits and Devices
Nondestructive Testing
Scanning Optical Microscopes

SOLID STATE

Applied Superconductivity
Crystal Preparation: Epitaxy and Ion Implan-
tations, and Molecular Beam Epitaxy
Defect Analysis in Semiconductors
Electron Spectroscopy
Electronic and Optical Properties of Solids
Generation of Focused Particle Beams
Laser, Electron, and Ion Beam Processing and Analysis
Microstructure Fabrication and Applications
Molecular Beam Epitaxy
Novel Packaging Approaches for Electronic Systems
Physics and Chemistry of Surfaces and Interfaces  
Semiconductor and Solid State Physics  
Solar Energy Conversion  
Solid State Devices: Physics and Fabrication  
Tunneling Microscopy  

**SPACE PHYSICS AND RADIOSCIENCE**

Computer Simulation of Wave-Particle Interactions  
Electromagnetic Waves and Plasmas  
Electron Beam Experiments in Space  
I onospheric and Magnetospheric Physics  
Planetary Exploration  
Propagation Studies of Winds and Turbulence  
Radio Wave Scattering  
Remote Sensing of Atmospheres and Surfaces  
Solar-Terrestrial Interactions  
Space Engineering  
(also see Space Science and Astrophysics)  
Space Plasma Physics  
Space Vehicle Electrodynamics  
Very Low Frequency Wave Propagation  
VLF Wave-injection Experiments  
Wave-induced Particle Precipitation  

**TELECOMMUNICATIONS AND SPACE INFORMATION SYSTEMS**

Communication Channels  
Digital Telephone Switching  
High Performance Digital Signal Processing  
Radar Signal Processing  
Radiating Systems  
Satellite Communication Stations  
Search for Extraterrestrial Intelligence  
Space Data Management  
Telephone and Data Networks  
Voice Signal Processing  
Underwater Communications  

**COURSES**

**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

The Electrical Engineering Department offers graduate courses in the following areas:

- Communications and Information Theory
- Computer Applications and Systems
- Electromagnetic Theory and Microwave Devices
- Electronic Circuits and Devices
- Information Processing
- Integrated Circuits and Systems
- Modern Optics and Optical Devices
- Quantum Theory and Applications
- Radioscience
- Solid State Devices
- Solid State Materials and Properties
- Space Plasma Physics
- Systems and Control Theory
- VLSI

Descriptions of courses are found in the following pages.

**UNDERGRADUATE**

Attention is called to courses listed under the "Engineering" section of this bulletin that may be of special interest to electrical engineering undergraduates.

100. Seminar—Weekly discussion of special topics of interest to electrical engineering undergraduates: research in E.E., the department, graduate schools, employment opportunities, and state-of-the-art technology.  
1 unit, Aut (Shott) M 3:15

3 units, Aut (Helliwell) MWF 9  
Win (Hellman) MWF 9

3 units, Aut (Peterson) MWF 9  
Spr (Franklin) MWF 9

3 units, Aut (Peterson) MWF 9  
Spr (Franklin) MWF 9
106. Planetary Exploration—The other worlds of our solar system as revealed by recent space missions. Comparative properties of the terrestrial and Jovian planets; planetary atmospheres, surfaces, interior rings; planetary and satellite orbits and spacecraft trajectories, orbital perturbations; properties of the interplanetary gas, dust, comets, and meteorites. What the planets can tell us about potential terrestrial catastrophes (nuclear winter, runaway greenhouse, collision with an asteroid or large comet). Origin and evolution of planetary systems. Remote sensing from spacecraft at radio, infrared, light, and ultraviolet wavelengths. U.S. and Soviet space programs and their comparative engineering and scientific aspects. Prerequisite: One year of college engineering, mathematics, or physics. (DR:8)

3 units, Spr (Eshleman) MWF 9

111. Electronics I — Basic solid-state devices, integrated circuits. Physical principles of charge motion in doped semiconductors leading to the operating principles and device equations for MOS capacitors and transistors. Integrated circuit fabrication techniques. Small signal models of MOS transistors. Prerequisite: Engineering 40.

3 units, Aut (Siegmam) MWF 10

Win (da Rosa) MWF 11

112. Electronics II—Basic MOS amplifier design including DC and AC characteristics. Introduction to NMOS and CMOS digital logic including switching speed, power consumption, programmable logic arrays, and gate arrays. Operating principles and device equations for p-n junction diodes and transistors. Prerequisites: 101, 111.

3 units, Win (Siegmam) MWF 10

Spr (da Rosa) MWF 11

113. Electronic Circuits—Bipolar amplifier design including DC bias, small signal models, multi-stage amplifiers, and frequency compensation. Design and use of bipolar operational amplifiers as signal processing elements. Bipolar logic and memory design including gate array and ECL circuit configurations. Introduction to electronic systems. Prerequisites: 102, 112.

3 units, Aut (da Rosa) MWF 11

Spr (Staff) MWF 10

121. Digital Design Laboratory—Introduction to digital circuits and their applications. Topics: measurement technique, logic families, switching speed, Boolean algebra, state machines, digital data transmission, analog and digital converters, and digital displays. Prerequisite: Engineering 40.

3 units, Win, Spr (Wakerly) TTh 1:15 plus 3-hour lab weekly by arrangement

122. Analog Laboratory—Design and testing of analog circuits. Transistor amplifier with feedback; discrete components differential amplifier; op-amps and their applications; active filters and oscillators; regulated power supplies; class AB power amplifier; AM and FM communications. Corequisite: 113.

3 units, Aut (da Rosa) TTh 9:30-10:20

Spr (da Rosa) MW 3:15

plus 3 hour lab weekly by arrangement

139. Design Project—A laboratory 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 make a team and propose a project. Requirements: a report giving details of the project and test results, a presentation to the class of the design features, and the constructed (hopefully, working) project. Those primarily interested in digital circuits or microprocessors should take 183 or 281. Class limited to 15. Prerequisite: 122.

3 units, Win, Spr (McWhorter) Th 1:15 plus lab by arrangement


3 units, Aut (Quate) MWF 1:15

Win (Banks) MWF 2:15


3 units, Spr (Banks) MWF 2:15


3 units, Spr (Banks) MWF 2:15

183. Advanced Logic Laboratory—Experiments in digital logic design using TTL integrated circuits, including SSI gates and flip-flops. MSI registers and ALU’s, and LSI mem-
ories and PLA’s. 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. Class size limited. Prerequisite: 121 or equivalent.

3 units, Aut (Flynn) MWF 3:15
Win, Spr (Staff) MWF 3:15
plus 4 hour lab by arrangement

190. Special Studies or Projects in Electrical Engineering—Independent work under the direction of a faculty member. Individual or team activities involving laboratory experimentation, design of devices or systems, or directed reading. Graded on a Pass/No Credit basis.

by arrangement

191. Special Studies and Reports in Electrical Engineering—Independent work under the direction of a faculty member. A letter grade is given on the basis of the required written report or examination. If a letter grade based on written work is not appropriate, student should enroll in 190.

by arrangement

192. Special Seminars—Each year special seminars and experimental courses are given on topics of current interest. These are usually announced one or two quarters prior to their presentation and are given by specialists in the field. See the Time Schedule and bulletins in the department office.

by arrangement

UNDERGRADUATE AND GRADUATE

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/No-credit only. Students with a conflict may view seminar via videotape in the library.

200A. 0 units, Aut (Linvill) Th 11
200B. 0 units, Win (Pantell) Th 11
200C. 0 units, Spr (Manning) Th 11

201A, B, C. Seminar—Weekly discussion of special topics of current interest in electrical engineering. Speakers from faculty and from outside the University. Normally graduate students are required to enroll each quarter. Given for Pass/No-credit only. Students with a conflict may view seminar via videotape in the library.

201A. 1 unit, Aut (Linvill) Th 11
201B. 1 unit, Win (Pantell) Th 11
201C. 1 unit, Spr (Linvill) Th 11

202. Medical Electronics—Primarily biological in nature. Introduces electrical engineers to the physiological and anatomic aspects of medical monitoring and imaging. Biological content, transducers, electronic systems, the socio-economic impact, and the constraints unique to medicine. Presumes no biological background, but some familiarity with circuits and electrical instrumentation techniques (e.g., 113) make it more meaningful.

3 units, Aut (Thompson) TTh 4:15-5:30

205. The Entrepreneurial Engineer—A seminar to further the knowledge base of prospective entrepreneurs with an engineering background. Major content includes contributions made to the business world by engineering graduates. Speakers include Stanford (and other) engineering and MBA graduates who have founded large and small companies in nearby communities. Also, contributions from E.E. faculty members and other departments, law, business, and industrial engineering.

1 unit, Win (Melen) T 11

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 and IC's in these highly nonlinear circuits. Prerequisite: 113 or equivalent.

3 units, Aut (MeWhorter) MWF 10

212. 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. Designed to be taken Autumn Quarter by students who will be using the laboratory facilities for doctoral research. Prerequisite for 410. Those interested in the course as part of their breadth sequence may take it either Autumn or Spring Quarter. Prerequisite: 112 or equivalent.

3 units, Aut (Staff) TTh 1:15-2:30
Spr (Plummer) TTh 9:30-10:45

213. Digital Integrated Circuit Analysis and Design—The internal component-level design of digital integrated circuits is considered for bipolar (TTL, ECL and IIL) and MOS (NMOS and CMOS) technologies. Using first-order nonlinear device models, hand calculations and circuit simulation are used to design gates and small-scale digital IC’s. The SPICE program is used as a circuit analysis tool (no programming required). Design considerations include DC
transfer characteristics and transient behavior. Prerequisite: 112 or equivalent.

3 units, Aut (Wooley) TTh 9:30-10:45

216. Principles and Models of Semiconductor Devices—Fundamentals of carrier generation, transport, recombination, and storage in semiconductors. Physical principles of operation of the p-n junction, metal-semiconductor contact, bipolar junction transistor, MOS capacitor, MOS and junction field-effect transistors, and related devices such as CCD’s and solar cells. First-order device models that reflect physical principles and are useful for integrated-circuit analysis and design. Prerequisites: 111, 112 for undergraduates, none for graduates (though equivalent of 111, 112 is recommended).

3 units, Aut (Plummer) MWF 2:15
Win (Lincoll, Fazarine) MWF 11

217. Electron and Ion Beams for Semiconductor Processing—Focused and flood beams of electrons and ions are employed for processing semiconductor devices. Part I: the generation of such beams including thermionic emission, field-induced emission, first-order focusing and glow discharge processes. Part II: the interactions of such beams with the target including scattering in solids, the distribution of energy, heating, sputtering, beam-induced etching (including reactive-ion etching) and beam-induced deposition. Introduction to computer modeling of etching and deposition. Prerequisite: 212 or equivalent.

3 units, alternate years, given 1989-90

218. Semi-custom VLSI Systems—Introduction to the architectures and design automation of semi-custom integrated circuits. “Hands-on” experience in designing a processor using semi-custom tools. Lecture topics: semi-custom design methodology; design entry, CMOS macro library, simulation, automated placement and routing, and testing; performance optimization for macro library-based design; packaging; power and ground distribution; routability analysis; sea of gates; EPROM and EEPROM-based programmable logic arrays; programmable gate arrays. Prerequisites: Basic knowledge of digital systems, logic design at the level of 182 and CMOS circuits at the level of 112, or consent of instructor.

3 units, Win (El Gamal) MWF 1:15
plus lab by arrangement

221. Linear Active Circuits—Analysis and design of discrete and integrated circuits. Properties of common building blocks at low and high frequencies. Circuits, such as active filters, using operational amplifiers. Filter functions for high, low, and bandpass filters. Introduction to noise limitations in amplifiers. Prerequisites: 102, 113.

3 units, Win (McWhorter) MWF 10

228. Basic Physics for Solid State Electronics—Intended as a prerequisite for graduate level courses in physics of solid state devices. Topics: a review of classical kinetic theory, introduction to statistical mechanics, and introduction to the band theory of solids. Prerequisite: Physics 57 or equivalent.

3 units, Aut (J. Harris) TTh 9:30-10:45

231. Lasers—Introduction to lasers and how they work, including quantum 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 241, and some knowledge of atomic or modern physics at an advanced undergraduate level, such as 238, Engineering 50, Physics 130-131.

3 units, Aut (Bloom) MWF 11

232. Lasers—Continuation of 231. More detailed coverage of selected topics in lasers, optics, quantum electronics. Prerequisite: 231.

3 units, Win (Staff) MWF 9

238. Electrical and Magnetic Properties of Solids—Electrical and magnetic properties of solids from a fundamental point of view. Introduction to band theory, surface states, dielectric and ferroelectric materials, magnetic materials, ferromagnetism, and superconductivity. Emphasis on physical understanding. A large amount of material is systematized using the twin concepts of extended wave functions (transport, band theory, etc.) and more localized wave functions, ferroelectricity, ferromagnetism. Prerequisites: 111 and Physics 57, or graduate standing.

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

239A. Solid State Theory—(Enroll in Applied Physics 271.)

239B. Solid State Theory—(Enroll in Applied Physics 272.)

241. Waves I—Introduction to waves and wave phenomena as they appear in different natural, laboratory, and application settings. Electromagnetic, acoustic, seismic, atmospheric, plasma, and water waves and their mathematical and physical correspondence in terms of Hamilton’s principle. Propagation, attenuation, reflection, refraction, surface and laminal guiding, and intrinsic and structural dispersion; energy density, power flow, and phase and group velocities. Geometrical and structural complexities are minimized to stress basic wave concepts common to diverse fields of applica-
tion. Analysis in terms of transmission line and impedance concepts using exponential notation and vector phasors. Treatment limited to plane harmonic waves in isotropic media. Nonhomogeneous cases limited to plane interfaces and exponentially stratified media. Prerequisite: 142 or equivalent or other wave course.

3 units, Aut (Eshleman) MWF 9

242. Waves II—Continuation of 241 emphasizing fundamental topics for further study and application of microwave, optical, acoustic, or plasma phenomena. Plane, cylindrical, and spherical waves and boundary value problems; radiation, dipole and array antennas, interferometers, and reciprocity; wave guides, fiber optics, and acoustic delay lines. Uniaxial and gyrotropic anisotropic media with magnetoionic plasma, and ferrite applications. Non-linear effects. Mode coupling, resonators, and gaussian wave packets. Prerequisite: 241.

3 units, Win (Eshleman) MWF 10


3 units, Win (Pantell) MWF 11

244A. Communication Engineering Telephony—Current design problems in telephone switching and transmission systems: telephone traffic characteristics and important models, voice digitization and multiplexing, analog and digital switching systems, transmission of analog and digital voice and data on wire, cable, and fiber optics, subscriber loop and long distance transmission design and related international standards, and new design problems for Integrated Service Digital Networks (ISDN). Prerequisite: Senior or graduate standing or permission of instructor.

3 units, Aut (Lusignan) TTh 2:45-4

244B. Communication Engineering Transmis-
sion Systems—The design of transmission systems for television, telephone and data-using satellites, microwave repeaters, mobile radio, and broadcast transmitters. Performance of FM, AM, SSB common digital schemes and spread-spectrum modulation, time frequency, and code multiplexing. Emphasis on link performance, capacity, total system design, and cost optimization. Introduces current industry design problems and research results. Prerequisite: Senior or graduate standing in Electrical Engineering, or permission of instructor.

3 units, Win (Lusignan) TTh 9:30-10:45

245. Wave Measurement Techniques—Combined lecture and laboratory on experimental techniques used for measurement of waves. The techniques employed are common to several fields. Experiments are selected from the following examples related to research at Stanford: measurements with the HP network analyzer of impedance, reflection coefficient and circuit parameters in the frequency and time domain. Fiber-optic waveguide measurements, optical diffraction, noise from optical detectors, scanning optical microscope, ultrasonic waves and acousto-optic diffraction. Prerequisite: 142 or equivalent. Registration by consent of instructor. Enrollment limited to 15.

3 units, Spr (Kino) TTh 9:30-10:20

246. Microwave Circuit Theory—A coherent development of the concepts and applications of distributed circuits. Emphasis on MIC structures (microstrip, coplanar waveguide, slotline, finline, and imageline) capable of transmitting millimeter wave analogue signals and picosecond pulses. Modal properties (TEM, quasi-TEM, TE, TM) of general waveguides. Higher order mode excitation effects at discontinuities (steps, bends, etc.) and junctions are modeled by lumped equivalent circuits, using Z- Y- and S-matrix representations. Dispersion, attenuation, and distributed source excitation in distributed circuits. Analysis of circuit components (impedance transformers, directional couplers, hybrids, circulators, filters, solid state amplifiers). Illustrations given of IC circuit structures. Computer-aided design principles. Recommended: 142 or equivalent.

3 units, Win (Staff) MWF 2:15

249. Introduction to Space, Telecommuni-
cation, and Radioscience—Experimentation in the near-earth environment using radio waves and other probes. The STAR environment: earth, ionosphere, magnetosphere, interplanetary space, planetary environments. Tools including transmitters, antennas, receivers, sensors, radars, displays. Telecommunications. Electromagnetic waves, acoustic waves, gravity plasmas. Applications to current experimental programs. Planning and execution of experiments. Prerequisites: Familiarity with electromagnetics at the level of Physics 53 and senior or graduate standing.

3 units, Aut (Banks) MWF 1:15

alternate years, not given 1989-90

250. Communications Design Seminar—Seminars on recent developments in telecommunications research, including fiber-optic networks, high-speed switching, voice and data processing, packet radio, and satellite applications. Speakers are from Stanford laboratories and the telecommunications industry.

1 unit, Aut, Win, Spr (Lusignan) T 4:15
262. Two Dimensional Imaging—Two dimen-
sional autocorrelation, Fourier spectra, spatial
frequencies, diffraction, antennas, Hankel and
Abel transforms, circular symmetry, line integra-
tion, two dimensional impulses and sam-
pling, restoration, principal solution, restoring
with noise and correlation, reconstruction from
line integrals, mapping instrumentation, applica-
tions to various fields. Prerequisite: 261 or equivalent.
3 units, Win (Bracewell) MWF 3:15

263. Digital Signal Processing—An introduc-
tion to computer-implemented signal process-
ning systems. Digital impulse response and
transfer functions; convolution; sampling theory;
z-transforms; digital Fourier transforms; FFT
algorithms; filters; generation of stochastic
signals; digital Wiener filters. Prerequisite: 102.
3 units, Aut (Widrow) TTh 9:30-10:45

272A. Design Projects in VLSI Systems—Ex-
perience in designing large-scale MOS ICs.
Working in teams of two, students must com-
plete modest-sized CMOS projects through lay-
out, simulation, and design-rule checking.
Topics: design tools and techniques—instruc-
tion on the use of computer tools; common
design problems and some solutions to them;
testing and testability; and floor planning and
communication. Intended for students with re-
search and applications interest in VLSI sys-
tems. Students taking 272A are expected to take
272B for at least one unit. Prerequisites: 271,
experience with timesharing facilities.
4 units, Win (Horowitz) Th 1:15-2:30
plus lab by arrangement

272B. Testing and Simulation of VLSI Sys-
tems—A continuation of 272A, principally for
simulating, testing, and elaborating projects
designed in 272A. Students must functionally
simulate and test their projects and report the
results. By arrangement, students may under-
take more extensive work for additional credit.
Lectures include simulation and testing tech-
niques used in the laboratory. Prerequisite: Completing the 272A design project.
1 unit, Spr (Horowitz) TTh 9:30-10:45
plus lab by arrangement

3 units, Aut (Hellman) TTh 1:15-2:30
win (Tobagi) TTh 9:30-10:45

279. Introduction to Communication Systems—Analysis and design of communication systems; analog and digital modulation and demodulation, frequency conversion, multiplexing, noise and quantization; spectral and signal-to-noise ratio analysis. Prerequisite: 278 and 102 or 261.
3 units, Win (Gray) MWF 3:15

281. Microcomputer Laboratory—Introduction to a specific microprocessor, e.g., the Zilog Z-80. Lectures covering the programming and design of a microcomputer system are accompanied by laboratory exercises. A final laboratory project is required. Prerequisites: 182 or equivalent, and some hands-on experience with TTL logic, such as 121 or 183.
3 units, Aut (Gill) TTh 2:45-4
Win (Peterson) TTh 9:30-10:45
plus lab by arrangement

282. Computer Architecture and Organization—Structure of systems using processors, memories, input/output (I/O) devices, and I/O interfaces as building blocks. Computer system instruction set design and implementation, including memory hierarchies and pipelining. Issues and tradeoffs involved in the design of computer system architectures with respect to the design of instruction sets. Prerequisite: 182.
3 units, Aut (Hennessy) TTh 1:15-2:30
Spr (Staff) TTh 4:15-5:30

283. Compilers—(Enroll in Computer Science 143A.)
3 units, Win (Tobagi) TTh 9:30-10:45

285. Programming Languages—(Enroll in Computer Science 242.)
286A,B. Operating Systems—(Enroll in Computer Science 240A,B.)
288. Software Engineering Laboratory—(Enroll in Computer Science 194.)

292. Special Seminars—Each year special seminars and experimental courses are given on topics of current interest. These are usually announced one or two quarters prior to their presentation and are given by specialists in the field. See the Time Schedule and bulletins in the department office.

3 units, Aut (da Rosa) MWF 3:15

3 units, Win (da Rosa) MWF 3:15

GRADUATE

310. Integrated Circuits Technology and Design Seminar—In-depth treatment of technology and circuit design problems in integrated circuits. Designed to complement topics in 212 (Aut), 313 (Win), 314 (Spr) and 315 (Spr).
1 unit, Aut (Plummer) T 4:15
Win (Wooley) T 4:15
Spr (Saraswat) T 4:15

311. Characterization and Computer Modeling of Semiconductor Devices—Computer simulation techniques for IC process and device modeling. Use of SUPREM for process modeling and SEDAN for device analysis to characterize effects such as bipolar current gain and MOS threshold voltage. Model parameter extraction for SPICE. Prerequisite: 216.
3 units, Win (Staff) TTh 2:45-4

of simple approximations and computer-aided circuit analysis. Transistor-level design techniques for implementing specific digital circuit functions. Logic and memory subsystem considerations. Adjunct to courses in VLSI architecture and layout. Prerequisite: 213 or equivalent.

3 units, Win (Wooley) TTh 9:30-10:45

314. Bipolar Analog Integrated Circuits—Discussion, analysis, and design of bipolar analog IC's, emphasizing quantitative study of circuit performance, figures of merit, limitations, and recent techniques for optimization. Topics: linear IC's—operational amplifiers, wide-band, high-frequency and low-noise amplifiers; quasi-linear circuits for signal processing—multipliers and translinear circuits; plus phase-locked loops, A-to-D and D-to-A converters. Prerequisites: 216 or equivalent, and 221.

3 units, Spr (Angell) TTh 8-9:15


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

316. VLSI Devices and Technology—In modern VLSI technologies, MOS and Bipolar device electrical characteristics are very sensitive to structural details and hence to fabrication techniques. How VLSI devices and circuits are fabricated and what future changes are likely. Implications for device electrical performance caused by fabrication techniques, physical models for submicron structures, point defect mechanisms in fabrication technology, control of electrical characteristics (threshold voltage, breakdown voltage, current gain) in small structures, and alternative device structures for VLSI. Prerequisites: 212, 216, or equivalent.

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

317. Microlithography—Fundamentals of exposure and development of resist patterns down to sub-micron dimensions. The interaction of the exposing radiation with resists and the generation of high quality images using light, x-rays, electrons, and ions. Some "hands-on" computer simulation of the exposure and development of patterns in resist. Prerequisites: 212 and basic competence in computing.

3 units, Win (Pease) MWF 8 alternate years, not given 1989-90

318. Computer-Aided Design of VLSI Systems—Presentation of techniques for computer-aided synthesis of VLSI circuits. Topics: layout compaction, procedural design and module generation; partitioning, placement, and routing; PLA and gate matrix compaction; structural and logic synthesis. Provides a theoretical framework for understanding the CAD problems. Heuristic, deterministic and probabilistic algorithms. VLSI design problems using existing CAD tools, and developing algorithms and tools for specific applications. Prerequisite: 271 or consent of instructor. Recommended: Familiarity with algorithm development and programming.

3 units, Win (De Micheli) TTh 4:15-5:30

319. Integrated Systems Laboratory—Students do a group CAD project (e.g., a synthesis system for a particular VLSI design style), or a system level design project (e.g., a board level system involving semi-custom ICs). Lectures present topics related to the project area (e.g., design representation and capture); simulation and verification techniques; synthesis systems; design management methods for large scale systems. Prerequisites: 218, 318, or consent of instructor.

3 units, Spr (De Micheli, El Gamal) MWF 11

320. Condensed Matter Seminar—(Same as Applied Physics 470.) Discussion by guest specialists, faculty, and students of research topics and current literature in solid state physics.

1 unit, Aut, Win, Spr (Kapitulnik, Spicer) Th 4

322A. Basic Quantum Mechanics—Two quarter sequence provides a firm foundation in quantum mechanics in condensed matter physics and solid-state electronics. 322A: postulates are developed emphasizing their physical interpretation. Topics: wave mechanics, probability amplitudes, matrix mechanics, the Dirac formalism, free particles, the harmonic oscillator, angular momentum, and the hydrogen atom. Prerequisites: Physics 57 or equivalent, differential equations. Recommended: Linear algebra.

3 units, Aut (Swanson) MWF 1:15


3 units, Win (Swanson) MWF 1:15

324. Applications of Quantum Theory—A unified approach involving the density matrix to
lasers, field quantization, and multiple quanta effects. Emphasis on the techniques for obtaining the appropriate equations of motion, not detailed investigation of specific devices. Topics: rate equations, spontaneous emission, laser action, infrared absorption, multiple photon absorption, relativistic quantum effects, and free-electron lasers. Prerequisite: 322B or Physics 231.

3 units, Spr (Pantell) MWF 11
alternate years, not given 1989-90

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 on understanding device operation, rather than circuit properties. 328A concentrates on charge and heat transport in semiconductors. Topics: formal transport theory, the Boltzmann transport equation and its solution, scattering mechanisms, carrier trapping and recombination, and metal contacts. 328B considers the p-n junction and MOS capacitor, and bipolar and MOS transistors. Prerequisites: 216, 228, and 328A (for 328B). Recommended: 238.

3 units, Win, Spr (Staff) MWF 3:15

329. The Electronic Structure of Surfaces and Interfaces—The basic physical concepts and phenomena for various surface science techniques probing the electronic structure of surfaces and interfaces. Microscopic and atomic models in understanding microstructures have many technologically important applications, e.g., within semiconductor device technology and catalysis. Lectures cover the basic physical processes of low energy electron diffraction, Auger electron spectroscopy, UV and x-ray photoemission spectroscopy, electron/photon stimulated ion desorption, inelastic tunneling spectroscopy, ion scattering, surface EXAFS, and energy-loss spectroscopy; and experimental aspects of these surface science techniques. Prerequisites: Physics 57 or equivalent; 238 or consent of instructor.

3 units, Aut (Lindau) TTh 8-9:15

331. The Science of Semiconductor Interfaces—Advancements in experimental (329) and theoretical capabilities have produced an explosion of scientific work on semiconductor surfaces and interfaces on an atomic level. The results and implications, practical and scientific, are covered systematically. Semiconductor-metal, -oxide, -semiconductor, and -insulator interfaces are included and correlations made between them. Emphasis on 3-5 and other compound semiconductors. Identified key concepts give unity and allow the student to follow new developments as they arise. Prerequisites: 238 or equivalent, and consent of instructor.

3 units, Spr (Spicer) TTh 1:15-2:30
alternate years, not given 1989-90


3 units, alternate years, given 1989-90

333. GaAs Process Technology—Fundamental properties of GaAs important for device fabrication. Differences in fundamental mechanisms such as diffusion, defect chemistry, and annealing from those of Si. Emphasis on fabrication procedures and techniques based on a planar direct ion implantation process in semi-insulating GaAs directed toward digital IC's, MESFET; and primary logic cells discussed in detail. Course similar to 212. Prerequisites: 228, 238.

3 units, Win (Sigmon) MW 11-12:15
alternate years, not given 1989-90

334. Superconducting Electronics—Introduction to superconducting electronics and applications. A brief introduction to the phenomena of superconductivity through a discussion of Josephson junctions and superconducting quantum devices and an analysis of promising applications in computer logic and memory, magnetometry, and low noise electromagnetic detectors and mixers in the millimeter and submillimeter wave region. Recommended: An exposure to quantum mechanics and a good grounding in electromagnetic theory.

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

337. Solid-State Characterization Laboratory—Laboratory involving experimental techniques used to characterize the electronic and optical properties of solids and solid-state devices. Present experiments: Hall Effect, Deep Level Transient Spectroscopy (DLTS), Electron Beam Induced Conductivity (EBIC), photoluminescence and optical absorption.

3 units, Aut, Win, Spr (Bates) by arrangement


339B. Thin Films and Interface Microanalysis—Enroll in Materials Science and Engineering 255.

344. High Frequency Laboratory—Combination lecture/laboratory emphasizing the lab.
Techniques in the 1MHz-1GHz range useful in designing and measuring oscillators, amplifiers, and mixers. Basic high frequency measurement techniques including S-parameter measurements. Lectures given by the professor and experts from Hewlett Packard. (Two lectures, one lab per week.) Prerequisites: A good understanding of transmission lines, Smith charts. Limited to 20 students.

3 units, Aut (McWhorter) WF 3:15-4:30

plus lab by arrangement

346. Introduction to Nonlinear Optics—Wave propagation in anisotropic, non-linear, and time-varying media. Microscopic and macroscopic description of electric dipole susceptibilities. Free and forced waves — phasematching; slowly varying envelope approximation — dispersion, diffraction, space-time analogy; harmonic generation; frequency conversion; parametric amplification and oscillation; and electro-optic light modulation. Prerequisites: 241, 242, 322A, or equivalent.

3 units, Spr (S. Harris) MWF 2:15

347. Optical Methods in Engineering Science—(Enroll in Aeronautics and Astronautics 220.)

348. Ionospheric and Magnetospheric Processes—The role of solar ionizing radiation; production, loss, and diffusion processes in the makeup of the ionosphere; thermal behavior of the ionospheric plasma; temperature and electron density profiles. The earth's magnetic field and plasma environment. Coupling processes between the upper atmosphere, ionosphere, and the magnetosphere, emphasizing mass, energy, and electric transfer. Global current system. Space plasma electrodynamics. Substorms and geomagnetic disturbances. Prerequisite: 142 or 241, or Physics 121 or equivalent.

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

alternate years, not given 1989-90

350. STAR Laboratory Seminar in Radioscience—Seminars by internal and external speakers primarily in: planetary exploration, magnetospheric and ionospheric physics, space plasma physics, radar and radio remote sensing of the environment, and information systems with space applications. Student-faculty discussions follow the seminar.

1 unit, Aut, Win, Spr (Vesecky) M 4:15-5:30

352. Electromagnetic Waves in the Ionosphere and Magnetosphere—Magnetotonic theory in multi-component media; signal dispersion; group ray velocity; wave polarization; refractive index surfaces; ray tracing; absorption; boundary effects; interpretation of natural phenomena (whistlers, VLF emissions); remote sensing in plasmas; communication; theory of wave-particle interactions in the magnetosphere. Prerequisite: 142 or equivalent.

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

alternate years, not given 1989-90

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: 241 or equivalent, or consent of instructor.

3 units, alternate years, given 1989-90

357. Microstructures Fabrication Laboratory—Laboratory projects on the application of microfabrication technologies to exploratory devices. Planar fabrication techniques including contact lithography, vacuum deposition, and chemical etching emphasized. Use of analytical instruments including the scanning electron microscope, surface profilometer, and wafer probe station. Enrollment preference to students pursuing doctoral research programs requiring the use of the Ginzton microfabrication facility. Registration by consent of instructor. Prerequisite: 212 or 333.

3 units, Sum (Bloom, Khuri-Yakub) by arrangement

358A. Lasers Laboratory—(Enroll in Applied Physics 304.)

358B. Nonlinear Optics Laboratory—(Enroll in Applied Physics 305.)

359. Remote Sensing of Planetary Atmospheres—Basic physics of the neutral atmosphere with examples from a variety of planets; thermodynamics, radiative transfer, equations of motion, waves and turbulence. Interactions between electromagnetic radiation (visible, infrared, microwave) and atmospheric media, including refraction, scattering, reflection, absorption, and emission. Techniques for remote sensing of atmospheric properties: vertical and horizontal structure, composition, circulation, energy balance, and dynamics. Applications to meteorology, environmental issues, climate studies, and solar system exploration. Comparative studies of planetary atmospheres. Recommended: 106, 142, 241, basic thermodynamics and classical mechanics.

3 units, Spr (Staff) TTh 8-9:15

alternate years, not given 1989-90

Design of controllers and observers; linear quadratic regulator. Prerequisites: 102 or Engineering 104, Mathematics 103 or equivalent.

3 units, Spr (Staff) TTh 8-9:15

363H. Introduction to Linear System Theory (Honors)—All of 363, plus additional advanced topics. Introduction to Lyapunov Stability Theory. Adjoint and least-square methods. Time-varying systems. Recommended for students specializing in the Information Systems Laboratory or related fields—Aeronautics and Astronautics. Familiarity with linear algebra is assumed.

3 units, Aut (Boyd) MWF 1:15


3 units, Win (Boyd) MWF 1:15


3 units, alternate years, given 1989-90


3 units, Win (Goodman) MWF 4:15

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) MWF 10 alternate years, not given 1988-90

368. Digital Image Processing—(Enroll in Aero and Astro 263.)

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, magnetic resonance, 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. Prerequisite: Fourier transforms. Recommended 366.

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

370. Information Systems Seminar—Lectures and discussion of topics and research areas in information systems. Topics: communication and information theory, signal processing, systems and control, and optical information processing.

1 unit, Aut (Cover) Th 4:15
Win (El Gamel) Th 4:15
Spr (Franklin) Th 4:15

371. Advanced VLSI Circuit Design—Analysis and design of high performance digital integrated systems. Focus is on developing and using simple models to quickly evaluate the trade-offs involved in obtaining high performance systems. Involves the base technology, including bipolar, CMOS, and biCMOS. Common subsystems (e.g., memory arrays, register files, ALUs) are used to evaluate technologies and circuit designs. The final project involves the design of subsystems for a high speed computer. Prerequisites: 271, 313, or consent of instructor.

3 units, not given 1988-89


3 units, Spr (Widrow) TTh 1:15-2:30

374. Digital Transmission Systems in Telecommunications—Introduction to and comparison of analog and digital telecommunications; voice digitization—PCM, DPCM, and DM...
3 units, Aut (Cover) TTh 11-12:15

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

378A. Linear Estimation—Least-squares estimation. Wiener and Kalman filters for processes with state-space models. Square-root and Chandrasekhar algorithms. Quadratic regulators and the separation theorem. Prerequisites: 278 or equivalent, 363 or 363H.
3 units, not given 1988-89

378B. Fast Algorithms for Signal Processing—Levinson-Schur algorithms and lattice filters for stationary processes. Parallel and modular implementations. Processes with low displacement rank: generalized constant gain lattice filters; adaptive lattice and transversal filters. High resolution spectral estimation techniques for autogressive and sinusoidal signals in noise. Applications in speech, communications, sonar, etc. Prerequisite: 278 or 378A.
3 units, alternate years, given 1989-90

3 units, Win (Cioffi) TTh 9:30-10:45

379B. Digital Communication II (Coding)—Channel coding and capacity, capacity-cutoff regions for multilevel transmission, convolutional and trellis codes, trellis-coded modulation and partitioning, multidimensional coset codes, line coding techniques, Viterbi decoding, coding for bandlimited channels, spectrum methods. Prerequisites: 278, 379A.
3 units, Spr (Cioffi) TTh 2:45-4
terconnection of networks); presentation layer protocols (virtual terminal and file transfer protocols). Specific examples and standard protocols are cited for point-to-point, satellite, packet radio, and local area networks.

3 units, Aut (enroll in Computer Science 244) Win (Tobagi) TTh 2:45-4

385. Special Seminars in Computer Systems — Seminars on current research topics in computer systems are given occasionally and are usually announced one or two quarters in advance. See the Time Schedule and bulletins in the department office.

385A. Digital Systems Reliability Seminar — Student-faculty discussions of research problems in the design of reliable digital systems. Specific areas include Fault-Tolerant systems, design for testability and system reliability. Emphasis on student presentations and Ph.D. thesis research.
1-4 units, Aut (Staff) M 4:15
Win, Spr (McCluskey) M 4:15

385B. Computer Architecture Seminar — Student/faculty discussions of research problems in computer organization, memory hierarchy, machine representation, and simulation of conventional and abstract machines.
1-4 units, Aut, Win, Spr (Flynn) W 12-2

387. Error-Correcting Codes — Theory and implementation of codes for detection and correction of random and burst errors. Finite field theory. Linear block codes, cyclic codes, Hamming codes, Fire codes, BCH codes, Reed-Solomon codes. Decoding algorithms for BCH codes. Prerequisites: Some familiarity with discrete mathematics and linear algebra.
3 units, Spr (Gill) MWF 2:15

388. Programming Language Design — (Enroll in Computer Science 342.)

389. Topics in Programming Systems — (Enroll in Computer Science 349.)

390. Special Studies or Projects in Electrical Engineering — Independent work under the direction of a faculty member. Individual or team activities involving laboratory experimentation, design of devices or systems, or directed reading. Graded on a Pass/No Credit basis.
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. A letter grade is given on the basis of the report. 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 and experimental courses are given on topics of current interest. These are usually announced one or two quarters prior to their presentation and are given by specialists in the field. See the Time Schedule and bulletins in the department office.

395. Electrical Engineering Instruction: Practice Teaching — Open to a limited number of advanced graduate students in Electrical Engineering who plan to make teaching their career. Qualified students conduct a small section of an established course taught in parallel by an experienced instructor.
(McWhorter) by arrangement

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 silicon gate NMOS or CMOS integrated circuits. Emphasis on practical aspects of IC fabrication, including silicon wafer cleaning, photoengraving, chemical etching, oxidation, diffusion, ion implantation, chemical vapor deposition and vacuum evaporation. Enrollment preference given to students pursuing doctoral research programs in which the facilities of the IC lab is used. Registration by consent of instructor. Prerequisite: 212.

3 units, Win (Plummer) by arrangement

412. Advanced Integrated Circuit Laboratory — Experimental projects and seminars on integrated circuit fabrication using epitaxial deposition, oxidation, diffusion, ion implantation and photolithographic processes emphasizing techniques for achieving advanced device performance. May be repeated for additional credit. Prerequisites: 212, 410, and consent of instructor.

3 units, Spr (Saraswat) TTh 1:15-2:30

428A,B. Physics of Advanced Electronic Devices — A two-quarter course for second and third year graduate students specializing in solid state electronics and integrated circuits. Emphasis on the use and advantages of GaAs and related materials for high speed and optoelectronic integrated circuits. The use of heterostructures, quantum wells and structures of ultra-small dimensions. The fundamentals for creating new devices based upon quantum size effects, tunnelling, and ballistic electron transport. Prerequisites: 328A and B, and Physics 230 or equivalent.
3 units, Win, Spr (J. Harris) MWF 9
430. Surface and Interface Seminar—Understanding of electronic structure of surfaces and interfaces is increasingly important for practical applications—semiconductor devices and metal catalysts. Emphasis is on electron spectroscopic methods and basic theoretical approaches for studying surfaces and interfaces. Electrical measurements, device, and IC performance. Faculty, advanced graduate students, and invited speakers from outside the University present material for discussion.

1 unit, Aut, Win, Spr (Spicer) W 2:15-4:15

438A,B. Special Topics in Condensed Matter Physics—(Enroll in Applied Physics 473.)

453. Geomagnetically Trapped Radiation—Charged particle trapping in planetary magnetic fields, and its importance in near-earth-space phenomena. Motion of charged particles in inhomogeneous magnetic and electric fields, adiabatic invariants, distribution functions and diffusion equation methods. Useful theorems for interpreting experimental data. Source and loss processes and the physical mechanisms responsible for producing trapped radiation at the earth and other planets. Prerequisite: 142.

3 units, Win (Staff) TTh 9:30-10:45 alternate years, not given 1989-90

478. Topics in Information Systems—Problems selected from recent research of the faculty in areas of information systems that have reached a level of development suitable for course presentation. Topics for 1988-89 will be drawn from VLSI design and design automation, configurable VLSI, and system prototyping.

3 units, Aut (El Gamal) MW 3:15-4:30

482. Advanced Computer Organization—Topics in high performance and concurrent systems; single and multiple instruction stream systems; memory structures and control; high performance networks; algorithms; concurrency detection; applications considerations; system design and analysis. Prerequisites: 282, 382.

3 units, Spr (Staff) MWF 11

483. Topics in Compilers—(Enroll in Computer Science 343.)

484. Computer Networks: Modeling and Analysis—Network functions, architectures and protocols; computer traffic characterization; resource sharing; packet-switched-store-and-forward networks—ARPAnet: delay analysis, network design and optimization including capacity assignment, routing and topological design; multi-access/broadcast protocols (used in packet-switched satellite, ground radio, and local networks); fixed assignment, random access, demand assignment, adaptive strategies, stability considerations and dynamic control.

Prerequisite: 284. Recommended: Knowledge of 384.

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

486. Advanced Computer Architecture—Machine mapping issues, design of instruction sets, including addressing, name space design, operations and formats; emulation. Image machine analysis and statistical usage. Information theoretic limits and canonic interpretive program forms for high level languages. Prerequisites: 282, 382.

3 units, alternate years, given 1989-90


3 units, Spr (Peterson) MWF 10

488. Testing Aspects of Computer Systems—Fundamental principles of testing computer systems and designing for testability. Failure and fault models. Deterministic and probabilistic techniques of test generation and testing. Techniques for testing memories and microprocessors. Design for testability. Prerequisite: 381.

3 units, Spr (McCluskey) TTh 2:45-4 alternate years, not given 1989-90


3 units, alternate years, given 1989-90

492. Special Seminars—Each year special seminars and experimental courses are given on topics of current interest. These are usually announced one or two quarters prior to their presentation and are given by specialists in the field. See the Time Schedule and bulletins in the department office.
ENGINEERING-ECONOMIC SYSTEMS

Emeritus (Professor): Willis W. Harman
Chairman: David G. Luenberger
Professors: Donald A. Dunn, Ronald A. Howard, David G. Luenberger, James L. Sweeney
Associate Professors: Edison T. S. Tse, John P. Weyant
Assistant Professors: Samuel S. Chiu, Ross D. Shachter, Ennio Stacchetti
Lecturer: Gerd D. Wallenstein
Consulting Professors: James E. Matheson, Peter A. Morris, D. Warner North
Consulting Associate Professor: Michael R. Fehling
Consulting Assistant Professor: Samuel Holtzman

GENERAL INFORMATION

GOALS

The Department of Engineering-Economic Systems (E.E.S.) is dedicated to preparing individuals for careers in analyzing, managing, and creating activities of a business, financial, technical or social nature ranging from individual projects to entire enterprises. The department emphasizes logical analysis using mathematical representations and advanced computational procedures, but complements this analysis with careful attention to framing of issues, formulation of problems and implementation of results.

CAREERS IN ENGINEERING-ECONOMIC SYSTEMS

Students are prepared for a variety of professional careers in business, industry, universities, and government. Graduates have pursued careers in project management, product development, consulting, strategic planning, financial analysis, government policy analysis, and university teaching and research. Some E.E.S. graduates have started companies specializing in management and systems consulting, high technology products, software, or financial services. Other graduates have helped establish new analysis capability in existing firms or government agencies and still others have established courses similar to those of E.E.S. in other universities.

APPROACH

The formal coursework is organized around a set of problem solving concepts drawn from the fields of dynamics, uncertainty, optimization, economics, and decision analysis. These "portable concepts" are transferable to problems in a variety of specific areas. These concepts are presented in a set of core courses that provide a foundation for direct application and prepare students for advanced courses that explore the frontiers of research.

Students benefit most from the program by acquiring first-hand experience in the capabilities of present methodology. Project courses, on-campus applied projects, and internships are available to provide this experience.

BACKGROUND REQUIRED

Students admitted for graduate study in Engineering-Economic Systems must have a background of undergraduate work that indicates a level of problem-solving maturity customarily found in an undergraduate engineering or physical science program. A full year's college-level calculus course and several courses applying calculus would constitute minimum preparation. A course in linear algebra is strongly recommended, as is some familiarity with formal proofs. Incoming students who are not adequately prepared should plan to take suitable mathematics courses prior to taking the core courses. Those needing a review of linear algebra or calculus are advised to attend the two-week intensive workshop offered by the department just prior to Autumn Quarter. Undergraduate coursework in economics is not required, but will prove helpful.

GRADUATE PROGRAMS

There are three primary 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. In addition, the department offers a co-terminal B.S./M.S. program.

Study programs should be selected to give a broad coverage as well as work in depth in one or more specific areas. The student's course program should include a selection of foundation material from the offerings of other departments to provide breadth.

MASTER OF SCIENCE

Department requirements for the degree of Master of Science provide great flexibility for meeting individual objectives. The master's degree may be viewed as a terminal degree program with a professional focus, or as an exploratory vehicle to formulate and select a more advanced graduate school program. Course programs are approved individually by the Engineering-Economic Systems (E.E.S.) faculty.

The degree of Master of Science requires a minimum of one academic year of study beyond the B.S. degree. University regulations govern-
ing 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. In addition to meeting University requirements, M.S. programs must contain a total of 45 units of course work. This total must include at least 36 units of regular lecture courses, 27 units of which must be courses in E.E.S. with letter grades. Included in these courses must be at least five of the department's core courses and at least 3 units of project work. (See "Courses" below for a list of courses that meet these requirements.) Finally, a letter grade indicator of 2.75 must be achieved on the course program.

Up to 18 units of a student's program for the M.S. degree may be taken outside the department. However, most M.S. programs include more E.E.S. units than the minimum required.

ENGINEER

Admission to the Engineer degree program must be obtained from the department. The decision of the department is based on its evaluation of the applicant's academic record, performance in independent work, and potential for advanced study. The ability of the faculty to support and supervise such study is also considered.

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.

In addition to the University requirements, the student must complete successfully: (1) An approved M.S. academic program with an achievement of a 3.0 letter grade indicator (LGI); (2) 45 units beyond the M.S. degree including completion of all E.E.S. core courses and the attainment of a 3.0 or better LGI; (3) approval of a thesis proposal by the thesis supervisor; (4) satisfactory oral presentation of the thesis to the thesis supervisor and one other faculty member appointed by the department; and (5) completion and approval of the Engineer's thesis by the thesis supervisor.

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.

In addition to University requirements, the student is to complete successfully (1) the department qualifying procedure, (2) an approved program of courses, (3) a 3.5 letter grade indicator on the core courses (see "Courses" below), (4) an oral examination near the completion of the doctoral program, (5) a dissertation, based on research, which must be a contribution to knowledge. The department does not have a foreign language requirement.

Ph.D. MINOR

Doctoral students throughout the University may complete a minor in Engineering-Economic Systems by taking 21 units of E.E.S. courses. The selection must be approved by the student's department advisor and by the Engineering-Economic Systems academic affairs chairman.

FINANCIAL ASSISTANCE AND ADMISSION

Most students in the E.E.S. 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. 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 $20,000 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 $680 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.

Information about loan programs may be obtained from the School of Engineering.

Applicants for all forms of assistance may
obtain the necessary application forms from the Graduate Admissions Office. Applications for fellowships must be made by February 15 preceding the Autumn Quarter that admission is desired and must be accompanied by a complete application for admission. (Applications not requiring financial aid will be accepted until August 1.) 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.

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.

INTERNSHIPS

Since most complex system problems cannot be realistically duplicated within a university, some internships are available to help the student develop the ability to solve system problems by working on real problems.

Problems of a 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, operation and planning of complex projects and systems; and in government agencies.

The duration of an internship ranges from six to 24 months, depending on the time required to complete the project successfully. Internships for international students must conform to visa restrictions. Internships are not required, but many students elect to participate.

RESEARCH AND SYSTEM 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.

Current research projects in E.E.S. are funded by the National Science Foundation, Electric Power Research Institute, the Center for Economic Policy Research, and the Department of Energy as well as our Industrial Affiliates.

BUSINESS SYSTEMS

The Business Systems Program is a department-wide program that responds to the fact that more Engineering-Economic Systems graduates now enter business firms directly, work for consulting firms on projects in the private sector, or do continuing research and teaching on business problems. The program emphasizes strategic, financial, and entrepreneurial aspects of business systems taking a fundamental quantitative approach. Research projects described under several of the programs outlined below have a business systems orientation. The decision analysis, systems economics, and organizational economics portions of the economic analysis program are particularly relevant to this program.

DECISION ANALYSIS
(Holtzman, Howard, Matheson, Shachter)

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 evaluating hazardous processes, research and development, and energy investment.

The University program maintains a close relationship with professional decision analysts working on major decision problems. Internships are available at several local 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 procedures for clarifying unstructured areas of concern as a first step in formulating decision problems, (3) the analysis of decisions and disputes involving risks of injury or death, (4) the use of decision analysis in medicine, and (5) the mutual exploration of the fields of decision analysis and artificial intelligence.
DECISION SYSTEMS
(Chiu, Fehling, Holtzman, Luenberger, Shachter, Tse)

This program is dedicated to the design, implementation, and evaluation of computer-based decision systems. A decision system is referred to as any environment that enhances the process of decision-making and includes human-machine decision systems, as well as fully automatic ones. The program emphasizes the impact of computer technology on the design of effective decision systems. In particular, it examines how computers can be exploited as a powerful tool to acquire, in real time, the relevant knowledge pertaining to a specified decision, perform the appropriate analysis (either analytical or verbal), and relate both of these to the decision maker.

Several disciplines are important components of the program: decision analysis, systems modeling, mathematical optimization, artificial intelligence, and cognitive psychology. The integration of these diverse disciplines is a research focus of this program.

Much of the research in this program is conducted through the Decision Systems Laboratory directed by Professor Tse. Internships are available at several local firms active in developing computer-based decision systems for different decision environments. Current research areas in the laboratory include: (1) integrated manufacturing enterprise management systems, (2) competitive analysis consulting system, (3) intelligent critical care decision system, (4) marketing support system, (5) product development decision support system, (6) cooperative problem solving, (7) structural editing for situation assessments.

ECONOMIC ANALYSIS
(Chiu, Dunn, Luenberger, Stacchetti, Sweeney, Tse)

This program includes modeling and analysis of economic entities and their interactions. Several specific areas, described below, have commanded particular attention.

Natural Resource Economics—Examines the particular problems associated with depletable or renewable natural resources, including energy, biological, mineral, and environmental resources.

Organizational Economics—Studies incentives and information in organizations and inter-organizational systems. Incentives include those created by rules governing activities such as information sharing, cost allocation, and transfer pricing within an organization.

Systems Economics—A response to the growing magnitude and complexity of economic decision problems, it combines economic theory (in finance, general equilibrium theory, and decision theory) with the problem solving viewpoint and techniques of systems analysis.

Current research areas include: (1) algorithms for calculating equilibrium prices, (2) power pooling and long-term planning for electric utilities, (3) mathematical techniques for dynamic economic problems, (4) disequilibrium adjustment processes in financial markets, (5) pricing shared services and facilities in inter-organizational networks with multiple owners, (6) incentive structured decomposition, (7) behavior of futures markets, (8) behavior of firms participating in highly concentrated natural resource markets, and (9) internal trade issues arising for electronics industries.

ENERGY MODELING AND ANALYSIS
(Huntington, Sweeney, Weyant)

The energy modeling and analysis activity centers around the Energy Modeling Forum (EMF) and the Energy, Natural Resources, and the Environment Program (ENREP) of the Stanford Center for Economic Policy Research (CEPR). The EMF involves the application of formal analysis in the study of energy policy issues. Sponsored by the Electric Power Research Institute, the Department of Energy, and about 15 industrial affiliates, the EMF is based at Stanford with Professor Weyant as Director.

Current EMF studies focus upon the North American natural gas market, electricity markets and planning, and the use of models in public utility commission decision making.

Research sponsored by CEPR includes modeling and analysis of world oil markets, of oil storage policies, and of long-term contracts in markets for coal. Additional research includes regulation of public utilities, 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.

INFORMATION POLICY
(Chiu, Dunn, Stacchetti)

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 trans-
fer, the regulation of telecommunications and information services, the operation of information services markets, and the roles of information in the operation of markets generally.

Current projects include studies of: (1) the adoption of new technologies in the telephone network, (2) the economics of electronic publishing, and, (3) optimal tariffs and product differentiation in telecommunications services.

MATHEMATICAL SYSTEM ANALYSIS
(Chiu, Luenberger, Stacchetti, Tse)

Mathematical system analysis is the development and application of those mathematical principles and techniques that form the basis for problem formulation and solution in the system area. The field is one of great diversity, both with respect to the types of mathematics employed and in the areas of application. The Stanford program emphasizes the interaction of theory and application. Faculty and students have developed methods in (1) modern control theory, including observers, dynamic programming, optimal control techniques, adaptive methods, and descriptor-variable theory; (2) optimization, including functional analysis methods, convergence theory for mathematical programming methods, decentralization methods, and new algorithms; and (3) economics including fixed-point methods, representation of dynamic phenomena, and investment theory.

SOCIAL ANALYSIS
(Howard, Matheson)

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) analyzing market arrangements for the provision of safety with hazardous goods and services, (3) comparing the parallel development of subjectivism in decision analysis and the Austrian School of Economics, and (4) an analysis of federal drug policy.

COURSES

There are four types of courses in the department, as follows:

Core Courses:

Project Courses:
214B, 218, 234, 235, 236, 281, 283 (4 units), 286.

Lecture Courses:
31, 105, 155, 209, 212C, 214A, 216, 223, 232,
235, 238, 253, 258, 263, 283 (3 units), 285, 287.

Other Courses:
290, 291, 292, 293, 294, 400 series.

Course descriptions, organized by general subject area, are listed below.

SYSTEMS


4 units, Win (Stacchetti) MW 9:30-10:45

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 Pontryagin maximum principle, the Hamilton-Jacobi-Bellman equation. Applications include: Volterra's predator-prey model, genetic transfer, the spread of epidemics, optimal resource allocation.

4 units, Spr (Chiu) TTh 1:15-2:30
209. Quantitative Methods in Transportation and Urban Service Systems—Quantitative techniques of engineering, management, and systems sciences emphasizing applications in transportation systems analysis (urban, air, ocean, highway, pick-up and delivery systems) and in the planning and design of logistically oriented service systems (e.g., fire and police departments, emergency medical services, emergency repair services). Unified study of functions of random variables, geometrical probability, multi-server queueing theory, spatial location theory, network analysis and graph theory. Implementation difficulties. Examples of applications: evaluation of technologies for vehicle location, routing and control, controlling randomness in mass transit systems, design of dial-a-ride transportation systems, operation and control of police patrol dispatch strategies. Prerequisite: 221 or equivalent.

3 units, Spr (Chiu) MW 1:15-2:30


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

ECONOMICS

60. Engineering Economics—(Enroll in Engineering 60.)

3 units, Aut, Sum (Staff) MWF 10
Win (Sweeney) TTh 9:30-10:50

212A. Economic Analysis—Presents basic principles for analysis of economic problems arising in industry, individual or institutional decision making, and government. Topics: (1) production: production functions, cost functions, duality; (2) the behavior of the firm: perfect competition, monopoly, oligopoly, pricing policy; (3) individual preferences and demands; (4) consumer theory; (5) economic efficiency: Pareto efficiency, welfare theorems. Emphasis on the translation of theory into qualitative understanding and concrete procedures for analysis and implementation. Recommended: 241 or equivalent.

3 units, Win (Luenberger) TTh 9:30-10:45

212B. Economic Analysis—Continuation of 212A. Topics: (1) equilibrium theory: existence of competitive equilibria, methods for computation, special models; (2) game-theoretic models: strategic behavior of firms, bargaining, market games; (3) public goods, externalities, truthful revelation of preferences. Emphasis on building a framework to formulate and solve important economic problems or as a basis for additional study.

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

212C. Economic Analysis—Continuation of 212B. Theoretical topics—(1) welfare: criteria for evaluation of public projects, impossibility theorems; (2) economics of uncertainty; and (3) economics and information.

3 units, Aut (Luenberger) TTh 1:15-2:30

214A. Public Policy Analysis—Law and economics as a conceptual framework for policy formulation and evaluation. Examples of policies expressed in the form of property rights, contract law, tort law, criminal law, antitrust law, and public utility regulation. Analysis of the economic effects of laws and regulations. Recommended: Economics 51 or concurrent registration in 212A.

3 units, Win (Dunn) MW 11-12:15

214B. Public Policy Analysis—Continuation of 214A. Political economy models of business-government relationships in rulemaking, rule interpretation, and rule enforcement. The state as an organizational system in which laws, as interpreted and enforced, represent policies consistent with the economic interests of the principal interest groups in the state. Analysis and design of policies consistent with the operation of this system.

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

218. Economic Analysis Practice—Project course focusing on applications of economic analysis. Students in teams model/analyze an economic issue and present findings to the class. Lectures will suggest project areas and methods useful for addressing problems. Potential projects for illustration: develop a forecasting model for semiconductor demand; model impacts of proposed trade restrictions; develop a competitive analysis for an anti-trust litigation; analyze investment options by a regulated industry.

4 units, Spr (Sweeney) TTh 11-12:15

255. Economics of Natural Resources—(Same as Economics 155; undergraduate students register for Economics 155.) Economic analysis of natural resource use and preservation, including clear air and water, pollution, depletable mineral resources, energy, and biological resources. Stock-flow relationships; wealth maximizing choices over time; short-run and long-run equilibrium conditions; depletion/extinction conditions; market failure mechanisms
(common-property, public goods, discount rate distortions, rule-of-capture); policy options. Prerequisite: Economics 51 or 51Q. Recommended: Math 43.

5 units, Aut (Sweeney) MWF 1:15-2:30

258. Systems Economics—The systems aspects of economic problems, emphasizing principles and techniques for dealing with complex investment opportunities. Relates economics, finance, and systems concepts to complex investment problems. Partially tutorial and partly research-oriented with presentations by faculty, guests, and students. Topics: individual investment (portfolio selection, the individual’s stochastic dynamic problem); the firm (project selection theories and procedures); the market (conditions of equilibrium, capital asset pricing theory, options theory, futures markets). Prerequisite: 212A.

3 units, Spr (Luenberger) T 2:45-4 alternate years, not given 1989-90

PROBABILITY

221. Probabilistic Analysis—A self-contained development of probability theory that is theoretically sound and suited to application. Appropriate as a terminal course or as a foundation for further graduate work in applied areas. Theory is presented axiomatically emphasizing outcome space representation for discrete and continuous random variables. Basic concepts, description of random variables, changes of variable, transform techniques, named distributions, and computer simulation. Most students have previous probability courses, but learn to apply probability concepts to problems of uncertainty. Objective: provide students with the same understanding and competence in analysis of probabilistic problems they possess in dealing with deterministic problems. Prerequisite: Working knowledge of calculus.

5 units, Aut (Chiu) MW 11-12:15

DECISION ANALYSIS

31. Introduction to Decision Analysis—Decisions, and how people make them. Psychological research shows that in simple situations people make decisions that upon close examination they regard as wrong. Decision analysis is a rationale that allows one to convert the opaque decision situations that confuse into a clear basis for action by using transparent, logical steps in personal or professional life, and in areas that run from health to investment. Topics: decision trees, influence diagrams, Bayesian updating, value of information, valuing intangibles, probability assignment, risk preference, and analysis of large-scale decisions; examples are from every major field of application and provide the philosophical concepts and practical techniques necessary to achieve mastery in decision-making in a complex, dynamic, and uncertain world. (DR:8)

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

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. Examples from business, engineering, law, and medicine. Applications from private and public sectors of the economy. Prerequisite: Knowledge of basic probability (221 or equivalent).

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

232. Advanced Decision Analysis—Extension of decision analysis beyond the basic paradigm. Emphasis on determining and extending the boundaries of logical analysis of decisions. Topics: 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 varies with current research interests. Prerequisite: 231.

3 units, Spr (Howard) Th 2:45-5:15

234. Intelligent Decision Systems—The use of artificial intelligence for delivering automated decision analysis assistance. Topics: design and analysis of classes of decisions, representation of the decision analysis process, automation of probability and risk attitude assessments, automation of sensitivity analysis, and representation of deterministic decision models. Discussions tailored around a substantial term project. Student teams design and implement a narrow-scope intelligent decision system, or write a paper addressing a major research topic in intelligent decision systems. Prerequisites: 231 and Computer Science 223.

4 units, Aut (Holtzman) MWF 3:15-4:30
235. Medical Decision Analysis—(Same as Medical Information Sciences 235, Computer Science 371). The use of decision analysis in medical practice. Student teams analyze specific clinical decision problems as a term project. Topics: the decision making role of patients and physicians, medical preference models, assessing decision models in a clinical context, medical ethics, and designing and using automated medical decision tools. A formal medical background is helpful but not required. Prerequisite: 31 or 231.
4 units, Spr (Holtzman, Matheson) MWF 3:15-4:30

236. Decision Analysis Practice—An opportunity for students trained in decision analysis theory to apply that knowledge in practice, and to extend the domain of rational analysis. Teams analyze a current decision problem faced by an actual decision maker, and carry out the technical procedures of modeling, information assessment, and value encoding by communicating with individuals who are usually not trained in logical analysis. Problems chosen have covered every level of decision-making from the university to the community of nations, and many fields of human endeavor. Project evaluations are based solely on the professional quality of analysis and presentation. Prerequisite: 231.
4 units, Spr (Holtzman, Matheson) MWF 3:15-4:30

238. The Ethical Analyst—The professional analyst who uses technical knowledge in support of any individual, organization, or government is ethically responsible for the consequences of the acts. Course sensitizes the individual to ethical issues, providing the means to form ethical judgments. Questions desirability of physical coercion, and deception as a means to reach any end. An exploration of human action and relation in society is conducted in the light of previous thought, and is used to provoke additional research on the desired form of social interactions. Attitudes toward ethical dilemmas are explored by creating an explicit personal code. Selected issues from the full range of human affairs test the student's framework for ethical judgment.
1-3 units, Spr (Howard) T 2:45-5:15

OPTIMIZATION

3 units, Aut (Stacchetti) TTh 9:30-10:45

4 units, Spr (Staff) MW 9:30-10:45

253. Optimal Dynamic Systems—Development of optimal control theory and its applications to social, economic, and life systems. Pontryagin maximum principle developed from geometric point of view. Problems with inequality constraints; transversality condition; singular control; linear systems with quadratic cost; discounting cost; infinite horizon problem. Sufficient conditions for optimality. Applications include: management of renewable resources, dynamic theory of the firm, control of predator-prey systems, and optimal economic growth. Prerequisite: 201B.
3 units, Aut (Tse) MW 1:15-2:30 alternate years, not given 1989-90

263. Principles of Optimization—Objective: demonstrate that a 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. Prerequisites: 201B or Mathematics 113, Mathematics 115.
3 units (Tse) alternate years, given 1989-90

APPLICATIONS AND RESEARCH

281. Product Planning—Product planning as a synthesis of technology, cost, demand, user preferences and legal rules. Students create
product plans for new information-telecommunications products that use existing technology and take existing laws as given. Products studied in 1987-88 were electronic mail and voice mail. Recommended: Engineering 60 or equivalent.

3 units, Aut (Dunn) T 3:15-5

283. Energy Policy Models—Design and application of formal models in the study of strategic public and private sector planning problems. Problems involving issues of individual choice, social welfare, technology tradeoffs, resource management, and uncertainty in a national or international setting. Emphasis on integrated utilization of modeling tools drawn from diverse methodologies and the requirements for successful application in a policy-making or strategy development context. The links between art, theory, and practice are emphasized. Prerequisites: 212A, 231, and 241, or equivalent.

3 or 4 units, Spr (Weyant) MW 1:15-2:30

285. Problem-Solving and Intelligent Systems—Interplay of levels and forms of reasoning in the process of solving complex problems. Interdisciplinary approach to surveying important problem-solving concepts and techniques from Artificial Intelligence (AI), comparing and integrating these AI concepts with analytical problem-solving methods from operations research, decision analysis, and statistical estimation and control. Topics: techniques for knowledge representation and modeling, basic inference methods and heuristic search strategies, management of uncertainty, planning and control, management and revision of beliefs, and adaptation and learning. Use of concepts and methods in AI systems to solve concrete engineering and management problems. Students with no knowledge of LISP programming must enroll in the 1-credit programming laboratory which introduces basic concepts of lisp programming and presents useful AI programming methods. Prerequisites: 221, 241.

3-4 units, Win (Tse, Fehling) MW 2:15-3:45

286. Intelligent Management Systems—Project focuses on the design and application of an intelligent management system (IMS) to a high technology product company. Lectures on nonmonotonic reasoning, reason maintenance, expert systems, management of uncertainty, and manufacturing enterprise management systems; simultaneously, students are involved in designing an IMS and using it to perform a case study with a local company or an industry. Prerequisite: 285.

3 units, Spr (Tse, Fehling) MW 2:15-3:30

287. Voluntary Social Systems—Exploration of the ethical theory, feasibility, and desirability of a social order in which coercion by individuals and government is minimized and people pursue ends on a voluntary basis. Topics: efficacy and ethics; use rights for property; contracts and torts; spontaneous order and the free market; crime and punishment; guardian-ward theory for incompetency; the state and interventionism, the hypothesis of reverse results; applications to various topics—help for the needy, victimless crimes, and environmental protection; transition strategies to a voluntary society.

1-3 units, Win (Howard) TTh 2:30-4

288. Environmental Health Risk Assessment—(Same as Industrial Engineering 244.) Principles of quantitative health risk assessment applicable to routine and catastrophic pollution problems. Three parts: dispersion models (air and water), dose-response analysis (epidemiological and animal studies) and two complete illustrative cases. Prerequisites: 231 or Industrial Engineering 240 or Civil Engineering 205 or equivalent; Statistics 116 and Engineering 60, and permission of instructor.

2 units, given 1989-90

OTHER COURSES

290. Introduction to Engineering-Economic Systems—Introductory lectures by faculty and research staff describing department research programs.

1 unit, Aut (Staff) Th 4:15

291. Seminar in Engineering-Economic Systems: Applications—Lectures on research applications and recent results by E.E.S. graduates and visiting scholars.

1 unit, Win (Tse) T 4:15

292. Directed Reading and Research in Engineering-Economic Systems—Directed study and research on a subject of mutual interest to the student and staff member.

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


1 unit, 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.

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 and applications, announced on a quarterly basis.

1 or more units, Aut, Win, Spr (Staff) by arrangement
455. **Economic Analysis Seminar**—Economic theory, analysis, and application research in progress. Highly interactive presentations, primarily given by graduate students.
1-2 units, Aut, Win, Spr (Sweeney) by arrangement

**INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT**

*Emeriti: (Professors)* Eugene L. Grant, W. Grant Ireson, Robert V. Oakford, David A. Thompson
*Chairman:* Warren H. Hausman
*Associate Chairmen:* James E. Hodder, James V. Jucker
*Associate Professors:* James E. Hodder, Robert H. Keeley, Hau L. Lee, Elisabeth Paté-Cornell
*Assistant Professors:* Paul S. Adler, Margaret L. Brandeau, Kathleen M. Eisenhardt, Robert I. Sutton
*Professor (Teaching):* Robert McGinn
*Affiliated Faculty Professors:* David Beach (Mechanical Engineering), Robert A. Burgelman (Graduate School of Business), J. Michael Harrison (Graduate School of Business), Frederick S. Hillier (Operations Research), Charles A. Holloway (Graduate School of Business), James G. March (Graduate School of Business), Evan L. Porteus (Graduate School of Business), Nathan Rosenberg (Economics), James L. Sweeney (Engineering-Economic Systems)
*Lecturer:* Charles F. Banfe

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.

**UNDERGRADUATE PROGRAM**

**BACHELOR OF SCIENCE**

The program leading to the degree of Bachelor of Science in Industrial Engineering is stated earlier under the “School of Engineering” section of this bulletin. 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 a group project represents 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.

**GRADUATE PROGRAMS**

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. The department also offers a master's degree in Manufacturing Systems Engineering in cooperation with Stanford’s Mechanical Engineering Department.

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. The deadline for applications is February 1.
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.

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.

The requirements for the Master of Science degree may be obtained from the Department of Industrial Engineering and Engineering Management.

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 17 units of these core courses may be applied toward the 45 units required for the M.S. degree.

Any student admitted to graduate standing on the basis of a bachelor’s degree in a field other than engineering must complete 45 units of work as outlined above, but must also have successfully completed or must complete the equivalent of 45 units of mathematics, 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.

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.). 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 Management area (designed to provide core managerial skills and focused on technology management) 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. While the program has a strong practitioner orientation, the department is also committed to furthering research in this area. The terminal degree for students interested in a research/academic career in engineering management would be the Doctor of Philosophy in Industrial Engineering with the appropriate concentration.

ENGINEERING: MANUFACTURING SYSTEMS ENGINEERING

The Master of Science in Manufacturing Systems Engineering (M.S.E.) addresses the need for engineers who combine management and design skills focused on manufacturing. There is a critical need for individuals who can deal directly with product design for manufacturability; design of integrated manufacturing systems; financial, organizational, and strategic management issues; and elements of automation technology such as computer-aided design, computer-aided manufacturing, robotics, and microprocessor control.

Manufacturing Systems Engineering is a joint effort of the Departments of Mechanical Engineering and Industrial Engineering and Engineering Management. The program seeks high-quality students with strong educational backgrounds in engineering and provides a demanding curriculum strong in both hardware and engineering management.

The hardware and engineering-design aspects of the program include:
- Computer-Aided Design
- Engineering Design
- Introduction to Robotics and Manipulation
- Manufacturing Engineering
- Microprocessor Applications
- Visual Thinking

The engineering management subjects include:
- Analysis of Production Systems
- Engineering Economy
- Industrial Accounting
- Manufacturing Strategy
- Organizational Behavior and Management
- Quality Assurance and Control

The hardware and engineering-design
courses provide hands-on knowledge of these functions and the trade-offs that must be made in selecting alternative systems configurations.

The engineering management subjects provide a suitable perspective so that alternative system choices can be appropriately evaluated for their financial, organizational, and production impact, as well as their impact on the firm's manufacturing policy. A key integrating experience in the program is a year-long project course (Mech. Engr. 210) revolving around an actual engineering design project.

Beyond the required core, the curriculum allows for elective courses chosen from a broad set of relevant electives providing additional training in both the engineering management perspective, engineering-design hardware, and aspects of computer science. Here a student may follow his or her individual interests and tailor the program to meet individual needs.

The requirements for the M.S./M.S.E. program are available from the Industrial Engineering and Engineering Management Department.

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 Ph. D. degree is a research degree and is intended for students who desire careers in teaching and research. The program requires a minimum of three years (nine quarters) of full-time graduate study, at least two years of which must be at Stanford. However, the typical student will take four years after entering the doctoral program to complete all Ph.D. requirements. The Ph. D. degree must include a minimum of 90 quarter units of approved course work beyond the bachelor's degree, not including units for dissertation research. Frequently, a Ph.D. applicant has already completed a master's degree and would therefore be required to complete a minimum of 45 additional units.

See the department's graduate secretary for more details.

ASSISTANTSHIPS AND SCHOLARSHIPS

A limited number of fellowships and assistantships 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 fellowships, assistantships and scholarships should be made by February 1 preceding the start of the academic year for which the award is to be made.

COURSES

UNDERGRADUATE

60. Engineering Economics—(Enroll in Engineering 60.)

100. Organizations: Theory and Management—A survey of classical and modern organization theory, covering the behavior of the individual, the work group, and the organization. Enrollment limited with preference given to I.E./E.M. majors. Graduate students are encouraged to take 203.

4 units, Aut (Jucker) TTh 8-9:50
Win (Eisenhardt) TTh 9-10:50

107. Work, Technology, and Society—(Enroll in VTSS 170.) The changing nature and public-policy context of work in contemporary society as affected by rapid technological innovation. The evolving nature of and attitudes toward work in the pre-industrial world, the impact of the Industrial Revolution on work, leisure, and community, early industrial management and the emergence of unions, the birth of industrial engineering, and influential philosophies of work and work-society relations (Marxism and Taylorism). Pivotal legislative, regulatory, and court cases affecting work in 20th-century America. Contemporary work issues: "technological unemployment"; worker retraining; the changing structure and status of the workforce; the decline of manufacturing and the demise of unions; women and work; employee rights; new technology agreements; and the future of work. Recent noteworthy post-Taylorist innovations in work theory and practice pioneered in Italy, Japan, Sweden, and West Germany and their applicability to, and reception in the U.S. Limited enrollment.

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

121. Quality Assurance and Control—Concepts and statistical methods employed in the assurance of product conformance to specifications in the industrial environment. Emphasis on acceptance sampling, process control, reli-

INDUSTRIAL ENGINEERING AND ENGINEERING MANAGEMENT
ability, design of quality, management of quality, and the economic design of control methods. Prerequisites: Statistics 110, 116.

4 units, Win (Lee) MW 8:30-9:45

125. Work Design—The concepts and techniques of designing, improving, and measuring performance and productivity in systems composed of and influenced by people, organizational factors (rules, procedures, structure, etc.), environmental factors, and technology. The history of work design and modern approaches. Prerequisites: 100, 121.

5 units, Spr (Jucker) TTh 8-9:50

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. 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. Students who have taken or are taking elementary accounting should not enroll. Videotapes are used.

3 units, Aut (Bhimjee) TTh 1:15-2:30

1 hour by arrangement

180. Senior Project: Organizations — Students participate in a major project as a group of four. Attention to problem identification and definition emphasizing synthesizing feasible solutions to real problems. Restricted to I.E. majors in their senior year not enrolled in either 180 or 183. Not open to graduate students. Prerequisites: 100, 121, 125, 133, 144, 235, 260, Engineering 40, Operations Research 152, 153.

4 units, Win (Jucker) TTh 11-12:15

183. Senior Project: Economic and Financial Analysis — Students participate in a major project in a group of four. Attention given to problem identification and definition, emphasizing synthesizing feasible solutions to real problems. Restricted to I.E. majors in their senior year not enrolled in either 180 or 183. Not open to graduate students. Prerequisites: 100, 121, 125, 133, 144, 235, 260, Engineering 40, Operations Research 152, 153.

4 units, Win (Jucker) TTh 11-12:15

186. Senior Project: Production—Students participate in a major project in a group of four. Attention to problem identification and definition. Students are expected to apply analytic methodology obtained from previous course work, when appropriate; emphasis on synthesizing feasible solutions to real problems. Restricted to I.E. majors in their senior year not enrolled in either 180 or 183. Not open to graduate students. Prerequisites: 100, 121, 125, 133, 144, 235, 260, Engineering 40, Operations Research 152, 153.

4 units, Win (Jucker) TTh 11-12:15

191. Directed Study—Directed study on a subject of mutual interest to student and faculty member. Student must find a faculty sponsor and submit a one-page description of plan.

1 or more units (Staff) by arrangement

PRIMARILY FOR GRADUATE STUDENTS

201. Problem Solving—(Same as Engineering 190; Values, Technology, Science, and Society 181.) Problem solving emphasizing problem definition, creativity, and interpersonal and organizational factors that influence thinking. Common blocks to problem solving and methods of dealing with them. The advantages of integrating various problem solving strategies is stressed through reading, abstracted problem situations, and projects. Open to all undergraduates and graduates.

3 units, Spr (Adams) MW 2:15-4:05

203. Organizational Behavior and Management—Organization theory; concepts and functions of management; behavior of the individual, the work group, and the organization. Emphasis on case and related discussion. Enrollment limited and restricted to graduate students.

3 units, Win (Sutton) MW 1:15-3:05

204. Organizational Transitions — A dynamic view of organizational behavior. Draws on behavioral sciences including psychology, sociology, and anthropology to describe and explore the management of a diverse set of organizational transitions. Prerequisite: 203 or equivalent. For graduate students only.

3 units, Win (Sutton) MW 10-11:15

235. Financial Decisions—(Same as Economics 112.) The models and techniques in financial decision-making under uncertainty. Topics: financial analysis and forecasting, decision analysis, portfolio and capital market theories, capital structure and cost of capital, and project evaluation. Prerequisites: 133, Engineering 60, Operations Research 152, and Statistics 116. Recommended: Statistics 110. Enrollment during Autumn Quarter is limited to Industrial Engineering or Materials Science and Engineering majors. Enrollment during Winter Quarter is limited and at discretion of instructor.

4 units, Aut (Hodder) MWF 9
Win (Keeley) MWF 10

237. International Investment and Financing —Evaluating international corporate invest-
ments including the implications of exposure to exchange rate movements, trade barriers, and international taxation. Capital structure and hedging decisions are examined in relation to taxation, exchange rate, and political risk issues. Implications for accounting, financial, and production practices. Prerequisite: 235. Recommended: Economics 165. Enrollment limited and at discretion of instructor (preference given to students with Economics 165).

3 units, Spr (Hodder) TTh 10-11:15

240. Engineering Risk Analysis — Techniques of analysis of engineering projects involving a trade-off between risks (technical, human, environmental, etc.) and benefits. Four parts: elements of decision analysis; reliability analysis and probabilistic techniques (fault trees and event trees); economic analysis of failure consequences (including property damage, financial loss, and human casualties); and case studies. The case studies (safety of nuclear power plants, liquefied natural gas terminals, and dams) are of interest to the students of engineering. Emphasis on the questions of human safety for decisions of the public and the private sector. Prerequisites: Statistics 116 and Engineering 60, or equivalent.

3 units, given 1989-90

244. Environmental Health Risk Assessment — (Same as Engineering-Economics Systems 288.) Principles of quantitative health risk assessment applicable to routine and catastrophic pollution problems. Integration of dispersion, exposure, and dose-response models. Use of decision analysis and probabilistic methods. Illustration by case studies. Prerequisites: 240, or Engineering-Economic Systems 231, or Civil Engineering 205, or equivalent; Statistics 116 and Engineering 60, and permission of instructor.

2 units, given 1989-90


3 units, Aut, Win (Brandeau) TTh 9:30-10:45

261. Inventory Control and Production Systems—Demand forecasting, inventory control, production scheduling, aggregate production and work force planning, materials requirements planning and integrated systems. Prerequisite: Operations Research 153.

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

265. Manufacturing Strategy—Development and implementation of the manufacturing functional strategy. Emphasis on the integration of manufacturing strategy with the business and corporate strategies of a manufacturing-based firm. Topics: types of manufacturing technologies and their characteristics, quality management, capacity planning and facilities choice, the organization and control of operations, and determining manufacturing's role in corporate strategy. Enrollment limited and at the discretion of the instructor. Prerequisite: 260.

3 units, Spr (Carlson) MW 8:15-9:45

269. Industrial Management—Introduction to marketing and management policy for industrial products. Focuses on real life industrial settings. Topics: technology selection, product design, pricing, channels of distribution, sales organization, promotion, communication, and response to competitive actions. The interaction of functional policies and overall corporate strategy is stressed. Extensive case studies. Open to graduate students only. Enrollment limited and at discretion of instructor. Prerequisites: 100 or 203, 133.

4 units, Win (Keeley) TTh 8-9:30

270. Managing Technology for Competitive Advantage—(Same as Business 359.) Key issues of technology management focusing on the business unit level. Part I: the management of specific product or process development projects. Part II: the diversity of strategic tasks incumbent on the manager of a product or manufacturing engineering function. Part III: the integration of projects and engineering functional into a business unit's technology and business strategy. Primarily case-based. Open to graduate engineers and second-year MBAs. Enrollment limited and at discretion of instructor. Prerequisite: 269 or first-year MBA core.

4 units, Spr (Staff) MF 10-11:45

271. New Enterprise Management—(Same as Business 353.) For students interested in starting a new business or participating in the management of a venture during its formative stages. Emphasis on the development and evaluation of business plans to launch new enterprises. Legal, financial, and operating problems that are peculiar to new ventures. Cases are used extensively. Students, working alone or in small groups, are required to develop a detailed business plan for a specific, new venture. Enrollment limited and at discretion of instructor.

4 units, Spr (Keeley) TTh 8-9:45

272. Automation and Work—(Same as VTSS 172.) A combination of theoretical reflection and pragmatic analysis of the implementation of
new technologies. Topics: human resource management in technology-intensive environments, skill and organizational impacts of advanced technologies (numerical control, word processing, CAD), technology and industrial relations, Taylorism and new job design approaches. Emphasis on current issues; some historical background. Enrollment limited and at discretion of instructor. Open to seniors and graduate students only.

4 units, given 1989-90

273. Entrepreneurship in High Technology —For graduate students interested in starting their own high technology business or who may become involved with smaller firms intent upon rapid growth. Also for those interested in consulting, venture capital, or in management of high technology ventures for large companies. One session each week is a case study discussion and analysis of a high technology venture. One session following is with an entrepreneur focusing on that issue. Student teams develop a new product and a business plan; recommendations for products are available. All functional areas of new ventures are studied. Enrollment limited to 55 graduate students, at the discretion of the instructor, based upon previous management training and the new venture proposed.

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

290. Risk Analysis Seminar Series — Five seminars (every other week) covering a range of aspects of risk analysis techniques and applications; assessment problems and valuation questions; technical, political, economic, and psychological aspects of risk-benefit decision making presented by speakers from universities and industry. No letter grades given. Attendance required. Recommended: Previous exposure to probabilistic methods.

1 unit, given 1989-90

291. Directed Study— Directed study on subject of mutual interest to student and faculty member. Student must find a faculty sponsor.

1 or more units (Staff) by arrangement


Aut, Win, Spr (Staff) by arrangement


Aut, Win, Spr (Staff) by arrangement

320. Doctoral Research Seminar in Organiza-

325. Psychology and Organizational Behavior —How basic psychological processes influence individual behavior in organizations, behavior of work groups, and organizations. How theory about cognition, emotion, and personality is used to enhance and obscure knowledge about organizations, and how such knowledge guides future research. Introduction to a variety of methods for studying organizations, and learning of some of the nuances of writing-up organizational research for publication. Enrollment is limited to Ph.D. students and permission of instructor.

3 units, Spr (Sutton) M 2:15-5

330. Doctoral Seminar in Financial Decisions —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 and economic theory to industrial engineering problems. Prerequisite: Business 629A.

3 units, Spr (Hodder) TTh 1:15-2:30

360. Doctoral Research Seminar in Production—Topics from current published literature and working papers. Content varies each year. Open to doctoral students interested in research problems and issues in the production area. Prerequisites: 260, and at least one of 362, 363, or 364, or equivalent.

3 units, Spr (Lee) MW 10-11:15

362. Advanced Models in Production and Operations—Design and operation of production-inventory systems. Production scheduling, capacity planning, plant location, sequencing, assembly line balancing, multigoal optimization. The reading material is drawn primarily from journal articles. Prerequisite: 260.

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

363. Advanced Models for Service Systems—A study of advanced models for operations planning and management in the service sector. Emphasis on extending quantitative models typically used in manufacturing production to problems in service operations. Topics: forecasting, scheduling, inventory control, product flow, capacity planning, facility location, logistics, and financial decision models. Application areas: health care, public emergency services, transportation, financial services, and retail sales. Prerequisites: 260 or equivalent, Operations Research 153 or equivalent.

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

364. Advanced Models in Production and Distribution—A theoretical treatment of the man-
agement and control problems of inventory systems in production and distribution. Models for both single and multi-location systems are studied. Emphasis on operating characteristics, performance measures, and optimal operating and control policies. Prerequisites: 260 and 261, or equivalent.

3 units, given 1989-90

370. Management of Technology Doctoral Research Seminar — Intensive review of the academic literature in the management of technology field. Topics: technological forecasting, R&D management, theories and models of technological revolutions, and the classic academic studies of technological innovation. Topics vary each year. Prerequisites: 269 and 270, or equivalent. Enrollment limited and at discretion of instructor.

3 units, given 1989-90

390. I.E.E.M. Doctoral Research Seminar—Presentations of current research papers by speakers from both inside and outside the department. Ph.D. students must attend during every quarter in residence. No letter grades or units given.

Aut, Win, Spr (Staff) by arrangement

MATERIALS SCIENCE
AND ENGINEERING

Emeriti: (Professors) O. Cutler Shepard, Oleg D. Sherby, John C. Shyne
Chairman: Stig B. Hagstrom
Assistant Professor: John C. Bravman
Professors (Research): Robert S. Feigelson, Alan K. Miller
Lecturers: Alan L. Fahrenbruch, Ann Marshall
Consulting Professors: Paul A. Flinn, Timur Halicioglu, Robert I. Jaffee, David Redfield, Arden Sher, John Stringer, Jeffrey Wadsworth, Henry Wise

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, 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. Capable students are encouraged to take at least one year of 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

The 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, scanning, and transmission electron microscopy. Facilities for x-ray diffraction and fluorescence, and electrical, magnetic, and optical measurements are also available.

The department, together with other engineering departments and the Departments of Applied Physics, Chemistry, and 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 “Stanford Synchrotron Radiation Laboratory” section in this bulletin.

UNDERGRADUATE PROGRAM
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**

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 letter grade indicator 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 listed below:

**MATERIALS SCIENCE**

This program should be taken by those who wish to pursue a Ph.D. degree in Materials Science and Engineering:

1. All courses in the 180 series (18 units) except for students who have had equivalent courses at other universities.
2. 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).
3. The entire 45-unit master's program should represent an integrated technical program. The program must include at least 24 units in the Materials Science Department (excluding cross-listed courses). 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 course 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.)

**MATERIALS ENGINEERING**

Additional programs may be designed for those students who wish to obtain a working knowledge of materials science and engineering (M.S.E.) applied to materials technology. These programs are terminal M.S. programs. A minimum of 24 units in materials science and engineering, (excluding cross-listed courses) including a minimum of 12 units of advanced course work (beyond the 180 series and excluding the 202 laboratory series, attendance-only seminars, and research and special problems), is required, and must be approved by the student's advisor and the Advanced Degree Committee. Course sequences listed below are illustrative and for the guidance of the student; program-oriented substitutions and changes are possible with approval.

**MECHANICS OF MATERIALS**

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S.E. 185</td>
<td>Mechanical Behavior of Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S.E. 203</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>M.S.E. 205</td>
<td>Mechanics of Materials</td>
<td>3</td>
</tr>
<tr>
<td>M.S.E. 238</td>
<td>Fracture of Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S.E. 249</td>
<td>Time-dependent Plasticity</td>
<td>3</td>
</tr>
<tr>
<td>Mech. Engr. 200A,B</td>
<td>Mathematical Methods (or equivalent)</td>
<td>6</td>
</tr>
<tr>
<td>Mech. Engr. 238A,B</td>
<td>Theory of Elasticity</td>
<td>6</td>
</tr>
<tr>
<td>Electives</td>
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<td>18</td>
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<tr>
<td>Total</td>
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<td>45</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>Elec. Engr. 322A,B</td>
<td>Quantum Mechanics</td>
<td>6</td>
</tr>
<tr>
<td>Elec. Engr. 332</td>
<td>Optical Properties of Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S.E. 189</td>
<td>Electrical, Optical, and Magnetic Properties of Materials</td>
<td>4</td>
</tr>
<tr>
<td>M.S.E. 210</td>
<td>Semiconductor Materials</td>
<td>3</td>
</tr>
<tr>
<td>M.S.E. 215A,B</td>
<td>Photovoltaic Solar Energy Conversion</td>
<td>6</td>
</tr>
<tr>
<td>M.S.E. 222</td>
<td>Statistical Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>M.S.E. 233</td>
<td>Quantum Theory of Energy States in Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S.E. 234</td>
<td>Electronic Transport in Solids</td>
<td>3</td>
</tr>
<tr>
<td>M.S.E. 235</td>
<td>Photoelectronic Properties of Solids</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
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</tr>
<tr>
<td>Total</td>
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<td>45</td>
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</tbody>
</table>

**ENGINEER**

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. At least 36 of the 72 course units must be taken from the Materials Science Department, excluding cross-listed courses.
4. Maintain a letter grade indicator 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

5. The Microscopic World of Technology—(Enroll in Engineering 5.)
given 1989-90

50. Introductory Science of Materials—(Enroll in Engineering 50.)
51. Materials Technology for Structural Applications—(Enroll in Engineering 51.)
52. Semiconductor Processing Materials Technology—(Enroll in Engineering 52.)

100. Undergraduate Special Problems—Independent study in materials science under supervision of a faculty member.
   1-3 units, any quarter (Staff)
   by arrangement

150. Atomic Arrangements in Solids—(For undergraduates, see 180 for description.)
   5 units, Aut (Bravman) MTWTh 10
   and M 2:15-3:05

151. Thermodynamics and Phase Equilibria—(For undergraduates, see 181 for description.)
   5 units, Aut (Barnett) MTWThF 9

152. Rate Processes in Materials—(For undergraduates, see 182 for description.)
   4 units, Spr (Huggins) MWF 9
   and by arrangement

155. Mechanical Behavior of Solids—(For undergraduates, see 185 for description.)
   4 units, Win (Nix) MWF 9 Th 4:15

158. Introduction to Electrical, Optical, and Magnetic Properties of Materials—(For undergraduates, see 188 for description.)
   4 units, Win (Bube) MWF 1:15
   and by arrangement

160, 161, 162. Experimental Methods in Materials Science—(For undergraduates, see 202A,B,C for description.) 160-162 equivalent to 202A-202C respectively

160. 2 units, Aut (Staff) T 1:15
161. 2 units, Win (Bravman) W 3:45-5
162. 2 units, Spr (Bates, Staff) M 3:15

170. Undergraduate Research—Participation in a research project.
   3-6 units, any quarter (Staff)
   by arrangement

180. Atomic Arrangements in Solids—Description and determination of atomic arrangements in perfect and imperfect crystals, including treatment of formal crystallography, crystal-line defects, and diffraction phenomena.
   4 units, Aut (Bravman) MTWTh 10
   and M 2:15-5:05

181. Thermodynamics and Phase Equilibria—Application of thermodynamics to the control of the properties of materials. Heterogeneous
equilibria emphasizing solids. Prerequisite: Elementary thermodynamics.

4 units, Aut (Barnett) MTWTh 9

182. Rate Processes in Materials—Diffusion in solids, structural transitions including re-crystallization and liquid-solid and solid-solid phase transformations, property control by microstructural control. Prerequisites: 180 and 181.

3 units, Spr (Huggins) MWF 9

185. Mechanical Behavior of Solids—Introduction to the mechanical behavior of solids emphasizing relationships between microstructure and mechanical properties; description of elastic, anelastic, and plastic properties of materials; study of the relations between stress, strain, strain rate, and temperature for plastically deformable solids; application of dislocation theory to the study of strengthening mechanisms in crystalline solids; description of the phenomena of creep, fracture and fatigue, and discussion of their controlling mechanisms.

3 units, Win (Nix) MWF 9

188. Introduction to Electrical, Optical, and Magnetic Properties of Materials—Survey of electrical, optical and magnetic properties of metals, semiconductors and insulators. A pre-quantum mechanical treatment designed for students with minimum background in condensed matter physics and electromagnetic theory. Emphasizes new concepts and opportunities to get acquainted with them. Satisfies the Core requirements; students majoring in electronic properties are encouraged to take 198.

3 units, Win (Bube) MWF 1:15 and by arrangement

198. Electronic Properties of Solid Materials—Survey of the electronic properties of metals, semiconductors and insulators, including the free electron model, properties of energy bands, electrical transport, optical properties, semiconductor junctions, and magnetic properties. For students with some background in condensed matter physics and quantum mechanics. Emphasizes the basis and models for these concepts. Satisfies the Core requirements. Prerequisite: 188 or equivalent.

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

200. Graduate Special Problems.

any quarter (Staff) by arrangement


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

201B. The Science of Crystallization: Applications—Emphasis on the application of principles to the tailor-making of new films or bulk crystals, and the controlling of the properties of old ones. Topics: thin film formation via solid and liquid state epitaxial regrowth, liquid phase epitaxy, solvent zone migration, vapor-solid, vapor deposition, molecular beam epitaxy, chemical vapor deposition, sputter deposition, bulk single crystal formation via the Czochralski and Bridgman techniques, fiber growth, edge defined growth, flux growth, chemical crystallizers, ingots, casting and welding, amorphous materials, purification of materials, and frozen foods, biological tissues and organs. Prerequisite: 201A.

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

202A, B, C. Experimental Methods in Materials Science—Laboratory involving experimental techniques in different areas of materials science. Typical experiments: 202A: Structural characterization by optical microscopy and scanning electron microscopy; experiments on thermodynamics and kinetics of materials. 202B: X-ray diffraction and transmission electron microscopy. 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.

202A. 2 units, Aut (Staff) T 1:15

202B. 2 units, Win (Bravman) W 3:45-5

202C. 2 units, Spr (Bates, Staff) M 3:15


3 units (Barnett) given 1989-90

204. Energy Storage—Technical principles and phenomena involved in various approaches to energy storage in both small devices and large systems, such as utility and solar system load levelling, and vehicular applications. Electrochemical, chemical and thermal, mechanical, and magnetic energy storage systems. Current status and problem areas, fundamental limits, economic aspects, and potential prospects. Prerequisite: Engineering 50.

3 units (Huggins) given 1989-90
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 to materials useful in technology. Directed primarily toward non-materials science majors. Prerequisite: Upper division or graduate standing in Engineering or Science.

3 units, Aut (Staff) MWF 8

206. **Imperfections in Crystalline Solids**—Relation of lattice defects to the physical properties of crystals. Introduction to point imperfections and their relation to transport properties in metallic, covalent, and ionic crystals, and to the geometric and energetic aspects of dislocation theory. Relation between dislocation mechanics and the mechanical properties of crystals. Structure and properties of interfaces. Prerequisites: 180, 185.

3 units, Aut (Nix) MWF 9

207A. **Stress Analysis of Thin Films and Layered Composite Media**—Introduction to methods of stress analysis of layered dissimilar media, including thin films deposited on substrates, composite laminates, and stratified anisotropic elastic materials based upon the technique pioneered by Stroh. Stress states generated by thermal and elastic mismatch and local stress concentrations at interfacial cracks or corners are studied with applications to integrated circuit devices, aircraft materials, and geophysical media. Prerequisites: Any introductory course in strength of materials or the theory of elasticity, and some familiarity with matrix algebra.

3 units, Win (Barnett) TTh 9:30-10:45

207B. **Mechanical Properties of Thin Films**—The mechanical properties of thin films on substrates. The mechanics of thin films and of the atomic processes which cause stresses to develop during thin film growth. Experimental techniques for studying stresses in and mechanical properties of thin films. Elastic, plastic, and diffusional deformation of thin films on substrates as a function of temperature and microstructure. The effects of deformation and fracture on the processing of thin film materials.

3 units (Nix) given 1989-90

209. **Mathematical Methods in Materials Science**—Formulation and solution of heat conduction and diffusion boundary value problems using separation of variables and related methods. Elementary complex variables, matrix, and tensor analysis with applications to problems of interest to materials scientists.

3 units (Barnett) given 1989-90

210. **Materials Considerations in Semiconductor Processing**—Emphasis on an atomistic understanding of the key processes involved in the synthesis of integrated circuits. Designed to help one think qualitatively and semi-quantitatively about the details of these processes. Topics: doping (diffusion and ion implantation), solid state regrowth and laser annealing, chemical vapor deposition and epitaxy, oxidation and nitridation, and defect generation during processing.

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

215. **Photovoltaic Solar Energy Conversion**—Introduction to photovoltaic principles, devices, fabrication, systems, and applications. Overviews of pertinent disciplines, photovoltaics, junction theory, crystal and film growth, solar insolation and power systems. Recommended: First year graduate understanding of solid-state electronics.

3 units (Fahrenbruch) given 1989-90

218. **Basic Physics for Solid State Electronics**—(Enroll in Electrical Engineering 228.)

222. **Statistical Thermodynamics**—Systematic development of the methods of statistical mechanics with application to problems in materials science. Prerequisite: 181.

3 units (Staff) given 1989-90

224. **Amorphous Silicon**—Introduction to amorphous semiconductors. Includes structure, electronic states and transport, optical properties, doping, defects, photoconductivity and luminescence, instability, and applications. Amorphous silicon is used as a principal example. Prerequisites: 188 and knowledge of semiconductor physics.

3 units, Aut (Redfield) TTh 2:15-3:30

226. **Electrochemistry and Corrosion**—Development of electrochemical principles with application to corrosion, electrolytic processes, and galvanic cells. Prerequisite: Elementary thermodynamics.

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

corrosion in gas turbines. Prerequisites: 181, 182.

3 units, Win (Stringer) MWF 8

228A, B. Physics of Semiconductor Devices—
(Enroll in Electrical Engineering 328A, B.)

229. New Methods on Thin Film Synthesis—
Novel techniques to control the growth of thin films on an atomic layer scale provide the materials base for new classes of devices. Seminar topics: the fundamentals of growth techniques, molecular beam epitaxy (MBE), chemical vapor deposition (CVD), beam assisted deposition, and plasma deposition. Relationship between deposition parameters and film properties. Industrial applications of thin film synthesis.

1 unit, Win (Hagstrom) W 1:15

230. Materials Science Colloquium.

1 unit, Aut, Win, Spr (Hagstrom) F 3:30

231. Electrical and Magnetic Properties of Solids—
(Enroll in Electrical Engineering 238.)

232. Solid State Ionics—Structure of point defects in crystalline and noncrystalline solids. Defect equilibria and transport; influence of chemical and electrical potentials, interfaces, and association. Solid-state electrochemical transducer systems and effects; compositional and structural control. Various scientific and technological applications including sensors, batteries, and fuel cells. Prerequisites: 181 and Engineering 50, or equivalent.

3 units, Win (Haggstrom) TTh 9:30-10:45


3 units, Aut (Bube) MWF 2:15


3 units, Win (Sinclair) TTh 2:30-3:45


3 units, Spr (Nix) MWF 10

239. Fundamentals of Optoelectronic Devices—Emphasis on the fundamentals of photodetection using various schemes and basic detector performance including thermal detectors (thermopile, bolometer, Golay cell and pyroelectric photoemissive detectors (photocathodes, negative electron affinity devices, photomultipliers, and image intensifiers), and solid-state photo detectors (photoconductors, p-n junctions, MIS and graded band gap multilayer detectors. Prerequisite: 188 or Electrical Engineering 216.

3 units, Spr (Bates) TTh 1:15-2:45

243. Transmission Electron Microscopy—Image formation and interpretation. The contrast phenomena associated with perfect and imperfect crystals from a physical point of view and from a formal treatment of electron diffraction theory. The importance of electron diffraction to systematic analysis and recent imaging developments. Prerequisite: 180.

3 units (Sinclair) given 1989-90

244. Failure Analysis—Techniques and methods used in the analysis of failures in the field of materials science and engineering. Laboratory work includes optical and electron fractography, localized chemical analysis, individual failure analyses, and a mock product liability trial. Lectures include failure in structural and electronic materials by ductile and brittle fracture, fatigue, corrosion, stress-corrosion cracking, surface damage. Selected case studies.

3 units, Spr (Miller) given 1989-90

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 (Staff) not given 1988-89

250. Life Prediction in Engineering Structures — Modeling of deformation and fracture in metals and alloys, emphasizing methods for quantitative predicting failure of structural materials under complex histories and environments. Topics: the modeling of creep and plastic deformation (constitutive equations), fatigue crack initiation and propagation, stress corrosion cracking, and ductile rupture. Types of life prediction methodologies are covered, from conventional design rules to advanced physical-phenomenological computer models based on internal state variables. Prerequisite: 185 or 205.

3 units (Miller) given 1990-91
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.

2-3 units, Aut, Win, Spr (Marshall) by arrangement

255. Thin Film and Interface Microanalysis—The science and technology of a variety of microanalytical techniques, including Auger electron spectroscopy (AES), Rutherford backscattering spectroscopy (RBS), secondary ion mass spectroscopy (SIMS), ion scattering spectroscopy (ISS), and x-ray photoelectron spectroscopy (XPS or ESCA). Also, generic processes such as sputtering and high-vacuum generation. Prerequisite: 188 or equivalent.

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

257. Structural Fatigue—(Enroll in Mechanical Engineering 245.)

258. Optical Properties of Solids—(Enroll in Mechanical Engineering 332.)

259. Basic Quantum Mechanics—(Enroll in Electrical Engineering 322A.)

260. Basic Quantum Mechanics—(Enroll in Electrical Engineering 322B.)

268. The Electronic Structure of Surfaces and Interfaces—(Enroll in Electrical Engineering 329.)

278. The Science of Semiconductor Surfaces—(Enroll in Electrical Engineering 331.)


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

300. Research.

any quarter (Staff) by arrangement

302. Solid-State Characterization Laboratory—(Enroll in Electrical Engineering 337.)

3 units, Aut, Win, Spr (Bates) by arrangement

310. Participation in Materials Science Teaching.

1-3 units, Aut, Win, Spr (Staff) by arrangement

341. Seminar in Mechanical Properties of Solids.

1 unit, Aut (Nix) T 4
Win (Staff)
Spr (Millner)


1 unit, Aut, Win, Spr (Huggins) Th 4:15

343. Photoelectronic Materials and Devices Seminar.

1 unit, Aut, Win, Spr (Bube) Th 12:15


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


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

MECHANICAL ENGINEERING


Chairman: Charles H. Kruger

Division Chairmen: Thomas J. R. Hughes (Applied Mechanics), James P. Johnston (Thermosciences); (the Design Division operates without a chairman.)

Laboratory Directors: David Beach (Program Director, Manufacturing Systems Engineering and M.E. Student Shops), Daniel B. Debra (Guidance and Control), John K. Eaton (Heat Transfer and Turbulence Mechanics), Ronald K. Hanson, (High Temperature Gasdynamics), Larry J. Leifer (Smart Product Design Laboratory; Center for Design Research Rehabilitation R&D Center), Elliott Levinthal (Stanford Institute of Manufacturing and Automation), Parviz Moin (Center for Turbulence Research)


Associate Professors: Brian J. Cantwell, John K. Eaton, Rolf A. Faste, Larry J. Leifer, Parviz Moin, Drew V. Nelson

Assistant Professors: Mark Cappelli, Mark Cutkosky, M. Godfrey Mungal, Stephen J. Niksa, Sheri D. Sheppard, Juan Simo

Professors (Research): Dennis Carter, Dean R. Chapman, Elliott Levinthal, Sidney A. Self, Felix E. Zajac
The programs in the Department of 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 have traditionally entered into the energy industries, into the product manufacturing industries, into government laboratories and agencies dealing with these problems, and a variety of academic situations.

Since mechanical engineering is a broad discipline, many students use the 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 and computational mechanics. The Design Division emphasizes the design process and is specifically concerned with manufacturing technology, automatic control, robotics, kinematics, fatigue and fracture mechanics, optimization, design aesthetics, human factors, biomechanics, computer-aided design, microcomputers in design, and design research. 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, combustion, fluid mechanics, heat transfer, plasma sciences, nuclear energy, and pollution control.

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.

Various research projects are conducted in the Applied Mechanics Division. 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 theoretical, computational, and experimental 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 Structures and Composites Laboratory, a joint activity with the Department of Aeronautics and Astronautics, is for the study of structures made of fiber reinforced composite materials. Equipment for fabricating structural elements includes presses, an autoclave, and a filament winder. X-ray, ultrasound, and an electron microscope are available for nondestructive testing. The laboratory is also equipped with mechanical testers, environmental chambers, and a high speed impactor. Projects in the laboratory include the design of composite structures, evaluation of environmental effects on composites, and the development of novel manufacturing processes.

The Applied Mechanics Division has a Computational Mechanics Laboratory. Its facilities include a CONVEX CI supermini computer (a vector machine with CRAY like architecture) SUN colorgraphics work stations, and a variety of terminals, laser printer and hard copy devices.

The Design Division provides facilities for laboratory work in experimental mechanics and experimental stress analysis. Additional facilities, including an MTS electrohydraulic mate-
foundry, welding, wood, and plastics facilities. Student shops offer tools and coaching to provide prototype fabrication as an intrinsic part of the design process. 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 project center offers facilities for CAD, simple fabrication, assembly, and testing of original designs by master's students in the engineering design program. A Smart Product Design Laboratory supports nine microprocessor application projects. The Center for Design Research provides an excellent facility for CAE/CAD/CAM research development and education. Resources include an IBM 4341-2, with eight high-performance graphic workstations, CAD workstations, an IRIS-2400 animation computer, two SUN 3/160 AI workstations, and two Symbolics Lisp machines. In addition, the Center for Design Research has several industrial robots available for student projects and research. The Design Division also has a unique "Product Design Loft," in which students in the Product Design program develop their graduate design projects.

Research and Design/Development opportunities in Rehabilitation Engineering and Biomechanics are available at the Veterans Administration Medical Center in cooperation with the School of Medicine. The program includes graduate assistantships and is led by members of the Design Division faculty. Facilities include a VAX 11/780 and two PDP-11/34's dedicated to realtime experiment control, a wide variety of microcomputers, an IRIS 2400 real-time graphics workstation, and a Symbolics Lisp machine. Neuromuscular Biomechanics and Electrophysiology Laboratories compliment campus facilities.

The Thermosciences Division has two major laboratories and a Center for Turbulence Research. 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. A VAX-750 computer serves as the central laboratory computer and several MINC-11 minicomputers are dedicated to individual experiments. The High Temperature Gasdynamics Laboratory (HTGL) is engaged in variety of research activities in the areas of plasma sciences, magnetohydrodynamics (MHD) for energy conversion, laser chemistry and processing, electrostatic precipitation, combustion, chemistry of pollutant formation, and the development of laser-based diagnostics for high temperature gases. The experimental capability of the HTGL includes plasma facilities, normal and superconducting magnets, two shock tubes, a model precipitator, several advanced laser systems, diagnostic devices for combustion gases and plasmas, dedicated minicomputers, a central laboratory computer (VAX-750), and laboratory combustors, including a coal combustion facility and a supersonic combustion facility. A wide variety of instrumentation, extensive shop facilities, utilities, and research space are all available within and shared by these laboratories. The Center for Turbulence Research (CTR) has direct access to the major computing facilities of NASA-Ames Research Center. Together with others working in computational fluid mechanics, this group uses NASA's CRAY- XMP, CRAY-2, and CDC CYBER 205 computers, the most powerful computer systems presently available.

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 robotics for manufacturing 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.

A wide range of computation facilities are available to department students. Three of the department's laboratories are equipped with superminicomputers, three DEC VAXes and a Prime. Numerous smaller minicomputers and microcomputers are used in the research and teaching laboratories. A microcomputer applications development laboratory equipped with several development systems is also available. Free computation is available on the DEC-20 LOTS system while larger computations are possible on the IBM 3081 at the Stanford Data Center.
The library facilities at Stanford are also outstanding. In addition to the general library, there are special libraries for Engineering, Mathematics, 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.

UNDERGRADUATE PROGRAMS

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 students who elect this program continue on through the master’s degree in this field. All courses taken for the departmental major (math, science, VTSS, engineering fundamentals, and engineering depth) must be taken for a letter grade if the instructor offers the option.

Grade requirements—In order to be recommended by the department for a Bachelor of Science Degree in Mechanical Engineering, a student must achieve the minimum letter grade indicator (LGI) set by the School of Engineering (2.0 in engineering fundamentals and engineering depth). Students completing their degrees under the old requirement must achieve an LGI of 2.0 in engineering breadth and depth courses.

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 after the beginning of the eighth quarter of undergraduate work and before the end of the 11th quarter. The applicant’s petition must provide evidence of a strong academic performance as a graduate student. The petition will be evaluated and acted upon by the graduate admissions committee of the department. Typically, at least a 3.25 letter grade indicator in engineering, science, and math is expected. Applicants must have completed two of 111, 112, 113, 131A, 131B, 131C, and must take the Graduate Record Examination (GRE) before action will be taken on the application. Coterminal information and forms can be obtained from the Mechanical Engineering Department office.

GRADUATE PROGRAMS

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. The student’s undergraduate record and personal recommendations must demonstrate the 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, ordinary differential equations) 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 (see item “3” below) to obtain the M.S. degree in the normal three quarters.

Graduate Program—Mechanical Engineering (M.E.) 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, magneto-
hydrodynamics, biomechanics, and 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 stu-
dent. At least 36 of these units must be taken at
Stanford; any units transferred from other uni-
versities (up to 9 are allowed) must be graduate
level courses taken while registered as a grad-
uate student, and may not be applied toward
fulfillment of item "2" below. No thesis is re-
quired. However, students who desire some
research experience during the master’s year
may participate in research through M.E. 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 fol-
   lowing areas: partial differential equations,
   linear algebra, complex variables, or nu-
   merical analysis as demonstrated by comple-
tion of two appropriate courses from the
following list: M.E. 200-208; 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 me-
   chanical engineering consisting of:
   a) **A Specialty in Mechanical Engineering:**
      A set of graduate-level courses in me-
      chanical 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 sig-
      nificant component of applications of the
      material in the context of engineering
      synthesis. Lists of approved depth pack-
      ages are available from the department
      office. The currently approved depth
      packages involve three to four courses.
   b) **Breadth in Mechanical Engineering:** Ad-
      ditional graduate level courses in me-
      chanical engineering to bring the total
      number to at least 18 units in mechanical
      engineering courses numbered 210 and
      above, excluding 290-301 and mathemat-
      ics courses. Of these additional courses,
      there must be at least one each in two
      independent subject areas that add
      breadth to the program, as approved by
      the advisor.

   Courses 200-208, 280, and 286-301 may not
   be counted in these categories.

3. **Approved Electives:** to bring the total num-
   ber of units to 39. All of these units must be
   approved by the student’s advisor. Graduate
   engineering, math, and science courses are
   normally approved. Advisors may approve
   upper-level undergraduate courses if consis-
tent with the student’s program objec-
tives. Of these 39 units, no more than 6 units
may come from M.E. 291, 292, and no more
than 3 units may come from the other
courses numbered 290-299 or other semi-
nars. A student planning to go on for a Ph.D.
degree should discuss with his or her faculty
advisor the desirability of taking 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 encour-
aged to use these units outside of engineer-
ing, mathematics, or the sciences. Students
should consult their advisors for recommenda-
dations on course loads and on ways to use
the unrestricted electives to make a manage-
able program.

5. Within the courses satisfying the require-
ments above, there must be at least one
graduate-level course dealing with labora-
tory studies. Courses which satisfy this
requirement are M.E. 210C, 218A, B, C, 226A,
248, 249, 254, 268. M.E. 292 will satisfy this
requirement if 3 units are taken for work
involving laboratory experiments. A student
who has had a substantial laboratory experi-
ence in an industrial or government research
institute may be exempted from this require-
ment by his advisor.

Candidates for the degree of Master of Sci-
ence will be expected to have the approval of the
faculty, and a minimum letter grade indica-
tor (LGI) 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
seminars, and courses for which a Pass/No
Credit grade is given to all students).

Students falling below an LGI of 2.50 at the
end of 20 units may be disqualified from further
registration. Students failing to meet the com-
plete 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,
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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 the student’s advisor, with a stronger component of CFD. Students intending to seek a Ph.D. degree with an emphasis on CFD should prepare for the post-master’s series in CFD (M.E. 269 and/or Aeronautics and Astronautics 214A,B,C) by planning a M.S. program strong in mathematics and numerical analysis (M.E. 200A,B,C or equivalents) and in advanced fluid mechanics (M.E. 251A,B, or 258, 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.

ENGINEERING PRODUCT DESIGN

The following graduate program leading to a Master of Science in Engineering (Product Design) is unique in that it is jointly offered by the Departments of Mechanical Engineering and Art. Students with undergraduate engineering degrees other than Stanford’s B.S. in Product Design spend an additional year taking prerequisite undergraduate and product design courses. The requirements for this degree are:

Course No. Subject Units
*Art 360A,B,C. Master’s Project 6
*M.E. 211A,B,C. Master’s Project 12
M.E. 214. Philosophy of Design 3
M.E. 221. Human Factors 3
**Approved Electives 15
Free Electives 6
Total 45

*Taken jointly each quarter.
**Students are expected to create a plan of graduate studies suited to their personal needs. The courses listed below are recommended electives and may require enrollment approval by the instructor.

GRADUATE DESIGN OPTIONS

Biomedical Design
M.E. 281. Orthopedic Biomechanics
M.E. 282. Neuromuscular Biomechanics
M.E. 284. Dynamics of Viscous Fluids and Suspensions
M.E. 285. Biomechanical Fluid Mechanics

Computers in Design
M.E. 212A,B. Geometric Modeling
M.E. 218A,B,C. Microprocessor Applications

Design Management
Indust. Engr. 133. Industrial Accounting
Indust. Engr. 269. Industrial Marketing
Indust. Engr. 272. Managing Small Technical Companies

Indust. Engr. 271. New Enterprise Management
Design Philosophy
M.E. 214. Philosophy of Design
M.E. 215. Designer in Society

Engineering Design
M.E. 210A,B,C. Engineering Design
M.E. 216. Optimal Design
M.E. 217. Design for Manufacturability
M.E. 222. Kinematic Synthesis of Mechanisms
M.E. 223. Design and Analysis of Dynamic Systems

Visual Design
Art 261. Advanced Graphics Design
Art 268. Design Synthesis
Art 269. Advanced Creative Studies

Admission requirements and letter grade indicator graduation requirements are the same as for the mechanical engineering master’s degree described above. In addition, applicants must also submit evidence of design ability (e.g., photos or slides of several design projects).

Students with non-engineering undergraduate degrees in design may apply to the Department of Art for a similar graduate design program administered by the Art Department and leading to an A.M. or M.F.A. in Design. Students with non-engineering degrees who wish to earn the M.S. degree should talk with the program advisor.


ENGINEERING: MANUFACTURING SYSTEMS (MSE)

The Master of Science in Manufacturing Systems Engineering (MSE) addresses the need for engineers who combine management and design skills focused on manufacturing. There is a critical need for individuals who can deal directly with product design for manufacturability; design of manufacturing tools; financial, organization and strategic management issues; and elements of automation technology such as computer-aided design, computer-aided manufacturing robotics, and microprocessor control.

Manufacturing Systems Engineering is a joint effort of the Departments of Mechanical Engineering, and Industrial Engineering and Engineering Management. The program seeks high-quality students with strong educational backgrounds in engineering and provides a demanding curriculum strong in both hardware aspects and the engineering management perspective.

The hardware and engineering-design aspects of the program include:
The objectives of the program, how it is coherent, includes the trade-offs that must be made for their financial, organizational, and production impact, as well as their impact on the firm's manufacturing policy. Beyond the required core, the curriculum allows for elective courses chosen from a broad set of relevant electives providing additional training in both the engineering management perspective, engineering design hardware, and aspects of computer science. Here a student may follow his or her individual interests and tailor the program to meet individual needs.

Students in the MSE program will be expected to have the approval of the faculty, and a minimum letter grade indicator (LGI) of 3.00 in the 45 units presented in fulfillment of the degree requirements.

ENGINEERING

As described in the "School of Engineering" section of this bulletin, each department in the School of Engineering may sponsor students in a more general degree, the Master of Science in Engineering. Sponsorship by the Department of Mechanical Engineering (M.E.) requires that the student file a petition for admission to this program on the day before instruction begins, 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 M.E. 200-208 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 the program 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 are
invited to apply and may be admitted providing they are sufficiently well qualified and that thesis supervision and financial aid arrangements are made.

The departmental requirements for the degree include an acceptable thesis; up to 15 units of 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 letter grade indicator 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-Based Design, or Man-Machine Systems).

The total of 90 units can 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 the 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 allows 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.

In special situations dictated by compelling academic reasons, Academic Council members who are not members of the departmental faculty may serve as the principal dissertation advisor when approved by the department. In such cases, a member of the department faculty must serve as a program advisor and member of the reading committee, and agree to accept responsibility that departmental procedures are followed and standards maintained.

Admission to the program involves much the same consideration as described under the Engineer degree. Since thesis supervision is required, the department cannot admit a student to the program until the student has personally, at least tentatively, arranged with some member of the faculty to supervise a research project. 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 a qualifying oral examination. The academic level and subject matter of this examination correspond approximately to the Master of Science degree program described above. The form and timing of the examination differs for the three divisions of the department; specific information may be obtained from the divisional or departmental offices.

Normally the examination will be taken during the first postmaster'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 indicator (LGI) equivalent of at least 3.25. Courses used in the LGI evaluation will be the same as those that would be used to meet the M.S. LGI requirement. Students entering Stanford with an M.S. from another school must have a 3.25 LGI in the M.S. program at the previous school to take the examination in their first quarter at Stanford. After the first quarter at Stanford, such a student must meet the LGI of 3.25 for courses taken 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: M.E. 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 (M.E. 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 the "Degrees" section in this bulletin) 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. This requirement may be satisfied either by a formal minor in another department or by course work that is approved for breadth 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 student wishing to complete the Ph.D. requirements in four years of graduate study should ordinarily complete the M.S. by the Spring Quarter of the first year, pass the qualifying examination by the Autumn Quarter 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 (M.E.) should consult the department office for designation of a minor advisor. A minor in M.E. may be obtained by completing 15 units of approved graduate level courses in M.E. 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.

Courses approved for the minor must form a coherent program, and must be selected from those satisfying requirement (2) of the Master of Science in Mechanical Engineering.

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 research assistantships used primarily for post-master's degree students. Preference for the teaching assistantships is generally given to students who obtain their bachelor's or master's degrees at Stanford. Research assistantships are awarded by the individual faculty research supervisors and not by the department as a whole. Applicants should contact the departmental administrative assistant for additional information.

Research assistants can, and normally do, carry out their dissertation research work and write their dissertation as an integral part of the commitments of their assistantships.

COURSES

FRESHMAN

The following courses offered by the faculty of the department are suitable for freshmen.

Course No.  Subject
101.  Visual Thinking
103. Manufacturing Technology
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 the day before instruction begins 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. Engineering Thermodynamics—(Enroll in Engineering 30.)


4 units, Win (Kruger) MWF 10
Spr (Mungal) MWF 11
lab MTWTh 1:15-3:05 or 3:15-5:05, or one 2-hour lab by arrangement

75. Introduction to Small Computer Hardware and Interfacing—Lecture and laboratory describing the hardware of modern small computer systems emphasizing interfacing to the external world. Topics: basic computer architecture, typical hardware components, analog and digital interfacing, and simple control systems. Prerequisites: Engineering 40 and 70, or equivalents.

3 units, Win (Eaton) TTh 3:15-4:30 plus lab

102. Design Communication — Fundamentals of the four basic methods of engineering design communication; (freehand sketching, technical drawing, verbal, and written presentations). Introduction to computer-aided tools in the design process. To encourage innovative and relevant use of engineering skills, class exercises and projects are based on instructor’s professional experiences.

3 units, Spr (Della Bona, Scott) MWF 8-10

103. Manufacturing and Design—(Graduate students enroll in 303.) Emphasis on prototype development techniques as part of the design process. Fundamentals of machining, welding, and casting introduced in lecture and supported by laboratory experience. Manufacturing processes described through lecture, films, and field trips. Design aspects are developed in an individual term project chosen, designed, and fabricated by the students. 103D is normally taken concurrently unless the student has prior drafting experience. Recommended: 101, Engineering 11.

4 units, Aut, Win (Beach) TTh 9-11
plus lab by arrangement

103D. Engineering Drawing—Fundamentals of engineering drawing including orthographic projection, dimensioning, sectioning, exploded and auxiliary views, and assembly drawings. Designed to accompany 103. Homework drawings are of parts fabricated by the student in the shop. Major assignments in 103 are supported by material in 103D and assignment dates are sequenced on the assumption that student is enrolled in both courses simultaneously. No prior knowledge of drafting required.

1 unit, Aut, Win (Milroy) one meeting per week by arrangement, Sec. 1 T 7:30-9:30 p.m., Sec. 2 W 3:30-5:30

104. Dynamic Response—(Enroll in Engineering 104.)

105. Control System Analysis and Design—(Enroll in Engineering 105.)

111. Design Methodology—Engineering design as a problem solving activity. Lectures on design methodology, the creative process, and general problem solving techniques. The proper roles of analysis, estimation and testing. Technical material is introduced in support of student project activity: mechanism design, applied strength of materials, mathematical modeling and finite element analysis. Students develop design concepts and produce engineering drawing, sketches, and models. Prerequisites: 101, 103, Engineering 11.

3 units, Aut (Manning) MW 2:15-4:05

112. Quantitative Aspects of Mechanical Design—An examination of stress, strain, and failure of mechanical components and the applica-
tion of these concepts to system and component design. Part I: free body diagram analysis; basic, elastic stress analysis; static failure theories; buckling; fatigue failure criteria; and life prediction methods. Part II: some real systems in the light of these fundamentals; the relationship between system functional requirements and the detailed loading, selection, and specification of existing mechanical devices subjected to hands-on examination and quantitative analysis of design features.

3 units, Win (Staff, Nelson)
TTh 1:15-2:40

113. Engineering Design—Design process involves application of information from various sources to create tangible objects and intangible system concepts to improve the quality of human life. Design is 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 (Cikutosky, Sheppard)
MW 1:15-3:05

115A. Human Values in Design—Active encounters with human values in design. Lectures survey central philosophy of product design program, emphasizing 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 (Kelley) MW 1:15-3:05
plus one evening lab by arrangement

115B. Expression of Function—Numerous tightly constrained projects requiring reconciliation of manufacturing, human factor, and aesthetic concerns; solutions presented in a variety of design media. Prerequisites: 103, 115A, Art 60.
3 units, Spr (Faste) MW 1:15-4:05

115C. Design Sketching—Freehand sketching, rendering, and design development. Work is under the guidance of instructors. Concurrent assignments in 115 and 116 series provide subject matter, but the class is open to anyone wishing to improve freehand drawing skills.
1 unit, any quarter (Scott, Reeder, Gehrke) one evening per week

116A. Advanced Product Design—Small-scale projects carried to a high degree of refinement. Emphasis upon craftsmanship and aesthetics. Prerequisites: 115B, Art 160.
3 units, Aut (Moggridge) TTh 9-12

116B. Advanced Product Design—Need identification by means of various strategies: technology push, market pull, design history, societal trends, self-awareness. The role of perception and personal values in problem definition and entrepreneurship. Students identify a project area to be pursued as a thesis in 116C.
3 units, Win (Faste) TTh 11-1:05

116C. Advanced Product Design—Summary project utilizing knowledge, methodology, and skills obtained in 101, 103, 115A, B and 116A, B. Final presentation to professional jury. Prerequisite: 116B.
3 units, Spr (Burnett) TTh 11-1:05

119. Precision Engineering—Lecturers, laboratory experiences, field trips, individual design and fabrication projects, current topics of interest in manufacturing emphasizing precision engineering. How to accomplish microinch resolution and repeatability? What are the applications for ultra-precision machining and measuring systems? Students select projects from the lecture material and pursue them to hardware. Final project presentation should demonstrate the application of design skills to some problem in precision engineering.
3 units, Spr (DeBra, Beach) TTh 9 lab by arrangement

130. Internal Combustion Engines—Internal combustion engines including conventional and turbocharged spark ignition engines, diesel, and gas turbine engines. Lectures: basic engine cycles, engine components, methods of analysis of engine performance, pollutant emissions, and methods of engine testing. Laboratory sessions involve hands-on experience with engines and test hardware. Prerequisite: Engineering 30 or equivalent. Limited enrollment.
3 units, Aut (Rinehart) MW 9 plus lab by arrangement

131A. Fluid Mechanics—First of a three-quarter sequence that should be taken in consecutive quarters. Lectures and laboratory cover fluid mechanics, heat transfer, and thermodynamics. Lecture sessions emphasize basic principles used in the energy sciences and their application in man-made systems. Laboratory sessions are 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: Engineering 30 and Mechanical Engineering 33. Mathematical background should include intermediate calculus and ordinary differential equations.
5 units, Aut (Mungal) MWF 10 plus lab one afternoon by arrangement

131B. Heat Transfer—Continuation of 131A.
5 units, Win (Moffat) MWF 10 plus one lecture hour and lab one afternoon by arrangement
131C. Thermosciences—Continuation of 131B. 4 units, Spr (Reynolds) MWF 10 plus lab one afternoon by arrangement

138. Noise Pollution—(Enroll in Aeronautics and Astronautics 138.)

161. Dynamic Systems—Linear modeling, analysis, and measurement of mechanical systems. Topics: resonance, damping, stability, harmonic analysis, and force transmission. Extensions to multiple degree of freedom using computers. Several sessions devoted to demonstrations and practical examples. Assumes a background in dynamics and mathematics. Prerequisites: Engineering 12, Math 43, or equivalent. Recommended: Math 113 or equivalent (can be taken concurrently).
4 units, Aut (Cutkosky) TTh 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.
1-5 units, any quarter (Staff) by arrangement

UNDERGRADUATE AND GRADUATE

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.

103. Manufacturing Technology
105. Control System Analysis and Design (Enroll in Engineering 105)
113. Engineering Design
138. Noise Pollution (Enroll in Aeronautics and Astronautics 138)
161. Mechanical Vibrations
250. Introduction to Heat Transfer
255. Gasdynamics

PRIMARILY FOR GRADUATES

ENGINEERING MATHEMATICS

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

200B. Mathematical Methods in Mechanical Engineering—Geometric interpretation of partial differential equations (PDEs), characteristics, solution of first order equations, characteristics and classification of second order PDEs, separation of variables, special functions, eigenfunction expansions, Fourier integrals and transforms, Laplace transforms, method of characteristics, self-similarity.
3 units, Win (Ferziger) MW 9

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

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

202. Stochastic Equations and Waves in Random Media—(Enroll in Mathematics 233.)

203. Perturbation and Asymptotic Methods with Applications—(Enroll in Mathematics 270.)

204A. Linear Transforms and Their Applications to Engineering Problems I—(Enroll in Aeronautics and Astronautics 291A.)

204B. Linear Transforms and Their Applications to Engineering Problems II—(Enroll in Aeronautics and Astronautics 291B.)

205A. Methods of Mathematical Physics—(Enroll in Mathematics 220A.) An exposition of characteristic and Green’s function, integral
transform, variational, perturbation and distribution theoretic methods for the analysis of differential, difference and integral equations, together with numerous specific illustrative examples. Prerequisite: Some familiarity with ordinary and partial differential equations.

3 units, Aut (Levine)

205B. Methods of Mathematical Physics—(Enroll in Mathematics 220B.) Continuation of 205A.

3 units, Win (Ward)

205C. Methods of Mathematical Physics—(Enroll in Mathematics 220C.) Continuation of 205B.

3 units, Spr (Keller)

206. Similitude in Engineering Mechanics—Reduction of physical problems: similarity rules revealed by dimensional analysis; supplementary information; self-similar solutions by dimensional analysis and other groups of transformations; applications to fluid mechanics and other fields; local solutions and their uses; self-similar solutions with concealed exponent. Prerequisite: 200B or Mathematics 131, 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; computer-extended series; slow variations; singular perturbation problems; the methods of matched asymptotic expansions, multiple scales, and other; improvement of series. Prerequisite: 200B or Mathematics 131, or consent of instructor.

3 units, Spr (Van Dyke) MWF 10

208. Vector and Tensor Analysis—(Enroll in Aeronautics and Astronautics 192.)

DESIGN AND CONTROLS

209. Aesthetics of Machinery—The effects of design strategy selection, design media, construction and assembly strategies, human factors, and explicit or intuitive personal criteria on the appearance of machinery and designed objects. Students explore these issues and develop an awareness of their personal design style through the design and construction of small scale mechanical devices. Limited to 15 students, consent of instructor required.

1-3 units, Win (Faste) Th 6-7:30 p.m. alternate years, not given 1989-90

210A, B, C. Engineering Design—Experience in the formulation, design, and analysis of real engineering projects offered by industry. Design is developed and constructed through hardware phase by small groups of students under supervision of Design Division faculty and in close cooperation with the industrial sponsor. Some sponsored projects are manufacturing-oriented, and some offer opportunity for application of automation principles, microprocessors, controls, and sensors. Students with such interests should enroll in both 210 and 218. Projects are carried through construction and testing of a prototype, and first design revision. Instruction includes design methodology, design for manufacturability, project planning, safety, liability, and patenting. Students must enroll for all three courses. Experience in technical presentations, oral and written is stressed. Students unfamiliar with manufacturing processes or drafting are encouraged to enroll also in 103 and 103D. Limited enrollment. Prerequisite: 113 or equivalent.

210A. 4 units, Aut (Leifer, Staff) TTh 3:15-5:05

210B. 3 units, Win (Leifer, Staff) W 3:15-5:05

210C. 3 units, Spr (Leifer, Staff) Th 3:15-5:05

211A, B, C. Product Design Master's Project—Three-quarter graduate design project taught jointly with Art Department faculty. First quarter: the rational and intuitive problem-finding procedures to identify design projects within an unexplored area of need. Second quarter: a design program, concepts, necessary experiments and research, and project to the stage of a working prototype. Third quarter: refine the design from the standpoint of cost, production and aesthetics. A demonstration model is built and presented to a professional jury. For Product Design or Design (Art) majors only. Co-requisite: Concurrent Art 360.

211A. 4 units, Aut (Faste, Kelley) by arrangement

211B. 4 units, Win (Faste, Kelley) by arrangement

211C. 4 units, Spr (Faste, Kelley) by arrangement


3 units, Win (Wilde) MWF 10 alternate years, not given 1989-90
3 units (Wilde) alternate years, given 1989-90

213. Computer Aided Prototyping—Prototype design and fabrication emphasizing the use of computer supported tools in the design process. Students choose, design, and build individual projects. The tool set includes Hewlett Packard CAD, CNC part programming software, and CNC milling machines. Lectures alternate between student and instructor presentations of work in progress. Enrollment limited to 12; priority based on student project proposals made at the first class meeting. Coaching in project development is available from instructors during Autumn and Winter Quarters. Prerequisites: Programming ability in Pascal (or other high level language), 101 and 103 or equivalent.
3 units, Spr (Beach, Larkin) MW 10
plus lab by arrangement

214. Philosophy of Design—Students develop and clarify 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 include personal creativity, design methodology, interpersonal relationships, ethics, goal-setting, aesthetics, human values in design, ecology, appropriate technology, and decision making. Corequisite: Concurrent enrollment in 210A or 211A.
3 units, Aut (Thornburg) M 2:15-5:05

215. The Designer in Society—The participants’ career objectives and psychological orientation are compared with existing social values and conditions. Emphasis on assisting individuals in assessing their roles in modern society. Required readings on political, social, and humanistic thought related to technology and design. Term project required. Limited enrollment; open to graduate students of all discipline. Mandatory class attendance.
3 units, Win (Roth) W 1:15-4:05

216A. Principles of Optimal Design—Modeling for compact and rapid optimization, free from errors, of realistic nonconvex engineering design or operations research project course.
3 units, Spr (Wilde) MWF 1:15-2:05

3 units (Wilde) alternate years, given 1989-90

217. Design for Manufacturability—The relationship between design and each aspect of manufacturing: part layout, material selection, product inspection, and repair. Topics: economic analysis, process planning, assembly, joining, deformation process, tolerances and inspection. Emphasis on emerging technologies and techniques for addressing manufacturing issues during the design process. Majority of the grade is based upon individual projects in which each student selects a design as the basis for applying a design-for-manufacturing analysis. CAD and CAM facilities may be available. Limited enrollment. Prerequisite or concurrent registration: 103, 213, or equivalent.
1 unit or 3 units with project (Cutkosky, Barkan) alternate years, given 1989-90

218A. Smart Product Design Fundamentals—Topics: basic digital and analog circuits, boolean algebra, logic, clocked circuits, encoders/decoders, microprocessor architecture, serial input/output, FORTH high level language prototype programming, and “C” high level language production programming. Enrollment in 218B,C is contingent on passing a Smart Product Design Fundamentals proficiency examination given at the beginning of Autumn Quarter. Students who do not pass, take 218A. Students who complete 218A and pass the proficiency examination are admitted to 218B.
3 units, Win (Staff) TTh 1:15-3:05

218B. Smart Product Design Methodology—Laboratory design problem driven lecture series deals with programmable electromechanical systems design methodology. Content
follows from three theses: strategic planning and technical trade-off analysis; design process methodology; and microcomputer technology application notes. Fundamentals and advanced topics introduced in the context of three laboratory assignments. Topics: advanced digital and analog circuits, double precision and floating-point arithmetic, math and memory management co-processors, signal conditioning and analysis, EPROM programming, sensors, actuators, real-time operating systems and smart product human factors. Prerequisite: Passing of the Smart Product Design Fundamentals proficiency examination.

3 units, Spr (Staff) TTh 1:15-3:05

218C. Smart Product Design Practice—Sponsored project driven lecture and case study series deals with advanced design methodology and the development of real smart product prototypes. Student teams carry their design from concept through to a functional prototype. Also, a continuing review of advanced technology issues. Smart Product Design Project Management topics: product specification, development environment selection, design team management, scheduling, and documentation design.

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

219A. Introduction to Robotic Manipulation—The basics of robot manipulators and a review of current applications. Topics: kinematic structure, coordinate transformations, manipulator solutions, workspace, path selection, control and dynamics, and programming. Recommended: Knowledge of matrix algebra and some familiarity with basic control theory and rigid body mechanics.

3 units, Aut (Roth) MWF 1:15-2:05

219B. Introduction to Computer Vision—(Enroll in Computer Science 327B.)

219C. Robot Reasoning—(Enroll in Computer Science 327C.)

220. An Introduction to Sensors — Sensors (transducers) are widely used in engineering and scientific research and as an integral part of products and automated systems. Introduction to available techniques for sensing displacement, force, pressure, acceleration, velocity, temperature, optical and nuclear radiation, and other physical parameters. Elementary electronic interface circuits are presented in a manner which assumes no prior knowledge of electronic circuits. Case histories of several sensing systems designed and patented by the instructor.

2 units, Win (Adler) T 3:15-5:05

221. Human Factors—Design of man-machine systems and analysis emphasizing conditions involving considerations of human anatomy, sensory acuity, strength and effort capability, and decision-making skills. Man-machine interface issues addressed in the form of design projects.

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

222. Kinematic Synthesis of Mechanisms—The rational design of linkages. The problem of determining linkage proportions to fulfill various design requirements is treated analytically. Topics: three- and two-dimensional displacements and motions, the theory of higher plane curves, higher-order path-curvature analysis, circle and center-point theory.

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

223. Design and Analysis of Dynamic Systems—Modeling, analysis, and synthesis of practical devices, operating open loop 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 or permission of instructor.

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

224. Advanced Manufacturing Automation—Intended for students who have some familiarity with controls and manufacturing, are interested in manufacturing research, and are familiar with solid mechanics. Discussions of the underlying physics of manufacturing processes. Sensor-driven flexible manufacturing. Basic issues at the unit process level; the acquisition and interpretation of sensory data, adaptive control, machine learning, in-process inspection, spatial reasoning, and integration with CAD. Prerequisites: 219A or experience with automated equipment, and a basic understanding of control systems, solid mechanics and manufacturing methods. Limited to 15 students.

3 units (Cutkosky) alternate years, given 1989-90

225A. Control System Design and Simulation—(Enroll in Engineering 206.)

225B. Nonlinear Control Logic—(Enroll in Engineering 209.)

226A. Digital Control I—(Enroll in Engineering 207.)

226B. Digital Control II—(Enroll in Engineering 208.)

227A. Optimal Control of Dynamic Systems—(Enroll in Aeronautics and Astronautics 278A.)
227B. Optimal Estimation and Control Logic in the Presence of Noise—(Enroll in Aeronautics and Astronautics 278B.)

227C. Differential Games—(Enroll in Aeronautics and Astronautics 278C.)

228. Advanced Robot Control Systems—Selected topics in robot control systems: robot manipulator task description; end-effector representations and operational coordinate systems; end-effector equations of motion; nonlinear dynamic decoupling; joint torque control and force control; redundant mechanisms and kinematic singularities; obstacle avoidance; kinematic and dynamic characterization of manipulator systems, and design issues. Prerequisites: 219A and consent of instructor.
3 units, Spr (Khatib) MW 2:15-3:45

3 units (DeBra) alternate years, given 1989-90

MECHANICS OF SOLIDS

230. Advanced Kinematics—Kinematics from the mathematical and engineering viewpoints. Introduction to algebraic geometry. Application of matrix, tensor, and dual-quaternion methods to kinematic analysis and synthesis. Students are required to prepare reports on problems in kinematics.
3 units (Roth) given 1989-90

3 units, Aut (Kane) TTh 9:30-10:45

231B. Dynamics — Generalized active forces. Contributing and noncontributing interaction forces. Generalized inertia forces. Relationship between generalized active forces and potential energy; generalized inertia forces and kinetic energy. Prerequisite: 231A.
3 units, Win (Kane) TTh 9:30-10:45

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

232A. Spacecraft Attitude Dynamics I—Kinematics of spacecraft; specification of large orientation changes of a rigid body in terms of direction cosines, Euler parameters, Rodrigues parameters, orientation angles; generalized speeds, partial angular velocities and partial velocities. Gravitational forces and moments. Dynamics of simple spacecraft; effects of gravitational moments and orbit eccentricity; gyrostats.
3 units, Win (Kane) TTh 2:45-4 alternate years, not given 1989-90

3 units, Spr (Kane) TTh 2:45-4 alternate years, not given 1989-90

3 units, Win (Breakwell) MWF 2:15

3 units, Aut (Hughes) TTh 2:45-4 alternate years, not given 1989-90

234B. Finite Element Methods in Fluid Mechanics—Continuation of 234A.
3 units, Win (Hughes) TTh 2:45-4 alternate years, not given 1989-90

234C. Finite Element Methods in Fluid Mechanics—Continuation of 234B.
3 units, Spr (Hughes) TTh 2:45-4 alternate years, not given 1989-90

235A. Finite Element Analysis — Emphasis on fundamental concepts and techniques of "primal" finite element methods. Method of weighted residuals, Galerkin's method, and variational

3 units (Hughes)  
alternate years, given 1989-90


3 units (Hughes)  
alternate years, given 1989-90


3 units (Herrmann) given 1989-90

236B. Wave Propagation — (Same as Mathematics 274.) Concepts presented: waves, wavefronts, rays, phase functions, amplitude functions, ray equations, eikonal equations, transport equations, reflection coefficients, transmission coefficients, edge diffraction coefficients, surface diffraction coefficients, asymptotic expansions. Applications are made to electromagnetic, acoustic, elastic, and other types of waves.

not given 1988-89

237. Free and Forced Motion of Structures—(Enroll in Aeronautics and Astronautics 244A.) Concepts presented: waves, wavefronts, rays, phase functions, amplitude functions, ray equations, eikonal equations, transport equations, reflection coefficients, transmission coefficients, edge diffraction coefficients, surface diffraction coefficients, asymptotic expansions. Applications are made to electromagnetic, acoustic, elastic, and other types of waves.

3 units, Aut (Herrmann) MWF 10


3 units, Win (Barnett) MWF 10

238B. Theory of Elasticity—Continuation of 238A: Analysis of plane stress and plane strain. Stress functions. Axisymmetric problems. Prerequisite: 238A.

3 units, Spr (Barnett, Herrmann) MWF 11

239A. Theoretical and Computational Inelasticity — Rate independent infinitesimal elastoplasticity. Thermodynamic basis and work assumptions. Relations connecting Ilyushin’s postulate, maximum plastic dissipation principle, convexity and normality. Loading/unloading

3 units, Aut (Simo) TTh 2:45-4
alternate years, not given 1989-90


3 units, Win (Simo) TTh 2:45-4
alternate years, not given 1989-90


3 units, Spr (Simo) TTh 2:45-4
alternate years, not given 1989-90

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 stress. Application to design of domes, pressure vessels, expansion joints and pressure sensing devices. Use of asymptotic solutions for "very large finite element computation." Membrane theory for general surfaces; hyperbolic paraboloids. Prerequisite: 111 or Civil Engineering 114.

3 units, Win (Steele) MWF 1:15


3 units, Spr (Steele) TTh 1:15-2:30


3 units, Win (Steele) TTh 1:15-2:30
trends in computational mechanics. Selected applications and computational methodologies.

242B. 3 units (Simo) alternate years, given 1989-90
242C. 3 units (Simo) alternate years, given 1989-90


3 units, Spr (Springer)

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 (Herrmann) alternate years, given 1989-90


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

246. Atmospheric and Space Physics—(Same as Aero and Astro 227.) Introduction to geophysics and astronomy emphasizing 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 conora 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. The principal features of the interaction of the solar wind with the Earth and other objects in the Solar System.

3 units, Aut (Spreiter) TTh 2:45-4

247A. Strength and Microstructure—(Enroll in Materials Science and Engineering 205.)

247B. Fracture of Solids—(Enroll in Materials Science and Engineering 238.)


3 units, Spr (Nelson) M 2:15-5:05
plus lab by arrangement

249. Experimentation in Aeronautics and Astronautics—(Enroll in Aeronautics and Astronautics 131.)

HEAT TRANSFER, FLUID MECHANICS, AND HIGH TEMPERATURE GAS DYNAMICS


3 units, Aut (Ferziger) MWF 3:15-4:05

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.). Topics: 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.

3 units, Aut (Johnston) MWF 8

251B. Advanced Fluids Engineering—Continuation of 251A emphasizing 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 boundary layers with blowing and suction turbulent boundary layers. Superposition methods for non-uniform boundary conditions. Development of the integral equations of the boundary layer; approximate and semi-empirical methods of solution. Prerequisites: At least one survey course in heat transfer and one in fluid mechanics, i.e. 250 and 251A, or equivalent.
3 units, Win (Kays) MWF 10

252B. Convective Heat and Mass Transfer—
Continuation of turbulent boundary layers. Heat exchanger analysis and design. Theory of compact heat exchangers. Compressible boundary layers. Introduction to mass transfer. Prerequisite: 252A.
3 units, Spr (Kays) MWF 2:15

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 for students with strong interests in heat transfer, as applied in high-temperature energy conversion systems. Take 252A,B to obtain depth in convective heat and mass transfer. Prerequisites: Graduate standing and an undergraduate course in heat transfer. Recommended: Some computer skills.
3 units, Spr (Niksa) MWF 11

254. Computers and Instrumentation in the Fluid Mechanics Laboratory— Use of laboratory computers including (1) interfacing of analog and digital instruments, (2) experimental control, (3) sampling strategies, and (4) data reduction techniques. Instrumentation including hot-wire, laser, and pulsed-wire anemometers. Prerequisite: Previous experience with computer programming.
4 units, Spr (Eaton) MTWF 10
plus one 4-hour lab

255. Gasdynamics—Introduction to compressible flow. Sound waves and normal shockwaves. Quasi-one-dimensional steady flows in variable area ducts with friction, heating and cooling; unsteady one-dimensional flow, two dimensional supersonic flow; oblique shock waves, Prandtl-Meyer expansions.
3 units, Aut (Kline) MWF 1:15

256. Fluid Dynamics of Turbomachinery—
Operation, theory, and elements of the design of turbines, bladed pumps and compressors, windmills, propellers and other machines that perform by the dynamic interaction of a moving fluid with a bladed rotor. Emphasis 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 (Johnston)
alternate years, given 1989-90

2 units, Spr (Self) by arrangement alternate years, not given 1989-90

3 units, Win (Spreiter) TTh 2:45-4

259A. Numerical Methods in Fluid Mechanics—(Enroll in Aeronautics and Astronautics 214A.)

259B. Numerical Computation of Compressible Flow—(Enroll in Aeronautics and Astronautics 214B.)

259C. Numerical Computation of Viscous Flow—(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: 258 or equivalent.

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

261A. Introduction to Turbulence—Basic physical properties of turbulent flows. Topics: a general discussion of turbulence structure, scales of motion, energy production and dissipation; the kinematics and dynamics of vorticity emphasizing shear flows and mixing processes; similarity rules for wakes, jets and boundary layers; universal behavior of turbulent boundary layers, effects of compressibility; tensor formulations of the governing equations, tensor manipulations. Prerequisite: Any graduate fluid mechanics course that has dealt with viscous flows.

3 units, Spr (Cantwell) MWF 3:15

261B. Analytical Methods for Turbulent Flows—The analytical framework of homogeneous turbulence, turbulent transport, rational modeling of turbulence in flows of engineering interest, zonal models for turbulent flows and sub-grid scale and near-wall modeling for large eddy simulation. Prerequisites: 261A, plus a graduate sequence in fluid mechanics.

3 units, Win (Reynolds) MWF 2:15

261C. Theoretical Approaches to Turbulence—Possible subjects: The Navier-Stokes equations in spectral space and its moments; eddy damped quasi-normal Markovian approximation; renormalization group approaches; direct interaction approximation in both Eulerian and Lagrangian coordinates. Connections with turbulence models; applications to passive scalars; influence of rotation and stratification; two-dimensional turbulence.

3 units, Spr (Ferziger) MWF 11

alternate years, not given 1989-90

262A. Physical Gas Dynamics—Concepts and techniques for the description of high temperature and chemically reacting gases from a molecular point of view. 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. Examples and applications from areas of current interest, such as combustion and gas radiation.

3 units, Aut (Cappelli, Hanson) MWF 10

262B. Transport Processes in Gases—For engineering students interested in mass, energy, and momentum transport in gases. Emphasis on transport in laminar flows, with continuum and molecular points of view. Methods for calculation of fundamental transport properties for single and multi-component mixtures. Approaches for computing transport in systems undergoing phase change or chemical reaction. Prerequisite: 262A or equivalent.

3 units (Bowman)

alternate years, given 1989-90

263. Partially Ionized Plasmas and Gas Discharges—Introduction to partially ionized gases and the nature of gas discharges. Topics: fundamentals of plasma physics emphasizing collisional and radiative processes, equilibrium and non-equilibrium plasmas; plasma diagnostics, application to energy conversion devices, and materials processing.

3 units, Win (Cappelli) MWF 3:15

264. Optical Diagnostics and Spectroscopy—Introduction to spectroscopy of gases and laser-based diagnostic techniques for measurements of species concentrations, temperature, density, velocity and other flowfield properties. Topics: electronic, vibrational and rotational transitions; spectral lineshapes and broadening mechanisms; absorption, fluorescence, Rayleigh and Raman scattering methods; collisional quenching. Prerequisite: 262A or equivalent.

3 units (Hanson)

alternate years, given 1989-90


3 units, Win (Hanson) MWF 1:15

alternate years, not given 1989-90

266. Industrial Applications of Lasers—Introduction to the use of lasers in industry. Lasers and related topics (e.g., nonlinear optics) from a users viewpoint. Relevant topics in optics: gaussian beams and delivery systems, acousto and electro optics used as modulators, fiberoptics, liquid crystals. Use of lasers are coherent sources for interference and holography. Lasers as tunable, narrow bandwidth sources for cutting, drilling, welding, and heat treating. Medical and sensing applications. Prerequisite: Graduate standing. Recommended: 262A.

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

3 units, Spr (Cappelli, Hanson) MWF 9 plus one 3-hour lab by arrangement alternate years, not given 1989-90

268. Experimental Methods in the Thermosciences—Planning experimental programs, uncertainty analysis, and the selection of instrumentation 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. Prerequisites: At least one graduate course each in heat transfer and fluid mechanics, or consent of instructor.

4 units, Spr (Staff) MWF 10 plus one 4-hour lab by arrangement


3 units (Ferziger) alternate years, given 1989-90

THERMODYNAMICS AND ENERGY CONVERSION

270A. Engineering Thermodynamics I—Thermodynamic analysis of engineering systems emphasizing systematic methodology for application of basic principles. Introduction to availability analysis. Thermodynamics of gas mixtures and reacting systems. Use of modern computational equations of state for comprehensive, realistic system analysis. Prerequisites: Undergraduate background in engineering thermodynamics and computer skills.

3 units, Aut (Reynolds) MWF 2:15

270B. Engineering Thermodynamics II—Continuation of 270A. Application of availability and irreversibility analysis to design and optimization of energy systems. Thermodynamics of gases, liquids, and solids. Introduction to statistical thermodynamics. Prerequisite: 270A or a graduate-level engineering thermodynamics course.

3 units, Win (Bowman) MWF 1:15

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; conservation equations for multi-component reacting flows; explosions, fuel oxidation; propagation and structure of laminar premixed flames; detonations. Prerequisite: 262A or 270, or consent of instructor.

3 units, Win (Niksa) 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

274. Introductory Hypersonic Aerophysics—(Enroll in Aeronautics and Astronautics 212.)

275. Solar/Thermal Processes in Buildings—Addresses energy issues as they arise in the residential and commercial building sectors. Emphasis to active/passive solar energy design and building envelope energetics. Associated topics: energy efficient space conditioning systems, state and federal building energy standards, daylighting schemes, indoor air quality, the economic evaluation of energy strategies, and solar/industrial process heating. Computer simulation techniques and nearby field trips. Prerequisite: An undergraduate course in heat transfer (131 or equivalent).

3 units, Win (Whitehouse) TTh 9:30-10:45

BIOMECHANICS


1-5 units, any quarter (Carter) by arrangement

282. Neuromuscular Biomechanics—Engineering mechanics applied to coordination of the human neuromuscular system including: mechanical properties and models of muscle and tendon; dynamics and models of limbs that consist of single- and multi-joint muscles originating and inserting on a multi-segmented skeleton; applica-
tions to sports and rehabilitation such as posture, walking, jumping, and cycling.

3 units, Spr (Zajac) Th 8-9:15 alternate years, not given 1989-90

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

289. The Nature of Technology in Modern Society—(Enroll in Engineering 221; Values, Technology, Science, and Society 106.)

DIRECTED STUDY AND SEMINARS

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 subjects 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.
1-5 units, any quarter (Staff) by arrangement

292. Experimental Investigation of Engineering Problems—Graduate engineering students 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.
1-5 units, any quarter (Staff) by arrangement

293. Innovation—(Enroll in VTSS 166.) The nature, processes, and management of research and development in industrial societies. Sociotechnical systems as the physical bases of society. The creation of abundant societies and the rise of R & D in the final quarter of 19th century in the U.S. and Germany. Conventional linear model and improved chain-linked model. Comparison of scientific (reductionist) view with the consistent view needed in innovation; operational consequences. Modes of institutionalizing R & D. Barriers to innovation and countervailing forces. Revolutionary and evolutionary innovation in small and large companies. Effects of management style. Effects of industry and of product life cycle. Government role in innovation.
3 units, Win (Kline)

294A,B. Design Forum—Invited speakers address issues of interest to designers. Brief presentation followed by open discussion.
1 unit, Aut, Win (Staff) F 3:15-4:05

294C. Craftsmanship Forum—Guest craftsmen make presentations exploring the romance of technology and the relationship between craftsmanship and design. Diverse presentations have included musical instrument building, micro-surgery, historical machinery, pipe organ construction and voicing, and blacksmithing.
1 unit, Spr (Freund) F 3:15-4:05

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 (Staff) Th 4:15-5:30

296. Manufacturing Systems Engineering Forum—Invited speakers address issues of interest to design and manufacturing engineers. Brief presentations are followed by open discussion. Sponsored by the Stanford Engineering Club for Automation and Manufacturing.
1 unit, Aut, Win (Beach) F 2-3

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

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

301. Thesis—Dissertation for degree of Ph.D.
2-15 units, any quarter (Staff) by arrangement

303. Manufacturing and Design—(Same as 103.)

3 units (Moin) alternate years, given 1989-90

309. Finite Element Analysis in Mechanical Design—Part 1: the basic concepts of finite elements, with applications to problems con-
fronted by mechanical designers. Linear static, modal, and thermal formulations emphasized; also nonlinear and dynamic formulations. Students implement simple element formulations in either Fortran or Pascal to obtain a deeper understanding of the essential elements of this numerical technique. Part II: the application of a commercial finite element code in analyzing design problems. Issues: solution methods, modeling techniques, basic problem definition. Individual projects focus on the interplay of analysis and testing in product design/development. Approval of instructor required. Prerequisites: Ability to program in Fortran or Pascal, Math 103, or equivalent. Recommended: 111, Computer Science 114, or equivalent course in structural and/or solid mechanics.

3 units, Win (Sheppard) TTh 3-4:30

319. Robotic and Vision Systems—For graduate students with some familiarity in robotics and who want project experience with robotic and vision systems. Current topics in robotics and machine vision with applications to flexible, automated manufacturing; emphasis on integrated problems and techniques for fine motion control, calibration, acquisition of sensory data, and programming. Cell level topics: architectures and strategies for cell control. Research issues: dextrous manipulation and languages for high-level task specification. Typical projects: robotic deburring, assembly using force feedback and/or vision, part inspection, and cell control. Short assignments provide practice with various equipment. Prerequisites: 219A or equivalent, and some familiarity with programming. Enrollment limited to 20.

3 units, Win (Cutkosky) TTh 7-8:30 p.m.

351. Vortex Dynamics—Basic of voricity transport and generation; kinematics; conserved quantities. Two-dimensional flows: motion of point vortex configurations, the vortex blob method, vortex sheet roll-up and instability with application to fluid and density interfaces, vortex patches and the method of contour dynamics, strained vortices. Three-dimensional cases: vortex filaments and the concept of local induction, the filament method and its implementation, vortex rings and helical waves on vortex tubes. Emphasis on numerical methods with one computing project. Prerequisites: Basic knowledge of fluid mechanics and ability to use and program ODE solution algorithms.

3 units (Shariff) TTh 11
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 (O.R.) 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.

O.R. 152 is an introduction to linear, nonlinear, and dynamic programming for students familiar with calculus. O.R. 153 is an introduction to stochastic processes and models in operations research for students with a knowledge of calculus and undergraduate level probability theory. O.R. 154 is a condensation of O.R. 152 and 153 for students with similar backgrounds. O.R. 160 is an introduction to scientific computing and numerical optimization.

O.R. 240 is a first course in linear programming having matrix algebra as a corequisite. O.R. 250 is a sequel which discusses nonlinear and dynamic programming as well as game theory. O.R. 251 is an introduction to stochastic processes and models in operations research for students acquainted with the elements of stochastic processes. O.R. 240 and 250 provide a more extensive and higher-level presentation of topics of 152. O.R. 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 O.R. 340, 341, 342, 343, 344, 347, 349, 351, 355, 356, and 359.

### UNDERGRADUATE PROGRAM

**BACHELOR OF SCIENCE IN MATHEMATICAL AND COMPUTATIONAL SCIENCE**

Although the department 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 and Computational Science. See "Mathematical and Computational Science" section of this bulletin.

### GRADUATE PROGRAMS

**MASTER OF SCIENCE**

The program leading to an M.S. in Operations Research is designed to prepare individuals for high-level professional work applying operations research. Thus, the emphasis is on providing a solid foundation for a life-long professional career involving the formulation, analysis, and use 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>Math. 103</td>
<td>Matrix Theory and its Applications</td>
<td>3</td>
</tr>
<tr>
<td>Op. Res. 240</td>
<td>Linear Programming</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 116</td>
<td>The Operations Research of Probability</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 200</td>
<td>Introduction to Statistical Inference</td>
<td>4</td>
</tr>
<tr>
<td>Stat. 203</td>
<td>Introduction to Regression Models and the Analysis of Variance</td>
<td>3</td>
</tr>
<tr>
<td>Stat. 217</td>
<td>Introduction to Stochastic Processes</td>
<td>3</td>
</tr>
<tr>
<td>Electives</td>
<td>from the 200 or higher-level offerings of the department (with at most 2 units of O.R. 290 counted) or from authorized courses in other departments</td>
<td>11</td>
</tr>
</tbody>
</table>

Total .................................................. 45

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.

No thesis is required. A minimum letter grade indicator of 2.75 is expected.

### ENGINEER

The Engineer degree in Operations Research is for students desiring additional academic pre-
paration 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, 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 Ph.D. 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.

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, or 171; Statistics 116, 200, 203, 217; Computer Science 106A. Engineering-Economic Systems 212A or Economics 51Q or 202. Students lacking background in some of these areas can include appropriate courses in their program at Stanford.

2. Requirements in Operations Research: At least five of the courses in Group 1 (340, 341, 342, 343, 345, 347); at least five in Group 2 (351, 355, 356, 357, 358, 359); and at least 14 total courses chosen from Group 1, Group 2, and Group 3 (344, 346, 349, 363, 371, 373, 377, 390B).

A doctoral candidate must also 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 two written comprehensive examinations. For the first examination, the students will be examined on their selection of three of the following four courses: 340, 341, 342, 345. Similarly, for the second examination the students will select three of the following four courses: 351, 355, 356, 359.

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
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 letter grade indicator 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 February 15.

COURSES
PRIMARILY FOR UNDERGRADUATES

50. Models and Applications of Operations Research in Society—Analysis of important socio-economic problems by methods of operations research. Problem areas drawn from energy, environment, health, and urban planning. 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 register for 150.) Prerequisite: High school algebra. (DR:6) or (DR:8)
3 units, Spr (Staff) MWF 10

150. Models and Applications of Operations Research in Society—Lectures same as 50, but a term paper is required. (DR:6) or (DR:8)
3 units, Spr (Staff) MWF 10

152. Introduction to Operations Research I—(Enroll in Engineering 62.) 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. (DR:8)
4 units, Aut (Manne) MWF 1-2:05
Spr (Staff) MWF 1-2:05

4 units, Win (Lieberman) MTWTh 1:15

154. Operations Research—An introduction to the techniques and models of operations research for students who have not had the equivalent of 151 or 152, and 153. Topics are similar to those of 152 and 153. Prerequisites: Calculus and Statistics 116.
4 units, Sum (Staff) TTh 3:15-5:30

OPERATIONS RESEARCH 215

PRIMARILY FOR MASTER’S CANDIDATES

These courses are oriented toward applications. Operations Research (O.R.) 240, 250, 251, 257, 250A and B 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. O.R. 245, 246, 258, and 260 are useful supplementary electives.

240. Linear Programming—Linear programming emphasizing standard model formulation, fundamental theorems, variations of the simplex method, and parametric programming. The orientation is applied and directed to those anticipating doing project work in government or industry involving deterministic systems. Corequisite: Mathematics 103.
3 units, Aut (Cottle) TTh 1:15-2:30
Sum (Staff) TTh 1:15-3

3 units, Win (Veinott) MW 8:30-9:45

246. Mathematical Programming Computation—(Doctoral students register for 346.) An overview of major computational procedures used in solving mathematical programming problems, including large-scale systems. Introduction to computer implementation of algorithms for: linear programming; quadratic programming; unconstrained, linearly constrained, and nonlinearly constrained optimization. Practical experience with techniques that increase speed, stability, and accuracy of computation. Prerequisites: 250 or 342, and Computer Science 106A or equivalent, or consent of instructor.
3 units, Sum (Staff) MW 3:15-5

250. Deterministic Models in Operations Research—Formulation, solution, and analysis of mathematical programming models in operations research, including those of network flow theory, dynamic programming, inventory theory, integer programming, quadratic and nonlinear programming, and game theory. Prerequisite: 240.
3 units, Aut (Eaves) TTh 2:45-4

251. Stochastic Models in Operations Research—Introduction to stochastic modeling. Directed to students anticipating doing project work in government or industry which involves stochastic modeling. Emphasis on formulation, solution, and analysis of stochastic models in
operations research. Topics: queueing theory, inventory theory, Markov decision processes, and dynamic programming. Prerequisite: Statistics 217.

3 units, Spr (Lieberman) TTh 11-12:15
Sum (Staff) TTh 3:15-5

257. Simulation—(Doctoral students register for 357.) 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 FORTRAN, or PASCAL; Statistics 217 or the equivalent.

3 units, Spr (Glynn) Sum (Staff) MW 1:15-3


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


3 units, Win (Eaves) MW 2:15-3:30

260B. Applications of Operations Research—(Doctoral students register for 380B.) Applications to problems in business, nonprofit institutions, and government. Case studies illustrate the interplay between theory and practice and involve formulation, analysis, data collection, discussion, report writing, and public presentation. Prerequisites: 280A, 151 or 152, or 240 and 250, and 153 or 251 (concurrently) or equivalent, or consent of instructor.

3 units, Spr (Manne) MW 2:15-3:30

290. Colloquium—Presentation of current research in operations research.

1 unit, Aut, Win, Spr (Staff) W 4:30-5:30

299. Independent Study—Intensive study of literature of special topics.

any quarter (Staff) by arrangement

PRIMARILY FOR DOCTORAL STUDENTS

These advanced courses are concerned with the development of the mathematical theory of operations research and sophisticated applications thereof.


4 units, Aut (Dantzig) TTh 1:15-2:30 laboratory by arrangement


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

342. Equilibrium Programming—A development and application of the solution of equations through piecewise linear deformations and curve following. Topics: subdivisions, piecewise linear maps, regularity, degree, fixed point theorems, special case algorithms, optimization, models of conflict, and models of competitive economies.

3 units, Spr (Eaves) TTh 1:15-2:30


3 units, Aut (Murray) TTh 2:45-4

344. Integer Programming—Introduction to the models and methods of integer programming. Structure of integer programs; implicit
enumeration and cutting plane algorithms; exploiting special structures; heuristics; extensions. Corequisite: 340 or consent of instructor.

1 unit (Hillier) given 1989-90

345. Network Optimization—(Same as 245.)
3 units, Win (Veinott) MW 8:30-9:45

346. Mathematical Programming Computation—(Same as 246.)
3 units, Sum (Staff) MW 3:15-5

347. Sectoral and Economywide Modeling—
3 units, Win (Manne) TTh 11-12:15

349. Combinatorial Optimization — (Same as Computer Science 364.) Algorithms for optimization of combinatorial structures. Topics: shortest paths, maximum flows, minimum-cost flows, bipartite matching and assignment problem, general matching, stable marriage, and linear programming and may include approximation algorithms for NP-hard problems and integer programming. Prerequisites: 151 and 161 or 264, or equivalent.
3 units, Aut (Goldberg) TTh 11-12:15

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

3 units, Aut (Lieberman) TTh 9-10:15

3 units, Aut (Veinott) TTh 10:30-11:45

357. Simulation—(Same as 257.)
3 units, Spr (Clynn) Sum (Staff) MW 1:15-3

358. Queueing Theory—(Same as 258.)
3 units, Spr (Iglehart) MW 11-12:15

3 units, Win (Clynn) TTh 9:30-10:45

363. Theory of Information and Organization—(Same as Economics 282.) The role of information in the design of various economic organizations, including teams and markets; problems of coordination and incentives under incomplete information: search, signaling, and related phenomena.
5 units, Win (Arrow) MW 9-11

366. Interdisciplinary Seminar on Decision, Conflict and Risk—(Same as Business 694, Economics 386, Law 325, Psychology 283.) Addresses problems of decision making, risk analysis, conflict resolution and negotiation from both normative and descriptive perspectives.
1-2 units, Win, sometimes Spr (Arrow, Mnookin, Ross, A. Tversky, Wilson) T 4-5:30

367. Welfare Economics—(Same as Economics 280.) Social choice theory and objectives for economic policy. Efficiency theorems with externalsities and public goods. The gains from trade. Incentive constraints which arise because economic agents have private information and may make unofficial trades which escape taxation, or circumvent other controls. Cost-benefit analysis and evaluating policy reforms.
5 units, Aut (Hammond) MW 11-12:50

368. Multi-person Decision Theory—(Enroll in Business 668.) The role of differences in information among economic agents. Topics: functioning of markets with differential information, and game-theoretic analysis of competi-
tive processes with differential information. Readings from current working papers.

4 units, Spr (Wilson) by arrangement

371. Topics in Mathematical Programming—
Seminar with presentations by students and invited speakers. Topics: 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. One or two research topics are selected from: linkage of models and submodels (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. Co-requisite: 341.

3 units, Win (Dantzig) by arrangement

373. Matrix Methods in Combinatorics—
(1Same as Computer Science 464.) Uses of linear programming and linear algebra in developing combinatorial theory. Topics: graph partitioning (including graph coloring), network flows, Dilworth's Theorem and generalizations, finite planes, block designs, orthogonal latin squares, parallelisms, perfect graphs, spectra of graphs. Prerequisites: Basic facts of linear algebra and linear programming.

3 units, Win (Hoffman)

377. Topics in Linear Complementarity—
Advanced seminar topics: classes of matrices and their bearing on the existence and multiplicity of solutions; variants of the principal pivoting method and Lemke's method including parametric linear complementarity algorithms; computational complexity questions; indirect methods for large-scale problems; applications. Prerequisite: 341 or consent of instructor.

3 units, Spr (Cottle) by arrangement

380A. Applications of Operations Research—
(Same as 280A.)

3 units, Win (Eaves) MW 2:15-3:30

380B. Applications of Operations Research—
(Same as 280B.)

3 units, Spr (Manne) MW 2:15-3:30


any quarter (Staff) by arrangement
Dean: Ewart A. C. Thomas
Associate Deans: Theodore Andersson, Michael E. Bratman, Bradley Efron, Walter P. Falcon, Ewart A. C. Thomas, Thomas A. Wasow
Administrative Associate Dean: Susan W. Schofield
Associate Dean for Development: Nancy W. Bruno


ORGANIZATIONS
The School of Humanities and Sciences includes the Departments of: Anthropology; Athletics, Physical Education, and Recreation; Applied Physics; Art; Asian Languages; Biological Sciences; Chemistry; Classics; Communication; Comparative Literature, Drama; Economics; English; Food Research; French and Italian; German Studies; History; Linguistics; Mathematics; Music; Philosophy; Physics; Political Science; Psychology; Religious Studies; Slavic Languages and Literatures; Sociology; Spanish and Portuguese; and Statistics.

Faculty members or academic staff of the School of Humanities and Sciences are listed under the respective departments, Stanford Overseas Studies, or Interdepartmental Programs.

UNDERGRADUATE PROGRAMS
A student wishing to take a departmental major leading to the degree of Bachelor of Arts, Bachelor of Science, or Bachelor of Arts and Sciences should consult appropriate sections of the announcements given on the following pages. Further information concerning requirements may be obtained from the department or program concerned.
The School of Humanities and Sciences also sponsors a number of non-degree programs: Innovative Academic Courses, Undergraduate Research Opportunities, Center for Teaching and Learning, and Overseas Studies.

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 the “Graduate Division Special Programs” section in this bulletin.

UNDERGRADUATE PROGRAM IN AFRICAN AND AFRO-AMERICAN STUDIES
Emeritus: St. Clair Drake (Anthropology and Sociology)
Chairman: Kennell A. Jackson, Jr. (History)
Steering Committee: Clay Bates (Engineering), Sandra Drake (English), James Gibbs (Anthropology), Sandra Richards (Drama), Arthur B. C. Walker, Jr. (Applied Physics), and undergraduates by appointment
Participating Faculty: Ronald Alexander (Communication), Clay Bates (Engineering), Clay Carson (History), Gregson Davis (Classics), Sandra Drake (English), John Gill (Engineering), William Gould (Law), Donald Harris (Economics), Lioba Moshi (Linguistics), Halifu Osumare (Athletics), Richard Pruitt (Philosophy), Richard Randell (Art), Condoleezza Rice (Political Science), Sandra Richards (Drama), John Rickford (Linguistics), Arthur B. C. Walker (Applied Physics), Henry Walker (Sociology), Edgar Yhap (Medicine)

UNDERGRADUATE MAJOR
The curriculum is based on the idea that the African and Afro-American Studies (AAAS) major should first have a broad introduction to the two fields of African and Afro-American history and culture. These are fields with an extensive scholarly tradition, and they include a wide range of well-debated issues. In addition to
these two areas, a student major will develop specialized knowledge in a number of related areas.

The AAAS undergraduate curriculum involves three interrelated parts. First, there are core courses (I) which are to be taken by all majors and double majors. Second, there are two narrower group of courses (IIA and IIB) that are derived from the themes of the core courses. Each of these course groupings consolidates the work of the core and further develops the understanding the major has for issues in the AAAS field. The third part of the curriculum (III) involves a concentration that further refines the student's understanding of the field. Section III can be used by a student to directly continue work started in IIA or IIB. The program requires that majors complete the courses listed as "core" totaling 33-35 units.

There are two options open to the student majoring in AAAS. Option A consists of 33-35 units in the core courses plus 15 units each from IIA and IIB. Option B consists of the core courses, IIA or IIB, and a choice of a thematic concentration in part III. Part III constitutes 15 units. Both option A and B consist of a total of 63-65 units.

AAAS majors will have numerous opportunities for academic advising. The chair will directly advise all the majors, and their progress will be closely followed by the program coordinator. When the time comes to choose between the two options for study, faculty with expertise in the different areas will be available. The program aims to provide the best possible advising for majors and to give the students a chance to discuss academic choices with the many faculty involved in the program.

**REQUIREMENTS**

**I. CORE COURSES (33-35 units)**

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>105. Introduction to Afro-American Studies</td>
<td>5</td>
</tr>
<tr>
<td>113. Western Culture and The Black Diaspora</td>
<td>5</td>
</tr>
<tr>
<td>History 21-22. The World Outside the West</td>
<td>10</td>
</tr>
<tr>
<td>History 148. Introduction to African History</td>
<td>5</td>
</tr>
<tr>
<td>History 157. Afro-American History: The Modern Civil Rights Movement</td>
<td>5</td>
</tr>
<tr>
<td>Sociology 145. Race and Ethnic Relations</td>
<td>3-5</td>
</tr>
</tbody>
</table>

**IIA. AFRICAN HISTORY and SOCIETY (15 units)**

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>History 148C. Africa in the 20th Century</td>
<td>5</td>
</tr>
<tr>
<td>Political Science 118B. Southern Africa: Race, Class, and Political Change</td>
<td>5</td>
</tr>
</tbody>
</table>

**II. EXPRESSIVE CULTURE of the AFRICAN DIASPORA (15 units)**

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>114. Africa and the Black Diaspora</td>
<td>5</td>
</tr>
<tr>
<td>Drama 5. Introduction to Black American Drama</td>
<td>5</td>
</tr>
<tr>
<td>English 161A. The Afro-American Novel</td>
<td>5</td>
</tr>
<tr>
<td>Linguistics 73. Black English</td>
<td>5</td>
</tr>
</tbody>
</table>

**III. THEMATIC CONCENTRATION**

This area allows the student to focus 15 units of work on themes that either develops previous work in the major or explores new areas. There are five possible themes. In choosing a theme, the student will be advised by a faculty person with a specialization in the area or discipline as well as by the chair of the program. The themes are as follows:

- **Expressive Culture of the Africa Diaspora**—(an extension of IIB): Afro-American Studies 162E, Introduction to Caribbean Poetry; Afro-American Studies 165, Afro-Hispanic Culture and Literature; Drama 5, Introduction to Black America Drama; Drama 157, Contemporary Black Playwrights; English 161F, The Harlem Renaissance; English 167F, Modern Literature of the Caribbean; Afro-American Studies 248; Dance 81 and 82, Jazz Dance I and II (suggested but units are not counted towards major).
- **African Development**—Food Research 103, The World Food Economy; Food Research 121, Development and Population Interaction; Food Research 136, Population Perspectives in the Third World; Food Research 250, Nutritional Problems of Developing Nations; Food Research 251, Food and Nutrition Strategies in Development; Economics 118, Economics of Development; Economics 122, Theory of Capitalist Development; Political Science 123D, Political and Ethical Aspects of Foreign Aid; and History 249A, Africa since 1945.
- **Afro-American History and Society**—History 146B, Afro-Americans and Africa; History 146A, The United States and Africa; Psychology 127, Afro-American Psychology; Afro-American Studies 126, Black Perspectives in Medicine; Afro-American Studies 127, Professional Development for Minority Engineers; and Sociology 144, Social Inequality and Social Stratification.
- **The fifth choice**—in part III allows the major to devise a special program around a theme. In organizing this plan, the major will work with a specialist on the theme of his or her choosing and with the chair of the program. The plan will be approved by the steering committee. Honors work will be possible as part of this option.
DOUBLE MAJORS

Many students involved with the program are double majors. Over the years, students have found that continuing a major in one field with a strong concentration in Afro-American Studies is an exciting intellectual choice. Almost any field complements the program offerings, even the sciences and engineering.

If a student decides to double major in Afro-American Studies, the core courses (33-35 units) should be taken. This would fulfill the double major requirements.

HONORS

Majors may receive a maximum of 10 units for completing an Honors thesis or project of comparable quality by the end of the senior year. The essay or project is intended to enable the student to synthesize several of the skills he or she has acquired and to produce a document or project demonstrating some measure of competence in the student’s speciality. The Honors project must be discussed with and approved by the major advisor and program chair. A written proposal must be submitted for consideration no later than Autumn Quarter of the senior year.

UNDERGRADUATE SCHOLARS PROGRAM

In the Autumn Quarter of 1986, the Afro-American Studies Program initiated an innovative project which brings together black faculty and students for research in fields of undergraduate interest. This program will continue in 1988-89. Essentially, the scholars program is an attempt to promote contacts between faculty and students on an intensive individual basis. In 1986, 30 students were placed with 19 professors in a variety of fields. Each student receives a stipend to assist their research, plus a certificate upon completion of the project. The program will list as a specific course (3-5 units, Winter and Spring Quarters) on the transcript of the participants. There is a special, high-quality video that has been made to advertise the program, available at the Afro-Studies office.

COURSES

The core course of the program (105) provides a broad survey of the Afro-American experience. It is team taught by faculty from the humanities and social sciences and will introduce themes such as retained Africanisms, the Black family, and Afro-American identity. Interaction with professors will also help students plan their future courses of study.

AAAS PROGRAM OFFERINGS

59 A,B,C. Dance Theater Production.
1-5 units (Osumare) not given 1988-89

81A,B,C. The Real News: A Student Publication.
1-3 units, Aut, Win, Spr

82A,B,C. Gospel Choir Workshop.
1-3 units, Aut, Win, Spr (Staff)

100. Designing an American Core Curriculum: Student Workshop Class.
5 units, Win (Staff)

105. Introduction to African and Afro-American Studies—(Same as Anthropology 105, History 149C.) Lecture introducing African and Afro-American Studies as an interdisciplinary field. Explores contrasting and contradictory interpretations of several key, representative aspects of African and Afro-American social and cultural institutions. Topics: African survivals in the New World; interpretations of slavery in the New World; contrasting interpretations of the Black family; the Afro-American as artist; and the Afro-American identity. Also, why particular ideas developed at particular times, and the relationship between African and Afro-American Studies and other academic disciplines.(DR:5*)
5 units, Aut (Staff, Jackson) MWF 11

114. Africa and the Black Diaspora: An Introduction to its Literature, Thought, and Cultural Worlds—The parallelisms and differences in the literature, thought, and cultural worlds, of contemporary Africa and of the African-descended communities in the New World, i.e., the U.S., Brazil, Spanish- speaking Latin America, and the Caribbean. (DR:5*)
5 units (Wynter) not given 1988-89

115. Africa and Philosophy, Philosophy and Africa: Introduction to a Polemic—Introduces an ongoing dispute between African intellectuals. Which political “philosophy” (liberal humanism or Marxism-Leninism in their African variants, or a resurgent/egalitarian fundamentalism) will best serve a viable contemporary Black African civilization? If not one of these, what then?
5 units (Wynter) not given 1988-89

126. Black Perspectives in Medicine—Through readings, discussions, and contact with Black doctors and other health care professionals, examines the role of Blacks in medicine and issues specific to the delivery of health care services in the Black community.
3 units, Aut (Staff)

127. Professional Development for Minority Engineers—(Same as Engineering 7.) The role of and opportunities available to Blacks in engineering and other technical fields emphasizing the relationship between technological devel-
opment and opportunities for Black and Third World communities.
3 units,Spr (Bates)

190A,B,C. Directed Reading.
3-5 units, Aut, Win, Spr (Staff)

195A,B,C. Independent Study.
3-5 units, Aut, Win, Spr (Staff)

195D,E,F. Independent Study: The King Papers.
3-5 units, Aut, Win, Spr (Carson)

198A. The Undergraduate Scholars Program.
3-5 units, Spr (Staff)

199A,B,C. Honors Project.
3-5 units, Aut, Win, Spr (Staff)

200A,B,C. MESA Tutors Project.
1-4 units, Aut, Win, Spr (Staff)

241. Afro-Hispanic Cultural Worlds: An Introduction—(Same as Spanish 241.) The literature and thought of Black Latin American writers in the Spanish-speaking Americas and Brazil. Introduction to the popular syncretic cultures of these interesting but as yet little known worlds. Reading in Spanish/Portugese, and in English translations.
3-5 units, Spr (Wynter)

248. The Caribbean-Americas: An Introduction to Their Literature, Thought, and Cultural Worlds—(Same as English 262C, Spanish 248.) The literature, thought, and popular cultures of the Caribbean Basin area within the context of an overview of its multiple cultural and linguistic worlds.
3-5 units, Aut (Gonzdles)

DEPARTMENT OFFERINGS
See respective department listings for course descriptions and (DR) information.

ANTHROPOLOGY
15/116. Anthropological Perspectives on American Culture—(Same as Education 116X.)
3-5 units, Spr (G. and L. Spindler)

5 units, Aut (Gibbs)

109. Dance of the African Diaspora—(Same as Dance 179.)
2-4 units, Spr (Cashion, Dunham, Stovall)
MW 3:15-5

DANCE

182. Jazz Dance II.
1 unit, Aut, Win, Spr (Staff)
TTh 2:15-3:30

183. Jazz Dance III.
1 unit, Win (Osumare) TTh 12:40-2:05

2 units, Aut (Osumare) TTh 12:40-2:05

2 units, Spr (Osumare, Dunham)
TTh 12:40-2:05

DRAMA

5. Introduction to Black American Drama.
4 units (Richards) alternate years, given 1989-90

29. Theater Performance: Acting.
1-3 units (Staff) any quarter

39A,B,C. Theater Performance: Crew.
1-5 units (Staff) any quarter

157N. Contemporary Black Playwrights.
4 units, Aut (Kennedy)

351C. Seminar: Brecht in Africa.
5 units, Spr (Richards) TTh 10-12

ECONOMICS

118. The Economics of Development—Pre-
requisite: Economics 51.
5 units, Spr (Velenchik) MTWThF

EDUCATION

201. History of Education in the United States—(Same as History 158.)
3 units, Spr (Tyack) MW 10
and by arrangement

ENGLISH

161A. Afro-American Writing 1945-1970.
5 units, Win (Drake) MTWTh 1:15

161B. Afro-American Writing 1970, to the Present.
5 units, Spr (Drake) MTWTh 1:15

5 units, Aut (Thompson) TWTTh 1:15-3:05

FOOD RESEARCH INSTITUTE

103. The World Food Economy—(Same as Economics 106.)
3 units, given 1989-90

121. Development and Population Interaction in the Third World—(Same as Economics 119.)
5 units, given 1989-90

136. Population Perspectives in the Third World—(Same as Economics 133, Human Biology 136, Sociology 153.)
5 units, given 1989-90

166. International Trade Policy—(Same as Economics 166.)
5 units, Spr (Pearson)

250. Nutritional Problems of Developing Nations—(Same as Anthropology 250, Human Biology 110.)
5 units, Win (Martorell)
HISTORY

21. The World Outside the West: Change and Tradition Before the Age of European Imperialism—(Same as Anthropology 21.)
   5 units, Aut (Fox, Roberts, Van Slyke)

148C. Africa in the 20th Century.
   5 units, Spr (Roberts)

248A/348A. The End of Slavery in Africa and the Americas.
   5 units, Win (Roberts)

248D/348D. Law and Colonial Africa.
   5 units, Spr (Roberts)

249A. Undergraduate Colloquium: Africa Since 1945.
   5 units, Spr (Jackson) T 2:15-4:05

343D. Empire and Race: The Decline and Fall of the British Empire in India and South Africa.
   5 units, Spr (Worger)

349. History and Anthropology.
   5 units, Aut (Jackson, Rosaldo)

LINGUISTICS

73. Black English.
   4 units, Aut (Rickford)
   alternate years, not given 1989-90

150. Introduction to Social Linguistics.
   4 units, Win (Ferguson)

602A,B,C. Beginning Hausa.
   4 units, Aut, Win, Spr (Leben)

606A,B,C. Beginning Swahili.
   4 units, Aut, Win, Spr (Rubanza)

   4 units, Aut, Win, Spr (Rubanza)

PSYCHOLOGY

127. Afro-American Psychology.
   3 units, Spr (Hudson)

POLITICAL SCIENCE

118B. Politics of Race and Class in Southern Africa.
   5 units, Spr (Abernathy)

SOCIOLOGY

145. Race and Ethnic Relations.
   3-5 units, Spr (Walker) MWF 10 plus
   1 section by arrangement

AFRICAN STUDIES

Emeriti: St. Clair Drake (Anthropology and Sociology), Joseph H. Greenberg (Anthropology and Linguistics), William O. Jones (Food Research Institute)

Chairman: David B. Abernethy (Political Science)

Professors: David B. Abernethy (Political Science), Paul F. Basch (Medicine), Martin Carnoy (Education), Walter Falcon (Food Research), James Lowell Gibbs, Jr. (Anthropology), William B. Gould (Law), Bruce F. Johnston (Food Research Institute), William R. Leben (Linguistics), Scott R. Pearson (Food Research Institute), Hans N. Weiler (Education and Political Science), Sylvia Wynter, (African and Afro-American Studies)

Associate Professors: Sandra E. Drake (English and Comparative Literature), Kennell A. Jackson, Jr. (History)

Assistant Professors: Joel S. Beinin (History), Sandra Richards (Drama), Richard Roberts (History)

Professor (Teaching): Donald C. Johanson (Anthropology)

Lecturer: Khalil Barhoum (Linguistics)

Curators: Peter Duignan (Senior Fellow, Hoover Institution), Karen Fung (Deputy Curator, Hoover Institution), Lewis Gann (Senior Fellow, Hoover Institution)

The Committee on African Studies coordinates an interdisciplinary program in African Studies for undergraduate and graduate students from a variety of departments. Under special arrangement through the Stanford/Berkeley Joint Center for African Studies, it is possible to incorporate courses from both institutions into one's program.

Courses in African Studies are offered by departments and programs throughout the University. A sampling of these is listed at the end of this section. Graduate students and advanced undergraduates who wish to get an idea of how topics of current interest in African Studies are approached from different disciplinary perspectives are encouraged to take Anthropology 200, Seminar: Current Issues in African Studies. Each week's presentation is conducted by a different professor in African Studies; the first hour is a lecture, followed by a seminar discussion that lasts an hour and a half. Students may sign up for this course for variable units, depending on whether they wish units for the lectures or seminar or both.

Course offerings in African languages are also coordinated by the Committee on African
Studies. Along with regular courses in several levels of Swahili, Hausa, and Arabic, the committee also arranges with the Special Language Program in the Department of Linguistics to offer specialized instruction in a wide variety of other African languages.

The Committee on African Studies does not sponsor degree programs, but undergraduates and graduate students can specialize in African Studies under a number of arrangements listed below.

**UNDERGRADUATE STUDY**

Undergraduates may choose an African Studies focus among several alternatives:

1. A major in a traditionally defined academic department (e.g. Political Science, History, Anthropology, etc.) These departments afford ample opportunity to enroll in courses outside the major, leaving the student free to pursue the interdisciplinary study of Africa.

2. Interdepartmental majors, such as African and Afro-American Studies or International Relations, which offer coordinated and comprehensive interdisciplinary course sequences, permitting a concentration in African Studies.

3. An individually designed major in African Studies. Under the supervision of a faculty advisor, and two other faculty members, the student can plan a program of study focused on Africa which draws courses from any department or school within the University. If approved by the Dean’s Advisory Committee on Individually Designed Majors, the program becomes the curriculum for the A.B. degree.

Undergraduates can study for a year in Africa. In recent years, students have been able to enroll at the University of Nairobi, Kenya, and at Universite du Benin, Togo. Students should check with the Overseas Studies Office to see what arrangements are currently available.

**GRADUATE STUDY**

At the graduate level, Stanford offers the following possibilities for those who wish to become specialists in African Studies:

1. As a field of concentration within the regular master’s and doctoral programs of the different academic departments. It is common for students in the Departments of Anthropology, Political Science, History, and Sociology, and in the School of Education to declare African Studies as the area of specialization for their master’s and Ph.D. thesis work. Some other departments, programs, and institutes permit students to specialize in African Studies also. The A.M. program in International Policy Studies aims to prepare students for careers in policy-determining positions in an international setting in the private and public sectors. The Food Research Institute, which offers the A.M. and Ph.D., has a long-standing interest in research and teaching related to problems of food, agriculture, and rural development in tropical Africa. The programs in International Development Education in the School of Education focus on issues of educational policy and planning in Africa, and in the Third World more generally. SIDEC offers both an A.M. and a Ph.D., for which specialization in international educational policy and administration is possible.

2. Through a Graduate Division Special Program administered by the Dean of Graduate Studies. The student seeking a Ph.D. may, with approval, form a committee of four faculty members, representing at least two academic departments, and pursue an individually tailored graduate program.

**COURSES**

**AFRICAN AND AFRO-AMERICAN STUDIES**

105. Introduction to African and Afro-American Studies — (Enroll in African and Afro-American Studies 105, Anthropology 105, History 149C). Lecture introducing African and Afro-American Studies as an interdisciplinary field. Explores contrasting and contradictory interpretations of several key, representative aspects of African and Afro-American social and cultural institutions. Topics: African survivals in the New World; interpretations of slavery in the New World; contrasting interpretations of the Black family; the Afro-American as artist; and the Afro-American identity. Also, why particular ideas developed at particular times and the relationship between African and Afro-American Studies and other academic disciplines. (DR:5*)

5 units, Aut (Jackson, Staff) MWF 11

115. Africa and Philosophy, Philosophy and Africa: Introduction to a Polemic—Introduces an ongoing dispute between African intellectuals. Which political “philosophy” (liberal humanism or Marxism-Leninism in their African variants or a resurgent/Islamic fundamentalism) will best serve a viable contemporary Black African civilization? If not one of these, what then?

5 units (Wynter) given 1988-89

**ANTHROPOLOGY**

Afro-American Studies 108.) Lectures, discussions, and films introduce the social institutions and cultural forms of Black Africa in the wider context of colonialism, political independence, and national strategies of development. Topics: shifts in patterns of marriage and family life, the emergence of new classes, and the impact of Islam and Christianity. (DR.5*)

5 units, Aut (Gibbs, Staff)

157. Law in Radically Different Cultures—(Enroll in Anthropology 157, Law 316, Political Science 182L; graduate students register in Anthropology 257.) Uses American law as a benchmark to examine 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. Open to law students, graduate students in other departments, and to juniors and seniors. Registration required for both Winter and Spring Quarters starting January 23.

2 units, Win, plus 3 units, Spr (Barton, Staff)

200. Core Seminar: Current Issues in African Studies—(Enroll in Anthropology 200.) An interdisciplinary seminar introducing advanced undergraduates and graduate students to current issues in African studies. Each week is led by a different professor and consists of a lecture followed by a seminar discussion of assigned readings.

1-5 units, Spr (Staff) lecture T 2:15-3:15; seminar, 3:15-4:05

EDUCATION

206A. Seminar: Introduction to the Study of International Development Education—(Enroll in Education 206A.) Introduction to the theoretical orientations and the research agenda in International Development Education and to resources for study and research at Stanford. Consent of instructor.

1 unit, Aut (Carnoy) M 12-1:15


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

306B. Education and Political Change—(Enroll in Education 306B.) Introductory analysis of the relations between education and politics from a comparative perspective. Emphasis on different theoretical approaches to the study of education and politics, questions of legitimacy in educational policy, international factors in educational policy, international factors in educational development, the politics of educational planning and reform, processes and conditions of political learning.

5 units, Win (Altbach) MW 1:15-3:05 and by arrangement

408A,B,C. Research Workshop in International Development Education—(Enroll in Education 408A,B,C.) Continuing research workshop for the review of key issues in the methodology and epistemology as social research in education, and research proposals and findings by students and faculty. Prerequisite: 306A-D or equivalent. Limited enrollment.

408A. Research Workshop in IDE I. 2-5 units, Aut (Ramirez) MW 3:15-5:05

408B. Research Workshop in IDE II. 2-5 units, Win (Carnoy) MW 3:15-6:05

408C. Research Workshop in IDE III. 2-5 units, Spr (Altbach) MW 1:15-3:05

FOOD RESEARCH

225. Agricultural Development and Economic Growth—(Enroll in Food Research 225.) A theoretical-historical approach emphasizing agriculture's role in the development process. Issues: intersectoral resource flows, dualism, economic rationality, technical change, land tenure and taxation, and criteria relevant to the choice of strategies for agricultural development.

5 units, Spr (Johnson) TTh 1:15-3:05

367. Seminar: International Agricultural Policy—(Enroll in Food Research Institute 367.) Prepares students for comprehensive examination and dissertations in the internal agricultural policy field.

3 units, Spr (Josling, Pearson) TTh 3:15-5:05

FRENCH AND ITALIAN

268. The Literature of Decolonization—(Enroll in French and Italian 268.) The work of Francophone African and Caribbean writers who have confronted the phenomenon of colonialism and contributed to the struggle for liberation; readings from Aime Cesaire, Leopold Senghor, Frantz Fanon, Albert Memmi, and Jean-Paul Sartre, etc. Discussion in English, reading in French or English translation, at students' option.

4 units, Win (Giraud)
HISTORY

21. The World Outside the West: Change and Tradition Before the Age of European Imperialism—(Enroll in Anthropology 21, History 21.) A comparison of the cultural heritages and dynamics of change in three non-Western societies before extensive contact with Western Europe. Physical environment, economy, social and political structures, and religious and ethical values in China, Nigeria, and Mexico. (DR: 5*; also satisfies Area 3 when taken in sequence with 22.)

5 units, Aut (Fox, Roberts, Van Slyke) given 1989-90

22. The World Outside the West in the Age of European Imperialism—(Enroll in Anthropology 22, Political Science 22.) Confrontation and accommodation as non-European societies respond to Western Europeans, and to Western traditions and ideas, from the early 19th century to the present. Changes in production and trade, in social and political structures, and in religious and ethical values in Mexico, China, and Nigeria. Recommended: Anthropology/History 21. (DR: 5*)

5 units (Abernethy, Staff, Van Slyke) given 1989-90

47S. Introductory Seminar: Black Political Thought in Africa—(Enroll in History 47S.)

5 units, Win (Worger)

147B. History of South Africa—(Enroll in History 147B.)

5 units, Aut (Worger) MTWTh 9

148C. Africa in the 20th Century—(Enroll in History 148C.)

5 units, Spr (Roberts)

243D. Undergraduate Colloquium: Empire, Race, and Nationality: The Decline and Fall of the British Empire in India and South Africa—(Enroll in History 243D.)

5 units, Win (Worger)

246A. Undergraduate Colloquium: Big Business and Race in South Africa—(Enroll in History 246A.)

5 units, Spr (Worger)

248A/348A. Colloquium: The End of Slavery in Africa and the Americas—(Enroll in History 248A/348A.)

5 units, Win (Roberts)

248D/348D. Colloquium: Law in Colonial Africa—(Enroll in History 248D/348D.)

5 units, Spr (Roberts)

249A/349A. Africa Since 1945—(Enroll in History 249A/349A.)

5 units, Spr (Jackson) M 3:15-5:05

347B. Graduate Core Colloquium on African History—(Enroll in History 347B.)

5 units (Roberts) alternate years, given 1989-90

LINGUISTICS

602A,B,C. Beginning Hausa—(Enroll in Linguistics 602A,B,C.) Successful completion of 602C may fulfill the foreign language requirement.

4 units, Aut, Win, Spr (Leben)

606A,B,C. Beginning Swahili—(Enroll in Linguistics 606A,B,C.) Successful completion of 606C may fulfill the foreign language requirement.

4 units, Aut, Win, Spr (Rubanza)


4 units, Aut, Win, Spr (Staff)

614A,B,C. Beginning Igbo—(Enroll in Linguistics 614A,B,C.)

4 units, Aut, Win, Spr (Rubanza)

620A,B,C. Beginning Arabic—(Enroll in Linguistics 620A,B,C.) Successful completion of 620C may fulfill the foreign language requirement.

4 units, Aut, Win, Spr (Barhoum)

621A,B,C. Intermediate Arabic—(Enroll in Linguistics 621A,B,C.)

4 units, Aut, Win, Spr (Barhoum)

622A,B,C. Advanced Arabic—(Enroll in Linguistics 622A,B,C.)

4 units, Aut, Win, Spr (Barhoum)

Other African Languages—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: Bambara, Setswana, Shilluk, Shona, Wolof, and Yoruba. Contact the Special Language Program office, (415) 723-3636.

POLITICAL SCIENCE


5 units, Aut (Abernethy)

118B. Politics of Race and Class in Southern Africa—(Enroll in Political Science 118B.) The political history of the region’s 10 countries emphasizing relations among racial and ethnic groups. Diplomatic, economic, and military interactions among these states, and the impact of movements, corporations, and international
organizations based outside the region. Attention to domestic politics and foreign policy of South Africa. (DR:5*)

5 units, Spr (Abernethy)

140A,B,C. Ethics of Development in a Global Environment (EDGE)—(Enroll in Anthropology 133A,B,C; Engineering 297A,B,C; Political Science 140A,B,C.) EDGE seminars present a series of speakers on current development issues emphasizing problems of the poorer nations. Autumn Quarter: world resources — energy, food, housing, population and environment. Winter Quarter: the role of institutions affecting the transfer of technology — political systems, world bank, transnationals. Spring Quarter: the role and responsibilities of the individual who wants to affect development. One unit credit for attendance of the speaker series; 3 additional units for optional workshops treating selected issues in more depth and writing a term paper. (Sequential registration not required.)

1 unit, lecture only; 4 units, lecture plus workshop, Aut, Win, Spr (Fagen, Lusignan, McWhorter, Siegel)
W 7:30-9:30 p.m. workshops by arrangement

SOCIIOLOGY

152. Social Structure of World Society—(Enroll in Education 231, Sociology 152, VTSS 155.) A sociological analysis of society on a world-wide basis. 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 are reviewed and compared. Topics: 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. 5 units (Inkeles) given 1989-90

247. Democracy in Developing Countries—(Enroll in Sociology 247.) Seminar on the conditions related to the emergence, institutionalization, and consolidation of democratic government, and the factors making for instability and breakdown. Theoretical and empirical literature on the relationship between political democracy and social structure, culture, economic development, constitutional structure and the international environment, weighed against the historical experiences with democratic, semi-democratic and authoritarian government of numerous countries in Asia, Africa, Latin America and the Middle East. Open to advanced undergraduates with background in political sociology, political development or international relations. Major research paper required.

5 units, Spr (Diamond) W 2:15-5:05

RELATED MATERIALS

Students who wish to increase their knowledge of Africa may consider the following courses, of which at least 25 percent of the content is devoted to Africa:

ANTHROPOLOGY

128. Ethnographic Film.
164. Ecological Anthropology.

DANCE


EDUCATION

306C. Education and Sociocultural Change.
306D. Sociology of Development and Education.

FOOD RESEARCH


The following courses have some Africa content and present conceptual substance that is helpful to understanding African societies and institutions:

COMMUNICATION

151. Communication and Development.

ECONOMICS

118. Economics of Development

EDUCATION

206B. Project Workshop in International Development Education.

FOOD RESEARCH


HEALTH RESEARCH AND POLICY

270. International Health.
AMERICAN STUDIES

Administrative Committee: (Chairman) George Dekker (History), Barton Bernstein (History), Joseph Corn (American Studies), Wanda Corn (Art), Jay Fliegelman (English), Richard Gillam (American Studies), Judith Goldstein (Political Science), Hubert R. Marshall (Political Science), Gavin Wright (Economics)

The American Studies Program is administered through the Department of Humanities Special Programs.

UNDERGRADUATE 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 area of emphasis will include at least two courses from one of these groups: in American Thought and Imagination, English 122-126 (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's few general requirements give students considerable latitude to design their majors in order to reflect their own special interests. Thus, courses might be clustered around themes such as women and the arts, technology and American culture, or the meaning of ethnicity in the United States. 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 major must include in the program of study: (1) the introductory course, American Studies 150, to be taken as soon as possible after declaring the major; (2) at least the first two quarters of the History 165 sequence; (3) the core seminar, American Studies 200, The American Character (to be taken as soon as possible after declaring the major); and (4) one additional core seminar, usually during the junior or senior year.

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. All courses must be taken for a letter grade.

HONORS PROGRAM

Majors with a letter-grade indicator of 3.5 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 10 to 15 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. Units for the Honors project must be in addition to the 60-unit major.

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. See the Time Schedule each quarter for changes in listings.

CORE LECTURES

American Studies 150. American Literature and Culture to 1855—(Same as English 121.) A detailed study of important and representative works of American culture from 1630 to 1855. Close textual readings are supplemented with discussions of the intellectual, theological, and political history of the period. Required for the American Studies major. (Thought and Imagination)

5 units, Aut (Fliegelman) MTWTh 10

American Studies 151. The Transformation of American Thought and Culture, 1865 to the Present—(Same as History 163A.) Persistent strains and tensions in American intellectual life and culture over the past century and a quarter. Readings include autobiographies, novels, documentary works, and historical and theoretical analyses that bear upon technology and culture, consumerism, mass society, gender, sexuality, violence, political extremism, and power. (Thought and Imagination or Social Organization and Behavior)

5 units, Win (Gillam) MTWTh 10
AMERICAN THOUGHT AND IMAGINATION

American Studies 150. American Literature and Culture to 1855.
  5 units, Aut (Fliegelman) MTWTh 10

  5 units, Win (Gillam) MTWTh 10

  4 units, Aut (W. Corn)

Art 130A. American Art and Culture in the Gilded Age.
  4 units, Win (W. Corn)

  4 units, Win, Spr (W. Corn)

Drama 157N. Contemporary Black Playwrights.
  4 units, Win (Kennedy)

English 112. Masterpieces of American Literature.
  5 units, Aut (Islas)

English 122. American Literature, 1855-1917.
  5 units, Spr (Moser)

English 124. Identity and Other Enigmas in American Literature, 1850-1900.
  5 units, Win (Fields)

  5 units, Win (Drake)

English 161B. Afro-American Writing, 1970 to the Present.
  5 units, Spr (Drake)

  5 units, Aut (Thompson)

English 286. William Carlos Williams.
  5 units, Spr (Sorrentino)

Music 5A. Music in America.
  3 units, Aut (Cohen)

  4 units, Spr (Eisen)

AMERICAN SOCIAL ORGANIZATION AND BEHAVIOR

  5 units, Win (Gillam) MTWTh 10

  5 units, Spr (Barnett)

Anthropology 116. Anthropological Perspectives on American Culture—(Same as Education 116.)
  3-5 units, Spr (G., L. Spindler)

  5 units, Spr (Calomiris)

History 163. America and the “Bomb”: Politics, Diplomacy, and Culture in the Nuclear World, 1939-Present—(Same as History of Science 163, VTS 164.)
  4-5 units, Spr (Bernstien)

History 165A. 18th-Century America—(Required for the American Studies major.)
  5 units, Aut (Carp) MTWTh 11

History 165B. 19th-Century America—(Required for the American Studies major.)
  5 units, Win (Degler) MTWTh 11

History 165C. 20th-Century America.
  5 units, Spr (Kennedy)

History 172A. America Since 1945.
  4-5 units, Win (Bernstein)

History 173C. Introduction to Feminist Studies: Issues and Methods—(Same as Feminist Studies 101.)
  5 units, Aut (Freedman)

  5 units, Win (Kleiman)

History 257B. Undergraduate Colloquium: American Society in the 1960s.
  5 units, Aut (Carson)

History 273A. Undergraduate Colloquium: Childhood in Modern American History.
  5 units, Win (Horn)

Sociology 130. American Society in Film and Literature.
  3-5 units, Win (Zelditch)

AMERICAN POLICY AND INSTITUTIONS

American Studies 179. Introduction to American Law—(Same as Law 106, Political Science 182F.) American law for undergraduates. The structure of the American legal system, including the courts; American legal culture; the legal profession and its social role; the scope and reach of the legal system; the background and impact of legal regulation; the relationship between the American legal system and American society in general.
  5 units, Aut (Friedman) MTWTh 9

Communication 140. History of American Journalism.
  4 units, Win (Lewenstein)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Units</th>
<th>Term</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>Commun 142.</td>
<td>Broadcasting in America</td>
<td>4</td>
<td>Win</td>
<td>Breitrose</td>
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<tr>
<td>Polit Sci 10</td>
<td>American National Government</td>
<td>5</td>
<td>Win</td>
<td>Manley</td>
</tr>
<tr>
<td>Polit Sci 60</td>
<td>The American Dream</td>
<td>5</td>
<td>Spr</td>
<td>Manley</td>
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<tr>
<td>Polit Sci 101P</td>
<td>Politics and Public Policy—(Same as Public Policy 101.)</td>
<td>5</td>
<td>Spr</td>
<td>Brady</td>
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<tr>
<td>Polit Sci 180</td>
<td>Civil Rights and Civil Liberties in the U.S.</td>
<td>5</td>
<td>Spr</td>
<td>Steyer</td>
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<tr>
<td>Polit Sci 180D</td>
<td>The President and Congress</td>
<td>5</td>
<td>Win</td>
<td>Brady</td>
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<tr>
<td>Polit Sci 186K</td>
<td>American Education and Public Policy—(Same as Education 105, History 158B.)</td>
<td>3</td>
<td>Aut</td>
<td>Kirst, Tyack</td>
</tr>
<tr>
<td>Polit Sci 189</td>
<td>Voting in the American Electoral System</td>
<td>5</td>
<td>Aut</td>
<td>Brody</td>
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<tr>
<td>Polit Sci 191</td>
<td>Seminar: The President, the Press, the Public, and Politics—(Same as Communication 163.)</td>
<td>5</td>
<td>Win</td>
<td>Brody</td>
</tr>
<tr>
<td>Polit Sci 193</td>
<td>Seminar: Civil Rights and the Constitution</td>
<td>5</td>
<td>Aut</td>
<td>Steyer</td>
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<tr>
<td>Polit Sci 292A</td>
<td>Seminar: American Political Institutions</td>
<td>5</td>
<td>Aut</td>
<td>Ferejohn</td>
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<tr>
<td>Polit Sci 292B</td>
<td>Introduction to Political Behavior</td>
<td>5</td>
<td>Win</td>
<td>Brody, Sniderman</td>
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<tr>
<td>Polit Sci 292C</td>
<td>Seminar: American Political Institutions</td>
<td>5</td>
<td>Spr</td>
<td>Moe</td>
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<tr>
<td>Polit Sci 296M</td>
<td>Seminar: The Institutional Presidency</td>
<td>5</td>
<td>Spr</td>
<td>Moe</td>
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<tr>
<td>VTSS 101.</td>
<td>Science, Technology, and Contemporary Society</td>
<td>4-5</td>
<td>Aut</td>
<td>McGinn</td>
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**CORE SEMINARS**

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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Units</th>
<th>Term</th>
<th>Instructor(s)</th>
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<tbody>
<tr>
<td>Amer Studs 200</td>
<td>The American Character—(Same as History 261S.) Descriptions of historical, literary, psychological, and sociological insights into the American character since the 17th century. (Required for the American Studies major.)</td>
<td>5</td>
<td>Aut</td>
<td>Gillam</td>
</tr>
<tr>
<td>Amer Studs 201</td>
<td>The South Since 1880—Perennial questions of southern identity, distinctiveness, and continuity versus change from a variety of disciplines. Guest speakers from law, literature, economics, religious studies, political science, art, music, sociology, and psychology focus on Southern topics which lend themselves to interdepartmental study.</td>
<td>5</td>
<td>Spr</td>
<td>Steyer</td>
</tr>
<tr>
<td>Amer Studs 203</td>
<td>American Autobiography—(Same as English 186A.)</td>
<td>5</td>
<td>Win</td>
<td>Fiegelman</td>
</tr>
<tr>
<td>Amer Studs 209</td>
<td>Women in America—(Same as Feminist Studies 125, History 263.)</td>
<td>5</td>
<td>Spr</td>
<td>Regler</td>
</tr>
<tr>
<td>Amer Studs 211</td>
<td>Modern America in Historical Perspective—(Same as History 258.)</td>
<td>5</td>
<td>Win</td>
<td>Kennedy</td>
</tr>
<tr>
<td>Amer Studs 213</td>
<td>Sexuality in American History—(Same as History 265A.)</td>
<td>5</td>
<td>Spr</td>
<td>Freedman</td>
</tr>
<tr>
<td>Amer Studs 214</td>
<td>The American 1960s: Thought, Protest, and Culture—(Same as History 260S.) Attempts to define the meaning of the American 1960s, emphasizing the “new sensibility” that emerged during this crucial decade in American history. Topics: black protest, the New Left, the counter culture, the new literature and journalism, the role of the media in shaping dissent, and the legacy of the 60s protest.</td>
<td>5</td>
<td>Aut</td>
<td>Gillam</td>
</tr>
<tr>
<td>Amer Studs 217</td>
<td>Material Culture—(Same as History 251S.) Introduction to the study of three-dimensional objects, as reflections of, and influences on American culture. Seminar focuses on the built environment in the United States over the last 100 years.</td>
<td>5</td>
<td>Spr</td>
<td>Moe</td>
</tr>
<tr>
<td>Amer Studs 218</td>
<td>Sport in American Culture—The role of athletic activities in American life, emphasizing the historical development of sports and their role in artistic expression. Readings include primary documents, histories, and novels.</td>
<td>5</td>
<td>Win</td>
<td>E. Corn</td>
</tr>
</tbody>
</table>
American Studies 220. Photographs as Historical Documents—(Same as Art 231A, History 250S.) Methods, problems, and practice of “reading” photographs as historical evidence. The history of photography and theories of photograph interpretation. Development of an individual research project and writing of major essay.

5 units, Aut (J. Corn, W. Corn)
TTh 3:15-5:05

American Studies 221. Technology and American Culture—(Same as VTSS 157, History 252.) The relationships between technological change and culture in 19th- and 20th-century U.S. Emphasis on technology and work, technological display and celebration, utopian and anti-utopian attitudes surrounding technology, subcultures devoted to particular technologies, and technology in popular culture.

5 units, Spr (J. Corn) T 3:15-5:05

American Studies 223. American Lives—(Same as English 187B.)
5 units, Win (Islas) T 7-10 p.m.

American Studies 224. Core Seminar: The Early Nuclear Age, 1939-1953—(Same as History 270A.)
5 units, Spr (Bernstein) W 1:15-3:30

American Studies 226. Core Seminar: The American Dream—(Same as Political Science 162M.)
5 units, Spr (Manley)

INDIVIDUAL WORK

3-5 units (Staff) by arrangement

American Studies 199. Directed Reading.
2-5 units (Staff) by arrangement

5-15 units, any quarter (Staff)

ANTHROPOLOGY

Emeriti: (Professors) St. Clair Drake, Bert A. Gerow, Joseph H. Greenberg, Benjamin D. Paul, Bernard J. Siegel, George D. Spindler
Chairman: James Lowell Gibbs, Jr.
Associate Professors: Jane Collier (on leave), William H. Durham, James A. Fox, John W. Rick (on leave Autumn), Sylvia Yanagisako (on leave)

Assistant Professor: Carol Delaney
Professor (Research): Thomas P. Rohen (on leave Winter, Spring)
Professor (Teaching): Donald C. Johanson
Affiliated Professors: Shirley Brice Heath, Reynaldo Martorell
Lecturers: Thomas Abercrombie, Barbara B. Bacek (Campus Archeologist), Andrea Klint, Philip L. Ritter, Deborah Rubín, Louise S. Spindler, Janice Stockard, Stefano Varese, Barbara Voytek, Kwesi Yankah
Visiting Associate Professor: Verena Stolke

The Anthropology Department is responsible for a large collection of historic and prehistoric cultural and skeletal material from all over the world, most notably from Native North America, the Pacific, Central and South America, and Africa. Some of these objects are used in anthropology courses and are exhibited in the Felix M. Keesing Museum (room 111K) in the Anthropology Department. Continuing excavations on Stanford property by department archaeologists (under the direction of the Campus Archeologist) contribute materials to the collections.

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 culture, society, biological heritage, 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.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

The Department of Anthropology offers three programs leading to the Bachelor of Arts degree: the major in Anthropology, the Honors Program in Anthropology, and an interdisciplinary program, the Major in Social Sciences (Anthropology). To declare a major in one of these fields a student must fill out the Declaration of Major form in the Registrar’s Office, then contact the academic assistant in the department. The chair of the Undergraduate Committee will explain the degree requirements and help the student choose an appropriate academic advisor.

The major in anthropology is required to meet with his or her advisor at least once every quarter. Each student’s progress towards fulfillment of the major requirements is recorded in a file kept by the academic assistant. 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. To apply, candidates of sophomore or junior standing should submit an application to the academic assistant no later than the end of the fourth week of the Spring Quarter. The application must include a brief statement of the project, a transcript, a short paper, and a letter of recommendation from the professor who will supervise the Honors thesis. The Undergraduate Committee will review applications and notify students of their admission to the program.

The Major in Social Sciences (Anthropology) also requires a written application. The student must submit to the Undergraduate Committee 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 Sciences (Anthropology) allows a candidate to combine a concentration in anthropology with a selection of courses from history, sociology, economics, political science, and psychology.

Students who want a program that includes more than 10 units from a non-social science field (e.g. classics) are advised to petition for an Individual Directed Major.

All majors in the Department of Anthropology including those majoring in Social Sciences (Anthropology) must fulfill the following requirements:

1. Competence in a foreign language beyond the first-year level. Such competence is usually demonstrated by completing a course at 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 should be taken before the end of the junior year. It introduces students to anthropological theory and prepares them for upper division courses in the department.

The remaining requirements for each of the three degree programs are as follows:

**Major in Anthropology**—60 units, of which at least 40 are required in anthropology. The remaining 20 units may be taken from courses in related departments, such outside courses must be approved by the student's advisor. Students whose programs require language study may petition the Undergraduate Committee to count up to 10 units of language courses toward the degree if such courses are at the second year level or are in a second language. The units in anthropology must include at least one course in each of the five following topical categories: (1) Area Studies (8, 15, 100-127); (2) Social and Cultural Anthropology (1, 11-22, 128-168, 219, 276); (3) Linguistic Anthropology (4, 5, 75-78, 172-178, 277, 278); (4) Archeological Anthropology (3, 91, 183-189); (5) Biological Anthropology (2, 6, 181, 182). In addition, students must choose an area of concentration, taking at least 15 units in that field. Possible areas of concentration include archeology, biological anthropology, anthropological linguistics, and specialized areas within socio-cultural anthropology, such as health and nutrition, gender studies, economic development, symbolic systems, or a particular culture area. All students must have their areas of concentration approved by their advisors. Finally, all anthropology majors are urged to take a field work course in archeology, socio-cultural anthropology, or museum methods and to enroll in at least one departmental seminar in addition to Anthropology 90.

**Honors Program in Anthropology**—Candidates whose application to the Honors program has been approved by the Undergraduate Committee 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 is read by the candidate's advisor and a second reader appointed by the Undergraduate Committee. Honors candidates enroll in Anthropology 95, Honors Program Directed Individual Study, for as many as 15 units, but may not count more than 5 of those units toward the 60-unit degree requirement.

**Major in Social Sciences**—35 units in anthropology and 25 units in related social science fields. The 60 units must form a coherent program of study and must be approved by the student's academic advisor and the Undergraduate Committee. Students whose program includes linguistic studies may petition the Undergraduate Committee to have up to 10 units of language courses count toward the degree if such courses are at a second year level or are in a second language.

All units required for these programs must be passed with a letter grade indicator 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
archeology and social anthropology. In addition, they are encouraged to take part in departmental activities and to attend the department's biweekly colloquia (Mondays) and informal Thursday noon fieldwork reports. Specific topics are posted in the department.

GRADUATE PROGRAMS

Basic University requirements for the degrees of Master of Arts and Doctor of Philosophy are described in the "Degrees" section of this bulletin.

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 and graduate students in other departments or schools at Stanford should consult the "Degrees" section of this bulletin and consult with the academic assistant in the department. Other prospective 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. Successful applicants for the A.M. program may enter during any quarter. Application deadlines are: April 15 (for Autumn), November 1 (for Winter), and February 1 (for Spring). Outside applicants must file a report of their scores on the Graduate Record Examination. Students accepted for the terminal A.M. degree program cannot transfer to the Ph.D. program. They must reapply for the Ph.D. program on the same basis as other Ph.D. applicants. Students planning to obtain the Ph.D. degree should apply directly to the Ph.D. program. Only in exceptional cases will they be considered.

The University requires of all candidates for the master's degree, including coterminal students, residence at Stanford as a graduate student for at least three quarters. During these quarters, A.M. students in anthropology must take a minimum of 45 quarter units in anthropology beyond the undergraduate degree with a letter grade indicator of "B" or better in each course. The Anthropology Department further requires at least 15 additional units of anthropology, taken at Stanford or elsewhere, constituting a minimum total of 60 units in anthropology. At the discretion of the department, the 15 additional units may have been taken in fulfillment of the undergraduate degree. Within the 45 units taken at Stanford, students must take one quarter (5 units) of 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 course work 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 admission must file a report of their scores on the Graduate Record Examination and submit a sample of their writing which demonstrates ability to produce original analytical work at the graduate level. Successful applicants for the Ph.D. program may enter only at the beginning of the Autumn Quarter. The final date for applications is January 1.

The Ph.D. program includes a number of required courses and examinations. It also allows the student to develop a flexible program reflecting special interests, under the supervision of a faculty committee chosen by the student. Students are encouraged to plan a program that will enable them to complete all work for the Ph.D. in five years.

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 by the faculty as "core courses".
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. An approved internship may be substituted for part of this requirement.
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. Students whose native language is English pass, by the end of their second year, a reading examination in a language, other than English, in which there is a substantial body of general theoretical literature relevant to anthropology. Students whose native language is not English are exempted from this requirement by demonstration of satisfactory command of English.

6. Pass a special examination (written and oral), normally given during the Spring 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.

**Ph.D. MINOR**

The requirements for a minor in Anthropology consist of 30 units of anthropology taken at Stanford with a letter grade indicator 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 in the department and must include at least three courses in theory/methods and one course in a geographical area.

**FINANCIAL SUPPORT**

The department endeavors to provide needed financial support (tuition plus stipend) to all students admitted to the Ph.D. program who maintain a satisfactory course of study. Currently, the source of this support is University funds. 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. First-year students in the Ph.D. program who have not entered with outside funding are required to apply for such funding during their first quarter. No financial support is available to students enrolled only 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 the inquiry to the Credential Administrator, School of Education.

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**COURSES**

**UNDERGRADUATE GENERAL**

These courses are open to all students. Each is 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. A student who wants a comprehensive introduction to all four subfields of anthropology should take Anthropology 1, 2, 3, 4, and 6.

1. **Social and Cultural Anthropology**—(Upper division students register for 101.) Cross-cultural anthropological perspectives on human behavior, including cultural transmission, social organization, sex and gender, culture change, technology, war and other related topics. Lectures, films, and readings are used in the presentation of culture case studies illustrating basic generalizations. (DR:4* or DR:5*)

3 or 5 units, Aut (G. and L. Spindler)

2. **Genes, Culture, and Human Diversity**—(Same as Human Biology 1.) Introduction to genetic and cultural evolutionary theory as applied to the analysis of human diversity. A case study approach illustrates general principles of evolution and similarities and differences between genetic and cultural change. Topics: Mendelian genetics, molecular biology, Darwinian theory, the modern synthesis, the concept of culture, cultural diversity, marriage and kinship, and cultural evolution. May be taken as a first course in anthropology or human biology. (DR:5* or DR:7*)

3 or 5 units, Spr (Durham)

3. **Human Prehistory**—The aims, methods, and data of prehistoric archeology. The development of human society from early hunters through late prehistoric civilizations. Examines archeology 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:5*)

3-5 units, Win (J. Rick)

4. **Language and Culture**—(Same as Linguistics 4.) The ethnography of communication and theories of language and culture. Analysis of linguistic repertoire, rules of use, semantics, speech acts, discourse and poetic structure, language and identity, and linguistic models in anthropology. (DR:4*)

5 units, Aut (Fox)
5. Biology and Evolution of Language—(Same as Human Biology 113, Linguistics 5.) Lecture on the biology, function, and evolution of the organs of speech and the brain. Topics: animal communication; non-verbal communication; language structure; the biology and physics of speech; speech disorders; color terminology and color vision; biological influences from language universals and acquisition. (DR:4)

5 units (Fox) given 1990

6. Human Origins—Evidence for the evolution of humankind from its beginnings several million years ago to the emergence of Homo sapiens. Emphasizes a consideration of fossil hominid remains — from their discovery to their interpretations for elucidating human origins. (DR:7)

5 units, Spr (Johanson)

7. Experiencing Anthropology: An Introduction to Culture—Useful for students preparing to go overseas and for foreign students. Introduces the notion of culture as a meaningful and constructed phenomenon open to investigation of its implicit premises and explicit forms. Drawing on the common experience of entering the University, compares and contrasts disorientation and reorientation with that experienced by anthropologists entering another culture, providing a means for considering the culturally specific ways humans orient themselves, in space and time, with the body and structures of everyday life, by means of language and in terms of the symbols and frameworks provided by myth and religion. Lectures, discussions, and mini-fieldwork projects develop an anthropological approach to the experience and study of culture.

5 units, Aut (Delaney)

11. Sex Roles and Society—(Same as Feminist Studies 140.) The diversity of women's and men's roles, experiences, and self-conceptions in a number of human societies, provides a critical perspective on contemporary views of the "nature" of women and men, and how women and men shape and are shaped by particular forms of social life. (DR:5*)

3-5 units, Aut (Stockard)

15. Anthropological Perspectives on American Culture—(Same as Education 116X.) Convergence and divergence in values, life styles, and psychocultural attributes are analyzed for mainstream, minority, and variant cultural patterns in U.S. society. Processes of boundary maintenance and identity reference. Current social movements in the perspective of counter-culturalism, marginality, and cultural change. Field studies of relevant phenomena are encouraged. (DR:5)

3-5 units, Spr (G. and L. Spindler)

MW 1:15-3:05

16. Maritime Anthropology—Introduction to maritime anthropology. The sea considered from an anthropological perspective to learn of humankind's nature and mind from the diverse ways; ecological, conceptual, and symbolic, humans have coped with this element. Topics: early long-distance voyaging, fishing as an ecological adaptation; maritime economics and national development.

5 units, Spr (Frake)

17. Culture and Astronomy—A cross-cultural historical examination of a variety of astronomies focusing on the relations among conceptual systems, cultural practices, and empirical reality. Comparison of ancient Maya calendrical astronomy, Pacific Islanders' navigational astronomy, and ancient and Medieval Western astronomy.

cr.alternate years, given 1989-90

18. Writing and Literacy—(Same as Linguistics 16.) The origins, evolution, and diffusion of writing, its relationship to speech, and its roles in various cultures and civilizations. Topics: archaeological decipherment, scribal practice, and current issues and problems in literacy.

5 units, Spr (Fox)

21. The World Outside the West: Change and Tradition Before the Age of European Imperialism—(Same as History 21.) A comparison of the cultural heritages and dynamics of change in three non-Western societies before extensive contact with Western Europe. Physical environment, economy, social and political structures, and religious and ethical values in China, Nigeria, and Mexico. (DR:5*; also satisfies DR:3 when taken in sequence with Anthropology 22.)

5 units, Aut (Fox, Roberts, Van Slyke)

22. The World Outside the West in the Age of European Imperialism—(Same as History 22, Political Science 22.) Confrontation and accommodation as non-European societies respond to Western Europeans, and to Western institutions and ideas, from the early 19th century to the present. Changes in production and trade, in social and political structures, and in religious and ethical values in Peru, China, and Nigeria. Recommended: Anthropology/History 21. (DR:5*, also satisfies Area 3 when taken in sequence with 21.)

5 units (Staff, Abernethy, Van Slyke)

given 1989-90

SPECIAL

69. Practicum in Ethnographic Futures Research—(See 269.)
75A,B,C. First-Year Classical Nahuatl—Introduction to the language of the Aztecs of colonial Mexico. For beginners.
5 units (Fox) not given 1988-89

76. Intermediate Nahuatl and Colonial Ethnohistory—Readings in colonial Nahuatl. Introduction to palaeography and historiography of early colonial Mexico. Prerequisite: 75A,B,C or equivalent.
5 units (Fox) not given 1988-89

77A,B,C. First-year Quechua—Introduction to the language of the Inca and their descendants in the Andes of Peru, Bolivia, and Ecuador. Emphasis on modern spoken Quechua. For beginners.
not given 1988-89

78. Intermediate Quechua and Colonial Peruvian Ethnohistory—Readings in colonial Quechua. Introduction to palaeography and historiography of early colonial Peru. Prerequisite: 77A,B,C or equivalent.
5 units (Fox) not given 1988-89

90. Theory in Social Anthropology—Anthropological interpretations of other societies contain assumptions about ourselves and about “Western” societies. Seminar highlights that interplay and considers how underlying assumptions and implicit categories have influenced the presentation of data in a set of major anthropological monographs. Concentrates on Karl Marx, Emile Durkheim, and Max Weber, along with a particular anthropological analysis of a nonwestern society. Enrollment limited to 20.
5 units, Aut (Wolf)

91. Archeological Field Methods—Involves students in actual archeological field research in the local area. The practical working methodology of the archeologist, primarily through excavation and site survey, but including training in registration, preservation, and analysis of archeological data. Recommended: 3.
5 units, Spr (Bocek)

93. Pre-Field Research Seminar—Prepares students for anthropological field research in other societies and the United States. Instruction in broad range of data collection techniques including participant observation, interviewing, surveys, sampling procedures, life-histories, ethnohistory, and use of documentary materials. Strategies of successful entry into the community, research ethics, interpersonal dynamics, and the reflexive aspects of fieldwork. Prerequisite: Introductory course in anthropology or consent of instructor.
5 units, Spr (Delaney)

94. Post-Field Research Seminar—Training and experience in coding, processing, and analyzing qualitative and quantitative research data. Participants complete a full-scale report on a body of field data normally collected during the preceding summer.
5 units, Aut (Collier, G.)

95. Honors Program—Directed independent study and Honors thesis work for students admitted to program.
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.
any quarter (Staff) by arrangement

UNDERGRADUATE AND GRADUATE AREA STUDIES

100. Culture, Politics, and Society in Latin America—(Same as History 80, Latin American Studies 80.) Interdisciplinary survey of the interaction of Amerindian, African, and European cultures in the creation of New World societies from 1500 to the present. A basic introduction to the Latin American courses within several departments. (DR:5*)
5 units, Aut (G. Collier, J. Delaney, Phillips)

102. Native Peoples of North America—The cultures of the many indigenous peoples who made North America their home before European conquest. Lectures, readings, and films cover the pre-contact situation, post-contact changes (including governmental policies), influences of Native culture on American society and culture, and the contemporary situation of native peoples. A good antidote to TV and movie Western stereotypes. (DR:5*)
5 units, Spr (Barnett)

105. Introduction to African and Afro-American Studies—(Same as African and Afro-American Studies 105, History 149C.) Lecture introducing African and Afro-American Studies as an interdisciplinary field. Explores contrasting and contradictory interpretations of several key, representative aspects of Africa and Afro-American social and cultural institutions. Topics: African survivals in the New World; New World slavery; the black family; the Afro-American as artist; and the Afro-American identity. Considers why interpretations developed at particular times and the relationship between African and Afro-American Studies and other disciplines. (DR:5*)
5 units, Aut (Jackson, Staff)

108. African Societies in a Changing World—Lectures, discussions, and films introduce the social institutions and cultural forms of Black
Africa in the wider context of colonialism, political independence, and national strategies of development. Topics: shifts in patterns of marriage and family life, the emergence of new classes, the impact of Islam and Christianity. (DR:5*)

5 units, Aut (Gibbs)

109. Dance of the African Diaspora—(Same as Dance 179.) The study of selected cultures of Africa and the circum-Caribbean viewed as aspects of human behavior. Emphasis on cultural influences which have shaped ritual and social dance forms of Nigeria, Ghana, Haiti, Cuba, Suriname, and Brazil.

2-4 units, Spr (Durham, Stovall, Cashion) TTh 3:15-5

110. Introduction to Chicano Life and Culture—(Same as Spanish 135.) Interdisciplinary focus on the history and culture of Mexican Americans during the 19th and 20th centuries. Historical perspectives are balanced with anthropological and literary views of the cultural patterns of Mexicans in the U.S. Students interact with three different Chicano faculty from three disciplines. Historical texts, novels, poems, and ethnographies are required readings. (DR:5)

5 units (Camarillo, Cuellar) not given 1988-89

112V. Theory and Practice of Ethnicity—Examines processes of ethnic political consciousness and organization in contemporary world emphasizing "non-Western" societies in post-colonial times. Topics: ethnicity as a political phenomenon, inter-ethnic and class relations, the national question in socialist experience, multi-ethnicity and nation-building, ethnicity and the state. Current theoretical analysis of ethnopolitical facts and practical challenges of cultural diversity faced by post-colonial nation-states.

5 units, Aut (Varese)

113. Peoples of the Pacific—The role of Melanesia, Micronesia, and Polynesia in human culture history. Survey of Pacific cultures with detailed examination of selected societies. Response of Oceania to European contact and its place in the modern world.

5 units, not given 1988-89

114. Peoples and Cultures of Mainland Southeast Asia—Examines processes of sociocultural persistence and change by selectively surveying peoples of the area at the band, tribe, and state levels of sociocultural complexity. Topics: types of subsistence technology and land tenure; kin group and community organization; religion and world view; the phenomenon of corruption; the position of women; and differential impacts of British and French colonialism and American and Japanese postcolonial influence. Lecture/discussion approach to economic modernization (the guided market economy approach in Thailand, contrasted with the planned approaches in Vietnam and Laos); and to political unification (those embodying Brahmanical-Buddhist symbolism in Thailand, and Islamic symbolism in Malaysia). Case histories of efforts at guided cultural persistence or change (the Burmese prohibition of the import of modern technology, and of the Kampuchean abolition of money, cities, religion, and schools).

5 units (Textor) not given 1988-89

115. Peoples of Island Southeast Asia—Topics: prehistory, the process and impact of colonization, the contrast between hill and valley peoples, subsistence modes, social organization, religion, and aesthetics. (DR:5*)

5 units (Rosaldo) given 1989-90

116. Anthropological Perspectives on American Culture—(See Anthropology 15.)

117. Traditional Chinese Society—The society, culture, and political economy of late traditional China to 1949. The nature of social change in this premodern agrarian civilization. (DR:5*)

5 units (Skinner) given 1989-90

118. Communist Chinese Society—Sociocultural change, and economic development in the People's Republic of China, emphasizing how the Chinese case relates to social science theory.

5 units (Skinner) given 1989-90


5 units, given 1989-90

123. Japanese Economic Organization—The social and cultural factors in Japanese economic organization and business management, the motivational basis for commitment to work, the relation of kinship to economic system, "industrial gradation" and its correlates.

5 units, given 1989-90

125. Japanese Woman Through Novels and Films—(Same as Asian Languages 125.) In anthropological literature on Japan, women tend to be relegated to the background of the social stage. Through analysis of novels written by Japanese women and feature films made by Japanese, in conjunction with anthropological
literature, a new understanding of the position of women in Japan is presented.

SOCIAL AND CULTURAL
ANTHROPOLOGY

128. Ethnographic Film—(Same as Communication 115.) 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. Recommended: 1.

5 units, Win (Gibbs)

132. Anthropological Perspectives on Medieval Europe—An investigation of various aspects of medieval culture selected for relevance to issues and problems in cultural anthropology. Focus is on the interrelationships among technological, conceptual, linguistic, and social systems in the conduct of everyday life. Prerequisites: A background in Western European history and some experience with the social sciences. Recommended: A reading knowledge of at least one European language other than Modern English.

5 units, Win (Frake)

133A,B,C. Ethics of Development in a Global Environment (EDGE)—(Same as Engineering 297A,B,C, Political Science 140A,B,C.) EDGE seminars present a series of speakers on current development issues emphasising problems of the poorer nations. Autumn Quarter: basic world resources, energy, food, housing, population and environment, and the political development and dependencies of developing regions. Winter Quarter: international institutions and their roles: international banking, international businesses, U.S. and foreign universities, East-West political policies, and organizations of developing countries. Spring Quarter: the roles of individuals in national and international institutions dealing with the problems of developing countries. The speakers present a wide range of political, professional, and national backgrounds and present candid and differing points of view. The series gives students working in developing countries or in institutions dealing with developing countries a better knowledge of the challenges and issues they must deal with. One unit credit for attendance of the speaker series; 3 units additional credit for optional workshops treating selected issues in more depth. (Sequential registration not required.)

1 unit, (lecture only) or 4 units (lecture plus workshop) Aut, Win, Spr (Fagen, Lusignan, McWhorter, Siegel) lecture W 7:30-9:30 p.m. workshops by arrangement

138. Sociocultural Implications of High Technology—(See 238.) (Same as Values, Technology, Science and Society 159.)

140. Aging: From Biology to Social Policy—(Same as Human Biology 178.) The ranks of the elderly. What can we expect when we get there? What are the biological processes that contribute to aging and are they the same across all populations and cultures? What is the interaction between the biological processes of aging and the social status of the elderly in our and other cultures? What are the cultural, social, and economic consequences of a large proportion of elderly people? What implications do they have for social policy? These questions are addressed through readings, lectures, and films. Students are assisted in research and working with the elderly. Those with strong clinical interests should enroll in Medicine 210.

3-5 units, Win (Barnett)

145. Women in Cities: A Cross-Cultural Perspective—(Same as Feminist Studies 142.) Women’s experiences in cities throughout the world and the determinants of their similarities and differences. Topics: women and migration, changing forms of the sexual division of labor, changing family and kinship structures, prostitution, and political activism.

5 units, given 1989-90

146. Urban Problems in Anthropological Perspective—Issues from current urban problems examined from the cross-cultural perspective of anthropology. Topics: the social consequences of crowding, rural-urban migration, changing sex roles, changing family and kinship patterns, urban ethnic communities and inter-ethnic relations, urban poverty, stratification, crime, and prostitution.

5 units, Spr (Klint)

149. Anthropology of Development—(Same as VTSS 161.) A history of anthropology in development projects from the Colonial Period through WW II. The involvement of anthropologists at the community level, e.g. Vicos, Administration of Pacific Trust Territories; intervention in development projects and disillusionment with same, "Camelot": the "trickle-down" paradigm, e.g. the Green Revolution: the "Bottom-up" paradigm, anthropologists in AID, local systems analysis, including on the farm research, small-scale fisheries, the rationality of peasant producers, and a consideration of comparative research on diet, nutrition, and
forms of exchange (implications of change from subsistence production to production for the market). Extensive use of case studies. Lectures and seminar discussion. Major paper as a principal basis for grading.

5 units, Win (Siegel)

154. Creation/Procreation: A Comparative Study—An alternative to the study of religion and reproduction as distinct categories and separate domains. The gendered aspects of cosmological or religious systems and the cosmological significance of gender in terms of their symbolic interrelationships. Anthropological and other literature examines these relationships in several cultures including our own. Emphasis on the ways these beliefs are embedded in practices and structures of social life and on Western categories and meanings, and their implications for theorizing.

5 units, Aut (Delaney)

157. Law in Radically Different Cultures—(Same as Law 316, Political Science 182L; graduate students register for 257.) American law as a benchmark to examine comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt (religious law), and 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. Open to law students, graduate students in other departments, and to juniors and seniors. Students must register for Winter and Spring Quarters, starting January 23.

2 units, Win plus 3 units, Spr (Barton, Staff)

158. The Sociology of Scientific Knowledge—(Same as History of Science 155, History 133B, Philosophy 155, Sociology 140, VTSS 138.) Some of the classical problems in the sociology of knowledge as represented in the writings of Marx, Durkheim, and Mannheim. Recent work in the social construction of scientific knowledge. Emphasis on recent studies in the historical sociology of experimental science and laboratory practice. Using case studies and drawing on anthropological approaches in the works of Mary Douglas, Pierre Bourdieu, and others, a theory of practice and a critique of historically situated practical reason is explored as the foundation of the sociology of scientific knowledge.

4 units, Spr (Lenoir) MWF 11

164. Ecological Anthropology—(Same as Human Biology 134.) Seminar on ecological analysis in anthropology emphasizing patterns of covariation between social systems and ecosystems. Sample societies from diverse habitats (arctic, desert, tropical rainforest, ocean islands, mountain tops) motivate the exploration of theoretical topics including cultural evolution, adaptation, optimal foraging, resource management, population dynamics, resource competition, warfare, and social stratification.

3 or 5 units, Aut (Durham)

165. Psychological Anthropology—Introduction to contemporary themes in the anthropological study of cultural influences on psychological development and functioning. Socialization and cognition in life-cycle adaptations to behavioral and symbolic environments are highlighted. Topics: childhood and parental bonding; sex differences; cultural motivation and perception; ethnographic psychologies of cognition and consciousness; deviance and self-justification; and life cycle transitions. Prerequisite: 1 or Psychology 1, or consent of instructor. (DR:4*)

5 units, not given 1988-89

168. Medical Anthropology—Introduction to curing systems in our own culture and in non-Western cultures; problems of adapting modern medicine to diverse cultures; explication of the social and cultural correlates of physical and mental health and disease (social epidemiology). Designed for students with interests in health care, any major.

5 units, Aut (Barnett)

LINGUISTIC ANTHROPOLOGY

172. Indigenous Languages of North and South America—(Same as Linguistics 80.) Survey of American Indian languages, their history, classification, structure, and possible Old World relationships. The relationship between American Indian languages and the development of anthropological and linguistic theory. Native American writing systems. Problems of language, culture, and world view.

5 units (Fox) given 1989-90

177. Pidgins and Creoles—(Same as Linguistics 151/251.) The formation of simplified contact languages and their subsequent elaboration. Emphasis on the relationship between language structure and function, language universals, and the relevence of political power, ethnic identity, and social structure in the contact speech community. Other simplified languages and registers. Prerequisite: An introductory course in linguistics or anthropology or consent of instructor.

4 units, Win (Rickford)
comparative method; the rate of language change; glottochronology; migration theory. Prerequisite: Introductory course in linguistics, or consent of instructor.
5 units (Fox) given 1989-90

ARCHEOLOGY AND BIOLOGICAL ANTHROPOLOGY

180. Seminar in Current Problems in Human Evolution—The current state of knowledge on the earliest stages of hominid evolution, particularly the Australopithicines and the emergence of the genus Homo. Students prepare a detailed research paper and present findings in a seminar format. Prerequisite: 80, or consent of the instructor.
5 units, Spr (Johanson)

181. Evolutionary Anthropology—(Same as Human Biology 114.) Seminar on the relationships between genetic and cultural evolution in human populations. Reviews major new works relating genes, culture, and human diversity, including sociobiology, cultural transmission theory, Darwinian culture theory, and coevolution, emphasizing theory and supporting examples. Teams of students conduct original research projects and report to the class. Prerequisites: 2, the Human Biology Core, or consent of instructor.
4 units (Durham) given 1989-90

184. Archaeological Methods: Research Seminar—Methods of research and analysis of archaeological materials. Local stone tool materials serve as data within a class-developed research strategy. Data recording, computer entry, and statistical analysis are guidance from instructor. Class produces a major report on prehistoric stone tool technology of Stanford area. Prerequisite: 3, 185, 187, or consent of instructor.
5 units, Win (J. Rick)

185. Native California, from Prehistory to Present—The historic and prehistoric record of California’s indigenous peoples, from the earliest archeological sites through present-day Native populations. Ecological adaptations to coastal, valley, desert, and sierra environments emphasizing the diversity of hunting and gathering lifeways. The contributions made by historic documents, archeological data, and modern Native culture as sources of information about California’s early peoples.
5 units, Aut (Bocek)

186. Eastern Europe and the USSR: The Prehistory Basis—The prehistory of Eastern Europe and the European U.S.S.R. through the study of archaeological remains from the past 25,000 years. Emphasis on socioeconomic transformations in prehistory, especially the transition from hunter/fisher to farmer. Slides and lectures are based on recent archaeological research in an area generally between the Danube and the Volga. Topics: archaeological method and theory in Eastern Europe and the U.S.S.R., and the interaction between politics and interpretations of the past.
3-5 units, Spr (Voytek)

187. Hunter-Gatherers in Archeological Perspective—(Same as Human Biology 183.) The organization and subsistence of band-level hunter-gatherers as approached through archeological investigations. Modern hunter-gatherers provide background for prehistoric groups. The archeological record of Africa, Europe, and the New World provides examples of how archeological data reconstructs the cultural systems of extinct hunter-gatherers. (DR:5*)
5 units, alternate years, given 1989-90

RESEARCH METHODS

190A,B. Data Analysis—Introduction to data analysis through theory and use of parametric and non-parametric statistics emphasizing applications in anthropology. Training in the use of the computer for data analysis. Continuous enrollment through both quarters required for credit.
5 units, not given 1988-89

192A. Ethnographic Monitoring of Rapid Change I—(Same as Education 254A.) Seminar-practicum on the anthropological and empirical study of processes of rapid or sudden change, e.g. technological innovation (telemicro-electronic, biotechnical, materials-science, etc.), an ecological crisis, a precipitous economic downturn, or a fundamental shift in political or managerial control, where such change is judged likely to produce serious impacts on human well-being. Students, alone or with a team, receive training and frequent tutorial guidance in using appropriately adapted ethnographic techniques to carry out a fieldwork project in a local community or institution. The resulting paper assesses implications of findings for theory, public policy, and/or educational programs. Open to all graduate students, and to undergraduates contemplating Honors theses. Recommended: 138/238. Previous social science interviewing background helpful. Enrollment limited to 20.
3-5 units (Textor) given 1989-90

192B. Ethnographic Monitoring of Rapid Change II—(Same as Education 254B.) Optional continuation of 192A for the student requiring additional time, training, or seminar participation to complete a paper or undergraduate Honors thesis or prepare same for publication, or to develop a dissertation proposal.
3-5 units (Textor) given 1989-90
195. Museum Methods—Individually directed work on anthropology collections. Introduction to the computerized storage and retrieval system, cataloging, exhibit techniques. Can be taken for one or two quarters with consent of instructor.

1-4 units (Rick, Staff) by arrangement

198F. 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.

4-5 units, Spr (Schichilone)

GRADUATE AND ADVANCED UNDERGRADUATE

200. Core Seminar: Current Issues in African Studies—An interdisciplinary seminar introducing advanced undergraduates and graduates to current issues in African studies. Each week is led by a different Stanford or Berkeley professor and consists of lectures followed by a seminar discussion of assigned readings.

1-5 units, Spr (Staff)

219. Comparative Social Organization of China and Japan—Seminar analyzing Chinese and Japanese societies since the 17th century. Student research papers may treat either or both of the societies and may focus on any topic of analytical concern to anthropologists and historical sociologists.

5 units (Skinner) not given 1989-90

238. Sociocultural Implications of High Technology—(Undergraduates enroll in 138; same as VTSS 159.) Lecture/discussion, in cultural terms, on the development, diffusion, and utilization of technology emphasizing the high technology developed around Stanford: biogenetics, microelectronic information technology, and super conductors. How such technological innovations enable or drive profound changes in a sociocultural system's symbolic values and belief systems, and its social and economic organization. Also, unintended human damage such technological innovations have produced; and implications for appropriate technological design, and for public and educational policy. Case studies from non-Western cultures of varying levels of sociotechnical complexity, and a unit on modern Japan. Guest lecturers, include local technologists, venture capitalists, and political activists. Open to all graduate students, and undergraduates contemplating Honors theses. (DR:5)

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

239. Education and Sociocultural Change—(Same as Education 306C.) Models of cultural change are developed that stress the impact of abrupt changes in the conditions of life on the personal adaptations of individuals and local communities brought about by modernization and urbanization. Education as an instrument of change and its intervention in the process of indigenous cultural transmission as an aspect of these processes. Case studies document and help build appropriate models. Students will, in a seminar-like setting, apply the models developed to the analysis of third world and other relevant situations.

3-5 units, Win (G. and L. Spindler) MW 1:15-3:05

244. Family and Kinship Organization—(Same as Feminist Studies 144.) Seminar on the major issues anthropologists have confronted in the comparative study of family and kinship. Competing theoretical perspectives are evaluated through an examination of descent, marriage, gender, domestic groups, and kinship change. Prerequisite: Graduate standing in anthropology or consent of instructor.

5 units, Spr (Stockard)

245H. Traditional Rhetoric of Ghana.

5 units, Spr (Yangeh)

246. Anthropology and History—Seminar on cultural patterns and historical processes. Attention to historiography of oral tradition and written sources as well as research methods in social science.

5 units, Win (Jackson, Rosaldo)

247V. Cultural Construction of Gender—Seminar examining gender systems cross-culturally. The consequences of defining those systems in biological, social, and cultural terms. The interrelationships of gender, family, the economy, marriage, and politics.

5 units, Win (Stockard)

250. Nutritional Problems of Developing Nations—(Same as Food Research 250, Human Biology 110.) The malnutrition syndromes common in developing countries emphasizing protein-calorie malnutrition, nutritional anemias, and vitamin A deficiency. Methods and techniques of nutritional assessment applicable for use in developing nations. 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. Recommended: Food Research 119 or its equivalent. Open to graduate students and seniors in Human Biology and Anthropology.

5 units, Win (Martorell)

252. Symbolic Anthropology—Symbolic Anthropology is an approach to the study of human society developed along with the concept of
culture as a system of symbols and meanings, a system presumed to be embedded in and expressed by institutions, values, attitudes, structures of everyday life, and social action. The intellectual roots of this approach and some contemporary works motivated by it.

5 units, Win (Delaney)

255. Political Anthropology—Seminar presenting principle theoretical approaches in the anthropological analyses of political structures and processes, including structural functionalism, action theory, and political economy. Topics: levels of political organization from the band to the state; consensus and conflict in political behavior; and analysis of power and political process in contemporary developing societies, especially peasant-state relations. Theoretical works, selected classic and recent monographs assess alternative analytical frameworks.

5 units, Aut (Rubin)

256. The Politics and Ethno-politics of Community Development—(Same as Latin American Studies 256.) Seminar on the question of development in indigenous communities of the Third World emphasizing Latin America. Analyzes the historical roots and related theoretical issues of development's problems faced by indigenous people. Economic, political, and cultural perspectives are utilized to examine case studies involving ethnic communities of rural areas. Lecture/seminar format with active student participation encouraged and expected.

5 units, Aut (Varese)

260. Topics in Urban Anthropology—Seminar devoted to key issues in anthropological research on urbanism, urban communities, and urban- rural integration. Topics change each year.

5 units (Yanagisako) given 1989-90

261. Foucault and Social Theory—A seminar on the significance of Michel Foucault's works in the context of modern social theory.

5 units (Donham) given 1989-90

263. Regional Systems in Agrarian Societies—Comparative analysis seminar on 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.

5 units (Skinner) given 1990

264. Advanced Ecological Anthropology—Seminar on role of ecological models in the analysis of culture and social systems. Major monographs review early efforts linking environments and social systems (multilinear evolution, neo-functionalism, adaptive radiations), and evaluate current theory and research trends. Case studies include social stratification in Polynesia, agricultural involution in Java, ritual regulation in New Guinea, acculturation and social change in Amazonia, demographic change in the Swiss Alps, and peasant ecology of Central America. Prerequisite: 164 or graduate standing.

5 units (Durham) not given 1988-89

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, Aut (G. and L. Spindler)

266. Cultural Transmission: Education in Cross-Cultural Perspective—(Same as Education 315.) The transmission and communication of explicit and implicit cultural assumptions in a variety of formal and informal educational contexts. The patterning of education in a cross-cultural perspective, the sequence of culturally constructed experiences in life careers, cultural analysis, and sensitization. Attention to education in the U.S. and other complex societies, as well as in non-literate cultures.

3-5 units, Win (G. Spindler, L. Spindler) T 7-10 p.m.

267. Spatial Systems and Social Process—(Same as Sociology 267.) Seminar probing the differentiation of social process through spatial systems in agrarian and commercial societies. Analyses of the contingencies of human interaction in space aim to elucidate central problems of comparative social science history. Topics: peasant marketing, population processes and family demography, internal colonialism, economic development and decline, social movements and revolutions, regime consolidation and disintegration, and the world system.

5 units, Spr (Skinner)

268. Seminar on Technology in Culture—(Same as VTSS 259.) Anthropologists treat technology as an aspect of a sociocultural system and study its dynamic relationship with other aspects, e.g., ecological adaptation strategies, social and political structure, economic routines and reward systems, value orientations, world views, and symbolic forms. The seminar explores a variety of social science theories and models. Enrollment limited to 15; preference given to graduate and undergraduate majors in VTSS or a social science. Prerequisite: VTSS 159.

3-5 units, Win (Textor)

269A. Practicum in Ethnographic Futures Research I—(Same as Education 212A, VTSS
250A. The rationale and guidance in the practice of Ethnographic Futures Research (EFR), loosely structured, interactive, non-directive open-ended method for eliciting from a sample of interviewees their perceived and preferred middle-range sociocultural visions of alternative futures for their extant society or organization. EFR (1) complements other methods for studying values and on-going change processes; (2) augments conventional approaches to public and educational policy; and (3) provides an educational experience for interviewer and interviewee. The focus is on alternative futures enabled or driven by high technology, with reference to Stanford, viewed as a sociocultural entity.

3-5 units, Win (Textor) W 7-10 p.m.

269B. Practicum in Ethnographic Futures Research II—(Same as Education 212B, Values, Technology, Science, and Society 250B.) Continuation of 212A for those who require additional time and guidance, especially in writing up research results for publication. (IDE, SSE)

3-5 units, Spr (Textor) W 7-10 p.m.

270. Race, Class, and the Origins of Anthropology—Beginning in the Renaissance, examines the economic, political, and intellectual processes that fostered discussions of cultural differences and their causes. As Europeans encountered “others” in their expansion overseas, they developed new ideas of human beings, human nature, and individuality, which they used to question the relationship between culture and nature, and the relationship between society and the individual.

5 units, Aut (Stolke)

273. Seminar in Advanced Medical Anthropology—For those who wish to develop their research interests in problems which require a collaborative medical-biological orientation and a social science approach. Students work on topics of their choice. Prerequisite: 168 or consent of instructor.

5 units, Win (Frake)

274. Readings in Linguistic Anthropology—(Same as Linguistics 269.) Workshop: reading and discussion of key monographs and articles on a specific topic or geographic area, or by a specific author, on the relationships between language and culture.

2 units (Fox) not given 1988-89

275. Demographic Anthropology—Proseminar devoted to an examination of population dynamics in human societies. Includes a critical review of theories concerning the interaction between population processes and the political economy, and a comparative analysis of family demography.

5 units (Skinner) not given 1988-89

276. Cognitive Anthropology—Seminar on how people give meaning to behavior and other events they experience from the anthropological side of the intersection of anthropology, linguistics, cognitive psychology, and sociology. Presents a cross-cultural perspective on the relations among knowledge, language, and social behavior.

5 units, Win (Frake)

277. Linguistic Anthropology—(Same as Linguistics 255.) Seminar devoted to intensive reading and discussion of major works on the relationships between language and culture. Prerequisite: An introductory course in linguistics or consent of instructor.

5 units (Fox) given 1989-90

278. Topics in Linguistic Anthropology—(Same as Linguistics 256.) Seminar devoted to a key issue in the relationships between language and culture.

5 units, Spr (Fox)

279. Languages of the Pacific—An investigation of the Austronesian (Malayo-Polynesian) languages of the Pacific and Southeast Asia whose unique distribution, history, and social contexts provide an ideal laboratory for exploring a number of problems in linguistics, culture history, language contact, and sociolinguistics.

5 units (Frake)

280. Training Seminar: Ethnography of Schooling—(Same as Education 280.) Ethnographic approaches to the study of schooling emerging from recent anthropological work. Topics: the development of such approaches in educational anthropology and the emerging criteria of good ethnography in schools; problems of ethnographic “evaluation”; ethics and ethnography; and the potential relevance of school ethnography to educational policy. Focus: training participants to observe and record behavior, develop skills in the elicitation of cultural knowledge, and to develop an internally consistent conceptual structure that orients observation and elicitation productively. Selected techniques of ethnographic research applicable to the study of schooling are demonstrated. Application of such techniques in modest field research projects that can be carried out in settings accessible to students. Writing of one research report or proposal for research.

4 units, Sum (G. and L. Spindler)

W 2:15-5:05

287H. Popular Culture and Rites of Subordination in Colonized Societies—“Popular culture” in Renaissance Europe compared to the modern view of colonized societies, focusing on Mesoamerica, the Andes, and Brazil. Readings
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develop a critical stance on issues, methods, and theories as applied to the analysis of politico-religious public rituals in New World societies. The multi- or inter-cultural rites through which subordinated peoples and developing nation-states are described. The multiple interpretations of cultural hierarchies, historic and contemporary.

5 units, Spr (Abercrombie)


5 units, Aut (Wolf)

291. History of Anthropology: The 20th Century—A comparative analysis of the development of social and cultural anthropology in France, Britain, and the U.S., focusing on the interplay between the development of anthropological theory, and the changing political and economic circumstances in which it developed.

5 units, not given 1988-89

292. Dissertation Seminar—For graduate students in the process of writing dissertations and preparing for professional employment.

5 units, Aut, Win, Spr (Staff)

293. Fieldwork and Ethnographic Texts—Seminar considers the making of a series of classic ethnographic texts from fieldwork, with its methodological and ethical quandaries to writing, including its rhetorical and political strategies.

5 units, Aut (Staff)

294. Design of Field Research—Seminar treating research design and the research process, emphasizing the interrelation of theory and method. Also, problems of preparing dissertation proposals and applications for research grants. Prerequisite: Consent of instructor. Limited enrollment.

5 units, Spr (Delaney)

296. Research Apprenticeship—Supervised work with an individual faculty member on the students' research project. May be taken for more than one quarter.

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

299. Thesis—Research in connection with the master’s thesis or the doctoral dissertation.

any quarter (Staff) by arrangement

APPLIED PHYSICS

Emeriti: (Professors) Marvin Chodorow, C. Chapin Cutler, W. Conyers Herring, Mitchel Weissbluth; (Professor of Research) H. John Shaw
Chairman: Malcolm R. Beasley

Assistant Professor: Aharon Kapitulnik
Professors (Research): Bertram A. Auld, George S. Brown, Philip H. Scherrer, J. Gethyn Timothy, Helmut Wiedemann, Herman Winick

Courtesy Professor: Douglas D. Osheroff
Affiliated Professors: Gordon S. Kino (Electrical Engineering), Anthony E. Siegman (Electrical Engineering), William E. Spicer (Electrical Engineering)

Acting Assistant Professor: Martin M. Fejer

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 condensed matter physics, 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 Department of Applied Physics, the Ginzton Laboratory, the Stanford Electronics Laboratories, the Center for Space Science and Astrophysics, the Center for Materials Research, and the Stanford Synchrotron Radiation Laboratory.

The number of graduate students admitted to Applied Physics is limited. Applications should be received by January 1, 1989. Graduate students may normally enter the department only at the beginning of Autumn Quarter.
GRADUATE PROGRAMS

Admission requirements for graduate work in Applied Physics include a bachelor's degree in physics or an equivalent engineering degree. Students entering the programs from an engineering curriculum should expect to spend at least an additional quarter of study acquiring the background to meet the requirements for advanced degrees in Applied Physics.

The University’s basic requirements for the master's degree are discussed in the "Degrees" section in this bulletin. 36 units, of which at least 30 units must be graduate level courses in applied physics, physics, engineering, and mathematics, are the minimum requirements for the degree. The required program consists of the following:

1. Courses in physics and mathematics to overcome deficiencies, if any, in undergraduate preparation.

2. Basic Graduate Courses.
   a) Mathematical Physics and Advanced Mechanics: one quarter-3 units; Applied Physics 315, Physics 210, 211, 212; Mathematics 220A, 220B, 220C; Electrical Engineering 261
   b) Electrodynamics: two quarters-6 units; Physics 220, 221, Electrical Engineering 241, 242
   c) Quantum Mechanics: two quarters-6 units; Physics 230, 231, 232, 330, 331, 332, 370, Electrical Engineering 324

3. Additional advanced courses in science and/or engineering but not including Directed Study (Applied Physics 290) to complete the requirement of 36 units.

4. A letter grade indicator of "B" is required.

For students entering with a Master of Science degree, the course work requirements (Item 1) are modified as follows:

1. Item (Ib) may be partially or totally satisfied with equivalent courses taken elsewhere. The requirements under (Ic) are reduced to 18 units.

2. Research: May be conducted under the supervision of a member of the Applied Physics faculty, or appropriate faculty from other departments.

3. Departmental Oral Examination: Must be passed before the third year of graduate registration. The examination consists of a seminar on a suitable subject delivered by the student before the faculty academic advisor (or a suitable substitute), the research advisor, and one other member of the faculty selected by the department.

4. Research Progress Report: Before the end of the Winter Quarter of the fourth year, the student will arrange to give an oral research progress report of approximately 30 minutes, of which a minimum of 10 minutes should be devoted to questions from the Ph.D. Reading Committee.

5. The University Ph.D. Oral Examination: Will consist of a public seminar in defense of the dissertation, followed by private questioning of the candidate by the University Examining Committee.

6. The Dissertation: Must be approved and signed by the Ph.D. Reading Committee.

ASSISTANTSHIPS

Research assistantships are available for Ph.D. candidates. Applications for financial aid are included in the admission packet received from the Graduate Admissions Office.
COURSES

3A. Breakthroughs and Inventions in Science and Technology—(Enroll in Freshman Sophomore Seminars by same title.)
   Aut (Cutler)

15. The Nature of the Universe—For under-graduates without scientific background. The structure, origin, and evolution of the universe and our growing knowledge of the objects which make up galaxies, stars, planets, etc. Discussion of some enigmas of modern astronomy, such as quasars, x-ray sources, black holes, and pulsars. Presentation is non-mathematical. (DR:7)
   3 units, Win (Walker) TTh 2:15-3:30
   plus one hour discussion by arrangement

15A. Cosmic Horizons—(Enroll in Physics 15.)
   3 units, Spr (Bloom)

20. From Klystrons to Lasers: The Stanford Connection—The development of coherent radiation from the early radio and klystron sources to masers and lasers. Operational principles of the laser at the elementary level with laboratory visits. Principles of laser operation that are critical to many of the applications of modern lasers. Introduces the science and non-science student to the world of physics, chemistry, biology, and medicine through the application of modern laser sources. (DR:8)
   3 units, Aut (Byer)
   alternate years, not given 1989-90

25. Evolution of the Cosmos—Similar to 15A in its subject matter, but at a higher level; intended for more advanced students and students majoring in science or engineering. Origin and evolution of astronomical objects, planets, stars, galaxies, and the universe at large emphasizing modern development in astronomy and elementary particle physics relevant to the subject matter. The development of life and position of intelligent beings in the universe. Algebra used. Recommended: High school physics and calculus.
   3 units, Aut (Petrosian)

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. Individual observations with a 16-inch Cassegrainian telescope are supplemented by lectures/discussion of basic observational techniques, astronomical catalogs and coordinate systems, and the relation of observations to astrophysical models. Limited enrollment. (DR:7)
   3 units, Aut, Sum (Walker) M 4:15
   by arrangement

100. Introduction to Observational and Laboratory Astronomy—Introduction to observational techniques in astronomy for physical science or engineering students. Emphasis on measurement of fundamental astronomical parameters such as distance, temperature, mass, and composition of stars. One 2-hour lecture and one night of observation using the 16-inch telescope at the Stanford Student Observatory. Limited enrollment. Prerequisites: One year of physics or concurrent registration in Physics 25, 57, or 63; and consent of instructor. (DR:7)
   4 units, Spr (Walker) M 3:15-5
   lab by arrangement

160. Introduction to Stellar and Galactic Astrophysics—Physics of the sun. Evolution and death of stars. White dwarfs, novae, planetary nebulae, supernovae, neutron stars, pulsars, binary stars, x-ray stars, and black holes. Galactic structure: interstellar medium, molecular clouds, HI and HII regions, star formation and element abundances. Prerequisites: Calculus and one year of college physics at the level of the Physics 50 series or equivalent.
   3 units, Win (Staff)

161. Introduction to Extragalactic Astrophysics and Cosmology—Basic observational data on distances and the distribution of matter in the universe: galaxies, clusters, and superclusters of galaxies. Electromagnetic radiation from galaxies and quasars and the background radiation at radio, infrared, and x-ray frequencies. Introduction to cosmology, models of the universe, and their evolution. The Big Bang and the physical processes in the first three minutes. Prerequisites: Calculus and one year of college physics at the level of the Physics 50 series or equivalent.
   3 units, Spr (Petrosian)

169A,B,C. Independent Study In Astrophysics and Honors Thesis—(Enroll in Astronomy 169A,B,C.)
   Aut, Win, Spr (Staff)

172. Physics of Solids—(Enroll in Physics 172.)
   3 units, Spr (Kapitulnik)

181. Intermediate Optics—(Enroll in Physics 181.)
   3 units, Aut (Little)

192. Introductory Biophysics—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 re-
ceptors. Physics of nerve impulse propagation. Prerequisites: Biology 21, Chemistry 30 series, Physics 50 series, or equivalents.

3 units, Spr (Doniach) given 1989-90


3 units (Fox) given 1989-90

210. Advanced Particle and Continuum Mechanics—(Enroll in Physics 210.)
3 units, Aut (Wagoner)

211. Statistical Mechanics—(Enroll in Physics 211.)
3 units, Win (Wagoner)

212. Nonlinear Mechanics and Relativity—(Enroll in Physics 212.)
3 units, Spr (Wagoner)

220, 221. Classical Electrodynamics—(Enroll in Physics 220, 221.)
220. 3 units, Aut (Lynn)
221. 3 units, Win (Lynn)

230. 3 units, Aut (Laughlin)
231. 3 units, Win (Laughlin)
232. 3 units, Spr (Laughlin)

270. Electrical and Magnetic Properties of Solids—(Enroll in Electrical Engineering 238.)
3 units, Win (Spicer)


271. 3 units, Aut (Harrison) MWF 10
272. 3 units, Win (Harrison) MWF 10


3 units, Spr (Fetter) MWF 10


3 units (Harrison) given 1989-90

290. Directed Studies in Applied Physics—Special studies under the direction of a faculty member for which academic credit may properly be allowed. May include laboratory work or directed reading.
any quarter (Staff) by arrangement

301. Astrophysics Laboratory—Combined seminar/laboratory. Investigates the fundamental observational basis of physical models of astronomical objects. Observational component uses the 16-inch telescope at the Stanford Observatory and ancillary photometric and spectroscopic instrumentation. Emphasis on spectroscopic and photometric observation of main sequence, post-main sequence, and variable stars. Limited enrollment. Prerequisite: Consent of instructor.
3 units, Sum (Walker) alternate years, not given 1989-90

302. Condensed Matter Physics Laboratory—The physical phenomena in solid state and statistical physics via understanding the different materials in which they are observed. Students prepare materials, characterize them, and perform appropriate measurements. Topics: magnetism in insulators, nonlinear optical materials and fiber optics, ceramic superconductors, superconducting tunneling, nonequilibrium growth and fractal materials, metal/insulator transitions, and impurities in semiconductors. Techniques for synthesis include: thin films depositions, crystal growth, fiber pulling, electrochemistry, ion implantation, and ceramic techniques. Physical measurements include: magnetization, resistivity, Hall effect, magnetoresistance, optical measurements, and
304. Lasers Laboratory—Laser theory and practice. Lectures on the theoretical and descriptive background for the laboratory experiments, detectors and noises, the helium neon laser, laser beams and resonators, argon ion laser, cw dye laser, semiconductor diode laser, carbon dioxide infrared laser, and the Nd:YAG laser. Measurements of laser threshold, gain, saturation, and output power levels. Laser transverse and axial modes, linewidth, and tuning, Q-switching and modelocking. Prerequisites: Electrical Engineering 231 and 232, or consent of instructor.

3 units, Win (Fejer)

305. Nonlinear Optics Laboratory—Emphasis on laser interaction with matter. The laser devices provide the radiation required to explore the linear and nonlinear properties of matter. Experiments on modulation, harmonic generation, parametric oscillators, modelocking, stimulated Raman and Brillouin scattering, Coherent Anti-Stokes Scattering, other wave mixing interactions such as wavefront conjugation, and optical bistability. Optical pumping and spectroscopy of atomic and molecular species. Limited enrollment. Prerequisites: 304, Electrical Engineering 231 and 232, or consent of instructor.

3 units, Spr (Fejer)

307. Microstructures Fabrication Laboratory—(Enroll in Electrical Engineering 357.)

3 units, Sum (Bloom, Khuri-Yakub) by arrangement

308. Wave Measurement Techniques—(Enroll in Electrical Engineering 245.)

3 units, Spr (Kino)


3 units (Doniach)

alternate years, given 1989-90

312, 313. Basic Plasma Physics I and II—For the non-specialist who needs a working knowledge of plasma physics for space science, astrophysics, fusion, or laser applications. Material includes orbit theory, the Boltzmann equation, fluid equations, MHD waves and instabilities, EM waves, the Vlasov theory of ES waves and instabilities including Landau damping and quasilinear theory, the Fokker-Planck equation, and relaxation processes. More advanced topics are resistive instabilities, collisionless shock waves, particle acceleration, and radiation processes. Prerequisites: Physics 210 and 220, or Electrical Engineering 356, or permission of the instructor.

3 units, Win, Spr (Sturrock) MW 2:15-3:30 alternate years, not given 1989-90

314. Crystal Physics—A systematic development from a phenomenological viewpoint of the material properties of crystals; a background for research in crystals and their applications. Point, space, and magnetic symmetries. Reciprocal lattices and x-ray orientation. Tensor and matrix notation. Thermodynamic principles. Representation surfaces. Application to electric, magnetic, elastic, thermal, piezo, and optical properties of crystals. Prerequisite: Physics 172 or equivalent.

3 units (Auld)

alternate years, given 1989-90

315. Computational Physics—Survey of recent advances in numerical simulation of systems with many degrees of freedom emphasizing applications to problems in condensed matter physics. Topics: random-number generators; Monte Carlo simulations in classical statistical mechanics; critical phenomena; quantum systems; kinetics of phase transitions; polymers; cellular automata and nonlinear dynamics; diffusion-limited aggregation.

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

320. Quantum Optics—(Enroll in Physics 320.)

3 units, Aut (Chu)

321. Laser Spectroscopy—(Enroll in Physics 321.)

3 units, Win (Danzmann)

322. Bound States and High Precision Tests of QED and Electroweak Unification—(Enroll in Physics 322.)

3 units, Spr (Brodsky) alternate years, not given 1989-90

323. Applications of Quantum Theory—(Enroll in Electrical Engineering 324.)

3 units, Spr (Pantell) alternate years, not given 1989-90

324. 3 units, Aut (Miller)
325. 3 units, Win (Miller)

330, 331, 332. Quantum Field Theory—(Enroll in Physics 330, 331, 332.)
330. 3 units, Aut (Nelson)
331. 3 units, Win (Susskind)
332. 3 units, Spr (Susskind)

334. Superconducting Electronics—(Enroll in Electrical Engineering 334.)
3 units, Win (Staff)

360. Stellar Physics—Astronomical data on stars and star clusters; classification, Hertzspring-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. Prerequisite: Physics 220 or equivalent, or consent of instructor. Recommended: Physics 132.

3 units (Staff)
alternate years, given 1989-90

362. High Energy Astrophysics—Transport and radiation processes of high energy particles in relativistic magnetized plasmas. Accretion disk structures and stability. Application to acceleration of particles and their radiation in the interstellar medium and supernova remnants; in pulsars, binary x-ray sources, gamma ray bursts and active galactic nuclei or quasars. Prerequisites: 132 or 221, or equivalents.

3 units, Spr (Staff)
alternate years, not given 1989-90


3 units (Staff)
alternate years, given 1989-90

364. Gravitation—(Enroll in Physics 364.)
3 units, Win (Dimopoulos)

365. Extragalactic Astrophysics and Cosmology—Basic observational data and theories of the structure and evolution of the universe, emphasizing 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 emphasizing nonthermal processes. Prerequisite: Physics 221 or equivalent.

3 units, Win (Petrosian)

370. Theory of Many-Particle Systems—(Enroll in Physics 370.)
3 units, Aut (Doniach)

376. Phase Transitions and Critical Phenomena—(Enroll in Physics 376.)
3 units (Fetter)
alternate years, given 1989-90

380, 381. Lasers—(Enroll in Electrical Engineering 231, 232.)
380. 3 units, Aut (Bloom)
381. 3 units, Win (Staff)

382. Introduction to Nonlinear Optics—Enroll in Electrical Engineering 346.)
3 units, Spr (Harris)


3 units, Aut (Harris) MWF 2:15
alternate years, not given 1989-90

384. The Fourier Transform and Its Applications—(Enroll in Electrical Engineering 261.)
3 units, Aut (Inan)
Win, Spr (Gray)

385. Introduction to Fourier Optics—(Enroll in Electrical Engineering 366.)
3 units, Win (Goodman)

386. Two Dimensional Imaging—(Enroll in Electrical Engineering 262.)
3 units, Win (Bracewell)

any quarter (Staff) by arrangement

470. Condensed Matter Seminar—(Same as Electrical Engineering 320.) Discussion of current research and literature in condensed matter physics offered by faculty, students, and outside specialists.
1 unit, Aut, Win, Spr (Kapitulnik, Spicer)
Th 4
473. Special Topics in Condensed Matter Physics—Research level discussions of current topics in condensed matter physics. Content varies each quarter and year, depending on the interests of staff and students. The course may be repeated.


1 unit, Spr (Huberman) W 11

483. Current Topics in Optics and Electronics—Seminar discussions of current research in optics and electronics by faculty, students, and outside specialists.

1 unit, Aut, Win, Spr (Staff) M 4:15

ART

Emeriti: (Professor) Keith Boyle, Michael Sullivan, (Associate Professor) I. K. Raubitschek
Chairman: Lorenz Eitner
Principal Advisor to Undergraduate Studio Majors: Kristina Branch
Principal Advisor to Undergraduate Art History Majors: Wanda M. Corn
Chairman of Graduate Program in Studio Art: Nathan Oliveira
Director of Graduate Studies in Art History: Paul V. Turner

Professors: Elliot W. Eisner (Art Education), Lorenz Eitner (18th-19th century French art), Albert Elsen (mid-19th/20th century European art, since 1940), Matthew S. Kahn (Design), John-David La Plante (Indian art), Suzanne Lewis (Medieval Art, on leave Spring), Frank Lobdell (Painting), Dwight C. Miller (Baroque art, on leave Spring), Nathan Oliveira (Painting/Printmaking, on leave Spring), Paul V. Turner (Architectural History)

Associate Professors: Kristina Branch (Painting/Drawing), Wanda M. Corn (American Art), Jody Maxmin (Ancient art), Richard Randell (Sculpture)

Assistant Professors: Greg Lynch (Design, on leave Autumn and Winter), Melinda Takeuchi (Japanese art, on leave Autumn)

Affiliated Professor: John H. Merryman (Art and Law)

Senior Lecturers: Joel Leivick (Photography), Laura Volkerding (Photography, on leave 1988-89)

Visiting Assistant Professor: Alessandro Nova (Renaissance art)

The department offers courses of study in three areas: (1) the history of art; (2) the practice of drawing, painting, sculpture, design, printmaking, and photography; and (3) 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 History of Art 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 History of Art, Studio (including Product Design), and Art Education.

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, 2, 3, 5 and 10.

2. 40 units in art history courses above the 100 level, including one seminar and one other 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. All required coursework, including collateral requirements, 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 also take two upper-division courses in other departments that relate to his or her work in art history. These courses must be approved by the student's advisor.

5. Undergraduate majors planning to take courses at an overseas campus must have each course approved by their advisor prior to leaving for the overseas campus.

6. Art majors are required to meet with both their advisor and the department's academic secretary during the first two weeks of each quarter to have their coursework approved and to make certain they are meeting degree requirements. Failure to do so will result in the withholding of registration for that quarter.

7. Recommended Courses (but which do not count toward the major): Art 40, 51 or 52, or 53 and 70.

HONORS PROGRAM

The department offers a program leading to Honors in Art History. Students accepted into this program, in addition to completing all the requirements for the degree in art history and maintaining a 3.5 letter grade indicator, both in the major and overall, will write a scholarly essay. Prior to applying to the program, students must have discussed their proposed course of study with their advisor. A proposal lacking a faculty sponsor will not be considered. The application package will consist of a 3-5 page proposal. In addition, a paper demonstrating the writing ability and intellectual capacity of the student must also be submitted. Proposals and supporting documents may be submitted to a faculty committee as early as the Winter Quarter, but no later than the third week of the Spring Quarter of the junior year.

While working on the scholarly essay, the student will register for 8-12 units of Art 240, Individual Work: Art History. These units will be in addition to the 48 required for the major. The student's advisor will assign grades for the academic units; the faculty committee will decide whether the student will graduate with Honors. While it will normally take three quarters to complete the work, the scholarly essay may be turned in as early as the Winter Quarter but no later than the first day of Spring Quarter of the senior year.

MASTER OF ARTS

The Department of Art offers the Master of Arts degree 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—Completion of the University's requirements for a Bachelor of Arts degree in the History of Art, or 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-tuition quarters or the equivalent in partial tuition quarters of graduate work.
2. Completion of a total of at least 36 units of graduate work in the history of art in courses at the 200 level, including most coursework required as a result of deficiencies shown on the curriculum counseling test. 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 for consideration by the faculty of two from among the term papers written during the year.
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—A graduate student's progress will be formally reviewed during Spring Quarter of his or her second year; by the end of Winter Quarter of the second year the applicant for candidacy must have completed the requirements which govern the A.M. pro-
gram in the history of art (see above), and an additional 24 units. The graduate student does not become a formal candidate for the Ph.D. degree until he or she has fully satisfied these requirements and has been accepted as a candidate by the University Committee on Graduate Studies.

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, at least two years of which must be in residence at Stanford.

Dissertation Proposal—Dissertation subjects are chosen in consultation with the candidate's advisor. A concise written statement of the topic and a plan of research for the doctoral thesis must be submitted to the art history faculty for approval at the end of the third year.

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. In cases where the students' field of study requires competence in Greek and Latin or a third European language, or in the languages, institutions, thought and literature of the Far East, the permitted collateral units for the Ph.D. in art history will be increased, with the advisor's approval in each case, to 24 or 26 (excluding first year Chinese and Japanese).

Graduate Student Teaching and Museum Work Experience—As a required part of their art history training, all graduate students in art history, regardless of their source of funding, must assist with the department's teaching program or, on some occasions, with Museum projects. Twenty hours of training per quarter is required beginning with the second quarter of the entering year through the end of the third year. Additional assignments requiring actual teaching duties will carry either 4 units of teaching course credit or supplementary funding. Students will be informed of their quarterly assignments at the beginning of each quarter, after enrollments are determined.

Dissertation—A senior member of the department will act as the student's 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 apply for an extension of candidacy.

Oral Examination—The oral examination is taken after completion of the dissertation, and its acceptance by a majority of the committee, including the principal advisor. It serves primarily as a defense of the dissertation, over a wider field.

Ph.D. Minor

For a minor in Art History, a candidate is required to complete 24 units of graduate level art history courses (200 level or above), in consultation with a departmental advisor.

PRACTICE OF ART (STUDIO)

BACHELOR OF ARTS

The major program in the studio area must total 65 units. Students may major in one of five areas: painting/drawing, sculpture, printmaking, design, or photography.

REQUIREMENTS FOR PAINTING/DRAWING

Art 40, 50, or 53, 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 1)
18 units of painting courses
12 or more units of the modern art series (Art 120A through Art 121B)
Total Units Required: 49

REQUIREMENTS FOR SCULPTURE

Art 40, 50, or 53, 60, 70
Art 140, 141, or 142 (two quarters required)
18 units of sculpture courses
12 units of modern art series
Total Units Required: 50

REQUIREMENTS FOR MONOTYPE

Art 40, 50, or 53, 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 1)
Art 145 and 146
18 units of monotype courses
Art 120A, 121A, and 122
Total Units Required: 59

REQUIREMENTS FOR DESIGN

Art 40, 50, or 53, 60, 70
Art 1 plus two additional art history courses, Mechanical Engineering 101 plus one other Mechanical Engineering course at or above the 101 level
Art 160, 161, 162, 164, 166, 167 (intermediate design)
Art 261, 268 (advanced design)
Art 140, 145, or 150 (one quarter required)
Total Units Required: 59
Requirements for Photography

Art 40, or 53, 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: 47

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 65 units required for the major area of interest.

Students are required to meet with both their advisor and the department's academic secretary during the first two weeks of each quarter to have their coursework approved and to make certain they are meeting degree requirements. Failure to do so will result in the withholding of registration for that quarter.

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 or her advisor prior to planning their overseas campus program.

Transfer Credit Evaluation—Upon declaring a studio art major, a student transferring from another school must have his or her 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 or her 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.

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—Focuses on 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 the Master of Fine Arts degree program is based on:

1. The equivalent of a Bachelor of Arts degree in Art at this University.
2. A letter grade indicator of "B-" in at least 65 units of undergraduate work in art.
3. Portfolio Specifications
   a) Painting and Sculpture: Six or more slides of painting or sculpture and six or more of drawings. Send in a Kodak Universal carousel. No actual work will be accepted.
   b) 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.
   c) Photography: 12 or more photographs.
   d) Design: 12 or more slides or photographs of creative work.

All slides should be labeled with the applicant's name; if a carousel is sent, an accompanying slide list must be included indicating the size, date, and medium of each work; otherwise, slides should be labeled with the same information and sent in the standard cardboard box received from processing. If applicants want their portfolios returned, a stamped self-addressed container must be included.
4. Applications and portfolios for the studio program must be submitted by January 1. 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. 36 units of study must be completed; students must discuss their programs of study with the department’s Administrator for Programs to ensure that the most favorable registration arrangement is made.
3. Students must participate in a weekly seminar in which their work is criticized and discussed in detail.
4. As a part of their training for the Master of Fine Arts degree, all students, regardless of their source of funding, are required to assist with the department’s teaching program for the equivalent of eight hours per week over the period of six quarters; the percentage of work assigned in a given quarter is at the department’s convenience.

The requirements for the degree of Master of Fine Arts in Design 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 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.
4. As a part of their training for the Master of Fine Arts degree, all students, regardless of their source of funding, are required to assist with the department’s teaching program for the equivalent of eight hours per week over the period of six quarters; the percentage of work assigned in a given quarter is at the department’s convenience.

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.

Graduate students must remain in residence at Stanford for the duration of the 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 or relevant teaching experience. 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 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 in the “School of Education” section in this bulletin.

COURSES
HISTORY OF ART

1. Introduction to Art—Introduction to the fundamental problems of meaning, form, and historical development in the visual arts, emphasizing architecture, sculpture, painting, and printmaking. (DR:2)
   4 units, Aut (Staff)
2. Ideas and Forms in Asian Art—The religious and philosophical ideas and social attitudes of India, China, and Japan and how they are expressed in the architecture, painting, sculpture of the Orient and in such art forms as garden designing. (DR:2*)
   4 units, Win (La Plante, Takeuchi)
3. Introduction to the History of Architecture—A selective survey of Western architecture
from antiquity to the 20th century. In each period, specific buildings and historical issues are examined, as well as general principles relevant to the study of architecture. (DR:2)

4 units (Turner)

4. Theme and Style in Japanese Art—Designed as a broad overview of Japanese artistic traditions. Great masterpieces of Japanese art from pre-history to the present are examined in terms of the interplay between Japanese and Chinese cultural traditions. Material includes temples, castles, teahouses, painting, sculpture, garden design, and ceramics. Undergraduate lecture.

4 units, Spr (Takeuchi)

5. Introduction to Ancient Art—Survey of the arts of Greece and Rome emphasizing architecture, sculpture, and painting, and the broader cultural context in which they flourished. (DR:2)

4 units, Win (Maxmin)

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. (DR:2)

4 units, Win (Miller)

The emphasis in 20, 21, and 22 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.

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. (DR:2*)

4 units, Aut (LaPlante)

21. Introduction to the Art of Asia (7th Century-13th Century)—The art of India, South East Asia, China, and Japan from the 7th century A.D. to the Mongol invasion in the 13th century. (DR:2*)

4 units, Win (LaPlante)

22. Introduction to the Art of Asia (14th Century to the Present)—Moghuls, Mongols, and Shoguns; the art of Asia from the 14th century onward. (DR:2*)

4 units, Spr (LaPlante)

INTERMEDIATE

100A. Ancient Art I—Greek art of the Archaic and Early Classical periods. A selective survey of the development of Greek art from Protogeometric beginnings to the decades preceding the age of Pericles. (DR:2)

4 units, Aut (Maxmin)

100B. Ancient Art II—Greek art of the Classical and Hellenistic periods, with emphasis on the formation, in 5th century Athens, of the classical ideal and its development and diffusion in the centuries that followed. (DR:2)

4 units, Spr (Maxmin)

100C. Ancient Art III: Roman Art—Introduction to the rich and varied art and architecture of Rome from the Etruscans to the Late Empire. (DR:2)

4 units (Maxmin) not given 1988-89

100D. Ancient Art IV—The art of metropolitan Athens, from the city’s cultural awakening around 1000 B.C. to the Persian invasion in 480 B.C., with attention to the development of sculpture and painting in the 6th century.

4 units (Maxmin) not given 1988-89

102. Ancient Art V: Greek Vase Painting—(Same as Classics 120.) Introduction to the study and appreciation of Greek vases and their painters, especially the masters of Athenian black and red-figure who flourished in the culturally rich and volatile era of the tyrant Peisistratos and his sons.

4 units, Aut (Maxmin)

103. Late Antique and Byzantine Art and Architecture—Development of artistic traditions (mosaics, icons, manuscript illumination) and building types in the Mediterranean world, from the Late Roman Empire under Constantine (312 A.D.) to the Turkish conquest of Constantinople (1452), centered on patterns of imperial patronage in Rome, Ravenna, Istanbul, Mt. Sinai, the Balkans, and Sicily.

4 units (Lewis) not given 1988-89

104. Art and Architecture in Medieval Britain—Formation and development of artistic and building traditions from the Early Anglo-Saxon period through Gothic (7th-15th centuries), from the Book of Kells to Canterbury Cathedral and Westminster Abbey, viewed within the context of medieval institutions and patronage, monastery, cathedral, and royal court.

4 units (Lewis) not given 1988-89

105. Art and Architecture in Medieval France—Development of artistic and building traditions from the Carolingian period (9th century) to the last flowering of Gothic, from Mont-Saint-Michel to Chartres, Notre-Dame in Paris, Bourges, Reims, Beauvais, and Carcassonne, viewed within the context of medieval institutions and patronage, royal court, monastery, and cathedral. (DR:2)

4 units, Aut (Lewis)

107. Medieval Architecture—Development of functional and symbolic structures within the
context of major medieval institutions and patronage: monasteries, castles, cathedrals and towns of Western Europe. (DR:2)

110A. Renaissance Art I—(DR:2)
4 units, Aut (Nova)

110B. Renaissance Art II—(DR:2)
4 units, Win (Nova)

110C. Renaissance Art III—(DR:2)
4 units, Spr (Nova)

111. Northern Renaissance Art I—15th-century painting, sculpture, manuscript illumination, and prints in the Netherlands, France, and Germany, focusing on the art of the Limbourg brothers, Van Eyck, Campin, Van der Weyden, Van der Goes, Fouquet, and Bosch.
4 units, Win (Lewis)

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:2)
4 units (Miller) not given 1988-89

115B. 17th-Century Art in the Low Countries: The Age of Rubens and Rembrandt—Major artistic developments in the Low Countries during the 17th century focused on the great personalities and important episodes during this period. The artist's position in his society serves as the point of departure. (DR:2)
4 units, Aut (Miller)

4 units (Miller) not given 1988-89

116A. Masterpieces and Monuments of the Baroque Age—(DR:2)
4 units (Miller) not given 1988-89

120A. Modern Art I: Rococo to Revolution—Main currents in European art in the periods of the Enlightenment and Neoclassicism, Watteau, Boucher, Tiepolo, Chardin, Hogarth, Greuze, Fragonard, Robert, Piranesi, and early works of David, Goya, and Blake. (DR:2)
4 units (Eitner) not given 1988-89

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:2)
4 units, Win (Eitner)

120C. Modern Art III: Realism and Impressionism—The origins of Impressionism in mid-19th century realist art and in the work of the Barbizion School. The masters of Impressionism, Monet and Renoir, are dealt with in detail, as well as the painters, Manet and Degas, who shared some of their goals and interests without fully identifying themselves with Impressionism. (DR:2)
4 units, Spr (Eitner)

120D. Modern Art IV: Alternatives to Impressionism—European art 1880-1900, Cezanne, Van Gogh, Seurat, Gauguin, Symbolism, Lautrec, Ensor, Munch. (DR:2)
4 units (Elsen) not given 1988-89

121A. Modern Art V: 20th-Century Painting I, 1900-1920—Fauvism, Matisse, German and Austrian Expressionism, Picasso, and Cubism, Orphism, Futurism, and Abstraction. (DR:2)
4 units (Elsen) not given 1988-89

4 units (Elsen) not given 1988-89

123. Rodin—The art of Rodin and its relation to the time in which he lived. 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.
4 units, Aut (Elsen)

123A. Modern Sculpture in Europe and America—A thematic approach that stresses the animating ideas and formal daring of the most important artists including Rodin, Matisse, Brancusi, Picasso, Lipchitz, Gabo, Arp, Giacometti, Moore, Gonzalez, Noguchi, D. Smith, Segal, Oldenberg, and Christo. Films, field trips, and use of the University's collections are planned.
4 units, Win (Elsen)

124. Picasso—Given either as a colloquium or lecture depending upon enrollment.
4 units, Spr (Elsen)

125A. Indian Painting—The major expressions of painting in India beginning with the Buddhist period as seen in the wall paintings of the Ajanta Cave Temples and tracing the changes in style until the introduction of papermaking in the 16th century, which permitted the full bloom of the Moghul and Rajput schools of the 16th through the 18th centuries.
4 units (LaPlante) not given 1988-89

125B. The Art of India.
4 units (LaPlante) not given 1988-89
125C. The Art and Architecture of Moghul India.
4 units (LaPlante) not given 1988-89

126A. Introduction to Chinese Art.
4 units, not given 1988-89

126B Introduction to Chinese Painting.
4 units, not given 1988-89

126E. The Meeting of Eastern and Western Art—The interaction between the art of the Far East, Europe, and America from the 16th century to the present day.
4 units, not given 1988-89

126A. Ritual Bronzes of Ancient China.
4 units (LaPlante) not given 1988-89

126B. Chinese Ceramics.
4 units (LaPlante) not given 1988-89

126C. Buddhist Art in Asia.
4 units, Aut (LaPlante)

126D. Architecture and Gardens of Japan.
4 units (LaPlante) not given 1988-89

126E. Japanese Ceramics.
4 units (LaPlante) not given 1988-89

129A. Arts of Japan I—Introduction to the important historical developments in Japanese art from prehistory to the 15th century: the evolution of prehistoric ceramics, the great tombs and their contents, the introduction of Buddhism from China and its revolutionary effect on Japanese art and culture, the glittering arts of the age of courtly splendor, and the rise of samurai culture.
4 units (Takeuchi) not given 1988-89

129B. Arts of Japan II—Survey of the highlights of Japanese art from the 15th to the 19th century: the mighty castles, fragile tea houses, magnificent gardens, and variety of modes of painting of the opulent pre-modern era.
4 units (Takeuchi) not given 1988-89

129C. A Survey of Japanese Painting—Introduction to the richness and diversity of Japanese painting from the 8th century to the present.
4 units (Takeuchi) not given 1988-89

129G. Japanese Buddhist Art—A history of the development of Buddhist art from its introduction in the 6th through the 18th century.
4 units (Takeuchi) not given 1988-89

130A. American Art and Culture in the Gilded Age—Interdisciplinary study of the art, literature, patronage, and cultural institutions of the late 19th century. Covers aestheticism, conspicuous consumption, the grand tour, and the expatriate experience; also the period's great artists, collectors and tastemakers, and the symbolic importance of world fairs and expositions. (DR:2)
5 units, Win (W. Corn)

130B. Paris and New York: Transatlantic Exchange in Early Modernism—The artistic and cultural exchange between Paris and New York in the early decades of the 20th century. The Franco-American circles around Gertrude Stein, Alfred Stieglitz and Walter Arensberg, as well as movements such as Cubism, Expressionism, and Dada. Enrollment limited to juniors and seniors. (DR:2)
4 units (W. Corn) not given 1988-89

130C. Culture in Crisis: American Art in the 1930s—The American artists' response to the Great Depression, to the New Deal, and to European fashion. Emphasis on the rise of the short-lived Regionalist movement, Depression era photography, New York modernism, government patronage of the arts, and the heated debates on culture and politics. (DR:2)
4 units (W. Corn) not given 1988-89

130D. American Art after World War II—Contemporary art as it developed in New York and on the West coast after the war. The Abstract Expressionists and Pop artists in New York, and the Assemblagists, Bay Area figurative, and Funk artists on the West coast.
4 units (W. Corn) not given 1988-89

130E. The Poet and the Artist in American Modernism—Interdisciplinary study of the friendships, exchanges, and common concerns of writers and artists in the early modern period. Focuses on the writings of Pound, Williams, Stevens, Cummings, Crane, Anderson and the art of the Stieglitz circle, Joseph Stella, Demuth, Sheeler, and Murphy.
5 units, (W. Corn, A. Gelpi) not given 1988-89

132X. Issues of Women and Gender in Modern Art—(Same as Feminist Studies 155.) The roles and contributions of female artists in modern avant-garde movements, Realism/Impressionism through postmodernism; and societal attitudes about women and gender as reflected or reinforced in the visual world through the portrayal of women in art. Confronts some of the larger problems the traditional canon of art history presents: rigid definitions of what con-
stitutes “art” and standards of quality, and what gets excluded as a result.
5 units, Win (Ortel)

4 units (Turner) not given 1988-89

175A, B. Modern Architecture I, II—A two-quarter tracing of the development, 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:2)
4 units, Win, Spr (Turner)

176. American Architecture and Urbanism—The development of architecture and city planning in the U.S. since colonial times, concentrating on those characteristics and problems which are distinctively American. (DR:2)
4 units (Turner) not given 1988-89

190X. Readings in Art History—(Same as German 52C.) For students with a knowledge of German (one year or equivalent) who want to acquire German reading proficiency in art.
3-4 units (Staff) not given 1988-89

ADVANCED UNDERGRADUATE AND GRADUATE

4 units, Aut, Win, Spr (Maxmin)

201. Colloquium: Beyond the Development of Attic Black-Figure Painting—A study of certain 6th-century painters and the extent to which their work can be seen to reflect the history and political shenanigans of their age. Prerequisite: 100A or 102.
4 units, Spr (Maxmin)

202. Studies on Greek Vase Painting.
4 units, Aut (Maxmin)

203. Studies on Late Antique and Byzantine Art and Architecture.
4 units (Lewis) not given 1988-89

204. Studies on Art and Architecture in Medieval Britain.
4 units (Lewis) not given 1988-89

204A. Seminar: Medieval Manuscript Illumination—Introduction to the study of the illustrated medieval book, its technical, stylistic, and iconographical aspects, and problems of patronage and usage. (May be taken as a sequel to English 209.) Prerequisite: Consent of instructor.
4 units (Lewis) not given 1988-89

205. Studies on Art and Architecture in Medieval France.
5 units, Aut (Lewis)

4 units, Aut (Lewis)

207. Studies on Medieval Architecture.
5 units (Lewis) not given 1988-89

210A, B, C. Studies on Renaissance Art I, II, III.
4 units, Aut, Win, Spr (Nova)

211. Northern Renaissance Art I.
4 units, Win (Lewis)

214A, B, C. Seminars on Renaissance Art.
4 units, Aut, Win, Spr (Nova)

215A. Studies on Artistic Culture in Italy during the 17th Century: Caravaggio, Bernini, Borromini, and their Contemporaries.
4 units (Miller) not given 1988-89

215B. Studies on 17th-Century Art in the Low Countries: The Age of Rubens and Rembrandt.
4 units, Aut (Miller)

4 units (Miller) not given 1988-89

216A. Studies on Great Masterpieces and Monuments of the Baroque Age.
4 units (Miller) not given 1988-89

217. Connoisseurship in 17th-Century Italian Drawings.
4 units (Miller) not given 1988-89

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, Win (Miller)

219. Colloquium on Political Ideology in 17th-Century European Art in Court and Church—Monarchial eulogy and related political allegory; the art of religious propaganda of the age of the Counter-Reformation.
4 units (Miller)

219A. Colloquium on Caravaggio and the Artistic Culture of the Caravagisti.
4 units (Miller) not given 1988-89

219B. Colloquium on the History of Printmaking.
4 units, Aut (Miller)
219C. Colloquium: The 17th-Century School of Bologna.
   4 units (Miller) not given 1988-89

   4 units, Aut, Win, Spr (Eitner, Elsen)

221. Seminar on 19th-Century Art.
   4 units, Aut (Eitner)

221A. Studies on 20th-Century Painting From 1900-1920.
   4 units (Elsen) not given 1988-89

221B. Studies on 20th-Century Painting From 1920-1960.
   4 units (Elsen) not given 1988-89

222. Studies on Rodin.
   4 units, Aut (Elsen)

223A. Studies on Modern Sculpture in Europe and America.
   4 units, Win (Elsen)

223C. Seminar on Late 19th-Century Art: Rodin.
   4 units (Elsen) not given 1988-89

223D. Colloquium: Modern Sculpture in Europe and America.
   4 units (Elsen) not given 1988-89

224. Picasso.
   4 units, Spr (Elsen)

225A. Studies on Indian Painting.
   4 units (LaPlante) not given 1988-89

225B. Studies on the Art of India.
   4 units (LaPlante) not given 1988-89

225C. Studies on the Art and Architecture of Moghul India.
   4 units (LaPlante) not given 1988-89

226A. Studies on Chinese Art.
   4 units, not given 1988-89

226B. Studies on Chinese Painting.
   4 units, not given 1989-89

226E. Studies on Meeting of Eastern and Western Art.
   4 units, not given 1988-89

227A,B. Seminar on Chinese Art.
   4 units, not given 1988-89

227C. Seminar on Far Eastern Art.
   4 units, not given 1988-89

228A. Studies on Ritual Bronzes of Ancient China.
   4 units (LaPlante) not given 1988-89

228B. Studies on Chinese Ceramics.
   4 units (LaPlante) not given 1988-89

228C. Studies on Buddhist Art in Asia.
   4 units, Aut (LaPlante)

228D. Studies on the Architecture and Gardens of Japan.
   4 units (LaPlante)

228E. Studies on Japanese Ceramics.
   4 units (LaPlante) not given 1988-89

229A. Studies on the Arts of Japan I.
   4 units (Takeuchi) not given 1988-89

229B. Studies on the Arts of Japan II.
   4 units (Takeuchi) not given 1988-89

229C. Studies on Japanese Painting.
   4 units (Takeuchi) not given 1988-89

229D. Seminar on Japanese Art.
   4 units, Spr (Takeuchi)

229E. Colloquium: Japanese Woodblock Prints—Aspects of the history, technique, and connoisseurship of the Japanese print, including early Buddhist examples of the medieval period, the great flowering of ukiyo-e ("pictures of the floating world") during the great age of urban culture, and the modern day "creative print" movement. Undergraduate colloquium.
   4 units (Takeuchi) not given 1988-89

229F. Colloquium: Japanese Art in the Zen Tradition—Aspects of the Zen-related arts which flourished from the 14th to 16th centuries, declined, and were revived in the 18th and 19th centuries. Undergraduate colloquium.
   4 units (Takeuchi) not given 1988-89

229G. Studies on Japanese Buddhist Art.
   4 units (Takeuchi) not given 1988-89

229J. Colloquium: Japanese Painting in the 18th Century—An investigation of the established traditions, of the factors behind the unprecedented appearance of new styles and artistic revivals, and of the extraordinary number of "eccentric" painters during this fertile epoch of Japanese painting. Undergraduate colloquium.
   4 units, Win (Takeuchi)

   4 units, Aut (W. Corn)

230A. Studies on American Art and Culture in the Gilded Age.
   4 units, Win (W. Corn)

   4 units (W. Corn) not given 1988-89

230C. Studies on Culture in Crisis: American Art in the 1930s.
   4 units (W. Corn) not given 1988-89

230D. Studies on American Art After World War II.
   4 units (W. Corn) not given 1988-89

230E. Studies on the Poet and the Artist in American Modernism.
   4 units (W. Corn, A. Gelpi) not given 1988-89
231A. Undergraduate Seminar: Photographs as Historical Documents—(Same as American Studies 220, History 230S.)
5 units, Aut (J. Corn, W. Corn)

232A,B. Consumer Culture and the Visual Arts—A two-quarter colloquium on the new historical and theoretical literature on consumerism, seeking to identify the ways in which the visual arts have responded to and been shaped by a consumption ethos. Students must take both quarters to receive credit.
4 units, Win, Spr (W. Corn)

233. Colloquium on the History of Photography—Readings on the history and criticism of photography combined with a close study of works in Bay Area collections. Enrollment limited.
4 units (W. Corn) not given 1988-89

235. Graduate Seminar on 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 (Lewis) not given 1988-89

236. Art History Bibliography and Library Methods—Introduction to important reference works in art and architectural history. Familiarity is encouraged through the assignment of relevant bibliographical problems. A working reading knowledge of German, French, and Italian is assumed. Primarily for art history graduate students; 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 (Ross) not given 1988-89

4 units (Elsen) not given 1988-89

238A,B. 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; consumer protection and counterfeit art, etc. Restricted to graduate students in law, business, and art history. Undergraduate senior art history majors need approval of the instructor.
2 units, Win (Elsen, Merryman)
3 units, Spr

239. Colloquium: The Artist From Antiquity to the Present—Extensive readings and discussion of important developments in the history of the artist’s profession. For art history majors. Recommended: 1 or 5 and 10.
4 units (Elsen) not given 1988-89

any quarter (Staff) by arrangement

274. Studies on Baroque Architecture.
4 units (Turner) not given 1988-89

275A,B. Studies in Modern Architecture I, II.
4 units, Win, Spr (Turner)

4 units (Turner) not given 1988-89

4 units (Turner) not given 1988-89

278. Seminar on American Architecture: The Design of the American College Campus—Prior consent of instructor required.
4 units, Aut (Turner)

279. Seminar on Frank Lloyd Wright—Prior consent of instructor required.
4 units, Spr (Turner)

4 units, Win (Stout, Turner)

295. Teaching and Professional Work Experience.
4 units, Aut, Win, Spr (Staff) by arrangement

any quarter (Staff) by arrangement

any quarter (Staff) by arrangement

RELATED TOPICS
Topography and Monuments of Greece—(See Classics 108.)

Classical Athletics—(See Classics 14.)

PRACTICE OF ART (STUDIO)
Students enrolled at the overseas campuses who wish to sign up for studio courses during advanced registration for the following quarter must send notification to the Art Department detailing course number and section for the classes in which they wish to register.

SPECIAL SEMINARS
These courses are designed for non-majors in studio art. There are no prerequisites.

14. Special Seminar in Drawing.
2 units, Aut (Shuster)
Spr (Rosenberger)
15. Special Seminar in Printmaking.
2 units

2 units, Win (Dolarian)

17. Special Seminar in Photography.
2 units, Spr (Isaac)

BASIC

40. Basic Drawing—Basic drawing concepts introduced through charcoal.
3 units, Aut, Win, Spr (Staff)

50. Clay Modeling—The human head and figure. Class projects are concerned with modeling from life using historical and modern sources.
3 units, Aut, Win, Spr (Randell)

53. Constructed Art—Simple assembly techniques, welding, and metal fabrication are used to construct non-representational sculpture using wood, metal, plastic.
3 units, Aut, Win, Spr (Randell)

60K,L. Basic Design—Introduction to visual language and media, and their applications to communication and environment. Two- and three-dimensional projects.
4 units, Aut, Win, Spr (Kahn, Lynch)

70. Photography I—Introduction to basic camera and laboratory techniques. Class lecture and discussion, viewing of slides, and some field work. Viewing sessions in the Stanford Museum and Art Gallery scheduled according to current exhibitions. A 35mm camera is required.
4 units, Aut, Win, Spr (Leivick, Volkerding)

INTERMEDIATE

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. Recommended as the beginning drawing class for studio art majors.
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, Spr (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.
3 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. Prerequisite: 40 or 140. May be repeated for credit.
3 units, Aut, Win, Spr (Oliveira)

153. Recent Sculpture Concepts and Projects — Study and practice of the art of recent decades emphasizing current post-abstract procedures. Various materials and non-materials. Prerequisites: Any one of 40, 51 or 52, or 53, 60 or 70.
3 units (Randell)

160K,L. Design I: Intermediate Design—Comprehensive design assignments in diverse media emphasizing the relationship between professional design problems and their underlying elements and procedures. Prerequisite: 60.
3 or more units, Aut, Spr (Kahn, Lynch)

161. Design II: Type and Symbol Design—An introduction to the principles of type and symbol design, emphasizing conceptual thinking. Prerequisite: 60.
3 units (Lynch)

162. Design III: Typographic Design—An introduction to typography, emphasizing the expressive use of type. Prerequisite: 161.
3 units

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

166. Silkscreen Process/Textiles — Design projects in pattern as it applies to cloth, paper, and other surface materials. Production empha-
sis is on the silkscreen printing process. Prerequisite: 160 or 161.
3 or more units (Kahn)

167. Metallurgy—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, Spr (Kahn)

168A. Introduction to Urban Design—Urban design in theory and practice. Overviews important theoretical ideas of city form and image, from historical principles inherited from the cities of Western Europe to late 20th-century models exemplified by Los Angeles and the sunbelt cities. Case studies examine urban design examples, projects, and controversies in North America. Workshops on analysis of the image and physical characteristics of San Francisco neighborhoods. A 5-week term urban design problem summarizes principles discussed in the readings, seminars, and workshops.
5 units, Win (Cast)

168B. Urban Design Studio—A 10-week comprehensive urban and architectural design project taken from a current problem in San Francisco. A systematic understanding of the urban design process and problem solving methods. Graphic, diagrammatic, and other visual tools of analysis and communication are used in the study project. Recommended: Urban Studies 170. Enrollment limited to 14 students.
5 units, Spr (Cast)

169. Professional Design Exploration.
5 units (Kahn)

170. Photography II — Students individually pursue a topic of their own definition. Class sessions meet for individual and group critiques, lab demonstration, and discussions.
3 units, Win, Spr (Volkerding)

172. Alternative Processes—Concerned primarily with technical procedures; investigate the uses of primitive and hand-made photographic emulsions. Prerequisite: 70, 170, 270, or consent of the instructor. Limited to 10 students; priority is given to advanced students.
3 units, Aut (Leivick)

173. Photography Abroad — Students may register for 1, 2, or 3 units of photography while enrolled in an overseas program. Additional units may be taken for lab work upon return to Stanford campus. Consent of instructor required prior to going overseas.
Aut, Win, Spr (Leivick, Volkerding)

ADVANCED UNDERGRADUATE AND GRADUATE

241. Advanced Drawing and Painting Criticism I—Prerequisites: At least two quarters of painting or drawing; prior consent of instructor.
Aut, Win, Spr (Oliveira) by arrangement

242. Advanced Drawing and Painting Criticism II—Prerequisite: At least two quarters of painting or drawing; prior consent of instructor.
Aut, Win, Spr (Staff) by arrangement

243. Advanced Drawing and Painting Criticism III—Prerequisite. At least two quarters of painting or drawing; prior consent of instructor.
Aut, Win, Spr (Lobdell) by arrangement

244. Advanced Drawing and Painting Criticism IV—Prerequisite: At least two quarters of painting or drawing; prior consent of instructor.
Aut, Win, Spr (Branch) by arrangement

Any quarter (Staff) by arrangement

248. Advanced Monotype—Continuation of monotype, dealing with advanced technical and aesthetic problems in the medium. Prerequisite: 148.
3 or more units, Aut, Win, Spr (Oliveira)

Any quarter (Randell) by arrangement

256. Individual Work: Design.
Any quarter (Kahn, Lynch) 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. Class projects focus on producing a cohesive visual program of identity system. Prerequisite: Any two design courses above 160.
3 or more units (Lynch)

262. Advanced Design II: Graphic Organization—Design experiences in visual communication through analytical approaches of visual problem solving. Class projects developed as book or similar sequential formats.
3 or more units (Lynch)

268. Design Synthesis—Mature semi-elective problems in composite and multi-media design areas. Prerequisite: Any two design courses above 160.
3 or more units, Spr (Kahn)

269. Advanced Creative Studies—Evening seminar based upon elective design projects in areas of individual specialization. Consent of instructor required.
3 or more units, Aut, Win (Kahn)

270. Photography III.
Aut, Win, Spr (Leivick, Volkerding) by arrangement
271. Directed Advanced Photography: The View Camera, Its uses and Techniques—Designed for the serious student of photography who wishes to gain greater control and refine skills in image-making. 4 x 5 view cameras are provided. Limited to eight students.

   3 units, Aut (Volkerding)
   Win, Spr (Leivick)

272. Individual Work: Photography. any quarter (Leivick, Volkerding)

by arrangement

281. Concepts of Text—(Same as Computer Science 273.) What every literate person should know about the basic principles of the visual organization of text. Subjects include handwriting, typewriting, typography, and computerized documents. Perceptual, linguistic, and semiological issues are discussed. Consists primarily of visual exercises.

   3 units, Spr (Bigelow)

340. M.F.A. Seminar: Studio. Aut, Win, Spr (Staff) 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) by arrangement

RELATED TOPICS

Visual Thinking—(See Mechanical Engineering 101.)

Human Values in Design—(See Mechanical Engineering 115A.)

Philosophy of Design—(See Mechanical Engineering 214.)

ART EDUCATION

Artistic Development of the Child—(Enroll in Education 219.)

   4 units (Eisner) given 1989-90

OVERSEAS STUDIES

The following courses are approved for the Art major and taught overseas at the campus indicated below. Students are encouraged to discuss with their major advisors on campus which courses would best meet their individual educational needs. More detailed descriptions of these courses can be found in the "Overseas Section" section of this bulletin or in the Overseas Studies Program office, 126 Sweet Hall.

111A. Tuscan Art from Giotto to Leonardo—Florence. (DR:2)

   4 units, Aut, Spr (Todorow)

111B. High Renaissance and Mannerism in Florence, Rome, and Venice—Florence. (DR:2)

   4 units, Win (Todorow)

ASIAN LANGUAGES 263

119X. Introduction to French Art: Romanesque to Renaissance—Tours.

   4 units, Aut (Dufresne)

120X. New Ways of Seeing—Berlin. (DR:2)

   4 units, Win (Neckenig)

123X. German Art in the Weimar Republic and the Nazi Period—Berlin. (DR:2)

   4 units, Spr (Neckenig)

171X. Photography and Society—Tours.

   3 units, Win (Volkerding)

173X. Field Work in Photography—Tours.

   3 units, Win (Volkerding)

173Y. Industrial Revolution and its Impact on Art, Architecture, Theory—Berlin. (DR:2)

   5 units, Aut (Neckenig)

176X. History of English Architecture—Oxford. (DR:2)

   4-5 units, Win (Tyack)

ASIAN LANGUAGES

Emeriti: (Professors) David S. Nivison, Frederick Spiegelberg

Chairman: John C. Y. Wang

Professors: Albert E. Dien (on leave Autumn), Makoto Ueda, John C. Y. Wang

Associate Professors: Kung-yi Kao (on leave 1988-89), Ian Levy, William A. Lyell, Susan K. Matisoff

Assistant Professors: Thomas W. Hare, Steven Van Zoeren

Senior Lecturers: Yin Chuang, Hiroyasu Kubota, Kimie Nishimura Nebrig, Hiroshi Sakamoto, Dorothy Shou

Lecturer: Kazuko M. Busbin

Chinese-Japanese Language and Area Studies Faculty

Professors: Masahiko Aoki (Economics, on leave 1988-89), Harumi Befu (Anthropology), Albert E. Dien (Asian Languages, on leave Autumn), Peter Duus (History), Harold L. Kahn (History), John D. LaPlante (Art), Lawrence Lau (Economics), John W. Lewis (Political Science, on leave 1988-89), Jeffrey Mass (History), G. William Skinner (Anthropology), Makoto Ueda (Asian Languages), Lyman P. Van Slyke (History), John C. Y. Wang (Asian Languages), Arthur P. Wolf (Anthropology)

Associate Professors: Carl W. Bielefeldt (Religious Studies), Bernard Faure (Religious Studies), Kung-yi Kao (Asian Languages, on leave 1988-89), Ian Levy (Asian Languages), William A. Lyell (Asian Languages), Susan K. Matisoff (Asian Languages), Daniel I. Oki-
moto (Political Science), Lee H. Yearley (Religious Studies)

Assistant Professors: Nina Halpern (Political Science), Thomas W. Hare (Asian Languages), John D. LaFlante (Art), William J. Fosler (Linguistics), Melinda Takeuchi (Art, on leave Autumn), Steven Van Zoeren (Asian Languages)

Professor (Research): Thomas P. Rohlen (Anthropology, on leave Winter and Spring)

Senior Lecturers: Yin Chuang, Hiroyasu Kubota, Kimie Nishimura Nebrig, Hiroshi Sakamoto, Dorothy Shou (Asian Languages)

Lecturers: Kazuko M. Busbin (Asian Languages), Philip J. Ivanhoe (Religious Studies)

Acting Assistant Professors: Ann Klein, Alan Sponberg (Religious Studies)

Visiting Assistant Professor: Lothar van Falkenhausen (Asian Languages)

The Department of Asian Languages offers courses in the languages, cultures, and literatures of China, Japan, and Korea. 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.

For information concerning other opportunities for study in the Asian field, see listings under the following departments and programs: Anthropology, Art, Business, Comparative Literature, East Asian Studies, Economics, Humanities Special Programs, History, Law, Linguistics, Philosophy, Political Science, Religious Studies, and Sociology. Students interested in Asian languages not listed should contact the Special Language Program, Department of Linguistics.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

The degree of Bachelor of Arts is granted both in Chinese and in Japanese. The following courses must be completed with a letter grade indicator of "C" or better:

1. Concentration in Chinese: Asian Languages 91, Chinese 113, Asian Languages 131, 132, 133, and four other content courses dealing with China at the 100 level, as approved by the Undergraduate Advisor.

2. Concentration in Japanese: Asian Languages 92, Japanese 103, and seven other content courses dealing with Japan at the 100 level, as approved by the Undergraduate Advisor.

At least two of these courses must be selected from the sequence Asian Languages 135, 136, 137, 138.

These requirements are in addition to the University's basic requirement for the bachelor's degree. Letter grades are mandatory for all required courses.

HONORS PROGRAM

 Majors with an overall letter-grade indicator 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 10 to 15 units of credit will be granted for the finished thesis.

COTERMINAL PROGRAMS

Students may elect to combine programs for the A.B. and A.M. degrees in Chinese or Japanese. For details, see the "Degrees" section of this bulletin.

EAST ASIAN STUDIES THEME HOUSE

EAST House, located at Governor's Corner on campus, is an undergraduate residence which houses 60 students and offers them a wide variety of opportunities to expand their knowledge, understanding, and appreciation of China and Japan. Assignment is made through the regular undergraduate housing draw.

SUMMER PROGRAM OF INTENSIVE LANGUAGE COURSES

A nine-week program, which begins at the same time as the University's general summer program and continues one week 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 Lan-
guages, preferably before the end of the preceding Winter Quarter.

GRADUATE PROGRAMS

ADMISSION

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, including a 36 unit minimum requirement, are given in the “Degrees” section in this bulletin. Departmental requirements are set forth below.

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, 221, 222, 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. Letter grades are mandatory for all required courses.

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, 211, 212, 213, 247, 299; five courses in Japanese numbered between 256 and 298; 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 by passing examinations to demonstrate that they have attained equivalent language competence. Letter grades are mandatory for all required courses.

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 an 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.

REQUIREMENTS
A candidate must fulfill the following requirements:

1. Demonstrate a reading knowledge of French, German, or another European language approved by the Graduate Advisor before completing the A.M. degree.

2. Complete two seminars at the 300 level. These seminars must be in different subjects.

3. 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. 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 religion, 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 "Degrees" section 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.

Ph.D. MINOR
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. The student must elect either Chinese 201-202 or Japanese 201-202 unless the department is satisfied that work done elsewhere has provided similar training. The student must also pass a written examination in the Chinese or Japanese language.

SPECIAL PROGRAMS
Properly qualified students may plan special interdepartmental programs in the Asian field for the degree of Doctor of Philosophy. See the "Graduate Division Special Programs" section in this bulletin.

SPECIAL OPPORTUNITIES FOR STUDY ABROAD
Starting in Autumn Quarter 1989-90, the new Stanford overseas campus in Kyoto, Japan, will offer a nine-month program (September to June) for students interested in a serious concentration in Japanese language, history, culture, and social organization. In Spring Quarter, the Stanford Center in Technology and Innovation (SCTI), also at the Kyoto campus, offers a six-month program which provides the opportunity for a structured three-month study followed by a summer internship with an agency, firm, or laboratory in Japan. Interested students should contact the Overseas Studies Office in Sweet Hall.

Attention is called to the programs of the Inter-University Program for Chinese Language Studies in Taipei and the Inter-University Center for Japanese Studies located in Yokohama (both of which are administered by Stanford University). See the "The Institute of International Studies" section in this bulletin.

Special attention is called to the exchange program recently established with the Chinese Department at Peking University in Beijing. All those interested in the program should consult the chairman of the department early in the academic year.

COURSES
Since unavoidable changes occasionally have to be made in course offerings after Courses and Degrees has gone to print, students are advised to consult the department each quarter.

GENERAL
These courses are open to all undergraduates and graduate students, are taught in English, and do not require a knowledge of an Asian Language.

46. Introduction to Chinese Thought — (Same as Philosophy 46, Religious Studies 55.) Reli-
91. Traditional East Asian Civilization: China—An introduction to Chinese culture (thought, literature, and art) set against the backdrop of history. (DR:3*)
4 units, Aut (Ivanhoe) MWF 10

92. Traditional East Asian Civilization: Japan—An introduction to traditional Japanese culture emphasizing the relation between intellectual currents and the arts from the 8th-18th centuries. (DR:5*)
5 units, Win (Hare) MWThF 10

125. Japanese Women Through Novels and Films—(Same as Anthropology 125.) In anthropological literature on Japan, women tend to be relegated to the background of the social stage. Through analysis of novels written by Japanese women and feature films made by Japanese, in conjunction with anthropological literature, a new understanding of the position of women in Japan is presented.
5 units (Befu) not given 1988-89

131. Chinese Poetry in Translation—Readings in traditional Chinese poetry and poetics with emphasis on genre, theme, and style. (DR:2*)
4 units, Aut (Van Zoeren) MWFThF 1:15

132. Chinese Fiction and Drama in Translation—A survey of Chinese prose fiction and drama from early times to the late Ch'ing period, emphasizing literary and thematic discussions of major representative works available in English translation. (DR:2*)
4 units, Win (Wang) MWF 11

133. Modern Chinese Literature in Translation—Readings in representative 20th-century works of fiction, drama, and poetry. (DR:2*)
4 units, Spr (Lyell) MWF 1:15

135. Japanese Drama in Translation—The development of Japanese drama from early religious ritual forms through nô, puppet theater, and kabuki. Plays are analyzed as dramatic literature and in terms of performance. Video tapes and short films extensively supplement lectures. (DR:2*)
4 units (Maisoff) not given 1988-89

4 units, Aut (Levy) MWF 1:15

137. Japanese Fiction in Translation—An introduction to major works of prose narrative from pre-modern Japan (7th through mid-19th centuries.) Works are read in English translation with attention to the historical, intellectual, and cultural context in which they were written. Works will vary each year; course may be repeated for credit with the instructor's permission. (DR:2*)
4 units, given 1989-90

4 units, Spr (Ueda) MWF 1:15

151. Survey of Chinese Archaeology—The development of Chinese civilization through the Han dynasty, stressing the origins of civilization, the interrelation of technology and culture, and regional interaction networks. (DR:5)
5 units, Spr (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. (DR:5*)
4 units, Spr (Dien) MWF 1:15

153. Science and Technology in Traditional China—(Same as History 193, History of Science 153.) The technological achievements and scientific undertakings of traditional China and the ideological and social factors which aided or hindered such enterprises. (DR:5*)
5 units (Dien) given 1989-90

156. China from Earliest Times to the 9th Century—(Same as History 192A). Geohistorical origins to the Tang period: the first 4,000 years of social formations and historical transformations of ancient and early medieval China. (DR:5*)
5 units (Dien, Kahn) given 1989-90

178. Performance of Lyric Poetry—The nexus between author and reader in a literary work has become a major controversy in contemporary critical theory, appropriate for investigation from the perspective of performance. Taking the performance of a literary text as its central task, students prepare performances of a wide variety of lyric texts for class. Recommended: A reading knowledge of a foreign language (classical or modern). Upperclass students have priority. Enrollment limited to 15.
3 units (Hare) given 1989-90

181. Japanese Women Writers—The social and cultural factors affecting the preeminence
of Japanese women’s writing in the classical period, its decline in medieval and early modern Japan, and its reappearance in the modern period. Analysis of classical and modern literary works read in translation. (DR.2*)

4 units (Matisoff) given 1989-90

CHINESE

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 Chinese before entering Stanford.

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.

1. 5 units, Aut (Shou) MTWThF 9, 10, 1:15, or 2:15
2. 5 units, Win (Shou) MTWThF 9, 10, 1:15, or 2:15
3. 5 units, Spr (Shou) MTWThF 9, 10, 1:15, or 2:15

5. Intensive First-Year Modern Chinese—Equivalent to 1, 2, and 3 combined.
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

27,28,29. Intermediate Conversation—Prerequisite: 3 or consent of instructor.

27. 2 units, Aut (Shou) TTh 11
28. 2 units, Win (Shou) TTh 11
29. 2 units, Spr (Shou) TTh 11

51. Chinese Calligraphy—Practice in writing Chinese characters with a brush and learning different scripts. Prerequisite: Chinese 3 or equivalent.
1-2 units, Spr (Chuang) TTh 1:15

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 (Lyell) 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 (Staff) TTh 2:15-4:05
112. 5 units, Win (Staff) TTh 2:15-4:05
113. 5 units, Spr (Staff) TTh 2:15-4:05

121,122,123. Advanced Conversation—Prerequisite: 23 or equivalent.

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. Business Chinese—Year-long sequence for those interested in China’s foreign trade. A familiarization with the technical language and current economic policies. Emphasis on close text reading. Knowledge of Chinese economics is useful. Prerequisite: 23 or equivalent.

131. 3 units, Aut (Staff) by arrangement
132. 3 units, Win (Staff) by arrangement
133. 3 units, Spr (Staff) by arrangement

199. Individual Reading in Chinese—(Asian Languages majors only). Prerequisite: 103 or consent of instructor.
4 units, Aut, Win, Spr (Staff) by arrangement

GRADUATE

200. Directed Reading in Chinese—Prerequisite: 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, Win (Dien) W 2:15-4:05
202. 5 units, Spr (Dien) W 2:15-4:05

211,212,213. Advanced Modern Chinese—A year-long sequence designed to help students become functional speakers, readers, and writers of modern Chinese through articles and essays from newspapers, magazines, and scholarly journals. Frequent opportunities for oral presentations will reflect the students’ own interests and form the basis of their papers. Appropriate for non-majors and individuals with language experience overseas. Prerequisite: Minimum three years of Chinese language training.

211. 5 units, Aut (Staff) by arrangement
212. 5 units, Win (Staff) by arrangement
213. 5 units, Spr (Staff) by arrangement

221,222,223. Advanced Classical Chinese—Prerequisite: 113 or equivalent.

221. Philosophical Texts.
5 units, Aut (Staff) MWF 1:15
222. Historical Narration.
5 units, Win (Dien) MWF 1:15

223. Literary Essays.
5 units, Spr (Van Zoeren) MWF 11

230. Interpreting Confucian Texts—(Same as Religious Studies 212.) Philosophically interesting passages from a variety of early Confucian texts and how they have been interpreted by Asian and Western interpreters. Prerequisite: Consent of instructor.
5 units, Win (Ivanhoe) TTh 4:15-6:05

241, 242, 243. Modern Chinese Literature—Introduction, through the use of annotated texts, to the short story, essay, poem, play, and novel. Prerequisite: 103 or 113.
241. Short Story.
5 units, Aut (Lyell) MWF 2:15
5 units, Win (Chuang) MWF 11
5 units (Lyell) given 1989-90

251. Ritual in Classical China—Classical Chinese sources in the original, including bronze inscriptions, examined as they relate to ancient Chinese ritual. Relevant data is placed into meaningful cultural-historical framework and reviewed in light of recent anthropological approaches to ritual.
4 units, Spr (von Falkenhausen) TTh 2:15-4:05

260. Introduction to Chinese Poetry—Introduction to the basic assumptions, techniques, and genres of Chinese poetry. Prerequisite: 223 or consent of instructor.
4 units, Win (Van Zoeren) MWF 11

261. Shih-ching and Ch’u-tz’u—Selected readings in the two earliest anthologies of Chinese poetry. Prerequisite: 260 or consent of instructor.
4 units (Van Zoeren) given 1989-90

263. Lyric (shih) I—Selected readings in the early history of the lyric (shih), Han through Sui dynasties. Prerequisite: 260 or consent of instructor.
4 units (Van Zoeren) not given 1988-89

264. Lyric (shih) II—Selected readings in the Tang dynasty lyric (shih). Prerequisite: 260 or consent of instructor.
4 units, Spr (Van Zoeren) MWF 1:15

266. Songs and san-ch’ü—Selected readings of songs (tz’u) and san-ch’ü, Tang through Ming. Prerequisite: 260 or consent of instructor.
4 units (Van Zoeren) given 1988-89

271. Traditional Chinese Fiction—Selected readings in short stories and longer works of fiction from early times to Ch’ing. Prerequisite: 113 or consent of instructor.
4 units, Aut (Wang) TTh 11-12:15

273. Chinese Drama—Selected readings in dramatic works of the Yuan, Ming, and Ch’ing periods emphasizing literary, not theatrical qualities. Prerequisite: 113 or consent of instructor.
4 units (Wang) not given 1988-89

291. The Structure of Modern Chinese—(Same as Linguistics 278.) Prerequisite: 23 or equivalent. Recommended: A general introductory course in linguistics.
4 units, not given 1988-89

292. The Chinese Language and Current Linguistic Theories—(Same as Linguistics 279.) Prerequisite: 103 or equivalent. Recommended: A general introductory course in linguistics.
4 units, not given 1988-89

299. Master’s Thesis or Translation—A total of 5 units taken in one or more quarters.
Aut, Win, Spr (Staff) by arrangement

334. Seminar in Modern Chinese Literature—May be repeated for credit. Prerequisite: 243 or consent of instructor.
5 units (Wang) given 1989-90

1-12 units, Aut, Win, Spr, Sum (Staff) by arrangement

400. Advanced Language Training—Open only to students in the Taipei Program. For more information, see the "Inter-University Program for Chinese Language Studies in Taipei" section in this bulletin. Offered on a Pass/No Credit basis.
15 units per quarter (Staff)

JAPANESE

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 Japanese before entering Stanford.

1, 2, 3. First-Year Modern Japanese—Conversation, grammar, reading, elementary composition. Daily sections may be set at the beginning of the quarter to suit schedule requirements.
1. 5 units, Aut (Sakamoto, Nebrig, Busbin) MTWThF 9, 10, 11, or 1:15
2. 5 units, Win (Sakamoto, Nebrig, Busbin) MTWThF 9, 10, 11 or 1:15
3. 5 units, Spr (Sakamoto, Nebrig, Busbin) MTWThF 9, 10, 11, or 1:15

230. Interpreting Confucian Texts—(Same as Religious Studies 212.) Philosophically interesting passages from a variety of early Confucian texts and how they have been interpreted by Asian and Western interpreters. Prerequisite: Consent of instructor.
5 units, Win (Ivanhoe) TTh 4:15-6:05

241, 242, 243. Modern Chinese Literature—Introduction, through the use of annotated texts, to the short story, essay, poem, play, and novel. Prerequisite: 103 or 113.
241. Short Story.
5 units, Aut (Lyell) MWF 2:15
5 units, Win (Chuang) MWF 11
5 units (Lyell) given 1989-90

251. Ritual in Classical China—Classical Chinese sources in the original, including bronze inscriptions, examined as they relate to ancient Chinese ritual. Relevant data is placed into meaningful cultural-historical framework and reviewed in light of recent anthropological approaches to ritual.
4 units, Spr (von Falkenhausen) TTh 2:15-4:05

260. Introduction to Chinese Poetry—Introduction to the basic assumptions, techniques, and genres of Chinese poetry. Prerequisite: 223 or consent of instructor.
4 units, Win (Van Zoeren) MWF 11

261. Shih-ching and Ch’u-tz’u—Selected readings in the two earliest anthologies of Chinese poetry. Prerequisite: 260 or consent of instructor.
4 units (Van Zoeren) given 1989-90

263. Lyric (shih) I—Selected readings in the early history of the lyric (shih), Han through Sui dynasties. Prerequisite: 260 or consent of instructor.
4 units (Van Zoeren) not given 1988-89

264. Lyric (shih) II—Selected readings in the Tang dynasty lyric (shih). Prerequisite: 260 or consent of instructor.
4 units, Spr (Van Zoeren) MWF 1:15

266. Songs and san-ch’ü—Selected readings of songs (tz’u) and san-ch’ü, Tang through Ming. Prerequisite: 260 or consent of instructor.
4 units (Van Zoeren) given 1988-89

271. Traditional Chinese Fiction—Selected readings in short stories and longer works of fiction from early times to Ch’ing. Prerequisite: 113 or consent of instructor.
4 units, Aut (Wang) TTh 11-12:15

273. Chinese Drama—Selected readings in dramatic works of the Yuan, Ming, and Ch’ing periods emphasizing literary, not theatrical qualities. Prerequisite: 113 or consent of instructor.
4 units (Wang) not given 1988-89

291. The Structure of Modern Chinese—(Same as Linguistics 278.) Prerequisite: 23 or equivalent. Recommended: A general introductory course in linguistics.
4 units, not given 1988-89

292. The Chinese Language and Current Linguistic Theories—(Same as Linguistics 279.) Prerequisite: 103 or equivalent. Recommended: A general introductory course in linguistics.
4 units, not given 1988-89

299. Master’s Thesis or Translation—A total of 5 units taken in one or more quarters.
Aut, Win, Spr (Staff) by arrangement

334. Seminar in Modern Chinese Literature—May be repeated for credit. Prerequisite: 243 or consent of instructor.
5 units (Wang) given 1989-90

1-12 units, Aut, Win, Spr, Sum (Staff) by arrangement

400. Advanced Language Training—Open only to students in the Taipei Program. For more information, see the "Inter-University Program for Chinese Language Studies in Taipei" section in this bulletin. Offered on a Pass/No Credit basis.
15 units per quarter (Staff)

JAPANESE

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 Japanese before entering Stanford.

1, 2, 3. First-Year Modern Japanese—Conversation, grammar, reading, elementary composition. Daily sections may be set at the beginning of the quarter to suit schedule requirements.
1. 5 units, Aut (Sakamoto, Nebrig, Busbin) MTWThF 9, 10, 11, or 1:15
2. 5 units, Win (Sakamoto, Nebrig, Busbin) MTWThF 9, 10, 11 or 1:15
3. 5 units, Spr (Sakamoto, Nebrig, Busbin) MTWThF 9, 10, 11, or 1:15
5. Intensive First-Year Modern Japanese—
Equivalent to 1, 2, and 3 combined.
12 units, Sum (Staff) MTWThF 8-12
7/107. 3 units, Aut (Busbin) 9 or 11
8/108. 3 units, Win (Busbin) 9 or 11
9/109. 3 units, Spr (Busbin) 9 or 11
21, 22, 23. Second-Year Modern Japanese—
Further instruction and practice in conversation, grammar, reading, and composition. Prerequisite: 3 or equivalent.
21. 5 units, Aut (Nebrig, Sakamoto) MTWThF 9, 11, or 1:15
22. 5 units, Win (Nebrig, Sakamoto) MTWThF 9, 11, or 1:15
23. 5 units, Spr (Nebrig, Sakamoto) MTWThF 9, 11, or 1:15
Equivalent to 21, 22, and 23 combined. Prerequisite: 3 or equivalent.
12 units, Sum (Staff) MTWThF 8-12
27, 28, 29. Intermediate Conversation—
Prerequisite: 3 or consent of instructor.
27. 2 units, Aut (Kubota) TTh 1:15
28. 2 units, Win (Kubota) TTh 1:15
29. 2 units, Spr (Kubota) TTh 1:15

ADVANCED
101, 102, 103. Modern Written Japanese—
Primarily reading representative texts of modern written styles from magazine articles, literary criticism, and short stories. Prerequisite: 23 or equivalent.
101. 5 units, Aut (Kubota) MWF 11-12:20
102. 5 units, Win (Kubota) MWF 11-12:20
103. 5 units, Spr (Kubota) MWF 11-12:20
105. Intensive Modern Written Japanese—
Equivalent to 101, 102, and 103 combined. Prerequisite: 23 or equivalent.
12 units, Sum (Staff) MTWThF 9-12
Primarily a reading course to achieve basic skills in business Japanese. Class is conducted in Japanese. Prerequisite: 23 or 25 or permission of instructor.
111. 3 units, Aut (Kubota) MW 2:15-3:30
112. 3 units, Win (Kubota) MW 2:15-3:30
113. 3 units, Spr (Kubota) MW 2:15-3:30
121, 122, 123. Advanced Conversation—
Prerequisite: 23, 29, or consent of instructor.
121. 2 units, Aut (Kubota) TTh 11
122. 2 units, Win (Kubota) TTh 11
123. 2 units, Spr (Kubota) TTh 11
199. Individual Reading in Japanese—
(Asian Languages majors only.) Prerequisite: 103 or consent of instructor.
4 units, Aut, Win, Spr (Staff) by arrangement

GRADUATE
200. Directed Reading in Japanese—
Prerequisite: 213 or consent of instructor.
units to be arranged, Aut, Win, Spr (Staff) by arrangement
201, 202. Proseminar—
Bibliography and research methods in Japanese studies. Prerequisite: 103 or equivalent.
201. 5 units (Matisoff) given 1989-90
202. 5 units (Hare) given 1989-90
211, 212, 213. Advanced Modern Japanese—
Readings in modern Japanese scholarly, journalistic and literary prose. Each quarter may be taken separately. Prerequisite: 103 or equivalent.
211. Essays and Scholarly Articles.
5 units, Aut (Levy) TTh 2:15-3:30
212. Newspaper Articles.
5 units, Win (Ueda) MW 11-12:15
213. Fiction.
5 units, Spr (Matisoff) TTh 11-12:15
246, 247. Introduction to Classical Japanese—
The basic principles of the classical literary language. The first quarter concentrates on basic grammar and vocabulary, subsequent quarters involve reading in progressively more difficult text. Prerequisite: 103 or equivalent.
246. 5 units, Aut (Hare) by arrangement
247. 5 units, Win (Hare) by arrangement
248. Readings in Classical Japanese—
Select readings of texts in classical Japanese from Nara through Tokugawa periods. Attention to literary analysis, rhetoric, and poetics (Japanese and Western). Prerequisite: 247.
5 units (Staff) given 1989-90
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.
4 units, Spr (Ueda) TTh 2:15-3:30
251. Graduate Seminar: Japanese Historical Texts—
(Same as History 498.) Medieval historical sources and research methods. The reading of documents in Kambun.
5 units, Spr (Mass) by arrangement
255. Readings in Japanese Culture—
Reading and discussion of articles on the identity of Japanese culture. Works of prominent essayists, social critics, anthropologists, sociologists, and scholars in a wide variety of other fields. Taught in Japanese.
4 units, Spr (Ueda) not given 1988-89
258. Japanese Buddhist Studies—
( Same as Religious Studies 258.) Readings in the litera-
ture of medieval Japanese Buddhism; introduction to Japanese Buddhist studies. Prerequisite: Background in Japanese.

5 units (Bielefeldt) not given 1988-89


4 units, Win (Levy)

279. Readings in Modern Japanese Poetry—The evolution of modern Japanese poetry from the Meiji Period through the WW II. Readings include selections from major poets such as Kambara Ariake, Hagiwara Sakutaro, Miyazawa Kenji, and Nishiwaki Junzaburo. Prerequisite: 213 or consent of instructor.

4 units (Levy) not given 1988-89

280. Medieval Japanese Narrative and Dramatic Literature—Reading/discussion of selected works of the Muromachi through early Edo periods. Prerequisite: 247 or equivalent.

4 units, Spr (Matisoff) MW 2:15-3:30

286. The Structure of Japanese—Overview of Modern Japanese phonology, morphology, and syntax, emphasizing current theoretical interest. Some previous background in linguistics and knowledge of Japanese assumed. Prerequisite: Consent of instructor.

4 units (Poser) not given 1988-89

287. Images of Women in Modern Japanese Literature—Reading and discussion of selected literary works illuminating various aspects of female experience in modern Japan. Prerequisite: 213 or equivalent.

4 units (Ueda) not given 1988-89

294. Major Haiku Poets — Reading and discussion of selected haiku by Bashō, Buson, Issa, and others. Prerequisite: 103 or equivalent.

4 units (Ueda) given 1990-91

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 (Ueda) MW 2:15-3:30

396. Seminar in Japanese Literature — May be repeated for credit.

5 units (Ueda) given 1989-90


1-12 units, Aut, Win, Spr, Sum (Staff) by arrangement

400. Advanced Language Training—Open only to students at the Yokohama Center. For more information, see the program description under the “Inter-University Center for Japanese Studies in Yokohama” section in this bulletin. Offered on a Pass/No Credit basis.

15 units per quarter (Staff)

KOREAN

1,2,3. First-Year Modern Korean—Conversation, grammar, reading, elementary composition. Daily sections may be set at the beginning of the quarter to suit schedule requirements.

5 units, Aut, Win, Spr (Staff) MTWThF 1:15

21,22,23. Second-Year Modern Korean—Further instruction and practice in conversation, grammar, reading, and composition. Prerequisite: 3 or equivalent.

5 units, Aut, Win, Spr (Staff) MTWThF 2:15

101,102,103. Third-Year Modern Korean—Readings in modern Korean scholarly, journalistic, and literary prose. Prerequisite: 23 or equivalent.

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

ASTRONOMY COURSE PROGRAM

Committee in Charge: Vahé Petrosian (Chairman), Peter Banks, Ronald N. Bracewell, Von R. Eshleman, John R. Spreiter, Peter A. Sturrock, Robert W. Wagoner, Arthur B. C. Walker, Jr.

Professors: Peter Banks, (Electrical Engineering), Ronald N. Bracewell (Electrical Engineering), Von R. Eshleman (Electrical Engineering), Vahé Petrosian (Applied Physics), John R. Spreiter (Mechanical Engineering; Aeronautics and Astronautics), Peter A. Sturrock (Applied Physics), Robert V.
Wagoner (Physics), Arthur B. C. Walker, Jr. (Applied Physics)

Professors (Research): Philip H. Scherrer, J. Gethyn Timothy, G. Leonard Tyler (Electrical Engineering)

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 the Departments of Aeronautics and Astronautics, Applied Physics, Electrical Engineering, and 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 courses numbered below 100 are designed to serve this group of students.

Astronomy courses numbered 100-199 serve 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

The University does not offer a separate undergraduate major in astronomy. Students who intend to pursue graduate study in astronomy or space science are encouraged to major in physics, following the advanced sequence if possible, or in electrical engineering if the student has a strongly developed interest in radio-science. The course descriptions for these basic studies are listed under the appropriate department sections in this bulletin. Students desiring guidance in developing an astronomy oriented course of study should contact the Chairman of the Astronomy Program Committee. The following courses are suitable for undergraduates interested in astronomy and are recommended to students considering advanced study in astronomy: 100, Introduction to Observational and Laboratory Astronomy; 163, Planetary Exploration; 160, Introduction to Stellar and Galactic Astrophysics; 161, Extragalactic Astrophysics and Cosmology. Students planning study in astronomy beyond the B.S. are urged to consider an undergraduate thesis (Astronomy 169).

GRADUATE PROGRAMS

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 are available within the "Center for Space Science and Astrophysics" section in this bulletin, and the Stanford-Ames Institute for Space Research.

The following courses are recommended for students planning to conduct research in astronomy and astrophysics: 301, Astrophysics Laboratory; 363, Solar Physics; 360, Stellar Physics; 312, 313, Basic Plasma Physics I and II; Extragalactic Astrophysics and Cosmology; 364, Gravitation.

Students interested in the research programs involving spacecraft studies of the planets, their satellites, and their near-space environments should consider the following courses: 195, Physics of Planetary Interiors; 227, Atmospheric and Space Physics; 279A, Space Mechanics; 279B, Advanced Space Mechanics; 279C, Optimal Space Trajectories; 348, Ionospheric Processes; 350, Radioscience Seminar; 352, Wave Propagation in the Ionosphere and Magnetosphere; 354, Introduction to Radio Wave Scattering.

COURSES

15. Topics in Modern Astronomy—15A and B are addressed to students not majoring in the sciences and are taught in different quarters by different instructors but related in topic. Students should not take more than one of the courses.

15A. The Nature of the Universe—(Enroll in Applied Physics 15.) For undergraduates without scientific background. The structure, origin, and evolution of the universe and our growing knowledge of the objects which make it up; galaxies, stars, planets, etc. Discussion of some enigmas of modern astronomy, quasars, x-ray sources, black holes, and pulsars. Presentation is non-mathematical.

(DR:7) 3 units, Win (Walker) TTh 2:15-3:30

15B. Cosmic Horizons—(Enroll in Physics 15) Familiarizes the non-science student with modern cosmology. The physical laws that govern the universe, its evolution from the initial primeval fireball through the formation of galaxies, stars, and planets to the development of life. Also, exotic astronomical
25. Evolution of the Cosmos—(Enroll in Applied Physics 25.) Similar to 15 in its subject matter but at a slightly higher level; intended for more advanced students and students majoring in science or engineering. Origin and evolution of astronomical objects e.g., planets, stars, galaxies, and the universe at large, emphasizing modern development in astronomy and elementary particle physics relevant to the subject matter. The development of life and position of intelligent beings in the universe. Algebra used. Recommended: Knowledge at the level of high school physics and calculus.

3 units, Spr (Bloom)

16. Evolution of the Cosmos—(Enroll in Applied Physics 25.) Similar to 15 in its subject matter but at a slightly higher level; intended for more advanced students and students majoring in science or engineering. Origin and evolution of astronomical objects e.g., planets, stars, galaxies, and the universe at large, emphasizing modern development in astronomy and elementary particle physics relevant to the subject matter. The development of life and position of intelligent beings in the universe. Algebra used. Recommended: Knowledge at the level of high school physics and calculus.

3 units, Spr (Bloom)

50. Astronomy Laboratory and Observational Astronomy—(Enroll in Applied Physics 50.) 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. Individual observations with a 16-inch Cassegrainian telescope are supplemented by lectures which include discussions of basic observational techniques, astronomical catalogs and coordinate systems, and the relation of observations to astrophysical models. (DR:7)

3 units, Aut, Sum (Walker) lecture M 4:15 laboratory by arrangement

100. Introduction to Observational and Laboratory Astronomy—(Enroll in Applied Physics 100.) An introduction to observational techniques in astronomy for physical science or engineering students. Emphasis on measurement of fundamental astronomical parameters e.g., distance, temperature, mass, and composition of stars. One 2-hour lecture and one night of observation using the 16-inch telescope at the Stanford Student Observatory. Limited enrollment. Prerequisites: One year of physics or concurrent registration in Physics 25, 57, or 63; consent of instructor. (DR:7)

4 units, Spr (Walker) M 3:15-5 laboratory by arrangement


3 units, Win (Staff) MW 2:15-3:30

161. Extragalactic Astrophysics and Cosmology—(Enroll in Applied Physics 161.) Basic observational data on distances and the distribution of matter in the universe: galaxies, clusters, and superclusters of galaxies. Electromagnetic radiation from galaxies and quasars and the background radiation at radio, infrared, and x-ray frequencies. Introduction to cosmology, models of the universe, and their evolution. The Big Bang and the physical processes in the first three minutes. Prerequisites: Calculus and one year of college physics at the level of the Physics 50 series or equivalent.

3 units, Spr (Petrosian)
methods used and results of the research program.
1-9 units, Spr (Staff) by arrangement

3 units, Spr (Sleep) TTh 10-11:30

227. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)
3 units, Aut (Spreiter) TTh 2:45-4

249. Introduction to Space, Telecommunications, and Radioscience—(Enroll in Electrical Engineering 249.)
3 units, Aut (Banks) alternate years, not given 1989-90

279A. Space Mechanics—(Enroll in Aeronautics and Astronautics 279A.)
3 units, Win (Staff) TTh 9:30-10:45

279B. Advanced Space Mechanics—(Enroll in Aeronautics and Astronautics 279B.)
3 units, Spr (Breakwell) not given 1989-90

279C. Optimal Space Trajectories—(Enroll in Aeronautics and Astronautics 279C.)
3 units (Breakwell) alternate years, given 1989-90

301. Astrophysics Laboratory—(Enroll in Applied Physics 301.)
3 units, Sum (Walker) not given 1989-90

312,313. Basic Plasma Physics I and II—(Enroll in Applied Physics 312, 313.)
3 units, Win, Spr (Sturrock) MW 2:15-3:30 alternate years, not given 1989-90

348. Ionospheric and Magnetospheric Processes—(Enroll in Electrical Engineering 348.)
3 units, Spr (Staff) TTh 2:45-4 alternate years, not given 1989-90

350. STAR Laboratory Seminar in Radioscience—(Enroll in Electrical Engineering 350.)
1 unit, Aut, Win, Spr (Vesecky) M 4:15-5:30

352. Electromagnetic Waves in the Ionosphere and Magnetosphere—(Enroll in Electrical Engineering 352.)
3 units, Spr (Staff) alternate years, not given 1989-90

354. Introduction to Radio Wave Scattering—(Enroll in Electrical Engineering 354.)
3 units (Staff) alternate years, given 1989-90

360. Stellar Physics—(Enroll in Applied Physics 360.)
3 units (Staff) alternate years, given 1989-90

3 units, Spr (Staff) alternate years, not given 1989-90

3 units (Staff) alternate years, given 1989-90

364. Gravitation—(Enroll in Physics 364.)
3 units, Win (Dimopoulos)

365. Extragalactic Astrophysics and Cosmology—(Enroll in Applied Physics 365.)
3 units, Win (Petrosian)

ATHLETICS, PHYSICAL EDUCATION, AND RECREATION

Emeriti: (Professors) John E. Nixon, Wesley K. Ruff, (Associate Professors) Luell W. Guthrie, Miriam B. Lidster, Marian S. Ruch; (Director of Intramurals) William P. Fehring; (Athletic Director) Joseph H. Ruetz, (Associate Director) Robert C. Young

Director: Ferdinand A. Geiger
Assistant to the Director: Sue LemMon
Senior Associate Director: Alan A. Cummings
Director, Major Gifts: John R. Kates
Director, Annual Giving: Elizabeth Sloan
Associate Director, Intercollegiate Services: Thomas Beckett
Associate Director: Cheryl Levick
Assistant Director Financial Planning: Karen Bennett
Assistant Director, Facilities and Operations: Greg Asbury
Assistant Director Marketing, Promotions, and Events Management: Gary Bruner
Director of Club Sports Assistant, Recreation, and Education Programs: Shirley H. Schoof
Director, Physical Education: Elizabeth P. Weeks

Chairperson of Dance Division: Susan Cashion
Senior Lecturers: Susan Cashion, Carroll Diaz, Sharon Donovan, Elizabeth Weeks, Inga Weiss

Lecturers: Gail Barton, Anne Gould, Tony Kramer, Halifu Osumare, Janice Ross, Gwendolyn Watson

Sports Directors: Berhane Andeberhan (Soccer, women), Tim Baldwin (Golf, women), Frank Brennan (Tennis, women), John Davis (Crew, women), Tara Van Derveer (Basketball, women), Dante Dettamanti (Water Polo), Ken Dreyfuss (Crew, men), Jack Elway (Football), Wallace Goodwin (Golf, men), Richard Gould (Tennis, men) George Haines (Swimming, women), Sadao Hamada (Gymnastics, men), Chris Hörpel (Wrestling), Brooks Johnson (Cross Country, Track and Field), Sheryl Johnson (Field Hockey), Skip Kenney (Swimming, men), Sam Koch (Soc-
ATHLETICS, PHYSICAL EDUCATION AND RECREATION

PROGRAMS

ACADEMIC DEGREES

The academic curriculum, affiliated with the School of Humanities and Sciences, has been developed to focus on the interests of the undergraduate and graduate students. The Master of Arts: Education/Dance Specialization is offered through the School of Education either as a co-terminal degree or as a post-bachelor's degree program. At the undergraduate level, students may design an independent interdisciplinary major through the Dance Division. Undergraduate students interested in a teaching career are encouraged to seek specific information from the Dance Degree Advisor, Susan Cashion.

DANCE PROGRAM

Dance as a performing art is the focus of the Stanford Dance Program. The program introduces the student to traditional styles, techniques, and cultural forms of dance. Opportunities are provided for the accomplished dancer to practice his or her art in performance, choreography, teaching, or scholarly work.

The major concentration of course offerings is in modern dance. Classes in ballet, jazz, folk, social, and ethnic forms are also scheduled to increase the breadth of the student's dance training. Principles of choreography as well as courses and workshops for developing improvisation and performance techniques are also available. Undergraduate courses are intended to stress the study of dance as an art form, to enrich the general undergraduate program and to provide creative activity for the student community. Undergraduate students are encouraged to investigate the opportunity to propose an Individually Designed Major in Dance. For further advising, students should contact the Dance Division and/or the Undergraduate Advising Center. Undergraduates may also enter the co-terminal degree program during their eighth quarter, which permits them to study simultaneously for the Master of Arts: Education/ Dance Specialization degree and a bachelor's degree of their choice.

Graduate students interested in dance education leading to a performing or teaching career may apply for admission to graduate study. A prerequisite to successful completion of all graduate work in dance is technical proficiency as demonstrated by preparation in dance at Stanford, a bachelor's degree in dance from another college or university, or documented training in dance. The master's degree program expects graduate students to develop skill in
choreography, production, teaching, and research. Achievement of these skills is demonstrated by an individually designed creative project, completion of a teaching apprenticeship and submission of a research paper.

For further information about the Stanford Dance Program, contact Susan Cashion.

INTERCOLLEGIATE ATHLETICS

In keeping with our cultural heritage and American university tradition, Stanford offers a broad intercollegiate athletic program. The objectives of this program are to provide the opportunity to compete at the highest possible level without jeopardizing the integrity of the individual or the institution, to adhere strictly to all University, association, and conference rules governing athletic participation, and to encourage effectively the achievement of academic goals by student athletes at the same rate as by other university students. As a member of the National Collegiate Athletic Association (NCAA), Stanford fields both men's and women's varsity teams. Those for men are: baseball, basketball, crew, cross country, fencing, football, golf, gymnastics, sailing, soccer, swimming and diving, tennis, track and field, volleyball, water polo and wrestling; for women: basketball, crew, cross country, fencing, field hockey, golf, gymnastics, sailing, soccer, swimming and diving, tennis, track and field, and volleyball.

Conference affiliation is the Pacific Ten Conference for both the men and women, one of the premier athletic conferences in the nation. Additional or alternative intercollegiate athletic competition is available for all teams.

CLUB SPORTS

The Stanford Club Sports program is coeducational and exists to provide competitive opportunities in sports not included in the Intercollegiate Varsity program, provide opportunities for instruction in classes or activities not included in the Physical Education program, and develop student leadership in organizing, administering and funding their respective activities. Although the Club Program is actively supervised by the Director of Club Sports, the emphasis in this program is on student interest and leadership to initiate, organize, and conduct the respective clubs. Those which meet the criteria for inclusion in the formal curriculum may apply for units of credit through the Director of Physical Education, Elizabeth Weeks. 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 Director of Club Sports, Shirley Schoof. For further information, contact Shirley Schoof.

INTRAMURAL SPORTS (IM)

Students interested in intramural competition may receive information through their campus residences or the IM Director, Howard Dallmar. The program includes formal competition in league and tournament play for many different sports leading toward the All-University Coed and Women's Intramural championships. Competing organizations, teams and individuals are urged to contact the IM Office (room 354, Encina Gym) on the day before the start of classes to obtain meeting dates and times. Each quarter's printed materials and IM handbooks are available on or after the day before the start of classes. The Intramural Manager meetings are held the first Wednesday of the first week of classes each Autumn, Winter, Spring, and Summer Quarters.

RECREATION

The department provides facility-use for faculty, staff, and students (and, for some activities, their immediate families) to participate in aquatic, conditioning, dance, and sports for general recreation. Specific recreation hours for all the facilities are publicized throughout the year both in the Campus Report and at the respective facilities.

The Golf Course and Driving Range are available for faculty, staff, and student use on a fee basis; information is available from the Golf Pro Shop. For further information about recreation opportunities, contact the Recreation Coordinator, Shirley Schoof.

FACILITIES

Athletic fields, gymnasium buildings, swimming pools and volleyball courts, and weight training facilities are located at Roble Gym and Encina Gym. There are tennis courts on the west side of campus (near Governor’s Corner) and near Encina Gym. The deGuerre Complex houses swimming and diving pools as well as handball, racquetball, and squash courts. The Dance Studio (for classes and dance concerts) and small activity rooms are located at the Roble Gym. The 18-hole championship golf course, driving range, Lake Lagunita, a sailing center, and a rowing facility are all available for the department's broadly based programs.

CURRICULUM AND SERVICES

The basic instructional program is diverse to accommodate the dance and sport interest of undergraduate and graduate male and female
students. Only intercollegiate varsity men's and women's teams are limited to undergraduate enrollment. Homogeneous skill groupings and limited class sizes enable the student, beginner through the advanced performer, to achieve success within the limits of individual motivation and potential. Skill level in and knowledge about a specific activity as well as available space during class-list signing are the only limitations to enrollment. Physically handicapped students are encouraged to contact the Director of Physical Education, Elizabeth Weeks, or Chairperson for Dance, Susan Cashion for enrollment advice.

**Academic Credit**—Activity classes carry 1 unit of credit for satisfactory completion of work. Although there is no limitation on the number of activity classes in which a student may enroll, no more than 12 units of these activity classes (and/or music activity classes) may be applied toward undergraduate graduation requirements (see the “Undergraduate Degrees” section of this bulletin). Classes which are exempt from this University policy are identified as (PE:X); no limit is placed on “PE:X-units” counting toward graduation.

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.

**Auditing/Zero Unit**—No auditing is allowed in activity classes. Those students who wish to take a class but who cannot use or do not want the unit credit must still record enrollment on their Official Study Lists and indicate 00 units. Zero unit enrollment is acceptable on a space-available basis only after enrollment for credit and by permission of instructor. Enrollment and the grade received will be recorded on the End Quarter Grade Report and student transcript. Faculty and staff may take an activity class on a space-available basis with instructor permission when student enrollment is completed.

**Class Fees**—Fees are charged for enrollment in badminton, equitation, fencing, golf, sailing, SCUBA, windsurfing, martial arts, and the Club Sports classes.

Fees are payable at the first class meeting and required by the second class meeting for a student to remain in class. Enrollees after the first class meeting are required to submit their class fees no later than the second time they attend the class.

Full refund is given to students dropping a class during the first week of classes and requesting a refund at that time. Half refund is given to students dropping a class and requesting the refund during the second week of classes. No refunds will be given if a student either neglects to request a refund under the conditions listed previously or drops the class anytime after the second week of classes.

**Equipment and Uniforms**—No department uniform is required. Students must provide their equipment for badminton (racket), tennis (racket and balls), and SCUBA (see course descriptions). Specific information on equipment and recommended class attire is available from the department, from those at registration tables, and on the first day of class instruction.

**Lockers**—Lockers are available for students, without charge, from the equipment managers at Encina and Roble Gyms. 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 and Roble Gym locker-rooms. Towel laundry and exchange service is available, without charge, for those who purchase towels. Swim caps are required at the Roble Gym pool.

## COURSES

### DANCE ACTIVITY AND THEORY

All courses/classes are coeducational. Only courses with PE:X notation are exempt from the 12-unit activity class limitation policy. Series classes (I, II, III) should be taken in order or with consent of instructor.

**INTRODUCTORY**

Open to all students. No previous dance experience is needed.

57. **Introduction to Music for Dancers**—Includes basic musical vocabulary, rhythm, melody, harmony, phrasing, dynamics, keyboard, and percussion to accompany dance technique. (PE:X)

2 units, Spr (Watson)

61. **Modern Dance I**—Modern dance technique with emphasis on postural alignment, rhythmic coordination, and technical and creative principles of movement which develop the body as an articulate instrument.

1 unit, Aut, Win, Spr (Staff)

64. **Movement for Actors**—(Same as Drama 27A.) Basic movement knowledge and skills for the actor. (PE:X)

2 units, Spr (Cashion, Kramer)

65. **Musical Theater Workshop**—(Same as Drama 27B.) Dance performance skills and choreography appropriate for musical theater. (PE:X)

2 units, Win (Cashion) TTh 3:15-5:05
66. Movement and Music for Actors—(Same as Drama 27C.) Introduction to movement skill in conjunction with knowledge of music that is useful to the actor. Attention to voice and body training in development characterization. (PE:X)
   2 units, Aut (Kramer, Watson)
   TTh 3:15-5:05

71. Ballet Technique For Modern Dance I—Emphasis on fundamentals of classical technique: alignment, basic barre exercises, and movement sequences in the center and across the floor.
   1 unit, Aut, Win, Spr (Staff)

75. Mexican Dance and Folklore I—Three forms of Mexican dance: regional, popular/social and religious. Taught for technical and cultural understanding. Designed for the novice dancer. (PE:X)
   2 units, Aut (Cashion)

77. Dances of Latin America—Selected dances of Latin America, specifically Mexico, Cuba, Brazil, Argentina, and Chile. Dances in relation to their cultural context. Lectures amplified by readings, films, and movement examples. (PE:X)
   2-4 units (Cashion)
   alternate years, given 1989-90

   1 unit, Aut, Win, Spr (Staff)

91. International Folk Dance—Movement class exposes students to origins and characteristics of dance forms from a broad selection of cultures. Emphasis on exploration of ethnic dance as a resource for all dance study. Participation in folk dance as an enjoyable social activity.
   1 unit, Win, Spr (Barton)

   1 unit, Aut (Barton)

96. Social and Folk Dance Forms of North America—A sampling of dances found in the popular dance culture of North America including waltz, swing, contra, round, and square.
   1 unit, Aut, Win, Spr (Barton)

INTERMEDIATE

160. Women in Dance—A survey of the lives and works of women in Western theatrical dance from the Renaissance to the present through film lectures and discussions. Topics: public attitudes and perceptions of the Romantic ideal, the image of the ballerina, modern dance, and the pioneering matriarchs. (PE:X)
   3 units, Win (Ross)

161. Dance and Live Art in the 20th Century—(Same as Drama 127.) A critical history and analysis of the development of live art in Western theatrical dance and performance art of the 20th century. Topics: the body as an art medium, the interface of dance and art's ideas about structure and form, the pull between entertainment and expressionism. (PE:X)
   3 units, Spr (Ross)

162. Modern Dance II—Beginning-intermediate technique for extending range of movement and developing qualitative and technical skills. Creative application of dance principles through improvisation and problem-solving activities. Prerequisites: 61 or equivalent. (PE:X)
   2 units, Aut, Win, Spr (Staff)

163. Modern Dance III—Reinforcing and extending of concepts developed in 61 and 162. Emphasis on clarity of styling, rhythmic versatility, and phrasing. Prerequisite: 162 or equivalent. (PE:X)
   2 units, Win, Spr (Staff)

164. Contemporary Dance Workshop—Development of technical versatility and disciplines for strong control and expressive use of movement. Progressive study of projection and the dynamic image in form and function. (PE:X)
   2 units, Spr (Weiss)

165. Dance Heritage: History and Styles—Workshop/seminar on the origins of movement forms that have influenced western contemporary dance e.g., Graham, Cunningham, Limár. Specific approaches and techniques utilize cross-cultural and historical perspectives; studio work is amplified by lectures, films, and readings. (PE:X)
   3 units, Aut, Win, Spr (Staff, Ross)

166. Stanford Contemporary Dance Ensemble—Intermediate-advanced level of modern dance. Train to perform faculty and student choreography in a variety of settings: dormitories, University invitational concerts, and public performances. Concurrent participation in a technique class is required.
   2 units, Win, Spr (Kramer)

168. Performance Workshop: Public Performance—A workshop designed to explore and develop performance skills. Includes public performance in faculty and/or student-directed productions.
   1 unit (Staff) by arrangement

169. Faculty Choreography—Rehearsal and performance of faculty choreography. Selection by audition.
   1 unit (Staff) by arrangement
172. Ballet Technique for Modern Dance II—Beginning-intermediate level. Continuation of 70, repeating the fundamentals with increased complexity and introducing additional movement vocabulary. Prerequisite: 71 or equivalent.

1 unit, Aut, Win (Staff)

173. Ballet Technique for Modern Dance III—Stresses accuracy and facility with fundamental classical vocabulary. Attention to movement shape and line, spatial concepts, musicality and phrasing. Prerequisite: 172 or equivalent.

1 unit, Spr (Staff)

175. Mexican Dance and Folklore II—Emphasis on two to three selected regional dance styles. Taught within the framework of their cultural context. Concentration on increasing skill in footwork. (PE:X)

2 units, Win (Cushion)

178. Mexican Dance Performance—Regional dance material of Mexico taught and rehearsed for rhythmic, stylistic, and technical proficiency. Performances on and off campus are planned and executed by the students. Prerequisites: Mexican Dance and Folklore Series, or consent of instructor.

2 units, Aut, Win, Spr (Cashion)

187. Dance Composition and Improvisation—Development of the craft of choreography, emphasizing concepts of design, form, and content. (PE:X)

3 units, Aut, Win (Staff)

191. Stanford International Folk Dance Ensemble—Training in stylist versatility and mastery of traditional folk dance forms. Advanced folk dances taught in rehearsal-like format to prepare for several performances each quarter.

2 units, Aut, Win, Spr (Staff)

ADVANCED

Designed for advanced undergraduates and graduates in the A.M. program.

100/200. Individual Study—Administrative internship or in-depth study of topics directly related to the discipline of dance. (PE:X)

1-3 units, Aut, Win, Spr (Cashion) by arrangement

257. Dance/Music Repertoire—A class concerned with the selection process of music for dance. Presentation of resources for choreographic concepts. (PE:X)

2 units (Weiss) by arrangement

260. Labanotation—Introduction to the principles and tools for the analysis and recording of movement based on the Laban system of notation. (PE:X)

3 units, Spr by arrangement

264. Variations for Dancers—The integration of sound and motion, relating vitality and temperament to movement and music. Technical efficiency required in order to focus on musical form. (PE:X)

2 units, Aut, Win (Weiss)

265. Dance Research—Tools and methods for dance research. Seminar sessions focus on selection and development of research topics. Research paper required. (PE:X)

4 units, Win (Cashion)

266. Dance Education for Children—Examination of the role of dance in education emphasizing elementary and secondary school levels. The relationship of dance to the arts and other academic subjects. Weekly theory discussions and technique sessions; lab sessions with elementary school children. (PE:X)

3 units, Aut (Staff)

267. Dance Practicum Internship—Methodologies of teaching dance within a variety of situations. Instruction and guided practice in the preparation of lesson plans, developing sequence and progression in a class setting. Seminar and lab. (PE:X)

3 units, Win (Staff)
268. Perspectives in Dance—Dance in Western Culture from a variety of perspectives: historical, philosophical, ethnographic, dance in education, contemporary problems and current trends. Lectures amplified by readings, films, and discussion. (PE:X) 3 units, Aut (Cashion, Ross)

269. Graduate Design Project—A three part, individually designed creative project required for completion of the master’s degree. (PE:X) 5 units, Aut, Win, Spr (Staff)

PHYSICAL EDUCATION AND SPORTS THEORY

All courses listed below are exempt from the “12-unit” policy (marked PE:X).

100/200. Individual Study—Administrative internship or in-depth study of topics directly related to the discipline of physical education. (PE:X) 3-5 units, Aut, Win, Spr (Strathairn) by arrangement

104. Analysis of Human Movement—Overview of skeletal and muscular anatomy and study of the mechanical principles of movement as related to efficient performance in aquatics, dance, and sports. (PE:X) 3 units, Aut, Spr (Weeks) TTh 9-10:50

110. Classical Athletics—(Same as Classics 14.) The origins and history of competitive sport in the ancient world, from the funeral games for Patroclus (Homer) to the chariot races in the Hippodrome of Constantinople, based on the literary and monumental evidence. Attention to the spirit of competition apart from athletics. Lectures (illustrated) and discussion groups. (PE:X) (DR:5) 3 units, Spr (Raubitschek)

184. 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. Prerequisites: Consent of instructor and course in Human Anatomy or Analysis of Human Movement. (PE:X) 3 units, Win (Scott) TTh 9-10:50

205. 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 is to enhance enjoyment of these sports and to prevent injury. Recommended: Biology or basic physiology. (PE:X) 2 units, Aut (Spivack, Staff) W 3:15-5

LEADERSHIP OPPORTUNITIES IN PHYSICAL EDUCATION

81. Student Assistant—Directed observation; individual and small group instruction, organization, supervision and assistance; evaluation of skill performances, and other activities as directed by master teacher. Prerequisite: Consent of instructor. 1 unit, Aut, Win, Spr (Staff) by arrangement

181. Sport Internship—For highly skilled students in a given sport seeking experience in teaching/coaching. Work under close guidance of experienced teacher/coach. Includes lesson plans; organization and evaluation of practice; teaching; skill demonstrations; paper relevant to sport. Prerequisite: Consent of instructor. (PE:X) 2 units, Aut, Win, Spr (Staff) by arrangement

AQUATIC ACTIVITY AND THEORY

Only courses with PE:X notation are exempt from the 12-unit activity class limitation policy.

48. Swimming: Beginning—For the non-swimmers and those who can swim about 10 yards, but are not comfortable in deep water. Includes instruction in safety skills, front crawl, and a back stroke. Additional strokes introduced as ability warrants. 1 unit, Aut, Spr (Donovan, Weeks)

48A. Swimming: Advanced Beginning—For those with limited swimming ability and are not fully comfortable with safety skills. Includes work on safety skills, crawl, and elementary backstroke or back crawl. Introduction to side-stroke and breaststroke. Work to better skills and increase time and distance of swim. Prerequisite: Ability to swim 25-50 yards on front and on back reasonably comfortably. 1 unit, Aut, Win, Spr (Weeks, Donovan)

49. Swimming: Intermediate—Continued work on crawl, elementary backstroke, side-stroke, and safety skills. Introduction to or review of breaststroke and back crawl. Basic water safety. Conditioning as ability permits. Prerequisites: Fair crawl, elementary backstroke and sidestroke, fair level of conditioning. 1 unit, Aut, Win, Spr (Weeks, Kenney)

51. Water Polo—Introduction to and refinement of skills used in the sport of water polo. 1 unit, Aut, Spr (Dettamanti)

52. 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. Prerequisite: Strong sidestroke, crawl, breaststroke; tread water and float 3-5
minutes; surface dives; 500 yard continuous swim. Priority to those whose summer jobs depend upon certification. Letter from employer indicating same required at first class meeting.

2 units, Aut, Win, Spr (Donovan, Weeks)

55. Sailing: Beginning—Basic skills, theory, and techniques to enable beginners to sail with confidence. Fee.
1 unit, Aut, Spr (Petrucci, Middleton)

55A. Sailing: Intermediate—Refinement of skills. Introduction to racing. Fee. Prerequisite: Consent of instructor.
1 unit, Aut, Spr (Petrucci, Middleton)

56. Windsurfing—Theory and techniques of windsurfing safely and confidently. Fee.
1 unit, Spr (Petrucci, Middleton)

148. Swimming: Advanced—Review and refinement of all basic strokes and safety skills. Butterfly and flipturn introduced. Basic water safety. Extensive conditioning. Prerequisite: Average to good strokes.
1 unit, Aut, Win, Spr (Kenney, Donovan, Haines)

149W. Swimming Officiating—Rules, scoring records, responsibilities of officials. Practical experience in organizing meets as well as development of officiating skill and technique in meet situation.
1 unit, Win (Haines) by arrangement

152. Water Safety Instructor—Learning to teach swimming and lifesaving. Includes extensive textbook readings and written assignments. American Red Cross certification for successful course completion. Prerequisites: Current Red Cross Advanced Lifesaving certificate and advanced swimming skills. Priority to those whose summer jobs depend upon certification. Letter indicating same required at first class meeting. (PE:X)
3 units, Win (Haines)

153. Skin and SCUBA Diving—Lectures, skill sessions, and three field trips. Fee. Students to provide own gear. Priority given to those wishing to assist with SCUBA classes or classes at Hopkins Marine Station. Prerequisites: Current certification in first aid and CPR. Openwater II certification or equivalent.
2 units, Win (Donovan)

155. Sailing: Advanced—Refinement of heavy weather sailing skills, with emphasis on racing. Fee. Prerequisite: Intermediate sailing or consent of instructor.
1 unit, Spr (Petrucci)

253. Open Water SCUBA—Open water program developing confidence beyond basic levels. Weekly lecture/discussion and three diving field trips. Emphasis on navigation, skill review, dive planning. NAUI Openwater II upon successful completion. Fee. Student must provide own gear for dives including depth gauge, compass, watch, power inflator, and alternate air source. Pick up information sheet at advanced registration. Prerequisites: SCUBA certification, medical clearance, and consent of instructor. (PE:X)
1-3 units, Aut (Donovan)

INDIVIDUAL AND TEAM SPORT ACTIVITIES

All classes listed below are subject to the 12-unit limitation policy regarding physical education and music activity classes (see the “Undergraduate Degrees” section of this bulletin).

1. Posture Clinic—Individual posture evaluation; exercises for proper body alignment with emphasis on flexibility and balance of muscle strength development; techniques for correct body mechanics; weight management; group and individualized exercise program.
1 unit, Aut, Win (Weeks)

2. Conditioning—Introduction to basic principles of conditioning. General knowledge of physiological aspects of conditioning, fitness parameters, and principles of training. Emphasis on proper stretching, monitoring of heart rate, correct techniques of running, and development of own fitness program. May include introduction to other forms of conditioning and aerobic activities. Individualized according to ability.
1 unit, Aut, Win, Spr (Staff)

2A. Swim Conditioning—For students wanting to improve cardio-respiratory endurance through directed swimming workouts. Prerequisite: Advanced swimmer.
1 unit, Spr (Haines)
   1 unit, Aut, Win, Spr (Staff)

3A. Weight Training: Intermediate/Advanced — Review of basic exercises and techniques progressing to sports of power-lifting. Olympic lifting and body building. Emphasis on individualized programs. Further discussion on exercise physiology. Prerequisite: Beginning Weight Training or thorough knowledge of basic weight training principles.
   1 unit, Aut, Win, Spr (Horpel, Wollman)

3W. Weight Training for Women — Introduction to techniques and equipment for weight training, especially Universal Gym. Emphasis on stretching, proper form and progressions, and injury prevention. Basics of physiology of strength training and planning of individual programs. All levels welcome, but designed for the beginner.
   1 unit, Aut, Win, Spr (Horpel, Wollman)

15. Gymnastics: Beginning — Fundamental gymnastics movement including various flexibility and strength exercises taught on mats and on the Olympic apparatus for men and for women.
   1 unit, Aut, Win, Spr (Hamada)

20. Horsemanship: Beginning Riding — No background or very little. Includes walk, trot, canter.
   1 unit, Aut, Win, Spr (Saxe, Staff)

20A. Horsemanship: Advanced Beginning Riding — Can walk, and trot, but not with very secure seat. Involves gymnastic work to develop position and rhythm.
   1 unit, Aut, Win, Spr (Saxe, Staff)

   1 unit, Aut, Win, Spr (Saxe, Staff)

22. Golf: Beginning — Fundamentals of 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 (Diaz, Stotz)

23. Golf: Intermediate — Improvement and perfection of previously learned fundamentals. Utilization of these skills in the game. Fee. Prerequisite: 22 or the equivalent.
   1 unit, Aut, Win, Spr (Diaz, Mason)

   1 unit, Aut, Win, Spr (Dettamanti)

   1 unit, Aut, Win, Spr (Posthumus)

31. Fencing: Intermediate — Continuation of Beginning Fencing; introduction of electrical foil fencing. Prerequisite: 30 or consent of instructor.
   1 unit, Aut, Win, Spr (Tulum)

32. Tennis: Beginning — Covers fundamental strokes (forehand, backhand, service, and net play), rules, and scoring.
   1 unit, Aut, Win, Spr (A. Gould, D. Gould, S. Johnson)

33. Tennis: Low Intermediate — Intended as a bridge between beginning and intermediate classes. Review of fundamental strokes, and utilization of these skills in a game situation. Prerequisite: Beginning level class or knowledge of rules and scoring and average ability in fundamental strokes.
   1 unit, Aut, Win, Spr (Gould)

33A. Tennis: Intermediate — Fundamental stroke review and increased emphasis on singles and doubles tactics. Prerequisite: Low intermediate class or average ability in fundamental strokes and regular playing experience.
   1 unit, Aut, Win, Spr (A. Gould, S. Johnson, Schavone, Horpel)

34. Wrestling: Beginning/Intermediate — Introduces intercollegiate wrestling. Includes conditioning and cultivates the spirit of one-on-one competition. Basic skills as well as high level sequences of upper and lower body technique.
   1 unit, Win, Spr (Horpel)

40. Soccer: Beginning — Introduction to soccer. Includes skills of passing, shooting, control, dribbling as well as general offensive and defensive tactics and rules.
   1 unit, Aut, Win, Spr (Koch)

41. Volleyball: Beginning/Intermediate — Drills to improve skills and game playing strategy. As ability indicates, more emphasis on team play and strategy.
   1 unit, Aut, Win, Spr (Shaw, Sturm)

60A, B, C. Wilderness Skills — Introduction to living and traveling in the wilderness. Emphasis on interpersonal relations, appreciation of the wilderness and specific skills. Minimum impact camping, first aid, nutrition, baking, astronomy, group dynamics, tracking, environmental issues, and tree hugging. 60A emphasis
on navigation and natural science; 60B on cross country skiing and winter camping; 60C on rock climbing. Weekly discussions and several weekend outings. Food, group and major personal gear provided. Students provide own clothing. Fee.

60A. 1 unit, Aut (Schoof, Staff)
60B. 1 unit, Win (Schoof, Staff)
60C. 1 unit, Spr (Schoof, Staff)

103. Weight Training: Advanced—Designed around Olympic style lifting (cleans, jerks, snatches, high pulls) and power lifts. Prerequisites: Intermediate/advanced weight training or equivalent and consent of instructor.

1 unit, Win, Spr (Schulz)

115. Gymnastics: Intermediate/Advanced—For students with background in gymnastics. Group instruction and individualized work to enable some specialization on the various pieces of apparatus for men and women.

1 unit, Aut, Win, Spr (Sardina)

120. Horsemanship: Advanced Riding—For those who have developed good control over horse. Includes doing more advanced movements and jumping more demanding courses.

1 unit, Aut, Win, Spr (Saxe, Staff)

122. Golf: Advanced—Understanding of and refining the golf swing and increasing power and distance. Fee. Prerequisites: Ability to hit the ball with relative accuracy and distance, and swing with good form.

1 unit, Aut, Win, Spr (Saxe, Staff)

128. Badminton: Intermediate/Advanced—Review of all fundamental strokes with an emphasis on refinement. Concentration on developing high level of ability and on strategic skills practiced in a competitive atmosphere. Fee.

1 unit, Aut, Win, Spr (Dettamanti)

131. Fencing: Advanced—Continuation of intermediate fencing with the introduction of saber and épée. Prerequisite: 31 or consent of instructor.

1 unit, Aut, Win, Spr (Tulum)

131A. Fencing: Sabre and Épée—Emphasis on saber and épée technique with review of basic fencing footwork and skills; drilling and boutting. Prerequisite: 31 or consent of instructor.

1 unit, Spr (Tulum)

131W. Fencing Officiating—Supervised boutting with application of rules and officiating techniques. Prerequisite: 131 or consent of instructor.

1 unit, Spr (Tulum, Posthumus)

132. Tennis: Advanced—Review of fundamental strokes. Drills to emphasize footwork, serve 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 (Brennan, A. Gould, Horpel, Schavone)

132A. Tennis: Tournament—Advanced drills and practice sessions for tournament-experienced players of near varsity level ability. Tryouts at Varsity Courts in Autumn Quarter for autumn classes. Position on all-University ladder for winter and spring classes. Prerequisite: Consent of instructor.

1 unit, Aut, Win, Spr (Brennan, A. Gould, D. Gould)

137W. Field Hockey Officiating.

1 unit, Spr (Johnson) by arrangement

140. Soccer: Intermediate/Advanced—Review of the basic skills and rules. More in-depth work on offensive and defensive tactics. Includes work and scrimmage time.

1 unit, Aut, Win, Spr (Koch)

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 (Sturm)

182. Athletic Team Management—For student managers of intercollegiate teams. Prerequisite: Consent of respective varsity team head coach.

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

182A. Athletic Team Management: Computer Tennis—Use of computer for analyzing tennis matches. Assist players and coaches by collecting data on player performance. Background in computers and statistics helpful but not necessary. Prerequisite: Consent of instructor. Recommended: Excellent knowledge of tennis.

2 units, Aut, Win, Spr (Brennan, Gould) 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

MARTIAL ARTS


1 unit, Aut, Win, Spr (Moses)
7. Aikido—The way of harmony with the principles and forces of nature. A Japanese martial "Way." Practice develops: Aikido skills, conditioning, self-confidence, and a spirit of cooperation. Self-defense training in a supportive atmosphere, and at an energy level appropriate for each individual.
   1 unit, Aut, Win, Spr (Doran)

8. Shotokan Karate—A weaponless martial art developed in Okinawa cultivating mental strength, physical suppleness, and self-defense skills. Affiliated with Shotokan Karate of America whose head instructor is Tsutomu Ohshima. All levels.
   1 unit, Aut, Win, Spr (Sagawa)

   1 unit, Aut, Win, Spr (Haramoto)

10. Kenpo Karate: Beginning—Fundamental stretching and conditioning. Introduction to basic moves, self-defense techniques, forms, light sparring. Emphasis on physical/mental control. Simple effective combinations of hands and feet. Physical size has no advantage or disadvantage.
   1 unit, Aut, Win, Spr (Schnoor)

   1 unit, Aut, Win, Spr (Kim)

   1 unit, Aut, Win, Spr (Schnoor, John)

13. Taekwondo: Advanced—Continued work on fundamental skills. Includes free sparring and self-defense techniques. Emphasis on speed and control. Promotion through periodic belt testing. Prerequisites: Colored belt or consent of instructor.
   1 unit, Aut, Win, Spr (Kim)

INTERCOLLEGIATE ATHLETIC TEAMS

All classes listed below are subject to the 12-unit limitation policy.

Varsity and junior varsity men's and women's teams in PAC-10 are for the highly talented and motivated undergraduate student. Unless specified, team tryouts are open to men and women students.

   1-2 units, Aut, Win, Spr (Hamada)
   MTWThF 2:30-5:30 S 10-12 (men)
   1-2 units, Aut, Win, Spr (Sardina)
   MTWThF 2-6 (women)

117. Track and Field: Varsity (men's and women's teams).
   1-2 units, Aut, Win, Spr (B. Johnson, Staff)
   MTWThF 3:30
   Spr (Johnson, Staff) MTWThF 2

118. Cross Country: Varsity (men's and women's teams).
   1-2 units, Aut (B. Johnson, Staff)
   MTWThF 3:30

123. Golf: Varsity (men's and women's teams).
   1-2 units, Aut, Win, Spr (Goodwin, Baldwin)
   MTWThF by arrangement

131. Fencing: Varsity—Men's foil, epee, and saber teams and women's foil team.
   1-2 units, Aut, Win (Tulum, Posthumus)
   MTWThF 3:30-5:30

133. Tennis: Varsity (men's and women's teams).
   1-2 units, Aut, Win, Spr (Gould, Brennan)
   MTWThF 2:15-5:15 (men)
   MTWThF 2-5 (women)

134. Wrestling: Varsity.
   1-2 units, Aut, Win (Hörpel)
   MTWThF 3:15-5:30
   Spr MTWThF 4-5:30

   1-2 units, Aut, Win (Marquess, Stotz) MTWThF 1:30-4:30

   1-2 units, Aut, Win (Montgomery, Staff)
   men's team MTWThF 3:30-6
   (VanDerveer, Staff) women's team
   Aut, Win, Spr, MTWThF 12:45-3:30

137. Field Hockey: Junior Varsity (women's team).
   1-2 units, Aut (S. Johnson)
   MTWTh 3:15-3:15
   Win T 3:30-5 Th 8-10 p.m.
   Spr MTWTh 3:15-5:30

137. Field Hockey: Varsity (women's team).
   1-2 units, Aut (S. Johnson)
   MTWThF 3:15-5:30
   Win T 3:30-5
   Th 8-10 p.m.
   Spr MTWTh 3:15-5:30
138V. Football: Varsity.
1-2 units, Aut (Elway, Staff) MTWTh 2:30-5 and Spr TTh 2:30-5 S 9-12

140J. Soccer: Junior Varsity (men's team).
1-2 units, Aut (Koch) MTWThF 3:15-5:45
Win, MWF 3:30-5:30
Spr MTWThF 3:30-5:30

140V. Soccer: Varsity (men's and women's teams).
1-2 units, (Koch) men's team
Aut, 8/15-9/26: MTWThFS 10-12, 2:30-5:30
9/27-11/15: MTWThFS 3:15-5:05
Win, MWF 3:30-5
TTh 3:15-5; and Su 8-10 p.m.
Spr MTWThF 3:15-5:15
1-2 units, (Andeberhan) women's team
Aut MTWThF 3:15-6
Win MTWThF 3:15-6
Spr MTWThF 3:15-6

141V. Volleyball: Varsity (men's and women's teams).
1-2 units (Sturm) men's team
Aut, Win, Spr MTWTh 6-8:30 p.m.
1-2 units (Shaw) women's team
Aut MTWThF 6-9 p.m.
Win MWF 7:30-9 p.m.
Spr MTWThF 6-9 p.m.

149V. Swimming: Varsity (men's and women's teams).
1-2 units, Aut, Win, Spr (Kenney, Haines)
MTWThF 6:30-8, 2:30-5, and S 8-10:30

150V. Diving: Varsity (men's and women's teams).
1-2 units, Aut, Win, Spr (Schaone)
MTWThF 2:15-4

151V. Water Polo: Varsity.
1-2 units, Aut (Dettamanti) MTWTh 2:30-5
Win, MWF 3:30-5
Spr MTThF 3-5

155V. Sailing: Varsity (men's and women's teams).
1-2 units, Aut, Spr (Middleton) TThF 2:30-6
Win (Middleton) TWF 2:30-6

156V. Crew: Varsity (men's and women's teams).
1-2 units (Dreyfuss) men's team
Aut MTWThF 3:30-5:30
Win MTWThF 3:30-5:30, S 7-9
Spr MTWThF 7-9
1-2 units (Davies) women's team
Aut, Win MTWThF 3:15-6
Spr MTWThF 6-8:15

CLUB SPORTS

The Stanford Club Sports Program is a student initiated, organized, and conducted sports program affiliated with the department. All clubs are coeducational except as specified. Clubs, whose instructional classes meet the criteria for academic credit, are scheduled for meeting times as published each quarter in the Time Schedule. For additional information, contact Club Sports Director, Shirley Schoof.

113C. Judo.
1 unit, Aut, Win, Spr MWF 1-2:30

124C. Ski Club Team.
1 unit, Win

125C. Cycling Club.
1 unit, Aut, Win, Spr

139C. Rugby Club Teams (men's and women's).
1 unit, Aut, Win

142C. Lacrosse Club Teams (men's and women's).
1 unit, Aut, Win, Spr

143C. Ice Hockey Club Team.
1 unit, Aut, Win

145C. Softball (women).
1 unit, Aut, Win, Spr

147C. Synchronized Swimming Club Team.
1 unit, Aut, Win

Additional clubs (Badminton, Bowling, Cricket, Equestrian, Horse Polo, Men's Field Hockey, Racquetball, Squash, Ultimate Frisbee, and Women's Water Polo) schedule activities each quarter for no credit.

BIOLOGICAL SCIENCES

Emeriti: (Professors) Isabella A. Abbott, Lawrence R. Blinks, Arthur C. Giese, Daniel Mazia, Colin S. Pittendrigh, John H. Phillips, Jr., David C. Regnery; (by Courtesy) C. Stacy French

Chairman: Philip C. Hanawalt
Associate Chairman: Robert D. Simoni


All classes listed below are subject to the 12-unit limitation policy.
Associate Professors: William F. Gilly, Patricia P. Jones, Sharon R. Long (Winter, Spring, Summer), Richard Scheller, Stuart H. Thompson, Peter Vitousek, Virginia Walbot
Assistant Professors: Mark W. Denny, Ron R. Kopito, Robert Sapolsky; (by Courtesy) Christopher Field, Arthur Grossman, Neil S. Hoffman
Senior Lecturers: Charles H. Baxter, Ellen F. Porzig
Lecturers: Carol Boggs, Sara Fultz, Barbara Snapp, Fran Thomas
Directors of Systematic Collections: Paul R. Ehrlich (Entomological Collections), John H. Thomas (Dudley Herbarium)
Librarian: Joseph G. Wible

OFFERINGS AND FACILITIES

The Department of Biological Sciences is comprised of facilities and personnel housed in Herrin Laboratories, Herrin Hall, Keck Science Building, and the Jasper Ridge Biological Preserve on the main campus; and at the Hopkins Marine Station in Pacific Grove on Monterey Bay.

The department provides: (1) courses designed for the non-major; (2) a major program leading to the degree of Bachelor of Science; (3) a program leading to the Master of Science degree, designed for students not intending to proceed to the Ph.D. degree in Biological Sciences at Stanford; and (4) a program leading to the degree of Doctor of Philosophy.

The Jasper Ridge Biological Preserve is a 1,200-acre natural area containing an unusual diversity of plant communities. The preserve is managed solely for teaching and research purposes, and is available to investigators from various institutions. Many classes use the preserve. Stanford-based research at Jasper Ridge presently concentrates on physiological, ecological, and population studies.

Special laboratory facilities for marine research are described in the Hopkins Marine Station Bulletin, available at the department’s Student Services Office (Herrin R-211) or from Hopkins Marine Station.

The department’s large collections of plants (Dudley Herbarium), fishes, reptiles, and amphibians, as well as smaller collections of birds, mammals, and invertebrates are now housed at the California Academy of Sciences in San Francisco, where they, as well as the other extensive collections of the academy, are available to those interested in the systematics of these groups. Entomological collections, restricted to those being used in particular research projects, are housed in the Herrin Laboratories. No general collections are maintained except for teaching purposes.

The Falconer Biology Library in Herrin Hall contains over 1200 current subscriptions and an extensive collection of monographs and reference works. A specialized library is maintained at the Hopkins Marine Station.

UNDERGRADUATE PROGRAMS

BACHELOR OF SCIENCE

UNDERGRADUATE ADVISING

Most members of the Biological Sciences faculty are available for advising. The Student Services office maintains a current list of faculty advisors, advising schedules, and research interests.

The Student Services office is prepared to answer questions on administrative matters, such as requirements for the major, eligibility of courses as electives, and necessity for petition. The Bachelor of Science Handbook, which delineates policies and requirements, is also available. 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. Biobridge undergraduate staff members provide advice on choosing an advisor and courses, organize departmental functions and activities such as the weekly noon lecture series and new majors orientation, and are also available for informal, drop-in counseling in the Barth Room (Herrin T-333).

Each declared major in Biological Sciences 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
   - Biology 31: 5
   - Biology 32: 5
   - Biology 33: 5
   - Biology 44X: 4
   - Biology 44Y (may be replaced by 3 units of 175H): 3

   Total: 22

2. Elective Courses
   - Electives: 21

   Total Core and Electives: 43
3. Cognate Courses

Required courses in cognate fields include:

a) Introductory, organic, and physical chemistry with laboratory: Chemistry 31, 33, 35, 36, 131; 130 or 132; 135
b) General Physics: Physics 21, 22, 23, 24; or 51, 53, 55
c) Mathematics through Calculus: Mathematics 19, 20, 21; or 41, 42
d) One additional course in Mathematics, Statistics, or Computer Science: Mathematics 43 or beyond; Biology 141, or Psychology 60, or Statistics 60 or beyond; or Computer Science 101, 105A, 105B, or 106

Elective courses must be 100 level or above and selected from the offerings in the Department of Biological Sciences or from the list of approved out-of-department electives. This list may be obtained from the Student Services office. In completing the elective course requirement, a biology major must take approved elective courses from at least three different faculty members of whom at least two must be faculty in the Department of Biological Sciences.

No more than 6 units from a single faculty member or in a single in-depth course, such as 155H, 175H, 198, or 199, may be applied toward the total number (43) of required biology units.

Students intending to pursue research careers in biology, especially in ecology, population genetics, or in the theory of any subdiscipline in biology, should be aware that the mathematics requirements (Math 19, 20, 21, or Math 41, 42) for the Bachelor of Science degree in Biological Sciences are minimum mathematics requirements. Substantial additional training in mathematics, including differential equations, linear algebra, and probability theory, is often highly advisable. Students should consult Biology faculty for detailed advice on particular needs.

Additionally, even though only two-three quarters of physics are required, students should be aware that many graduate and professional schools (e.g., medicine and education) require a year of general physics with laboratory. Biology majors are therefore advised to take the year-long physics sequence Physics 21, 22, 23, 24, 25, 26, (or Physics 51, 53, 54, 55, 56, 57, 58).

For students considering taking the 15 unit research course at Hopkins Marine Station during Spring Quarter (175H), or going overseas, fulfillment of as many University distribution requirements as possible in the first two years is highly recommended. Note that 175H may count as 6 biology elective units and may also substitute for 44Y. Careful schedule planning will guarantee free quarters during junior and senior years for those courses.
199 or 199X research project; (2) have an Honors petition proposal approved by the department's Undergraduate Studies Committee; (3) complete and submit by the end of his/her quarter of graduation an Honors thesis approved by at least two readers (one must be from the faculty of the Department of Biological Sciences); (4) if graduating in June, participate in the Undergraduate Honors Research Symposium which takes place Spring Quarter (or, if graduating in a quarter other than Spring, produce a poster); and (5) obtain at least a 3.0 (B) letter grade indicator in all major requirements taken at Stanford (cognate, core, and elective courses). Biology 199 grades are not computed into this letter grade indicator. Further information on the Honors program is available from the Student Services Office, Herrin R-211.

PREMEDICAL, PREDENTAL, AND PREPARAMEDICAL REQUIREMENTS

It is recommended that premedical, predental, and preparamedical students who are not biology majors take at least the following courses in Biological Sciences: 31, 32, 33, 44XY, 110, 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 (Undergraduate Advising Center, Sweet Hall).

GRADUATE PROGRAMS

MASTER OF ARTS IN TEACHING

The degree of Master of Arts in Teaching is offered jointly by this department and the School of Education. The degree is intended for candidates who have a teaching credential and who wish further to strengthen their academic preparation. The program consists of a minimum of 25 units in the teaching field and 12 units in the School of Education. Detailed requirements for the course are outlined in the School of Education section or may be obtained from the Credential Administrator, School of Education.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the "School of Education" section of this bulletin or address your inquiry to 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 a research-oriented department. Requirements for the degree include three full-time academic quarters (or equivalent in part-time quarters) of registration during which at least 45 units of credit are earned. At least 33 of the 45 units must be completed in biological sciences or approved biology-equivalent courses (minimum 24 of the 33 units) or cognate area courses (maximum 9 units in chemistry, physics, mathematics, computer science, and/or statistics courses beyond the level required for the B.S. degree). In addition, of these 33 units a minimum of three courses of at least 3 units each must be taken from the Department of Biological Sciences. No financial support derived from Stanford University funds is available for either tuition or living expenses associated with the master's program. Some M.S. students, however, do locate teaching assistantships or research assistantships on their own. Appropriate application materials for the program can be obtained from the Graduate Admissions office. A more detailed description of the master's degree program may be obtained from the Student Services office of the department.

DOCTOR OF PHILOSOPHY

Preparation for Graduate Study—Students seeking entrance to graduate study in biology ordinarily should have the equivalent of an undergraduate major in biology at Stanford. However, students from other disciplines, particularly the physical sciences, are also encouraged to apply. Such students will be advised at the time of initial registration how they should complete 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 submits applications to the department for approval. The deadline for receipt of applications is December 15.

An applicant must file a report of scores on the general test 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.

Competition for admission is very keen and in recent years it has been possible to offer admission to less than 15-20 per cent of applications received.

All admitted students are normally offered financial support in the form of Biology Teaching 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 fifth 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. Some printed information on graduate school is available at the Student Services office (Herrin R-211) while a more extensive collection is available at the Undergraduate Advising Center at Sweet Hall.

An admitted applicant is required to fulfill the requirements of the University as outlined in the "Degrees" section in this bulletin and the department requirements stated below.

Each student must take at least 3 units of course work under each of four or more Stanford faculty members. Course work to be taken will be determined in consultation with the departmental advising committee. All first year graduate students in the Ph.D. program are required to complete Biology 301 each quarter of their first year.

Teaching experience and training are part of the graduate curriculum. Each student assists in teaching 8 units, usually during the first two years in residence. At least 4 of the required 8 units must be done in the core laboratory courses 44X or 44Y.

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 are announced by the various research groups.

A 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 before their first quarter to plan an integrated first year program, taking into consideration the students' needs in their area of specialization, and his or her deficiencies both in and out of the specialty. At the end of Spring Quarter of the first 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 is also responsible for reporting to the departmental faculty on the student's progress. 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 prospective major professor should ordinarily be a member of the Department of Biological Sciences. Choice of a major professor elsewhere in the University requires special permission of the chairman of the department and the Director of Graduate Studies.

The Dissertation Committee and the Departmental Oral Examination—No later than the end of the Spring 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 defends the dissertation proposal in an oral examination administered by the dissertation committee. The exam covers the proposed dissertation and the area of specialization.

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 to five years.

The dissertation is 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 University oral examination 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. More information on oral examination procedures is available at the Student Services office.

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. degree. However, 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.

COURSES

Additional courses not listed here are frequently offered in the areas of their special research competence by selected postdoctoral or terminal Ph.D. personnel. These will be listed in the quarterly Time Schedule, with course descriptions available in the Student Services Office, Herrin R-211.

INTRODUCTORY

5A, B. Biology and Society—A residence-based freshman seminar introducing areas of modern biological research that have potential applications for improving the human condition. Discussion on the potential implications this research has for society, including moral and ethical questions arising from the practice of scientific research and from the potential uses of new knowledge and technologies. For both science and non-science students. Recommended: High school biology.

5A. 1 unit, Spr (Jones) T 7-9 p.m.

5B. 2 units, Spr (Jones) T 7-9 p.m.

11. Biology for Humanists—Intended for majors in the humanities and social sciences. Topics: a history of contemporary ideas in biology; an introduction to the modes of thinking used in different fields of biology; the analysis of scientific writing; and a study of economic and political forces affecting the direction of biological research. Presents the pursuit of biological research as a human activity. Does not qualify toward biology elective units for biology majors (DR:7)

3 units, Win (Schimke, Staff) TTh 11
44X, Y. Core Experimental Laboratory—Two quarters of laboratory projects which give students a working familiarity with the concepts, organisms, and techniques of modern biological research. Emphasis is on experimental design, critical analysis of data and written presentation of the experiments. Recommended: Take concurrently with, or subsequent to, Biology or Human Biology core courses. Prerequisites: Chemistry 31 and 33. Grading is mandatory Pass/No Credit.

44X. 4 units, Win (Boggs, Snapp, Watt) labs W, Th, or F 1:15-5:05 discussion sections by arrangement
44Y. 3 units, Spr (Boggs, Snapp, Watt) labs W, Th, or F 1:15-5:05 discussion sections by arrangement

45. Research Biology—Designed, for those who have taken 44X and 44Y to pursue specific experiments in greater detail. Also, a possible entry into an Honors project.

3 units, Aut (Woodward) discussion Th 2-4 or by arrangement

50A,B. Biology and the Oceans—Introduction to life in the sea emphasizing topics felt to be exciting by the faculty of Hopkins Marine Station. Including: aspects of ecology, coastal oceanography, plate tectonics, neurobiology, biomechanics, behavior, cell biology, developmental biology, and organismal diversity. Provides a broad background for those interested in pursuing studies in the marine sciences, and a general overview of the subject for nonbiological sciences majors. (DR:7)

50A. Lectures and two weekend field trips to Hopkins Marine Station. Field trips provide “hands on” experience with the marine world: collecting trips to the Monterey submarine canyon and the intertidal zone of the Big Sur Coast; whale observations on Monterey Bay; laboratories dealing with fertilization of sea urchin eggs, octopus behavior, wave dynamics, etc.; a tour of the Monterey Bay Aquarium. Accommodations provided by Hopkins Marine Station. Enrollment limited to 40.

4 units (Denny, Staff) alternate years, given 1989-90

50B. Lectures only.

3 units (Denny, Staff) alternate years, given 1989-90

96A,B. Jasper Ridge Biological Preserve Docent Training Program—Two-quarter course preparing students to serve as docents in the Jasper Ridge Biological Preserve. Aspects of natural history of plants and animals, ecology, archaeology, geology, meteorology, etc. are presented by a variety of faculty and staff. Pass/No credit only. Prerequisite: Consent of the Jasper Ridge Program Coordinator. Apply before November 15.

2 units, Win, Spr (Vitousek) Th 1:30-4:30

The descriptions refer to prerequisite courses from the core sequence by the old and new numbers. Students who took the core lecture courses between 1980-81 and 1985-86 should follow the guidelines listed under courses 31, 32, 33 after the prerequisites.

102. Biology of Marine Communities—Treats a set of marine communities by considering (1) physical environment, (2) resident species, (3) their biology and interactions, (4) population and community structure and dynamics, and (5) selected topics related to these communities. Emphasis on local coastal communities. Provides a background in the natural history of marine systems and the issues confronted by marine research. Prerequisites: 33 or 40, or equivalent.

3 units, Win (Baxter) MT 3:15-4:30 alternate years, not given 1989-90

105. Biological Circadian Rhythms—Biological clocks that sense daily cycles are analyzed in a variety of organisms. Physiological, genetic, and biochemical approaches to understanding mechanisms of the oscillator and its blue light photoreceptor. Learning how organisms track time. Prerequisite: Biology or Human Biology core.

3 units, Spr (Woodward) TTh 1 alternate years, not given 1989-90

105H. Subtidal Communities—Lectures, laboratory, and field trips treating shallow water marine communities. Emphasizes local habitats and the introduction of 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 background in biology. Taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Staff)

107. Theory of Development—Theories which account for the progression of the cell through its cycle and for the progression of the embryo through its development. The unsolved problems of the origin of form and pattern are addressed from a biophysical perspective. Prerequisites: 31, 32; or 41, 42, or equivalent. Recommended: An interest in college physics and/or mathematics.

3 units, Spr (Green) MWF 2:15

108. Organismal Development—The processes responsible for development of multicellular organisms. Topics: the early development
of invertebrates and vertebrates and the morphogenesis of single cells and organ systems. Current research emphasized. Prerequisites: Biology or Human Biology core, senior status, and consent of instructor.

3 units, Aut (Porzig) TTh 2:15-4:05

110. Vertebrate Biology—Structure, function, behavior, and evolution of vertebrates. Prerequisite: Biology or Human Biology core.
4 units, Spr (Porzig) TTh 2:15-4:05

110L. Vertebrate Biology Laboratory — Dissection of selected vertebrates. Pass/No Credit only. Prerequisite: Same as for 110.
3 units (Porzig) not given 1988-89

112. Human Physiology—(Same as Human Biology 111.) The functioning of organ systems emphasizing mechanisms of control and regulation. Topics: structure and function of the endocrine and central nervous systems, cardiovascular physiology, respiration, salt and water balance, exercise and gastrointestinal physiology. Lectures and discussion. Prerequisite: Human Biology or Biology core. Enrollment limited to 120.
4-5 units, Win (Heller, Lawry) MWF 9

113H. Introduction to Oceanic Biology—The ocean as an environment: its major categories of inhabitants, producer and consumer, benthic and pelagic, invertebrate and vertebrate; and the functioning of the oceanic ecosystem. Prerequisite: Introductory biology or general zoology. Taught at Hopkins Marine Station. Apply to Hopkins.
6 units, Sum (Staff)

114. Scientific Philosophy and Bioethics—(Formerly 51.) The philosophy of science analyzed from various perspectives (philosophy, science, politics, society), and treated from historical and contemporary considerations. Emphasis on analyses of bioethical controversies and how these relate to the philosophy and practice of science today. (DR:3)
3 units, Aut (Woodward) MWF 1:15

115. Evolutionary Ecology—(Same as Human Biology 102.) The fundamental concepts of evolutionary ecology including population growth equations, foraging, reproductive and life history strategies, predator/prey, and competitive and mutualistic interactions among species. Prerequisites: Human Biology Core, or Biology 33 or 40, or equivalent; Calculus 20 or 41, or equivalent; or consent of instructor.
4 units, Aut (Boggs) MWF 1:15 plus discussion

117. Biology and Global Change—Biological causes and consequences of anthropogenic and natural changes in the atmosphere, oceans, and terrestrial and freshwater ecosystems. Glacial cycles and marine circulation, greenhouse gases, ozone depletion, and tropical deforestation and species extinctions.
3 units, Win (Vitousek, Matson, Mooney) MWF 11

120. General Botany—The diversity of plant groups plus an introduction to the structure, development, physiology, and ecology of higher plants. Prerequisites: Biology core, Human Biology 2A, or permission of instructor.
5 units, Aut (Fultz, Mooney, Bay, J. Thomas) MWF 11; lab T 2:15-5:05 plus discussion

124. Plant Adaptation—The physiological ecology of plants of diverse environments. Prerequisites: 32 and 33, or 40 and 43, or consent of instructor.
4 units, Win (Mooney) TTh 11 field trips by arrangement alternate years, not given 1989-90

125. Ecosystems of California—Principles of ecosystem function with emphasis on vegetation components and on California systems. Prerequisite: 33 or 40, or Human Biology 2A.
3 or 4 units (Mooney) field trips by arrangement alternate years, given 1989-90

128. Systematics and Ecology of Vascular Plants—Lectures, laboratory, field studies. Prerequisite: Prior permission of instructor.
4 or 5 units, Spr (J. Thomas) WF 1:15; lab WF 2:15-5:05; field trips by arrangement

130. Algae/Fungi—An introduction to these groups, their utilization in studying biological problems and their ecological significance. Lectures, laboratories, field trips. Prerequisite: 33 or 40, or equivalent.
4 units, Win (Fultz, Grossman) MWF 1:15 lab W 2:15-5:05

131. Mosses and Ferns—Structure, development, evolutionary relationships of mosses and ferns. Lectures, laboratories, field trips. Prerequisites: 32, 33, or 40, 43; or consent of instructor.
5 units, Aut (J. Thomas) WF 2:15 lab WF 3:15-5:05; field trips by arrangement, alternate years, not given 1989-90

132. Seed Plants—Structure, development, evolutionary relationships of seed plants. Lectures, laboratories, field trips. Prerequisites: 32, 33, or 40, 43; or consent of instructor.
5 units (J. Thomas) alternate years, given 1989-90

133. Plants and Civilization—The economic uses of plants and plant substances. Food, fiber, medicinal, and structural uses from a biological
### BIOLOGICAL SCIENCES 293

#### and ecological point of view. Lectures and demonstrations. Prerequisite: Biology or Human Biology core, or consent of instructor.

4 units, Win (J. Thomas)
by arrangement

#### 134. Seminar on Replication of Nucleic Acids
—Modes of DNA replication and their control in prokaryotic and eukaryotic systems. Critical review of current literature. Prerequisite: 166 and/or consent of instructor.

3 units (Hanawalt)
alternate years, given 1989-90

#### 135. Seminar on Developmental Genetics—
Genetic expression and its developmental basis, especially in such representative organisms as *Drosophila*, mice, and men. Prerequisites: 31 or 32, 33; or 40, 42; or consent of instructor.

3 units, Spr (Center) T 7-9
alternate years, not given 1989-90

#### 136H. Cell Biology of Early Development—
Five-week workshop on cellular phenomena seen during early embryonic development, properties of sperm and egg, fertilization, mitosis and cell division, early morphogenesis of the embryo, and determination and polarity. Gametes of marine organisms are utilized emphasizing experimentation and observation of living cells, including their microscopy, micromanipulation, and chemistry. Post-graduate level course but advanced undergraduates considered. Taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Epel, Mazia)

#### 137. Maize Genetics—
Modern techniques in maize genetics and of phenomena such as controlling elements, paramutation, and cytoplasmic inheritance. Practical experience in setting up a field experiment, planting seed, tagging plants, and plant maintenance. Field projects may be continued over the summer as 199 or 300. Prerequisites: 166 or 167, or consent of instructor.

2-3 units, Spr (Walbot) MW 1:15
alternate years, not given 1989-90

#### 138H. Biomechanics of Intertidal Organisms—
Introduction to the mechanical design of wave-swept organisms emphasizing the ecological implications of wave forces. The basic theories of water waves, fluid dynamics and solid mechanics, and the applications of theory to understanding the design of materials, structures, whole organisms, and communities. Laboratory work on the various techniques of intertidal biomechanics. Each student is responsible for completing an individual research project. Recommended: Background in invertebrate zoology, algology or intertidal ecology. Also basic physics and calculus. Taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Denny)
alternate years, not given 1989-90

### 140. Highlights in Photobiology—
Basic principles of the action of light upon biological systems. Lectures, discussion of current literature, and student reports on special topics including: photosynthesis, photoperiodism, phototropism, vision, photoinactivation and recovery. Prerequisite: Biology core series.

3 units, Win (Hanawalt, Briggs) by arrangement, alternate years, not given 1989-90

### 141. Biostatistics—
An introduction to the statistical analysis of biological data. Lectures, discussion, and student exercises. (DR:6)

3 units, Win (Feldman) MWF 1:15

### 142H. Eco-physiology and Cell Biology of Marine Macrophytes—
The rich marine environments at Hopkins Marine Station introduce taxonomy and distribution of marine algae and seagrasses; characteristics of the intertidal and subtidal regions; and physiological, cellular, and molecular bases of adaptation by marine macrophytes. Individuals or teams of students conduct and report results of projects researched during the last two weeks.

6 units, Sum (Staff) by arrangement

### 147. Signal Transduction in Cells—
Advanced consideration of the mechanisms by which cells alter their activity in response to extracellular stimuli. Emphasis on cell-cell signaling, as by hormones and growth factors, and on triggers for developmental change, as during germination, fertilization, and embryonic inductions. Relies heavily on current literature.

2 units, Aut (Epel) W 2:15-4:05
alternate years, not given 1989-90

### 153. Introduction to the Nervous System: Cell Signaling and Behavior—
(Same as Psychology 107.) A survey of neural mechanisms and interactions underlying behavior. Recommended: 32 or 43 or Psychology 107 or Human Biology 4A.

4 units, Aut (Wine) TTh 1:15-2:30
alternate years, not given 1989-90

### 154. Cellular and Molecular Neurobiology—
The function of the nervous system at the cellular and molecular level. Membrane biophysics, synaptic transmission, biochemistry and molecular genetics of neuronal function, and their relationship to behavior and learning. Prerequisites: 32 or 42 and 153 (Psychology 107), or consent of instructor.

4 units (Scheller)
alternate years, given 1989-90

### 156. Plant Physiology—
Physiological functions of land plants, considered from analytical and quantitative points of view; photosynthetic energy and gas exchange; water and photosyn-
that long-distance transport; mineral nutrient ion uptake and transport; growth at cellular and organismal levels, and its hormonal regulation; responses to light, gravity, temperature, etc.

4 units (Ray, Briggs)
alternate years, given 1989-90

157. Plant Biochemistry—Biochemical basis of plant structure and function: mechanisms of photosynthesis and plant respiration; mineral metabolism, including N\textsubscript{2} fixation; special features of plant nuclear and organelle genomes; cell wall polymers; protein and polysaccharide biosynthesis and its regulation; formation and mobilization of storage reserves; biosynthetic pathways for hormones, pigments, and other secondary products.

3 units, Win (Long, Ray, Grossman, Berry) MWF 10, alternate years, not given 1989-90

159H. Problems in Behavioral Biology—Group and individual studies on local marine organisms and communities in nature, tanks, and simulated habitats. Topics may deal with organisms from sea anemones to harbor seals introduced by lecture, group studies, research projects. Oral and written presentations of the research findings. Taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Baxter)

160H. Problems in Subtidal Ecology—Selected research in our local kelp forest. Topics vary each summer, determined by the research interests of a rotating staff member including community or population structure or processes, inter- or intraspecific interactions, or aspects of the behavior or ecology of a species. Participants will normally be continuing from 105H but equivalent training and background is considered. Intended for students seriously interested in designing and carrying out research studies in the SCUBA zone. Results are prepared as a scientific paper and presented at a course symposium. Taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Baxter)

163. Human Behavioral Biology—The biological bases of normal and abnormal human behavior are examined to train students in approaching complex behaviors in a multidisciplinary way. Relevant disparate disciplines: sociobiology, ethology, neuroscience and endocrinology are integrated in examining behaviors such as aggression, sexual behavior, language use, mental illness.

4 units (Sapolsky)
alternate years, given 1989-90

164. Animal Behavior: Neurobiological Aspects—(Same as Psychology 147.) Ethological studies of behavior with an emphasis on understanding physiological substrates of simple behavior. Prerequisites: Psychology 1 or equivalent, and elementary biology.

4 units (Wine)
alternate years, given 1989-90


3 units (Heller)
alternate years, given 1989-90

166. Genetics (Eukaryotes)—The principles of genetics as developed in and applied to studies of eukaryotic organisms. Emphasis on the transmission of genetic factors. Prerequisite: 33 or 40 or consent of instructor.

3 units, Win (Baker) TTh 11

167. Genetics (Prokaryotes)—Continuation of 166 with emphasis on prokaryotes. Basic genetic principles applied to bacteria and viruses. Methods of genetic mapping; correlation of genetic and physical structure; mechanism of recombination. Prerequisite: 166.

3 units, Spr (Campbell) MWF 11

168. Vegetation and Fire—The past and present role of fire in the evolution and maintenance of vegetation types, with reference to the diverse California flora. Prerequisite: Consent of instructor.

3 units (J. Thomas)
alternate years, given 1989-90

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. Lectures cover the physical principles. The laboratory involves partial assembly and extensive use of pertinent instruments. Prerequisites: 31, 32; or 41, 42, 43; and 44XY.

3 units, Aut (Green) TTh 1:15
lab T or Th 2:15-5:05


3-4 units, Win (F. Thomas) by arrangement

174. Seminar in Tumor Immunology—Examines the major players of the immune system, their role in the immunosurveillance of cancer,
and tumor markers and prospects for immunotherapy of cancer. Prerequisite: Biology core or equivalent. Previous immunology background not required. P/NC only.

2 units (Maeker)

175H. Problems in Marine Biology—Lectures, laboratory work, field studies, and individual problems. Designed primarily to give advanced undergraduates an opportunity to engage in research. Spring Quarter is in residence at the Marine Station, Pacific Grove. See Hopkins Marine Station Bulletin. Prerequisites: Junior or senior standing in biology, and permission of instructors.


3 units, Win (Gilly, Baxter, Denny, S. Thompson)

178. Biology of Natural Populations—Introduction to independent study of natural populations. Jasper Ridge Biological Preserve serves as an outdoor laboratory. Prerequisite: Consent of instructor.

4 units, Spr (Mooney) by arrangement alternate years, not given 1989-90

179. Mathematical Models in Population Biology—(Same as Math 126/226.) For advanced undergraduates and beginning graduate students in biology and mathematics. Topics: elements of population genetics and ecology, models of the evolution of behavioral traits (kin, altruism, group selection), theoretical studies of mating patterns in natural populations, problems of optimality of population sex ratio, population, growth model, age structure and life histories.

3 units, Spr (Karlin, Feldman) TTh 11-12:15 alternate years, not given 1989-90


3 units (Feldman) alternate years, given 1989-90

183. Colloquium on Population Studies—(Same as Food Research 188/288, Human Biology 60.) A series of talks by distinguished speakers, introducing students to a wide variety of topics in population studies.

1 unit, Win (Feldman, John) W 4:10-5:30

184. Biology of Insects—An introduction to the functional biology of insects. Insect anatomy, biochemistry, behavior, ecology, physiology and systematics, and more specialized topics intended to illustrate or emphasize unusual features of insects which make them attractive as objects of research. 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. Prerequisite: Biology core lecture series, or consent of instructor.

3-5 units (Watt) alternate years, given 1989-90

185. Coevolution—Evolutionary interactions among different kinds of organisms—plants and herbivores, models and mimics, predators and prey, parasites and hosts. Emphasis on the importance of these interactions in understanding problems of community structure and human ecology. Lectures, discussion, and library research. Prerequisites: 33 or 40 or Human Biology 3A, and consent of instructor.

3 units (Ehrlich) given 1990-91

188. Ecosystems of the Tropics—Tropical ecosystems ranging from lowland rainforest to savanna, from shifting cultivation to high-elevation ecosystems. Emphasis on regulation of ecosystem structure and function; 50% lecture and seminar, the specific content depends in part upon student participation.

2-3 units (Vitousek) alternate years, given 1989-90

189. Biology of Birds—The ways birds interact with their environments and each other; emphasis on studies that had broad impact in the fields of population biology, community ecology, and evolution. Field trips introduce students to local bird communities and emphasize bird identification and behavior. One-hour lecture and a three- hour lecture/field trip per week. Prerequisite: 33 or 40 or equivalent, and consent of instructor. Limited to 20 students.

3 units, Spr (Ehrlich) M 10 Th 8-11 alternate years, not given 1989-90

190. Population Biology of Butterflies—Lectures on field studies of the dynamics and genetics of butterfly populations, life histories, and resource utilization. Also, the evolution and taxonomy of this group of insects which has become a key research tool in population biology. Lab includes field work on Euphydryas populations now under study on campus and elsewhere in California. Students must register both quarters for field work credit. Prerequisites: 33 or 40, and consent of instructor.

2-3 units, Win (Ehrlich) T 1:15-3:05 2-5 units, Spr, by arrangement alternate years, not given 1989-90

191. Research in Bird Biology—Semi-independent field research in ornithology, empha-
sizing ecological relationships. Projects complement on-going research, planned and carried out by the student in consultation with the instructor. Results are written in publication format. Prerequisites: 33 or 115, concurrent or subsequent enrollment in 189, and consent of instructor. Enrollment limited.

3 units, Win, Spr (Ehrlich) 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, Mooney, J. Thomas, Vitousek) by arrangement

198H. Directed Instruction/Reading—May be taken as a prelude to research for one quarter only and may also involve participation in a laboratory or research group seminar and/or library research. Under supervision of Hopkins Marine Station faculty.

198O. Directed Instruction/Reading—May be taken as a prelude to research for one quarter only and may also involve participation in a laboratory or research group seminar and/or library research. By arrangement with a department instructor.

198X. Directed Instruction/Reading—May be taken as a prelude to research for one quarter only and may also involve participation in a laboratory or research group seminar and/or library research under the direction of an out-of-department sponsor. For Biological Sciences majors, by departmental petition.

199H. Special Problems—Research done under supervision of Hopkins Marine Station faculty. See 199O for more information on research work.

199O. Special Problems—Individual research taken by arrangement with department instructors. Completion of 10 units of “Special Problems” is applied toward graduation with departmental Honors. Entry into the Honors program requires submission of a petition to the Committee on Undergraduate Studies, forms available in the department's Student Services 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 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 the research director and the department. The essay, in duplicate, is deposited in the departmental Library in the University Archives. See unit limitation under “Bachelor of Science Course Requirements.”

199X. Special Problems—To be used for out-of-department instructors. For Biological Sciences majors by petition only. Forms available at Student Services office, Herrin Hall R-211.

GRADUATE

205. DNA Repair and Mutagenesis—(Same as Radiation Oncology 205, Pathology 292.) 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: 31 or 41, or consent of instructor.
3 units, Spr (Hanawalt, Friedberg, K.C. Smith) TTh 1:15, alternate years, not given 1989-90

208. Advanced Topics in Genetics—Deals in depth with topics of current interest. Subjects vary each year. May be repeated for credit. Prerequisites: 166 or 167 or equivalent, and consent of instructor.
2 units, Aut (Perkins) by arrangement

212. Advanced Topics in Cell Biology and Physiology—The organization, assembly, and dynamics of eukaryotic cells. Specific topics vary each year but may include: membrane receptors and signal transduction, cell-cell contacts, transport of ions and solutes, interaction with the extracellular matrix, organelle and membrane biogenesis. Emphasis on process rather than structure, i.e., mechanisms and significance of cell-cell and cell-substratum interaction, and intracellular transport of organelles. Lectures/reading stress classical and current research literature. Prerequisites: Biochemistry 200 and 201, or consent of instructor.
3 units, Aut (Kopito) TTh 11-12:30 plus discussion section to be arranged, alternate years, not given 1989-90

213. Viruses—Principles of virus growth, genetics, architecture, and assembly. Relation of temperate viruses and other episomes to the host cell. Prerequisite: 31 or 41.
3 units, Win (Campbell) MWF 9

215. Biochemical Evolution—Lectures and discussion covering biochemical viewpoints on diverse aspects of the evolutionary process. Topics: 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: 31, 32, 33; or 40, 41, 42, 43; or substantial equivalents.

3 units, Win (Watt) MWF 10

222H. Ionic Channels in Natural and Model Membranes: Single Channel Techniques—Advanced treatment of membrane physiology and several modern experimental techniques. Emphasis on the regulation of ionic channels. Laboratory work on patch clamp methods applied to native nerve and muscle cells, nerve cell lines, and ion channels reconstituted in artificial bilayers. Offered to graduate students and advanced undergraduates. Taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Gilly, S. Thompson) alternate years, not given 1989-90

228. Advanced Plant Systematics—A study of selected families of flowering plants emphasizing phylogenetic relationships. Prerequisite: Consent of instructor.

4 units, Aut, Win, Spr (J. Thomas) by arrangement

230. Topics in Immunology—Introduction to the basic elements of the immune system: structure and functions of antibody molecules; cellular basis of immunity and its regulation; molecular biology of antigen recognition structures, genetics of immunity and disease susceptibility. For graduate students and advanced undergraduates. Prerequisite (for undergraduates): Biology core or consent of instructor.

4 units (Jones) given 1989-90


4 units (Schimke) alternate years, given 1989-90

250. Molecular Biophysics—Physical biochemistry and physical approaches to biological problems at the molecular level. Lecture discussion of macromolecular structure and intermolecular interactions, physical methods for characterizing proteins and nucleic acids, the interaction of electromagnetic radiation with biological molecules, isotopic tracer techniques, and classical physics of cellular processes. Open to qualified advanced students upon consent of instructor.

4 units, Win (Simoni, Staff) TTh 10-12 alternate years, not given 1989-90

252. Gene Action—Lectures and student seminars on various aspects of gene structure and function, and regulation of gene expression in microorganisms. Prerequisite: Biochemistry 201 or equivalent.

3 units (Yanofsky) alternate years, given 1989-90

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) TTh 9-10:30 alternate years, not given 1989-90


3 units (Roughgarden) alternate years, given 1989-90

286H. Marine Ecology—The evolution of marine life histories, beginning with a review of terrestrial life history and the evidence relating to that theory. Phenomena that a marine life history theory should explain. New theoretical formulations appropriate to marine organisms. Prerequisites: Course in ecology and evolutionary biology, and one year of calculus. Taught at Hopkins Marine Station. Apply to Hopkins.

6 units, Sum (Roughgarden) alternate years, not given 1989-90

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—Graduate level.

(Staff) by arrangement

300H. Research—To be used for graduate research done under supervision of Hopkins Marine Station faculty.

300X. Research—To be used for out-of-department research supervisors. By petition only.

301. Current Topics in Biology—Lectures in the areas of current research interests of the faculty. Enrollment is limited to Biological Sciences Ph.D. students in their first year of graduate study. Pass/no credit only.

1-3 units, Aut, Win, Spr (Staff) by arrangement
302. Seminar in Plant Ecology — Discussions of current research in plant ecology. Prerequisite: Consent of instructor. 1-3 units, Aut, Win, Spr (Mooney) by arrangement

307. Neurosciences Journal Club — (Enroll in Neurosciences 300.) Students and faculty select and present for critical discussion articles from current journals. 1 unit, Aut, Win, Spr (Aldrich, 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, Aut, Win, Spr (Watt) by arrangement

325H. Seminar in Marine Sciences — Literature and research review of topics in marine sciences, including behavior, biomechanics, population dynamics, life history evolution, community ecology, biological oceanography, and allied areas. Taught at Hopkins Marine Station. Apply to Hopkins. 1-3 units, Aut, Win, Spr (Baxter, Denny, Roughgarden) F 12

335. Seminar in Immunobiology and Immunogenetics — Literature review of current topics in immunology. Prerequisites: Introductory immunology course and consent of instructor. 1-3 units, Aut, Win, Spr (Jones)

342. Plant Biology Seminar — Topics announced at the beginning of each quarter. In depth coverage of the current literature. 1-3 units, Aut, Spr (Walbot, Green, Long, Mooney, Ray, Vitousek, Briggs, Bjorkman, Berry, Grossman) T 5

343. Plant Molecular Biology — Review of genome structure, transposable elements and transformation techniques of higher plants followed by in-depth analysis of current literature on plant gene expression. Lectures and discussion section. 3 units (Walbot, Long, Grossman) alternate years, given 1989-90

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, Long, Perkins, Simoni, Walbot, Woodward, Yanofsky) M 12

346. Seminar in Regulatory Biology — Literature review of selected topics in eukaryote regulatory biology. Prerequisite: Consent of instructor. 1-3 units, Aut, Win, Spr (Schimke) T 12

349. Seminar in Population Ecology — Prerequisite: Consent of instructor. 1-3 units, Aut, Win, Spr (Ehrlich) by arrangement

354. Seminar in Population Biology — Prerequisite: Consent of instructor. 1-3 units, Aut, Win, Spr (Ehrlich, Feldman, Mooney, Roughgarden, J. Thomas, Vitousek, 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. 1-3 units, Aut, Win, Spr (Feldman) by arrangement

384. Seminar in Theoretical 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, Aut, Win, Spr (Roughgarden) by arrangement

DIVISION OF MARINE BIOLOGY
HOPKINS MARINE STATION

Emeriti: (Professors) Isabella A. Abbott, Lawrence R. Blinks, Arthur C. Giese, Daniel Mazia, John H. Phillips, Jr., Colin S. Pittendrigh

Director: Dennis A. Powers

Professors: David Epel, Dennis A. Powers, Jonathan Roughgarden

Associate Professors: William F. Gilly, Stuart H. Thompson

Assistant Professors: Mark W. Denny

Courtesy Professor: Irving L. Weissman

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 11 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, the Monterey Boat Works which houses the C. B. van Niel Library, SCUBA diving facilities, and the Walter K. Fisher Laboratory. The 15,000 volume library subscribes to approximately 450 journals, and its collections are particularly good in marine biology, oceanography, microbiology, and embryology.
The Station is open during the entire year and maintains a permanent staff of resident investigators and technical assistants; this staff is increased by visiting faculty members, especially during the summer. There are facilities for visiting investigators and for elementary and advanced instruction in biology. For further information, see the *Hopkins Marine Station Bulletin*, or write Hopkins Marine Station, Pacific Grove, CA 93950.

**COURSES**

**AUTUMN, WINTER, AND SPRING**

175H. Problems in Marine Biology—Lectures, laboratory work, field studies, and individual problems. Designed primarily to give advanced undergraduates an opportunity to engage in research. The entire Spring Quarter is in residence at the Marine Station, Pacific Grove. See *Hopkins Marine Station Bulletin*. Prerequisites: Junior or senior standing in biology and permission of instructors.

15 units, Spr (Gilly, Baxter, Denny, Thompson) by arrangement

199H. Special Problems—Properly qualified undergraduate students may undertake individual work in the fields indicated under 300H, listed below. Such studies are intended to give the serious student experience in biological research. Preference to Stanford students who have already completed 175H and wish to continue their studies, and to Stanford biology students enrolled in the Coterminal M.S. Program. Arrangements must be made by consultation or correspondence.

(Staff) by arrangement

300H. Research—Graduate study involving original work may be undertaken with members of the staff in the fields indicated below:


M. Denny: Biomechanics—The mechanical properties of biological materials and their consequences for animal size, shape and performance.

D. Epel: Developmental Biology—Physiology and regulation of early embryonic development.

W. Gilly: Membrane physiology of nerve and muscle cells; control of sodium and calcium ion channels and of excitation-contraction coupling. Comparative neuromuscular physiology of marine invertebrates.

D. Mazia: Cell Reproduction—Mitosis, cell division, and cell cycles in eggs of marine invertebrates.

D. Powers: Adaptational Biochemistry and Molecular Evolution.


**SUMMER**

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 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.

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.

Although some classes meet only on alternate days, the majority meet daily for formal work, and in all classes the laboratories are open all week long and most students spend part of their few "off" days in the laboratory or library. For this reason, registration is possible for only one course during each five week session.

**FIRST TERM**

105H. Subtidal Communities—Lectures, laboratory, and field trips treating shallow water marine communities. Emphasis on local habitats and the introduction of 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 background in biology.

6 units (Staff) by arrangement

136H. Cell Biology of Early Development—Five-week workshop on cellular phenomena seen during early embryonic development, properties of sperm and egg, fertilization, mitosis and cell division, early morphogenesis of the embryo, and determination and polarity. Gametes of marine organisms are utilized, emphasizing experimentation and observation of living cells, including their microscopy.

S. Thompson: Neurophysiology — Neuronal control of behavior and mechanisms of ion permeation in membranes.

325H. Seminar in Marine Sciences—Literature and research review of topics in marine sciences, including behavior, biomechanics, population dynamics, life history evolution, community ecology, biological oceanography, and allied areas.

1-2 units, Aut, Win, Spr (Baxter, Denny, Roughgarden) F 12
micromanipulation, and chemistry. Post-graduate level course but advanced undergraduates considered.

6 units (Epel, Mazia) by arrangement

138H. Biomechanics of Intertidal Organisms — Introduction to the mechanical design of wave-swept organisms emphasizing the ecological implications of wave forces. The basic theories of water waves, fluid dynamics and solid mechanics, and the applications of theory to understanding the design of materials, structures, whole organisms and communities. Laboratory work on the various techniques of intertidal biomechanics. Each student is responsible for completing an individual research project. Recommended: A background in invertebrate zoology, algology or intertidal ecology. Also, basic physics and calculus.

6 units (Denny) by arrangement

138H. Biomechanics of Intertidal Organisms — Introduction to the mechanical design of wave-swept organisms emphasizing the ecological implications of wave forces. The basic theories of water waves, fluid dynamics and solid mechanics, and the applications of theory to understanding the design of materials, structures, whole organisms and communities. Laboratory work on the various techniques of intertidal biomechanics. Each student is responsible for completing an individual research project. Recommended: A background in invertebrate zoology, algology or intertidal ecology. Also, basic physics and calculus.

6 units (Denny) by arrangement

142H. Eco-physiology and Cell Biology of Marine Macrophytes — Taking advantage of rich marine environments at Hopkins, introduces taxonomy and the distribution of marine algae and seagrasses, characteristics of the intertidal and subtidal regions, and physiological, cellular and molecular bases of adaptation by marine macrophytes. Individuals or teams of students conduct and report results of research projects conducted during the last two weeks.

6 units (Staff) by arrangement

159H. Problems in Behavioral Ecology — Group and individual studies on local marine organisms and communities in nature, tanks, and simulated habitats. Range of topics is broad and may deal with organisms from sea anemones to harbor seals. Topics are introduced by lecture, group studies, research projects. Oral and written presentations of the research findings.

6 units (Baxter) by arrangement

160H. Problems in Subtidal Ecology — Selected research area in our local kelp forest. Topics vary each summer, determined by the research interests of a rotating staff member, including community or population structure or processes, inter- or intraspecific interactions, or aspects of the behavior or ecology of a species. Participants normally continue from 105H, but equivalent training and background is considered. Intended for students seriously interested in designing and carrying out research studies in the SCUBA zone. Results prepared as a scientific paper and presented at a course symposium.

6 units (Baxter) by arrangement

199H. Special Problems — (See above, Autumn, Winter, and Spring Quarters.)

222H. Ionic Channels in Natural and Model Membranes: Single Channel Techniques — Advanced treatment of membrane physiology and several modern experimental techniques with emphasis on the regulation of ionic channels. Laboratory work on patch clamp methods applied to native nerve and muscle cells, nerve cell lines, and ion channels reconstituted in artificial bilayers. Offered to graduate students and postdoctorals.

6 units (Gilly, Thompson) by arrangement

222H. Ionic Channels in Natural and Model Membranes: Single Channel Techniques — Advanced treatment of membrane physiology and several modern experimental techniques with emphasis on the regulation of ionic channels. Laboratory work on patch clamp methods applied to native nerve and muscle cells, nerve cell lines, and ion channels reconstituted in artificial bilayers. Offered to graduate students and postdoctorals.

6 units (Gilly, Thompson) by arrangement

228H. Theoretical Ecology — The evolution of marine life histories, beginning with a review of terrestrial life history and the evidence relating to that theory. Phenomena that a marine life history theory should explain. New theoretical formulations appropriate to marine organisms. Prerequisites: Course in ecology and evolutionary biology, and one year of calculus.

6 units (Boughgarden) by arrangement

228H. Theoretical Ecology — The evolution of marine life histories, beginning with a review of terrestrial life history and the evidence relating to that theory. Phenomena that a marine life history theory should explain. New theoretical formulations appropriate to marine organisms. Prerequisites: Course in ecology and evolutionary biology, and one year of calculus.

6 units (Boughgarden) by arrangement

300H. Research — (See above, Autumn, Winter, and Spring Quarters.)

COMMITTEE ON BLACK PERFORMING ARTS

Director: Sandra L. Richards (Drama)
Committee in Charge: Keith Archuleta (Residential Education), Michael Britt (Resident Fellow, Ujamaa), James Cadena (Residential Education), Ronald Hudson (Student Affairs), Kennell Jackson (African and Afro-American Studies, and History), Halifu Osu-mare (Dance), John Rickford (Linguistics). Also, student representatives from the Gospel Choir, Kuumba Arts/Kuumba Dance Ensemble.

The Committee on Black Performing Arts is an interdisciplinary program supporting the
presence of Black art forms at Stanford. Starting as a student project in 1968, the committee has operated as an official University program since 1972. The committee serves three major functions as a: (1) liaison with departments in hiring faculty and devise courses in Black performing arts; (2) producer of shows in dance, drama, and music; and (3) resource for student organizations promoting artistic expression in the Black community. Through the cooperation of the departments, students are able to take relevant courses in dance, drama, music, and literature. While the offerings do not constitute the basis for an academic major, students are able to concentrate studies in Black performing arts as part of the A.B. major in African and Afro-American Studies.

**COURSES**

Students are advised to consult the Time Schedule each quarter to note changes.

5. **Introduction to Black American Drama**—(Enroll in Drama 5.) The development of Black Drama in the U.S. from 1858 to the present.  
4 units, Spr (Richards)

29. **Theater Performance: Acting**—(Enroll in Drama 29.) Students cast in committee productions may receive credit for their participation as actors.  
1-3 units, any quarter (Staff)

39. **Theater Performance: Crew**—(Enroll in Drama 39A,B,C.) Students receive credit for the participation in the design and technical areas of committee productions.  
1-5 units, any quarter (Staff)

59A,B,C. **Dance Theater Production**—(Enroll in African and Afro-American Studies 59.) Students may receive credit for technical and dance performance in committee productions.  
1-5 units, Aut, Win, Spr (Osumare)

82A,B,C. **Gospel Choir Workshop**—(Enroll in African and Afro-American Studies 82A,B,C.) The study and practice of gospel music. Includes regular rehearsals and performances. Credit given for organizational service with written reports describing the progress of the quarter. Maximum of 10 units may be applied towards the AAS major.  
1-3 units, Aut, Win, Spr (Staff)

85. **Black English**—(Enroll in Linguistics 73.) 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 Island ("Gullah"), in the Caribbean, and West Africa. The expressive uses of Black English and its educational implication.  
4 units (Rickford)

105. **Introduction to African and Afro-American Studies**—(Enroll in African and Afro-American Studies 105, Anthropology 105, History 149C.) Lectures exploring interdisciplinary interpretations of several representative aspects of African and Afro-American social and cultural institutions. Topics: retained Africanisms, slavery, the Black family, Afro-American artists, and Afro-American identity. (DR:5*)  
5 units, Aut (Jackson, Staff)

127. **Afro-American Psychology**—(Enroll in Psychology 127.) Introduction to ethnic psychology, specifically, the psychological dimensions of the Black experience in America. Lectures and readings. Black psychology from its evolution as a concentration area in the social sciences to present concerns that impact Black American mental health. Students are encouraged to expand upon the methodological constructs employed in the study of Black Americans.  
3 units, Spr (Hudson)

157N. **Contemporary Black Playwrights**—(Enroll in Drama 157N.) The dramaturgy, i.e., thematic issues, styles, and aesthetics of contemporary playwrights in the United States, the Caribbean, and Africa. The concept of an African Diaspora or cultural continuity between Africa and the Americas is the premise; also, diversity among the various societies represented. (DR:2)  
4 units, Win (Kennedy) given 1988-89

161A. **Afro-American Writing, 1945-1970**—(Enroll in English 161A.) Aims: identify central literary and intellectual concerns among Afro-American writers in historical and social context. Can be taken separately, but works in sequence with 161B.  
5 units, Win (Drake)

161B. **Afro-American Writing, 1970 to the Present**—(Enroll in English 161B.) See description of 161A. Can be taken separately, but works in sequence with 161A.  
5 units, Spr (Drake)

182. **Jazz Dance I**—(Enroll in Dance 182.) Beginning-intermediate level emphasizing control, rhythmic coordination, and the learning of movement combinations. Prerequisite: 81 or equivalent.  
1 unit, Aut, Win, Spr (Staff)

183. **Jazz Dance II**—(Enroll in Dance 183.) Intermediate jazz technique. Prerequisite: Consent of instructor.  
1 unit, Win (Osumare)

185. **African-Caribbean Roots of American Jazz Dance**—(Enroll in Dance 185.) The study of traditional African and Caribbean Dance forms and their influence on contemporary American jazz dance. Drummers and visual
resources support the introduction of traditional Afro-Caribbean dance styles.

2 units, Aut (Osumare)

186. African-Caribbean Dance Techniques —(Enroll in Dance 186.) Dance survey of selected styles from West Africa and the Caribbean with emphasis on the Katherine Dunham technique which formalized these styles. Prerequisite: Consent of instructor.

2 units, Spr (Osumare)

CHEMISTRY*


Chairman: John Ross

Professors: Hans C. Andersen, Steven G. Boxer, John I. Braunman, James P. Collman, Carl Djerassi, Michael D. Fayer, Keith O. Hodgson, Wray H. Huestis, David M. Mason, Harden M. McConnell, Robert Pecora, John Ross, Edward I. Solomon, Barry Trost, Paul A. Wender, Richard N. Zare; (by Courtesy) Michel J. Boudart, Robert J. Madix

Assistant Professors: Wesley D. Allen, John W. Frost, Steven M. George, Lisa A. McElweee-White, Michael C. Furrung, Robert M. Waymouth

UNDERGRADUATE PROGRAMS
BACHELOR OF SCIENCE

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.

MINIMUM REQUIREMENTS

University writing and distribution requirements: Mathematics 19, 20, 21, 43; or 41, 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. Chemistry 133 is offered as staffing permits. In years when it is not offered, students may petition to substitute other courses relevant to their programs in consultation with their faculty advisors. 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.

TYPICAL SCHEDULE FOR FOUR-YEAR PROGRAM

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
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</thead>
<tbody>
<tr>
<td>Chem. 31.</td>
<td>Chemical Principles</td>
<td>4 — —</td>
</tr>
<tr>
<td>Chem. 33.</td>
<td>Structure and Reactivity</td>
<td>— 4 —</td>
</tr>
<tr>
<td>Chem. 35.</td>
<td>Monofunctional Compounds</td>
<td>— — 4</td>
</tr>
<tr>
<td>Chem. 36.</td>
<td>Chemical Separations</td>
<td>— — 3</td>
</tr>
<tr>
<td>Math. 19, 20, 21.</td>
<td>Calculus and Analytic Geometry</td>
<td>3 3 3</td>
</tr>
</tbody>
</table>

Writing and Distribution Requirements or Electives (See Note below)

Totals 15 15 18

SECOND YEAR

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
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</thead>
<tbody>
<tr>
<td>Chem. 131.</td>
<td>Polyfunctional Compounds</td>
<td>3 — —</td>
</tr>
<tr>
<td>Chem. 132.</td>
<td>Qualitative Organic Analysis</td>
<td>5 — —</td>
</tr>
<tr>
<td>Chem. 133.</td>
<td>Special Topics in Organic Chemistry</td>
<td>— 3 —</td>
</tr>
<tr>
<td>Chem. 134.</td>
<td>Theory and Practice of Quantitative Chemistry</td>
<td>— 4 —</td>
</tr>
<tr>
<td>Chem. 136.</td>
<td>Synthesis Laboratory</td>
<td>— — 3</td>
</tr>
<tr>
<td>Math. 43.</td>
<td>Analytic Geometry and Calculus</td>
<td>5 — —</td>
</tr>
<tr>
<td>Physics 51, 53-54.</td>
<td>Mechanics, Sound, Electricity</td>
<td>4 5 —</td>
</tr>
<tr>
<td>Electives (see Note below)</td>
<td>3 6 7</td>
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</table>

Totals 16 17 15

THIRD YEAR

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Qtr. &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem. 151, 153.</td>
<td>Inorganic Chemistry</td>
<td>3 3 3</td>
</tr>
<tr>
<td>Chem. 171, 173, 175.</td>
<td>Physical Chemistry</td>
<td>3 3 3</td>
</tr>
</tbody>
</table>

* The curriculum leading to the B.S. degree in Chemical Engineering is described in the “School of Engineering” section in this bulletin.
Fourth Year

Course No. Subject Qtr. & Units
Electives (see Note below) A W S
Totals .......................... 15 15 15

Note—Elective courses must be used to complete the University Writing, Distribution, and Language Requirements. 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: App. Ear. Sci. 105; Biochem. 200, 201; Biol. Sci. 40, 41, 42, 43; Chem. Engr. 20, 120, 130; Civ. Engr. 170, 175, 276A; Comp. Sci. 106, 135; Econ. 1; English 191; Engr. 50; Geol. 1, 278; Math 44, 106, 113, 130, 131, 132, Mat. Sci. & Engr. 50; Microbio. & Immun. 101; Physics 110, 111, 132; Stat. 20, 110, 116.

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 6 units from Chemistry 136, 172, and/or 190; and at least 3 additional units from one of the following: Chemistry 136, 172, 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.

Honor Program

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 letter grade indicator 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 9 units of Chemistry 190 to be taken 3 units per quarter for three quarters; and 9 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 work in Chemistry 190. An overall letter grade indicator of 3.3 in mathematics, physics, and chemistry is required for a degree 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.

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.

Graduate Programs

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 nine quarters. Students on research or teaching assistantships may complete their requirements in three to four 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 letter grade indicator 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 their 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 Quarter will be advised to repeat them during the first week of the Winter Quarter. All qualifying examinations will be given September 22, 23, and 24, 1988 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 3 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 the degree of 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 under the “School of Education, the Master of Arts in Teaching” section in this bulletin.

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 must be met in German. The foreign language requirement in physical, biophysical, or inorganic chemistry may be met in either French, Japanese, German, or Russian. The requirement may be met by completion of one year (two semesters or three quarters) of the given language at the college level, by receipt of a passing grade in a college level intensive reading course (e.g., German 10) or by successful completion of a reading test in the language given by the Chemistry Department. Candidates for the Ph.D. degree are required to participate continually in the department seminar (Chemistry 300), and in the division seminar of the major subject. In addition, continuous enrollment in Chemistry 301 is expected after the student has passed the qualifying examinations and chosen a research supervisor. Ph.D. candidates are required to gain experience as teaching assistants as part of their graduate training.

Inorganic Chemistry—All students majoring in inorganic chemistry are required to take: (1) Chemistry 271, 273, and 275 (or be exempted therefrom by passing special examinations administered by the professors in charge of these courses); (2) two courses from Chemistry 251, 253, or 255; (3) Chemistry 221 or 223 or 225; and (4) two additional courses (at least 6 units) of approved advanced lecture courses.

Organic Chemistry—All students majoring in organic chemistry are required to: (1) take Chemistry 221, 223, and 225 during the first year, irrespective of background—those who fail to maintain a letter grade indicator of at least "B" in these three courses may not become candidates for the Ph.D. degree in organic chemistry; (2) take Chemistry 271 (or be exempted therefrom by passing a special examination administered by the professor in charge of this course); (3) take Chemistry 233 in the second and third year (3 units); (4) take Chemistry 227 or an approved substitute; and (5) take two additional courses (at least 6 units) of advanced lecture courses outside of the field of organic chemistry.

Physical Chemistry—All students majoring in physical chemistry are required to take: (1) Chemistry 271, 273, and 275 (or be exempted therefrom by passing special examinations administered by the professors in charge of these courses) during the first year, irrespective of background; those who fail to maintain a letter grade indicator of at least "B" in these courses may not become candidates for the Ph.D. degree in physical chemistry; (2) 6 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 6 units) of advanced lecture courses outside of the fields of biophysical chemistry, physical chemistry, and inorganic chemistry.

Biophysical 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 283; and (3) two additional courses (at least 6 units) of advanced lecture courses in fields appropriate to their research interests to be chosen in consultation with their research supervisors.
Chemical Physics—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.

Ph.D. MINOR

Candidates for the degree of Doctor of Philosophy in other departments who wish a minor in chemistry must complete, with a letter grade indicator of "B" or better, 12 units of chemistry courses more advanced than those that meet the minimum requirements for a bachelor's degree in chemistry.

FELLOWSHIPS AND SCHOLARSHIPS

In addition to the University fellowships and scholarships that are open to properly qualified students, there are at present several departmental fellowships in chemistry. The Edward Curtis Franklin Fellowship, James W. McBain Memorial Fellowship, Frederick P. Whitaker Fellowship, William H. and Myrtle B. Sloan Scholarship, David L. and Lavinia 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 Card Scholarship and Eastman Kodak Scholarships 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—Laboratory fees required in laboratory courses, against which charges are made for breakage, are a minimum of $35 per quarter.

UNDERGRADUATE

1. Chemistry and the World About Us—For non-science majors. Scientific principles and methods with emphasis on chemistry. What science is and how chemistry plays a central role in today's technological society. Simple experiments are conducted outside of class. (DR:7)

<table>
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<tr>
<th>Course Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>CHEMISTRY 305</td>
<td>3 units, SPR (Harman) MWF 10</td>
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</table>

30. Introduction to Chemistry—For students with no high school chemistry preparation. Introduction to chemical principles: moles, valence, stoichiometry, definitions.

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<th>Description</th>
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<tbody>
<tr>
<td>CHEMISTRY 7</td>
<td>3 units, AUT (Hutchinson) MWF 9</td>
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<th>Course Code</th>
<th>Description</th>
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<tr>
<td>CHEMISTRY 7</td>
<td>4 units, AUT (Boxer, George) LEC (1) MWF 9; LEC (2) MWF 11, one recitation by arrangement</td>
</tr>
</tbody>
</table>

33. Structure and Reactivity—Organic chemistry, functional groups, hydrocarbons, stereochemistry, thermochemistry, kinetics, chemical equilibria. Prerequisite: 31. Pre-register in Chemistry Department. (DR:7)

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<tbody>
<tr>
<td>CHEMISTRY 7</td>
<td>4 units, WIN (Collman, Trost) LEC (1) MWF 9; LEC (2) MWF 11, one recitation by arrangement</td>
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</table>

35. Organic Monofunctional Compounds—Organic chemistry of oxygen, nitrogen aliphatic and aromatic compounds. Prerequisite: 33. Pre-register in Chemistry Department.

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<tbody>
<tr>
<td>CHEMISTRY 7</td>
<td>4 units, AUT (Pirrung) MWF 1:15</td>
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<tr>
<td></td>
<td>LEC (1) MWF 9; LEC (2) TTH 11-12:15, one recitation section by arrangement</td>
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</tbody>
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36. Chemical Separations—Techniques for separations of compounds; distillation, crystallization, extraction, and various chromatographic procedures. The lecture treats the theory while the laboratory provides practice. Prerequisites: 33 and concurrent or previous enrollment in 35. Preregister in Chemistry Department.

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<tbody>
<tr>
<td>CHEMISTRY 7</td>
<td>3 units, SPR (McElwee-White) LEC T 1:15; LAB T 2:15-6:05, or MWTH or F 1:15-5:05</td>
</tr>
</tbody>
</table>

130. Theory and Practice of Identification—Lectures on theory and interpretation of ultraviolet, infrared, nuclear magnetic resonance, and mass spectral data. Laboratory involves identification of unknowns and components of a mixture using derivatives and spectra. For students in biomedical sciences. (Chemistry
majors take 132.) Prerequisites: 35, 36, and concurrent registration in 131.

4 units, Aut (Frost); lec (1) TTh 9
lab MTW or Th 1:15-5:05

131. Organic Polyfunctional Compounds—
Aromatic compounds, polysaccharides, amino acids, proteins, natural products, dyes, purines, pyrimidines, nucleic acids and polymers.
Prerequisite: 35.
3 units, Aut (Hodgson) lec TTh 11-12:15
Win (Huestis) TTh 1:15-2:30

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.
5 units, Aut (Frost) lec TTh 8
plus lab MW 1:15-5:05 or TTh 1:15-5:05

133. Special Topics in Organic Chemistry—
Primarily for chemistry majors. Mechanisms, orbital symmetry, physical methods, biogenesis, synthesis. Prerequisites: 131 and calculus.
3 units, Win (Staff) MWF 11

134. Theory and Practice of Quantitative
Chemistry—Theory and practice of quantitative analysis. Methods include gravimetric, volumetric, spectrophotometric, and electrometric. Prerequisite: 132.
5 units, Win (Waymouth) lec TTh 11 plus
lec F 1:15; lab MW 1:15-4:05 or
TTh 1:15-4:05

135. Physical Chemical Principles—Terminal
physical chemistry for non-chemistry majors. Emphasis on 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 (Pecora) lec TTh 11-12:15
Spr (Allen) TTh 1:15-2:30

136. Synthesis Laboratory—Advanced synthetic methods in organic and inorganic laboratory chemistry.
3 units, Spr (Staff) lab MW or TTh 1:15-5

137A. Biosocial Aspects of Birth Control—
(Same as Human Biology 150A.) Problems of introducing a new, practical birth control method involve legal, political, cultural, and economic factors in addition to purely biological ones. A critical evaluation of logistic aspects of human fertility control. Limited to 45 with at least junior standing. Application for admission in Human Biology office.
6 units (Djerassi) not given 1988-89

151. Inorganic Chemistry I—Systematic introduction to theories of electronic structure, stereochemistry, and symmetry properties of inorganic and organometallic molecules. Topics: ionic and covalent interactions, electron-deficient bonding, and elementary ligand field and molecular orbital theories. Emphasis on the chemistry of the metallic elements. Prerequisites: 35 and 171.
3 units, Win (Hodgson) MW 1:15-2:30

153. Inorganic Chemistry II—A systematic presentation of the theoretical aspects of inorganic chemistry. Group theory; many electron atomic theory; molecular orbital theory, emphasizing general concepts and group theory; ligand field theory; application of physical methods to predict the geometry, magnetism, and electronic spectra of transition metal complexes; and theoretical aspects of electron transfer reactions. Prerequisites: 151 and 173.
3 units, Spr (Solomon) MW 1:15-2:30

171. Physical Chemistry—Chemical thermodynamics: fundamental principles, Gibbsian equations, equilibrium conditions, phase rule, systematic deduction of equations, gases, solutions. Prerequisites: 35; Mathematics 19, 20, 21 (or equivalent); and Physics 51, 53, 54 and previous or concurrent registration in Physics 55.
3 units, Aut (Andersen) MW 11-12:15

172. Instrumental Methods of Chemical Analysis—A series of laboratory experiments to gain familiarity with important instrumental techniques of chemical analysis, including elastic and quasi-elastic light scattering; and Raman, optoacoustic, and optogalvanic spectroscopy. Lectures on instrument design and signal-to-noise considerations, and a series of student seminars on each of the laboratory techniques.
3 units, Spr (Staff) lec T 10
plus lab Th 1:15-5

173. Physical Chemistry—Introduction to quantum chemistry: basic principles of wave mechanics, the harmonic oscillator, the rigid rotator, infrared and microwave spectroscopy, the hydrogen atom, atomic structure, molecular structure, valence theory.
3 units, Win (Boxer) MWF 11

174. Physical Chemistry Laboratory—Use of chemical instrumentation to study fundamental areas of physical chemical concern. Lectures introduce spectroscopy using group theory. Experiments include rotational-vibrational, laser Raman, and visible spectroscopy; x-ray diffraction; and an introduction to integrated circuit electronics. An understanding of the theory relevant to each experiment is empha-
sized. Prerequisites: 134 and previous or concurrent enrollment in 173. Recommended: Familiarity with linear algebra on at least the level of Mathematics 113S.

3 units, Win (Allen) lec TTh 10 plus
lab MW 2:35-5:25 or TF 1:15-4:05


3 units, Spr (Pecora) MWF 11

176. Physical Chemistry Laboratory—Continuation of 174, with focus on time-dependent and spin processes. Experiments include gas-phase kinetics, fluorimetry, nuclear magnetic resonance spectroscopy, and electron paramagnetic resonance spectroscopy. Prerequisites: 174 and previous or concurrent enrollment in 175.

3 units, Spr (George) lec TTh 9;
lab Tor W 1:15-4:05

Chemistry and the Life Sciences in Historical and Philosophical Perspective—(Enroll in Values, Technology, Science, and Society 145.) Traces the development of some selected problems involving interrelations between chemically and biologically based sciences and society.

4 units (Clayton) given 1989-90

GRADUATE

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.


3 units, Aut (McElwee-White) TTh 9-10:30

223. Advanced Organic Chemistry—Continuation of 221 with emphasis on physical methods. Prerequisite: 221 or consent of instructor.

3 units, Win (Trost) MW 10

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 (Wender) MW 10:30-12

227. Selected Topics in Organic Chemistry—May be repeated for credit. Possible topics include synthetic organic chemistry, photochemistry, inorganic-organic chemistry, bio-organic chemistry, reaction mechanisms, stereochemistry, structural chemistry of organic and biological molecules. Prerequisite: 225 or consent of instructor.

3 units, Aut, Spr (Staff) MWF 9

229. Organic Chemistry Seminar—Attendance is required of all graduate students majoring in organic chemistry.

1 unit, Aut, Win, Spr (Brauman) W 4

233. Creativity in Organic Chemistry—The art of formulating, writing, and orally defending a research progress report is practiced and criticized with the student using his own research as a vehicle. Required of all 2nd and 3rd year Ph.D. candidates.

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

251. Selected Topics in Advanced Inorganic Chemistry—May be repeated for credit. Prerequisites: One year of physical chemistry, consent of instructor.

3 units, Aut, Win, Spr (Staff) TTh 11

253. Advanced Inorganic Chemistry—Physical-inorganic and bioinorganic chemistry for inorganic chemists. Introduction to metalloenzymes as unique inorganic complexes, review of ligand field theory and its applications to spectroscopic and magnetic techniques, and an overview of metalloenzymes containing copper, iron, and molybdenum active sites. No background in biochemistry is necessary; however, group theory and a basic understanding of quantum mechanics and molecular orbital theory is assumed.

3 units, Win (Solomon)


3 units, Spr (Collman) TTh 10-12

257. Research Proposals in Inorganic Chemistry—Research progress reports (Autumn) and research proposals (Winter and Spring) are presented in oral and written form. Writing ability and oral defense is criticized as well as scientific content. Required of all second-year inorganic students.

1 unit, Aut, Win, Spr (Staff) by arrangement
259. Inorganic Chemistry Seminar—Attendance required of all graduate students majoring in inorganic chemistry.
   1 unit, Aut, Win, Spr (Staff) T 4

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 (Payer) MWF 11

273. Advanced Physical Chemistry—Advanced quantum mechanics and angular momentum theory emphasizing applications to spectroscopy. Topics: addition of angular momenta, transformation under rotation, time evolution operator, the Wigner-Eckart theorem, spherical tensor operators and density matrix methods. Also applications to: scattering theory, molecular energy levels and selection rules, resonance fluorescence and quantum beats, correlation functions in molecular spectroscopy, interaction of molecules with polarized light, and angular distribution of photofragments. Prerequisite: 271 or Physics 230.
   3 units, Win (Zare) MWF 10

275. Advanced Physical Chemistry—Basic principles and methods of statistical mechanics from the ensemble point of view, statistical thermodynamics, heat capacities of solids and polyatomic gases, chemical equilibria, equations of state of fluids, phase transitions. Prerequisite: 271.
   3 units, Spr (Andersen) TTh 11-12:15

277. Selected Topics in Physical Chemistry—May be repeated for credit. Possible topics: 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, Spr (Staff) by arrangement

283. Research Proposals in Physical Chemistry—Students 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 of a related area in physical chemistry. Written form, oral presentation, and scientific merit is evaluated. May be required of 2nd- and 3rd-year graduate students at the discretion of the research advisor.
   1 unit, Aut, Win, Spr (Staff) by arrangement

287. Biophysical Chemistry—The theoretical and experimental aspects of biophysical phenomena with emphasis on membrane biophysics and membrane biology. Prerequisites: Previous or concurrent registration in 171 and 173, or the equivalent.
   3 units, Spr (McConnell)

289. Biophysical Chemistry—Experimental methods in biophysics. Emphasis on spectroscopic techniques including magnetic resonance and optical methods. Prerequisite: 287.
   3 units, Win (Staff)

291. Biophysical Chemistry—Special topics in biophysical chemistry. Prerequisites: Previous or concurrent registration in 171 and 173, or the equivalent.
   3 units, Win (Staff)

293. Structural Inorganic Chemistry—Structural biophysical chemistry, x-ray crystallography and related techniques as used in biophysical research. Electron and optical microscopy and neutron diffraction. Prerequisite: 291 or consent of instructor.
   3 units, Spr (Staff) by arrangement

297. Biophysical Chemistry—Physical-inorganic and bio-inorganic chemistry for inorganic chemists. Introduction to metallo-enzymes as unique inorganic complexes. Ligand field theory and its applications to spectroscopic and magnetic techniques. Metalloenzymes containing copper, iron, and molybdenum active sites. No background in biochemistry is necessary. Group theory and a basic understanding of quantum mechanics and molecular orbital theory is assumed.
   3 units (Staff) TTh 11-12:15

299. Teaching of Chemistry—Techniques of teaching chemistry by means of lectures and laboratories. All teaching assistants in chemistry are required to register.
   1-3 units, Aut, Win, Spr (Staff) by arrangement

300. Department Seminar—Attendance is required of all graduate students, and all undergraduates registered for 190.
   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.
   2 units, Aut, Win, Spr (Staff) by arrangement
190. Introduction to Methods of Investigation
—For general character and scope, see 200. 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

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 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

CHICANO FELLOWS PROGRAM

(UNDERGRADUATE STUDIES ON MEXICAN SOCIETY AND CULTURE IN THE UNITED STATES)

Visiting Associate Professor: Richard R. Valencia
Teaching Fellows: Teresa Carrillo, Olga Vasquez

Recognition of the growing social importance and size of the Mexican-origin population of the United States has led many leading American universities to establish Chicano Studies programs. Since 1971, the School of Humanities and Sciences at Stanford has affirmed the educational necessity of providing academic opportunities for undergraduates to learn about Mexican society and culture in the United States by sponsoring the Chicano Fellows Program.

Since its inception the Chicano Fellows Program has had a dual purpose: to offer a selection of courses on the Mexican experience in this country; and to provide a teaching mentorship opportunity to advanced Stanford graduate students. Each year the program offers courses designed especially for undergraduates which are taught by visiting faculty and graduate fellows in various disciplines. These offerings are often innovative and experimental; they are usually given as seminars rather than as lecture courses.

In 1988-89, as in the six previous years, a scholar of outstanding national reputation will be appointed to teach a total of three courses of special interest to students wanting to develop a scholarly understanding of the nation’s second largest minority, a minority that within the next few decades is projected to become the majority population in several states, including California.

The program's annual offerings supplement and complement a small selection of outstanding courses on diverse aspects of Mexican society and culture in the United States taught by regular members of the Stanford faculty.

Information on course offerings within this new study area is available from the Program Administrator of the Chicano Fellows Program; telephone (415) 723-3091.

COURSES PROGRAM

For the 1988-89 Chicano Fellows Course Bulletin, please check with Program Administrator, Chicano Fellows Program, Bldg. 590, Rm. L (El Centro).

110. Introduction to Chicano Life and Culture—(Same as Anthropology 110, Spanish 135.) Interdisciplinary focus on the history and culture of Mexican Americans during the 19th and 20th centuries. Historical perspectives are balanced with anthropological and literary views focusing on the cultural patterns of Mexicans in the U.S. Offers the opportunity to interact with Chicano faculty from different disciplines. Historical texts, novels, poems, and ethnographies are the basis for required readings. (DR:5)

5 units (Camarillo, Cuellar) not given 1988-89

185. Chicano Politics—Seminar on assessment of the status, role, and experiences of Chicanos in the American political system; analyzes Chicano political development within the context of the larger political system. Topics: the pluralist, marxist, and internal colonial models of race relations; historical and contemporary styles and strategies for political action; the Latino electorate; Chicano leadership; and key policy issues for Chicanos and Latinos in the 1980's. Reading, discussion, individual work; class will design and carry out a group research project.

3 units, Spr (Carrillo)

191. Minorities in the Schooling Process—(Same as Education 191S.) social foundations of education; analyzes themes, competing theories, and research findings concerning historical and contemporary minority schooling aspects. Focus is on Chicano and Black students, particularly the former. Emphasis on the construct of "minority school failure." Topics: schooling outcomes, ideology, structural considerations...
that shape schooling inequality (segregation; curriculum differentiation; testing), psychological and sociocultural considerations of achievement, and reform efforts. Lecture/seminar.

4 units, Aut (Valencia) TTh 3:15-4:45

192. Educational Testing and Minority Students—(Same as Education 196S.) The impact on Chicano and Black students of intelligence, achievement, and competency testing, particularly the former. Topics: overview of the "language" of educational testing, development and evolution of the intelligence testing movement, testing and curriculum differentiation, controversy of test bias, testing and special education issues (overrepresentation of Chicanos in educable mentally retarded classes), psychological and sociocultural correlates of test performance, contemporary testing issues (high school minimum competency tests; teacher competency tests). Lecture/seminar.

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

193. Special Topics: Seminar on Minorities in the Schooling Process—(Same as Education 193S.) For students interested in select topics within the spectrum of minority schooling. Seminar forum for in-depth study, critical thinking, and debate. Under instructor's guidance, students investigate several areas (i.e., gifted minority students, minority dropout issues, school reform) submit written work, orally present their work, engage in field work and participate in seminar discussion. Recommended: 191.

4 units, Spr (Valencia) W 3:15-6:05

194. Literacy Issues in a Minority Setting—Overview of selected contemporary and historical perspectives on literacy affecting minority children; examines the assumed dichotomy between oral and written language, literacy as a cultural expression, and literacy as critical pedagogy using an interdisciplinary and comparative approach. Focuses on the literacy experiences of Blacks and Chicanos but includes other ethnic minorities. Topics: the different ways of viewing literacy, the relationships between oral knowledge and the acquisition of reading and writing skills, and the impact of school literacy on minority children.

3 units, Spr (Vasquez)

DEPARTMENTAL

For (DR) information, see the respective departments.

ENGLISH

162. Chicano Literature: Creative Writing for Bilingual Students—(Same as Spanish 162B.)

5 units, Aut (Islas)

SPANISH

11B. Second-Year Spanish for Bilingual Students—Designed for students of Hispanic background. Intensive study of grammar with emphasis on written Spanish. Short readings by and about Hispanics in the United States. Prerequisite: Pass Bilingual Placement Test.

4-5 units, Aut (Staff)

12B. Second-Year Spanish for Bilingual Students—Introduction to various Hispanic dialects, with emphasis on Chicano Spanish and bilingualism in speech and literature. Some grammar review.

4-5 units, Win (Staff)


4-5 units, Spr (Staff)

131B. Mexican and Chicano Cultural Readings—Includes selected grammatical problems and emphasis on oral expression.

3-5 units, Win (Sandoval)

CLASSICS

Emeriti: (Professors) Lionel Pearson, Antony E. Raubitschek
Chairman: Susan M. Treggiari
Professors: George Brown (English and, by courtesy, Classics), Edward Courtney, N. Gregson Davis (Classics and Comparative Literature), Andrew M. Devine, Kenneth J. Dover (Winter), Mark W. Edwards, Edwin M. Good (Religious Studies and, by courtesy, Classics), Michael H. Jameson (Classics and, by courtesy, History), Marsh H. McCall, Jr., Julius Moravcsik (Philosophy and, by courtesy, Classics), Susan Treggiari (Classics and, by courtesy, History), John J. Winkler
Associate Professors: Wilbur Knorr (History of Science), Sabine G. MacCormack (Classics and History), Jody Maxmin (Art History and Classics), Susan A. Stephens, Michael Wigodsky
Assistant Professors: Mark H. Munn, Bruce B. Rosenstock
Professor (Teaching): Edward W. Spofford
Lecturers: Robert Hamerton-Kelly (Classics and Religious Studies), Mary-Lou Munn, Evangelia Prionas
Visiting Associate Professor: Joseph Solodow (Autumn)
Visiting Assistant Professor: David A. Cherry
Webster Visiting Professor: G. M. Sifakis (Spring)
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, in ancient philosophy, and in classical art and archaeology. The wide selection of non-language courses (see “General Courses” below) is intended both for those who currently are taking a Western Culture sequence and for those who have already taken one and who desire more thorough knowledge of various aspects of the ancient world.

The major in classics 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 other departments such as English, Philosophy, History, and the modern languages.

Normally students who major in classics go on to careers in law, medicine, or business. Some students may elect to go on to graduate work, with a goal of teaching classics.

**UNDERGRADUATE PROGRAMS**

**ADMISSION**

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.

**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. If possible, students should complete the sequence of third-year courses (111, 112, 113) before taking courses in the fourth-year sequences (141-4, 151-4, 161-4, offered in successive years), and it is recommended that they include some work in Greek or Latin style and syntax (Greek or 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 (it is recommended that one of these courses be Greek Style and Syntax), two courses in ancient history, and one 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 (it is recommended that one of these courses be Latin Style and Syntax), two courses in ancient history, and one 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 perhaps the time or the background to study the languages to the extent required by the major in classics, Greek or Latin. The Classical Studies 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: At least 55 units made up of: (a) at least two courses in Latin or Greek at the 100 level or higher; or one course in one of the languages at the 100 level or higher, plus the 1, 2, 3, or 51, 52 series in the other language or an equivalent approved by the department; (b) at least one course in the department from each of the following groups: literature; philosophy and political theory; ancient history; religion and mythology; art and archaeology. A second course in ancient history is strongly recommended. In some cases courses in other departments may satisfy one or more of the above groups with permission of the Undergraduate Advisor.

For all Classical Studies majors, a summer at Stanford-in-Greece or a semester at the Rome Classical Center 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—A letter grade is required in all courses taken for the major. No course receiving a letter grade indicator lower than "C" may be counted toward fulfilling major requirements.

Note 3—Students who are contemplating graduate work in classics, or professional careers as teachers of Greek and Latin, might suitably follow either of the first two programs, 1 or 2. Program 3 covers 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 PROGRAMS
CLASSICS

Students who wish to be considered for Honors in Classics must complete the bachelor's degree program in one of the above ways. In addition, at the beginning of their senior year they must submit to the department a proposal for an Honors essay of about 25-30 pages, which should normally arise from the subject-matter of a previously taken course. If the proposal is approved, the student will take Greek, Latin or Classical Studies 199 during Autumn and/or Winter Quarters of the senior year for 5 units of credit per quarter and write the essay under the supervision of a member of the department. Honors will be awarded on the basis of the essay and the student's entire program in the department.

HUMANITIES

For majors in classics with appropriate interests, an Honors Program in Humanities is offered, a description of which will be found under the "Humanities Special Programs" section of this bulletin.

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. Students planning to apply to the center should note that they are normally expected to have prepared themselves by taking at least one Roman history course.

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 a program operated by Stanford. Both programs are study-tours, and the Stanford program usually includes archaeological fieldwork. The American School program is recommended principally for classics majors. The Stanford program is open to both classics and non-classics majors. All applicants (to either program) are required to take Classics 108, Topography and Monuments of Greece, and, after acceptance, Classics 31, Beginning Modern Greek. Students are encouraged to prepare themselves by taking other courses in Greek archaeology (especially Classics 127,
Archaeological Practicum), Greek history, and Greek art. Those interested should see the chairman of the Classics Department early in the academic year.

**GRADUATE PROGRAMS**

**MASTER OF ARTS**

Students who have completed an undergraduate major in classics (Greek and/or Latin) or its equivalent may be accepted as candidates for the degree of Master of Arts in Classics, or Master of Arts in Classics, field of Greek or Latin, and may expect to complete the program in 12 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, or written work accepted by the graduate committee as an equivalent.
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. Completion of 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 brochure 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), and also from sight.
   c) Three general written examinations; a supplementary general oral examination; one special author and one special field written examination.
   d) An oral examination on the candidate's dissertation subject and on two attinging areas, to be defined in consultation with the candidate.

3. The examinations in translation from Greek and Latin authors and from sight will normally be taken in the second year of graduate work, the general written and oral examinations and the special author and field examinations in 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 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.

Ph.D. MINOR
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), or 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:

First Year—Course work, almost entirely in classics. One translation exam possibly taken in June. One or both modern language exams taken.

Second Year—Course work, both in classics and the minor field. Translation exams completed. French and German exams completed.

Third Year—Course work, both in classics and the minor field. General examinations in classics and special exams in classics taken.

Fourth Year—Remaining course work, both in classics and the minor field. General examination in the minor field. Preparation for dissertation.


GRADUATE PROGRAM IN
INDO-EUROPEAN STUDIES
This program is administered by the Classics Department, and may be taken as a supplement to a Classics Ph.D. program. 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 “Humanities Special Programs” section in this bulletin.

COMPARATIVE LITERATURE
The Classics Department cooperates closely with the Graduate Program in the Comparative Literature Department. Interested students should consult the chairman of the department.

COURSES
GREEK
INTRODUCTORY

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 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 Quarters by consent of the instructor.

Students who have done previous work elsewhere in Greek should consult the department’s undergraduate advisor 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.

The intensive Greek course (Greek 10) offered in Summer Quarter also prepares students to enter Greek 101 in Autumn Quarter.

1. First-Year Greek—For beginners.
   5 units, Aut (Rosenstock) MTWF 9
2. **First-Year Greek—Continuation of 1.**
   5 units, Win (Rosenstock) MTWF 9

3. **First-Year Greek—Continuation of 2.**
   5 units, Spr (Staff) MTWF 9

10. **Intensive First-Year Greek**—Intensive beginning Greek equivalent to 1, 2, 3 or 51, 52. The goal is the reading of easy classical or New Testament Greek by the end of the Summer Quarter. Short readings in philosophical Greek are included.
   8 units, Sum (Staff) MTWThF 10-12

51. **First-Year Greek—Accelerated course.**
   6 units, Win (Edwards) MTWThF 1:15

52. **First-Year Greek—Continuation of 51.**
   6 units, Spr (Edwards) MTWThF 1:15

**INTERMEDIATE**

101. **Second-Year Greek**—Reading of selections from Plato.
   5 units, Aut (Solodow)
   *review session by arrangement*

102. **Second-Year Greek**—Euripides, one play.
   5 units, Win (Stephens)

103. **Second-Year Greek**—Homer, *Odyssey*.
   5 units, Spr (Rosenstock)

104. **New Testament Greek.**
   2-3 units, Win (Hamerton-Kelly)

111. **Sophocles**—One play.
   4 units, not given 1988-89

113. **Attic Prose.**
   4 units, Aut (Jameson)

**ADVANCED**

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.

151. **Herodotus.**
   4 units, Win (Munn)

154. **Hesiod and Lyric.**
   4 units, Spr (Rosenstock)

155. **Plato’s Cosmology**—(Same as History of Science 113, Philosophy 113.) The world of order and creation that Plato elaborates in his dialogue *Timaeus.* His debt to earlier thinkers: materials from the Presocratic natural philosophers and the Hippocratic medical writers. The impact of Plato’s system: discussions from Aristotle (*On the Heavens, Metaphysics*), and Lucretius (*On the Nature of Things*). Issues: Is the world unique? Is it finite or infinite? Was it created, or is it eternal? Does the order in the world result from natural necessity or intelligent design? For additional credit, with the appropriate preparation in Greek language, extra weekly section is offered on passages from the Greek texts.
   4-5 units, Spr (Knorr) plus section

160. **Individual Work**—For department majors only.
   *by arrangement*

163. **Plato.**
   4 units, not given 1988-89

166. **Aristophanes.**
   4 units, not given 1988-89

**UNDERGRADUATE AND GRADUATE**

175A,B. **Greek Style and Syntax**—The nuances of Greek syntax and style. Stylistic analysis of selected prose authors, techniques of sight-translation, and the writing of idiomatic Greek prose. Designed for the major, but all enrollees in Greek language courses are encouraged to take 175A as soon as possible after the completion of 103.
   4 units, Aut (Solodow)
   2 units, Win (Solodow)

176. **Senior Seminar.**
   3 units, *by arrangement*

199. **Undergraduate Thesis.**
   *by arrangement*

**GRADUATE**

201. **Introduction to Classical Scholarship.**
   1 unit, Aut, Win, Spr (Courtney, Staff)

202. **Tutorial in Greek Poetry.**
   3 units, Aut, Win (Jameson, Dover)

205A,B. **Greek Language and Style.**
   2 units, Win (Stephens)
   4 units, Spr (Stephens)

The above courses are offered every year. Other courses alternate or vary each year. (See also seminars listed under Latin, literature, philosophy, ancient history, religion and mythology, art and archaeology, Indo-European linguistics, and history of science.)

260. **Directed Reading.**
   *by arrangement*

270. **Greek Prose or Verse Composition.**
   *by arrangement*

271. **Pronunciation of Greek II: Accent, Intonation, Rhythm**—Reconstruction of nonsegmental phonology of classical Greek on the basis of a combination of philological evidence (orthography, grammarians, verse, music) and typological evidence derived from living languages. Prerequisite: Permission of instructor.
   5 units, Aut (Devine)
326. Sophocles.  
5 units, Win (McCall)

345. The Transmission of Greek Texts 400 B.C.-1400 A.D.  
5 units, Win (Dover)

346. Greek Orators.  
5 units, Spr (Stephens)

1-15 units, any quarter (Staff) by arrangement

Note—Some of the courses listed above 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.

MODERN GREEK

31. Beginning Modern Greek.  
3 units, Spr (Prionas)

See also the Linguistics Department's Special Language Program for other courses in Modern Greek.

LATIN

INTRODUCTORY

Students with no previous experience may begin the study of Latin with either Latin 1 or 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 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 Quarter by consent of the instructor.

Students whose major work is in another department and who wish to fulfill a departmental foreign language requirement by taking Latin should consult their departmental advisors to determine what courses will be required, but most departments will be satisfied if part of the series 101, 102, 103 is completed.

The intensive Latin course (Latin 10) offered in Summer Quarter also prepares students to enter Latin 101 in Autumn Quarter.

1. First-Year Latin—For beginners.  
5 units, Aut (Chapman) MTWF

2. First-Year Latin—Continuation of 1.  
5 units, Win (Davis) MTWF

3. First-Year Latin—Continuation of 2.  
5 units, Spr (Veit) MTWF

10. Intensive First-Year Latin—Intensive beginning Latin equivalent to Latin 1, 2, 3 or 51, 52. The goal is the reading of easy Latin prose and poetry by the end of the Summer Quarter. 8 units, Sum (Staff) MTWThF 10-12

51. First-Year Latin—Accelerated course.  
6 units, Win (Devine) MTWThF 1:15

52. First-Year Latin—Continuation of 51.  
6 units, Spr (Devine) MTWThF 1:15

INTERMEDIATE

Students will be admitted to these courses by completing Latin 3 or 52 or on the basis of previous work done in secondary school or elsewhere. Usually two years of secondary school Latin qualifies a student for 101, three or four years for 111. New students should determine for which course they are best fitted by taking the Latin placement examination, which is set every autumn in orientation week, or by consultation with the department's undergraduate advisor.

5 units, Aut (Devine) with review session by arrangement

5 units, Win (Courtney) with review session by arrangement

103. Second-Year Latin—Selections from Virgil, Aeneid.  
5 units, Spr (Davis) with review session by arrangement

111. Horace, Odes.  
4 units, Aut (Myers)

113. Latin Elegy.  
4 units, not given 1988-89

118. Post-Classical Latin—Careful reading of Latin texts of graded difficulty, including late pagan writers, patristic writings, medieval literature, and Latin of the Renaissance. 4 units, not given 1988-89

ADVANCED

4 units, not given 1988-89

144. Lucretius.  
4 units, not given 1988-89

154. Latin Historiography.  
4 units, Spr (MacCormack)

155. Cicero Pro Caelo.  
4 units, Win (Cherry)

160. Individual Work—For department majors only.  
by arrangement
176. Senior Seminar.
3 units, by arrangement

177. Introduction to Paleography and Codicology—(Same as English 209.) Introduction to late antique and medieval manuscripts in Latin, medieval Latin and vernacular scripts, and the materials and composition of the medieval book.
5 units, Spr (Brown)

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.

UNDERGRADUATE AND GRADUATE

175A,B. Latin Style and Syntax—The nuances of Latin syntax and style. Stylistic analysis of selected prose authors, the techniques of sight-translation, and the writing of idiomatic Latin prose. Designed for the major, but all enrollees in Latin language courses are encouraged to take 175A as soon as possible after the completion of 103.
4 units, Aut (Courtney)
2 units, Win (Courtney)

201. Introduction to Classical Scholarship.
1 unit, Aut, Win, Spr (Courtney, Staff)

3 units, Aut, Win (Courtney, Edwards) TTh

205A,B. Latin Language and Style.
2 units, Win (Treggiari)
4 units, Spr (Treggiari)

The above courses are offered every year. Other courses alternate or vary each year. (See also seminars listed under Greek, literature, philosophy, ancient history, religion and mythology, art and archaeology, Indo-European linguistics, and history of science.)

260. Directed Reading.
1-15 units, by arrangement

270. Latin Prose or Verse Composition.
by arrangement

325A,B. Vergil Eclogues and Pastoral Poetry.
5 units, not given 1988-89
2 units, not given 1988-89

5 units, Spr (Courtney)

335. Classical Conventions in European Lyric—Analyzes and compares examples of a few central rhetorical conventions of the European lyric against the background of their classical antecedents. Also, non-European variants of the conventions. Topics: encomiastic topoi, generic disavowals (recusatio), and the priamel.
5 units, Win (Davis)

1-15 units, any quarter (Staff) by arrangement

363. Roman Novel.
4 units, not given 1988-89

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.

GENERAL

No knowledge of Greek or Latin is required for these courses, except for those at the 200 level. Most of them are suitable both for those who have taken a Western Culture sequence and desire more thorough knowledge of some aspects of the ancient world, and for those who are currently enrolled in the Western Culture Program.

NON-LANGUAGE

UNDERGRADUATE LEVEL

3. Democracy and Imperialism.

8. Political Philosophy in Classical Antiquity.

11. Age of Heroes.

12. Greek Tragedy.


18. Greek Mythology.

20. Introduction to Classical Archaeology.


65. Greek Philosophy.

101. Greek History.

102. Greek and Roman History.

103. Roman History.


108. Topography and Monuments of Greece.

117. Greek Religion and Society.

120. Greek Vase Painting.

127. Archaeological Practicum.

138A,B,C. Introduction to Cosmology.

140. Topics in History of Mathematics.

165. Hellenistic Philosophy.
172. Classical Influences in Modern Literature.


176. Athens in the Age of Demosthenes and Alexander.

181. Roman Society in the Age of Cicero and Augustus.

182. Rebuilding the Republic.

183. Law and Life in Rome.

185. The Roman Army and Frontiers.

201. Beyond Black Figure Painting.

ANCIENT HISTORY

These courses are accepted by the History Department for credit toward a major in history.

101. History of Greece—A survey of the history of ancient Greece from the Bronze Age through the Age of Pericles to the death of Alexander the Great (323 B.C.). (DR:5)
   4-5 units, Aut (Cherry) MTWTh 1:15

102. Greek and Roman History from Alexander to Caesar—A survey of the Mediterranean world from Alexander the Great to Julius Caesar (ca. 340-30 B.C.), including brief earlier Roman history from the foundation of Rome (ca. 750 B.C.); emphasis on the Hellenistic monarchies and the Roman Republic. (DR:5)
   4-5 units, Win (Cherry)

103. History of the Roman Empire—A survey of the Roman Empire from its beginnings under Augustus through its consolidation and later crises, to its transformation under Constantine into the Christian Roman Empire of the early Middle Ages (ca. 30 B.C.-330 A.D.). (DR:5)
   4-5 units, Spr (Cherry)

104. Early Christianity—(Same as Religious Studies 142.) History, literature, and art of the Christian movement to 500 A.D., emphasizing community organization and rituals, debates about orthodox and heretical doctrine, and interactions with other religions.
   5 units, Aut (Gregg)

107. Art, Religion, and Society in Late Antiquity (284-717 AD)—A turning point in world history. Why did the Roman empire fall? Invaders shattered the political unity of the empire, while Christianity transformed its religion and culture. Yet, by constructing a series of tensions between old and new, secular and sacred, this “decline” created concepts and images which shaped European thinking for centuries. Visual and literary documentation. (DR:5)
   5 units, Win (MacCormack)

109. Greek Civilization in Italy—(Same as Overseas Studies-Florence 109, History 214V.)
   4-5 units, Spr (Jameson)

160. Individual Work in Ancient History.
   by arrangement

183. Law and Life at Rome—The law of persons during the classical period of Roman law, from Cicero to the great jurists of the late 2nd and early 3rd century A.D. Original sources (in translation): the letters of Cicero and Pliny, the introductory textbook of Gaius and the extracts from legal writings collected in Justinian’s Digest. Emphasis on family law and slavery. The object is to study Roman law in its social context and to provide an opportunity to produce research papers.
   4 units, not given 1988-89

175/275. Athens 403-350 B.C.: Athens in the Age of Plato—(Undergraduate colloquium also open to graduate students). A history dealing with politics and ideology, and social and economic developments and archaeology in the two generations after the Peloponnesian War.
   4 units, Spr (Munn)

184. Asceticism in Pagan and Christian Antiquity—(Same as Religious Studies 241.) Battles of flesh and spirit, as seen in philosophical and medical writings, Roman educational disciplines, and in the emergent theories and practices of early Christian monasticism.
   4-5 units, Spr (Gregg)

185/285. The Roman Army and Frontiers—(Same as History 214/314, undergraduate colloquium also open to graduate students.) The army and the frontiers of the Roman provinces from Augustus to Constantine (ca. 30 B.C.-330 A.D.) Original sources (in translation): mainly inscriptions and papyri. An introduction to the archaeology of the Roman frontiers. Emphasis on Roman Germany and north Africa examining the function of the Roman frontiers and the social, economic, and cultural impact of the army on the frontier regions in which it was stationed.
   4 units, Aut (Cherry)

189. Colloquium: Settlement and Economy of Tuscany before the Modern Era—(Same as Overseas Studies-Florence 189.)
   3-4 units, Spr (Jameson)

Courses at the 200 level are mainly for graduate students.

261. Individual Work in Greek History.
   by arrangement

262. Individual Work in Roman History.
   by arrangement
336A, B, C. Problems in Roman History—
Some of the problems in late Republican and early Imperial history, spread out over the academic year to allow for reading sources and modern bibliography. Specifically intended as help towards preparation for the Classics General Exam.
6 units, Aut, Win, Spr (Treggiari)

1-15 units, any quarter (Staff)
by arrangement

ART AND ARCHAEOLOGY
See also Art 5, 100 A, B.

14. Classical Athletics—(Same as Athletics, Recreation, and Physical Education 110.) The origins and history of competitive sport in the ancient world, from the funeral games for Patroclus (Homer) to chariot races in the Hippodrome of Constantinople, based on the literary and monumental evidence. Emphasis on the spirit of competition apart from athletics. Lectures (illustrated) and discussion groups. (DR:5)
2-3 units, Spr (Raubitschek)

20. Introduction to Classical Archaeology—
The history of archaeological exploration in the Mediterranean from the Renaissance to the present day, and the principal archaeological discoveries of the Greek and Roman world. Great moments of discovery and decipherment. The present state of archaeological research into classical antiquity. (DR:5)
4 units, Spr (M. L. Munn)

108. Topography and Monuments of Greece —
A survey of the principal cities, sanctuaries, and historical places from the Mycenaean era to the Roman period. Familiarizes students with the physical setting of Greek history and culture, and prepares students for travel and study in Greece.
3-4 units, Win (Munn)

120. Greek Vase-Painting—(Same as Art 102.)
A survey of Greek vases and their painters from the Protogeometric period onwards. Emphasis on the masters of Athenian black-figure and red-figure painting, and to the problems involved in distinguishing individual hands.
4 units, Aut (Maxmin)

127. Archaeological Practicum.
2 units, Aut, Win, Spr (M. L. Munn)
F 2:15-4:05

160. Individual Work in Human Settlement and Landscape in the Aegean.
by arrangement
Courses at the 200 level are mainly for graduate students.

201. Beyond the Development of Attic Black-Figure Painting—(Enroll in Art 201.)
4 units, Spr (Maxmin)

260. Individual Work in Human Settlement in Landscape in the Aegean.
by arrangement

1-15 units, any quarter (Staff)
by arrangement

HISTORY OF SCIENCE
The Classics Department participates in the History of Science Program. For a description of the program see the "History of Science Program' section in this bulletin.

138A, B, C. Introduction to Cosmology —
(Same as History 138A, B, C, History of Science 138 A, B, C, Philosophy 138 A, B, C.) A three-quarter sequence on the history of the exact sciences, emphasizing cosmology. Technical aspects of the classical theories (Ptolemaic and Copernican), including mathematics, astronomy, physics, and chemical theory, together with speculative aspects in natural philosophy and theology...

138A. Ancient Period—(DR:3; also satisfies Area 6 when taken in sequence with 138B.)
4 units, Aut (Knorr)

138B. Middle Ages to Newton—(DR:3; also satisfies Area 6 when taken in sequence with 138A.)
4 units, Win (Knorr)

138C. Newton to Einstein—(DR:3; also satisfies Area 6 when taken in sequence with 138A.)
4 units, Spr (Magnus)

140. Topics in the History of Mathematics: From Antiquity to the 17th Century—(Enroll in History of Science 140, History 138D, Philosophy 140.)
3 units, Spr (Knorr)

INDO-EUROPEAN LINGUISTICS

5 units, not given 1988-89

LITERATURE

12. Greek Tragedy: Aeschylus, Sophocles, Euripides—(Same as Drama 153.) Intensive reading of 12-15 tragedies. Emphasis on placing the plays in their 5th-century Athenian context and on problems of staging and audience expectations. (DR:2)
3-4 units, Win (McCall)

160. Individual Work—For department majors only.
by arrangement

260. Directed Reading.
1-15 units, by arrangement
PHILOSOPHY AND POLITICAL THEORY
See also Philosophy 111, 112, 211.

3. Democracy and 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, the oligarchical states, formed around Sparta and Corinth, and after a long war Athens was defeated. Translated original sources show the development and interrelationships of democracy and imperialism, identifying the universal principles involved. (DR:3)
3 units, not given 1988-89

8. Political Philosophy in Classical Antiquity—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:3)
2-3 units, Win (Raubitschek)

65. Greek Philosophy—(Same as Philosophy 100.) The philosophies of Plato and Aristotle with some pre-Socratic background. (DR:3)
4 units, Win (Roberts) MWF 11

RELIGION AND MYTHOLOGY

18. Greek Mythology—Cosmology, the Herakles legend, the Underworld, Platonic myth-making, modern survivals, and the nature of myth itself. Readings are supplemented with material drawn from Greek art and modern Greek folklore. (DR:3)
3-4 units, Win (Rosenstock) MWF 11

117. Greek Religion and Society—The origins and development of Greek religious phenomena from Mycenae to Byzantium. (DR:5)
3-4 units, not given 1988-89

376. Alien Gods: Perception of Pagan Religion in Early Modern Europe—(Same as History 212B/312B.)
5 units, Spr (MacCormack, Ryan)

GRADUATE SEMINARS, 1988-89

Graduate seminars vary each year. In 1987-88, there were seminars on Homer, Aeschylus, Greek Prose Style, Vergil’s Eclogues, the Roman novel, Attic cults, the Roman family. The following are offered this year:

ANCIENT HISTORY

175/275. Colloquium: Athens 403-350 B.C.—Athens in the Age of Plato—(Undergraduate colloquium also open to graduate students.) The politics and ideology, social and economic developments, and archaeology in the two generations after the Peloponnesian War.
4 units, Spr (Munn)

185/285. Colloquium: The Roman Imperial Army and Frontiers—(Same as History 314; undergraduate colloquium also open to graduate students.) The army and the frontiers of the Roman provinces from Augustus to Constantine (ca. 30 B.C.-330 A.D.). Original sources (in translation): mainly inscriptions and papyri. The archaeology of the Roman frontiers. Emphasis on Roman Germany and north Africa. The function of the Roman frontiers and the social, economic, and cultural impact of the army on the frontier regions in which it was stationed.
4 units, Aut (Cherry)

336A,B,C. Problems in Roman History—The problems in late Republican and early Imperial history, spread over the entire academic year so students have time to read sources and modern bibliography. Specifically intended as help towards preparation for the Classics General Exam.
6 units, Aut, Win, Spr (Treggiari)

376. Alien Gods: Perception of Pagan Religion in Early Modern Europe—(Same as History 212B/312B.)
5 units, Spr (MacCormack, Ryan)

GREEK

271. Pronunciation of Greek: Accent, Intonation, Rhythm—Reconstruction of nonsegmental phonology of classical Greek on the basis of a combination of philological evidence (orthography, grammarians, verse, music) and typological evidence derived from living languages. Prerequisite: Permission of instructor.
5 units, Aut (Devine)

326. Sophocles.
4 units, Win (McCall)

5 units, Win (Dover)

346. Greek Orators.
5 units, Spr (Stephens)

LATIN

330. The Arrival of Alexandrianism in Rome. 4 units, Spr (Courtney)

335. Classical Conventions in European Lyric—Analyzes and compares a few central rhetorical conventions of the European lyric against the background of their Classical antecedents and Non-European variants of the conventions. Topics: encomiastic topoi, generic disavowals (recesatio), and the priamel.
4 units, Win (Davis)
COMMUNICATION

Emeriti: (Professors) Nathan Maccoby, Lyle M. Nelson, William Rivers; (Professor Teaching) Ronald Alexander; (Adjunct Professor) Julian Blaustein; (Lecturer) Jules Dundes

Chairman: Steven H. Chaffee
Director, Institute for Communication Research: Donald F. Roberts
Director, John S. Knight Fellowships for Professional Journalists: James V. Risser; (Managing Director) Harry N. Press
Director, Mass Media Institute: Jules Dundes

Professors: Elie Abel, Henry S. Breitrose (on leave, Spring), Steven H. Chaffee, Byron B. Reeves, Donald F. Roberts; (by Courtesy) Richard A. Brody, Michael L. Ray, Eugene J. Webb

Assistant Professors: Jeremy Cohen, June Flora, Clifford Nass

Professors (Teaching): Marion Lewenstein, James V. Risser

Associate Professors (Teaching): Jan Krawitz, Kristine Samuelson

Lecturers: Jules Dundes, Harry Press, Paul Voakes

Consulting Professor: Edwin B. Parker

The Department of Communication engages in research in communication and offers curricula leading to the A.B., A.M., and Ph.D. degrees. The Master of Arts degree prepares students for careers in journalism or documentary film. The Ph.D. degree leads to careers in teaching and research or other related specialties.

The Institute for Communication Research offers research experience primarily to advanced Ph.D. students.

The John S. Knight Fellowship Program brings promising mid-career professional journalists to the University to study for nine months in a non-degree program. Twelve U.S. journalists are joined by six International Fellows sponsored by Reuter Foundation, the German Marshall Fund of the United States, the Knight Foundation, and others.

ADMISSION

Prospective undergraduate students—Write to the University’s Office of Admissions, Stanford University, Stanford, California 94305.

Prospective graduate students—Write to the Graduate Admissions Office.

The department requires that applicants for graduate admission include verbal and quantitative scores from the Graduate Record Examination (area scores are optional).

COMMUNICATION 321

BACHELOR OF ARTS

The undergraduate curriculum is intended for liberal arts students who wish to build a fundamental knowledge of the communication function in society. Undergraduate majors take a core group of seven courses within the Communication Department, plus a selection of elective courses. In addition, undergraduate students will take one class in statistics and one class in elementary computer science programming, both offered in other departments. A student may be exempt from the computer sciences class if its equivalent has been taken in high school.

The core courses include both practicum and theory courses in media and society, print and broadcast journalism, visual communication (film/videotape), and communication research. Through electives, including an optional senior project, students may choose to build greater depth in any of these areas.

To be recommended for the Bachelor of Arts degree in Communication, students must complete at least 50 units and preferably not more than 60 units within the Communication Department, plus statistics and computer science (unless exempted from the latter). Not more than 12 units of transfer credit or Summer Session credit may be applied to meet department requirements. The seven core courses equal 33 units. An additional 17 elective units must be taken within the Communication Department. In addition, a statistics course offered in the Psychology, Statistics, or Human Biology Departments is 5 units and the computer science course is 4 units.

The statistics and computer science courses may be taken for Pass/No credit. All Communication Department courses required to fulfill departmental requirements must be taken for a letter grade unless offered only for Pass/No credit.

CURRICULUM

1. Students should declare the major during either the sophomore or junior year. Prior to, or concurrent with declaring a major in communication, students must have completed:
   a) Communication 1, Mass Communication and Society (core course)
   and have completed, or be enrolled in:
      b) Psychology 60, or Statistics 60, or Statistics 70, or equivalent course
      c) Computer Science 105A or 105B or equivalent.
These three courses are prerequisites, in varying combinations, for the remaining six core courses, which may be taken in any sequence (as long as additional prerequisites for certain courses are also met):

2. a) 104, Reporting and Writing the News (prerequisite: 1; Statistics; Computer Science)
b) 106, Research Methods (prerequisite: 1; Statistics)
c) 108, Mass Communication Theory (prerequisite: 1; Statistics; Computer Science)
d) 110, Communication Media and the Law (prerequisite: 1)
e) 114, Introduction to Film and Video (prerequisite: 1 and 104, or consent of instructor)
f) 140, History of Journalism; or 141, History of Film (prerequisite: 1)

Senior students interested in working one-on-one with a faculty advisor may apply to faculty of their choice for a Senior Project (190, 5 units). If accepted, a mutually agreeable project will be fashioned. This may be a research project, including literature review and analysis on a selected topic or an experimental research project; or production of a finished piece of work in print or broadcast journalism, or in film. It may be possible, under some limited circumstances, to combine the senior project with an internship.

GRADUATE PROGRAMS

MASTER OF ARTS

The Master of Arts degree is awarded by the department in the fields of Journalism or Documentary Film Production. The Master of Arts programs are terminal degree programs designed to train practitioners. Students interested in doctoral programs are evaluated for admission on different criteria, and students who complete the A.M. degree and who desire application to the Ph.D. program must file a new application for admission. They will be considered together with all other doctoral applicants. General requirements for the A.M. are as follows:

1. Candidates must earn at least 45 units in graduate residence at Stanford, and they must maintain a high academic performance during their entire program of study. At least 35 of the 45 units must be in courses numbered 200 or higher, and the other units in courses numbered 100 or above. 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, although it is typical that film students spend some time longer, depending on the complexity of their film project. A.M. journalism graduates are expected to finish within one academic year (three quarters). 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 in the Documentary Film master's program are required to take Communication 223A,B,C and 224A,B,C. Additional courses in film aesthetics, history, and criticism are offered. Students may select other relevant courses, in consultation with their advisors, from within or outside the department.

Note—While the department maintains film production facilities for teaching and research purposes, the costs of supplies and processing services are the responsibility of the student. These costs currently approximate $2,500 for the three quarters.

Students in the Journalism master's program are required to take: Communication 204, 205, 208, 210, 235, 275, and 290.

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. Following completion of the first-year core program, students take advanced courses and seminars in Communication and related social science departments. Each student builds several research specialties relating communication to the study of campaigns, children, families, health, law, opinion formation, organizations, politics and voting, psychological processing, and technology and work. 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 qualifying examinations by the beginning of the second academic year of study and two specialized area examinations by the completion of the third academic year of study.
3. Demonstrate proficiency in tools required in the 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. Complete a dissertation satisfactory to an advisory committee of three or more faculty members and to the University Committee on the Graduate Division.
7. Pass the University oral examination, which is a defense of the dissertation.

Students are expected to complete departmental examinations and a first-year project by the end of the second year of study, after which they must apply to the University for candidacy.

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 (Communication) course requirements:

1. 311A, Theory of Communication I
2. 311B, Theory of Communication II
3. 313, Computer Analysis of Communication Research Data
4. 317, Doctoral Research Methods I
5. 318, Doctoral Research Methods II
6. 319, Doctoral Research Methods III

One of the following two-quarter statistics sequences should be completed by the end of Winter Quarter in the first year:

1. Psychology 60, Statistical Methods
2. Statistics 160, Introduction to Statistical Methods I
3. Education 250A and B, Statistical Analysis in Educational Research
4. Any two equivalent courses

Students must also complete a third course that will advance their knowledge in a broad area of statistics, preferably in multivariate analysis. Each of the following courses would satisfy the requirement:

1. Psychology 152, Analysis of Data
2. Statistics 201, Introduction to Data Analysis
4. Statistics 206, Applied Multivariate Analysis
5. Education 250C, Statistical Analysis in Educational Research II
7. Any equivalent course agreed to by the department

In addition, students must complete a minimum of four other advanced Communication Theory courses (numbered 370 and higher). Specification of these courses depends on (1) individual student needs in order to prepare for preliminary and area examinations, and (2) 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:

1. Communication 397, First-year Research Project
2. 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

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, and will be examined by a representative of this department. 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 often available to qualified Ph.D. students in Communication. Among the qualifications that 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 eight week-long workshop production courses in Film, Radio/Television, Broadcast News, 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, New Technologies, Communication Law, and Mass Communication in Society are also offered. Stanford undergraduates may apply a maximum of 12 units to their Communication major requirements.

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

(*Core Courses)

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.

   *5 units, Aut (Cohen)

   sections by arrangement

101. Film Aesthetics—(Graduate students register for 201.) A theoretical, historical examination of the nature of the film medium. Emphasis to the problems of aesthetics and communication from the viewpoints of the practitioner, the critic, and the audience.

   4 units, Spr (Breitrose) not given 1988-89

   3 units, Sum (Staff)

104. Reporting and Writing the News—A reporting and writing course emphasizing various forms of journalism: news, broadcast, interpretation, features, opinion. Detailed criticism of writing. Prerequisites: Statistics; Computer Science; typing speed of 35 words a minute.

   *5 units, Aut (Lewenstein)

   Win (Abel)

   Spr, Sum (Staff)

105S. The New Technologies—The technological, institutional, and societal aspects of the new technologies: CATV, direct broadcast satellites, videotapes and video disk, text handling, and information management.

   3 units, Sum (Staff)

106. Communication Research Methods—(Graduate students register for 206.) Formulation of research problems, research design, sampling, data collection, and analysis. A variety of studies are critically evaluated. The class designs and conducts a small communication study. Prerequisites: Statistics, Computer Science.

   *4 units, Win (Nass)

108. Mass Communication Theory—(Graduate students register for 208.) Models of mass communication processes and effects, and the relationships between media, individuals, and society.

   *5 units, Aut (Roberts)

110. Communication Media and the Law—(Graduate students register for 210.) An introduction to mass communication law and policy. Issues such as libel, privacy, newsgathering, and broadcast regulation explore the roles of law on communication and introduce the application of communication research to law and policy formation. Prerequisite: 1.

   *5 units, Spr (Cohen)

114. Introduction to Film and Video—Preparation of visual media from conceptualization to completion of various super-8 and video assignments. Written preproduction of media projects is emphasized in conjunction with the practical visual and aural techniques necessary
for executing ideas on film and tape. Prerequisites: 1 and 104, or consent of instructor.

5 units, Aut (Samuelson)
Win (Krawitz)
Spr (Staff)

115. Ethnographic Film—(Same as Anthropology 128.) Nature of the ethnographic film as a documentary form through viewing and analysis of classical and current films; also 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.

5 units, Spr (Gibbs)

117. 16mm Film Production—A practical, hands-on course taken concurrently with 118 by those interested in a career in motion picture production. Provides a thorough grounding in the basic principles of film production through a series of 16mm exercises and the production of a short 16mm film. Prerequisites: Successful completion of 114 and consent of instructor. Lab fee to be announced.

5 units (Krawitz) not given 1988-89

118. Advanced Film Writing and Directing for Documentary Films—Develops writing skills for the pre-production, production, and post-production of visual media. Emphasis on research, treatments, and the writing of narration for documentary film. The skills and techniques of directing are developed and applied in actual production of 16mm films in 117, taken concurrently. Prerequisites: Successful completion of 114 and consent of instructor.

5 units (Krawitz) not given 1988-89

122. Documentary Film—(Graduate students register for 222.) Analysis of the techniques and strategies of films designed to effect attitudinal and behavioral change. Prerequisite: Consent of instructor.

4 units, Aut (Breitrose)

136. Broadcast Journalism—(Graduate students register for 236.) A survey of broadcast journalism focusing on commercial and public broadcast news outlets. Not a pre-professional skills course; students are introduced to broadcast newswriting and prepare tapes for radio news broadcast. Additional lab. Prerequisites: 100 or 200.

5 units, Spr (Staff)

139. Literature of the Press—(Graduate students register for 239.) Readings from journalists, their lives, and work. Several basic readings for all; additional readings by individual students for the purpose of leading seminar discussions. Ideas to be discussed: 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 12.

4 units (Lewenstein) not given 1988-89

140. History of American Journalism—(Graduate students register for 240.) Evolution of the democratic mass media in its social, political, economic, technological, and professional aspects. (DR:5)

4 units, Win (Lewenstein)

141. History of Film—(Graduate students register for 241.) Studies in the development of the motion picture as an art form and a means of communication. Lab: Screenings of films announced in class.

4 units (Breitrose) not given 1988-89


4 units, Win (Breitrose)

150. Magazine Writing—(Graduate students register for 250.) Practice in writing magazine articles, with emphasis on marketing manuscripts. Conferences. Prerequisite: 104.

4 units, Spr (Rivers)
3 units, Sum (Staff)

157. Public Information Programs—(Graduate students register for 257.) Emphasizes health information programs and their effects on public knowledge, attitude, and behavior; also information programs concerned with energy conservation, environmental protection, educational and occupational opportunity, consumerism, etc. The interplay of research and fieldwork is analyzed in case studies of successful programs.

3 units (Flora) not given 1988-89

163. Seminar: The President, the Press, the Public, and Politics—(Same as Political Science 191.) The interactions between the American President, the media, and the public in contemporary American politics. Standard and new conceptions of the sources of presidential power in policy making. Considers whether the evidence justifies the new conceptions of the role of President in the politics of policy making.

5 units, Win (Brody)

169. Communication, Technology, and Society—(Same as Sociology 149, VTSS 162; graduate students register for 269.) The intellectual tools for analyzing the question: Does technology drive societal change or does society drive technological change? How technology is related to psychological, social, economic, cultural, and political systems. Focuses on information and information-processing technologies in the U.S. since 1850.

4 units, Spr (Nass)

170. Communication and Children I—(Graduate students register for 270.) A development-
al approach to how children come to use the mass media, what information they obtain, and how their behavior is influenced by the media. Prerequisite: 1, Psychology 1, or Sociology 1 (DR:4)

4 units, Win (Roberts)

171. Communication and Children II—(Graduate students register for 271.) Research practicum; limited enrollment; consent of instructor. Prerequisite: 170.

3 units, Spr (Roberts)

173. Communication and Health—(Graduate students register for 273.) Seminar on campaigns designed to change information attitudes and behavior with particular reference to health.

4 units, Aut (Flora)

175. Reporting of Public Affairs—(For undergraduates; graduate students register for 275.) Coverage of traditional news beats: police, city hall, education, and courts and issue-oriented coverage of policy area beats. Prerequisite: 104.

5 units, Spr (Risser)

176. International Communication: Structures and Issues—(Graduate students register for 276.) Comparative survey of national media systems and the policy issues arising from the existing imbalances between developed and developing countries. Seminar examines the new technologies that have transformed the global flows of news, economic data, cultural and technical information. Prerequisite: 1. Seniors and graduate students in communication and international relations have first priority, with consent of instructor.

4 units, Win (Abel)

177. Specialized Workshops — (Graduate students register for 277.) One or more classes are offered in specializations such as Science Writing, Sports Writing, or other areas. Organized around writing projects oriented toward the field of specialization.

177A. Opinion Writing—(Graduate students register for 277A.)

4 units, Spr (Abel)

177B. Science Writing—(Graduate students register for 277B; same as VTSS 163.)

4 units, Spr (Lewenstein)

178. Media Management—The management and financial aspects of media organizations. Topics: capital investment decisions; circulation and audience-share planning; advertising strategies; personnel management; new technologies and their influence on business decisions; financial controls and promotion. The interplay between editorial and business decisions.

4 units (Lewenstein) not given 1988-89

180. Film Criticism—(Graduate students register for 280.) A critical view of film. Readings and discussion consider models of artistic and literary criticism as points of comparison. The journalistic, psychoanalytical, Marxist, structuralist, and semiotic approaches. Weekly reviews stress the meaning of the films and a lucid writing style. Prerequisites: 104, and 101 or 141.

4 units, Win (Breitrose)

185. Internship Experience—Professional experience in the media. Open only to Communication majors.

0 units graduate students; 1-4 units undergraduate students, Aut, Win, Spr (Lewenstein) by arrangement

190. Senior Project—A research project, or production of a finished piece of work in journalism or film. A combination of the senior project and an internship is possible. Prerequisite: Senior standing.

5 units, Aut, Win, Spr (Staff)

199. Individual Work—Major students with high academic standing are permitted to undertake individual work.

1-4 units, any quarter (Staff) by arrangement

PRIMARILY FOR A.M. STUDENTS

200S. Basic Film Production—Introduction to film writing and production techniques, covering the basics of cinematography, sound, and editing.

9 units, Sum (Staff)

201. Film Aesthetics—(Graduate section; see 101.)

204. Reporting and Writing and News—A reporting and writing course emphasizing various forms of journalism: news, interpretation, features. Detailed criticism of writing. For graduate students.

5 units, Aut (Abel)

205. Editing the News—Copy editing, headline writing, news display, and picture cropping. Laboratory includes editing copy, Associated Press, news evaluation, and page makeup.

3 units, Win (Voakes)


9 units, Sum (Staff)

206. Communication Research Methods—(Graduate A.M. section; see 106.)
208. Mass Communication Theory—(Graduate section; see 108.)

209S. Broadcasting News Workshop — Production and direction of news and documentary television programs.
9 units, Sum (Staff)

210. Media Law—(For graduate students.) Law and government regulation impacting on journalists. Topics: libel, privacy, newsgathering, protection of sources, contempt, commercial speech, free press/fair trial, and broadcast regulation. Attention to regulatory agencies, the FCC and FTC. Develops an understanding of the interaction among constitutional, legislative, common, and administrative law. A few undergraduates may be admitted with permission of instructor.
5 units, Win (Cohen)

210S. Television Production Workshop—Studies in television production theory and techniques in studio and remote locations. Mini-documentaries, public service programs, and program promotion are emphasized.
9 units, Sum (Staff)

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. Does not substitute for 1.
3 units, Sum (Dundes)

222. Documentary Film—(Graduate section; see 122.)

223A. Documentary Film Directing I—Emphasis on conceptualizing and executing ideas for the production work done jointly with 224A. All aspects of preproduction at an introductory level are covered. Open to graduates only. Prerequisite: Consent of instructor.
5 units, Aut (Samuelson)

223B. Documentary Film Directing II—Further professional training in preproduction and producing for motion pictures. Analysis of film structure, development of interviewing and other documentary directing techniques, and writing of narration scripts is emphasized. To be taken concurrently with 224A. Prerequisite: 223A.
5 units, Win (Samuelson)

223C. Documentary Film Directing III—Final quarter of study in film writing, producing, and directing. Includes further examination of film structures, and practical training in fundraising and distribution. Taken concurrently with 224C. Prerequisite: 223B.
5 units, Spr (Samuelson)

224A. Film Production I—First of a three quarter sequence leading to professional training in motion picture production. Super 8 exercises and a short 16mm non-synchronous film with sound track comprising narration, music, and sound effects. Prerequisite: Concurrent registration in 223A.
5 units, Aut (Krawitz)

224B. Film Production II—Produce a short 16mm film in color utilizing synchronous sound carried through post-production to an answer print. Prerequisites: Successful completion of 223A and 224A, and concurrent registration in 223B.
5 units, Win (Krawitz)

224C. Film Production III—Final quarter of professional training in motion picture production. A five minute, 16mm film utilizing all skills acquired in 224A and 224B. Prerequisites: Successful completion of 224B and concurrent registration in 223C.
5 units, Spr (Krawitz)

3 units, Sum (Wallenstein)

235. Inquiry in Journalism—The issues pertaining to the role of journalism in society and societal influence upon the media. In studying what we know about the media, and how we come to know it, students develop a body of knowledge based on evidence, not visceral instincts. Develops conceptual analysis and retrieval of documentary resource material through government archives, electronic database, and similar sources available to journalists.
5 units, Aut (Cohen)

236. Broadcast Journalism—(Graduate section; see 136.)

239. Literature of the Press—(Graduate section; see 139.)

240. History of American Journalism — (Graduate section; see 140.)

241. History of Film — (Graduate section; see 141.)

242. Broadcasting in America — (Graduate section; see 142.)
250. Magazine Writing — (Graduate section; see 150.)
   4 units, Spr (Staff)

257. Public Information Programs — (Graduate section; see 157.)

269. Communication, Technology, and Society — (Graduate section; see 169.)

270. Communication and Children I — (Graduate section; see 170.)

271. Communication and Children II — (Graduate section; see 171.)

273. Communication and Health — (Graduate section; see 173.)

275. Reporting of Public Affairs — (For graduate students.) Coverage of traditional news beats, such as police, city hall, education and courts as well as issue-oriented coverage of policy area beats. Prerequisite: 204.
   5 units, Win (Lewenstein)

276. International Communication: Structures and Issues — (Graduate section; see 176.)

277. Specialized Workshops — (Graduate sections; see 177.)
   277A. Opinion Writing.
   277B. Science Writing.

278. Media Management — (Graduate section; see 178.)

280. Film Criticism — (Graduate section; see 180.)

290. A.M. Project.
   4-8 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

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 (Chaffee)

311B. Theory of Communication — Continuation of 311A with emphasis on communication theory. Prerequisite: 311A.
   4-5 units, Win (Chaffee)

313. Introduction to the Use of the Computer — Specifically for social science data analysis. A brief discussion of computing concepts, followed by use of WYLBUR and EDIT, text editors on SCIP and LOTS systems; SPSS; and data storage.
   1-3 units, Win (Staff)

317. Doctoral Research Methods I — Application of scientific method to communication research. Logic of inquiry; conceptualization of variables; design of experiments, quasi-experiments, and nonexperiments. Previous or concurrent enrollment in statistics required.
   4 units, Aut (Reeves)

318. Doctoral Research Methods II — Continuation of 317. Sampling questionnaire design, attitude scale construction, survey administration, computer analysis of data.
   4 units, Win (Flora)

319. Doctoral Research Methods III — Continuation of 318. Project-oriented approach to relationship between theory and data analysis; advanced topics in data analysis.
   4 units, Spr (Nass)

370. Advanced Communication Theory and Method Seminar I — May be repeated for credit. Topic and instructor change each year. Prerequisites: 311A and 319.
   3 units, Aut (Roberts)

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 (Nass) by arrangement

372. Advanced Communication Theory and Method Seminar III — May be repeated for credit. Topic and instructor change each year. Prerequisites: 311A, 319.
   3 units, Spr (Reeves) by arrangement

375. Communication Theory Review Seminar — Limited to Ph.D. students. Prerequisites: 311A, 311B.
   3 units, Spr (Reeves) by arrangement

   3-6 units, Aut, Win, Spr (Staff) by arrangement

398. Pre-Dissertation Research Project — Advanced research for Ph.D. candidates.
   3-6 units, Aut, Win, Spr (Staff) by arrangement

399. Advanced Individual Work.
   1-8 units, Aut, Win, Spr (Staff)

400. Dissertation Research.
   6-10 units, Aut, Win, Spr (Staff) by arrangement
COMPARATIVE LITERATURE

Chairman: David Wellbery
Professors: John Bender (English and Comparative Literature), Russell Berman (German Studies and Comparative Literature), N. Gregson Davis (Classics and Comparative Literature), Joseph Frank (Slavic Languages and Comparative Literature), John Freccero (Italian and Comparative Literature), René Girard (French and Comparative Literature), Herbert Lindenberger (English and Comparative Literature), Patricia Parker (English and Comparative Literature), David Wellbery (German Studies and Comparative Literature)

Associate Professors: Mary Pratt (Spanish and Portuguese, and Comparative Literature), Jerrfrey T. Schnapp (Italian and Comparative Literature)

Courtesy Professors: Gerald Gillespie (German Studies and Comparative Literature), David G. Halliburton (English and Comparative Literature), Charles R. Lyons (Drama and Comparative Literature), Marjorie Perloff (English and Comparative Literature), Makoto Ueda (Japanese and Comparative Literature)

Courtesy Associate Professor: Sandra E. Drake (English and Comparative Literature)

The interdepartmental program in Comparative Literature admits students for the Ph.D. It works 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 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.

Comparative Literature as a major is one of the options within the Humanities Honors Program major. Students in the program do not need to complete an additional major in another department but, in order to satisfy the fourth requirement listed below, they will normally have the equivalent of a major in a single national literature. Requirements are as follows:

1. Completion of the Western Culture Requirement—15 units, freshman year, with a letter grade indicator (LGI) of at least "B" and an "A-" or better in at least one quarter of the sequence.

2. Humanities 90—5 units, sophomore year.

3. Two seminars drawn from the series Humanities 191-196, of which one must be 194.

4. Course distribution should be designed so that students develop an extensive background (six courses covering a broad 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.

5. Course distribution should also provide a background (at least three courses) in a second national literature read in the original language. This requirement pertains whether the main literature (section 4) is English or foreign. When the main literature is English, one additional course—preferably a literature course—in a second foreign language is also required. When the main literature is a foreign one for which conditions of linguistic preparation may be complex (Asian languages, for example), students should consult their advisors with regard to course work in a second literature.

6. 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.

7. 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.

8. Honors essay—an essay in literary criticism (2 units, Spring Quarter, junior year; 5 units,
Autumn Quarter, and 5 units, Winter Quarter, senior year. An LGI of at least "B" is required on the essay for graduation with Honors in Humanities.

9. Two courses related to the student's total program, but drawn from disciplines outside literature.

**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.

Before starting graduate work at Stanford, students should have completed an undergraduate program with a strong background in one literature and some work in a second literature studied in the original language. Since the program demands an advanced knowledge of two foreign languages and a reading knowledge of a third foreign language, students should at the time of application have a sufficiently advanced knowledge of one foreign language so that they will be able to take graduate level courses in that language when they enter the program. They should also be making sufficient progress in the study of a second foreign language so that they will be able to take graduate courses in that language no later than the beginning of the second year, but earlier if possible. Applicants are expected to take an intensive course in the third foreign language before entrance.

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 timetable 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.

**APPLICATION PROCEDURES**

Competition for entrance into the program is keen. The program is kept small so that students will have as much opportunity as possible to work in individual projects under faculty supervision throughout their period of graduate study. No more than 16 students are in residence at any one time. The committee does not plan to admit more than three or four new students for the class entering in September. Completed applications are due January 1. Because of the special nature of comparative literature studies, the statement of purpose included in the application for admission should contain the following information besides the general plan for graduate work called for on the application:

1. A detailed description of the applicant's present degree of proficiency in each of the languages he or she has studied, indicating the languages in which he or she is prepared to do graduate work at present and outlining plans to meet additional language requirements of the program.

2. A description of the applicant's areas of interest (for instance, theoretical problems, genres, periods) within literary study and the reasons for finding comparative literature more suitable to his or her needs than the study of a single literature. Applicants should also indicate what they think will be their primary field.

Applicants should arrange to have the results of the Graduate Record Examination sent to the Graduate Admissions office. They should take both the aptitude and achievement parts of the examination. The achievement section should be taken in the primary field in which applicants expect to work within the Comparative Literature program. If the primary field is not that of their undergraduate major, applicants may take the examination in the field of their major.

Recommendations should, if possible, come from faculty in at least two of the literatures in which the student proposes to work.

Applicants must submit a copy of one of their undergraduate term papers which they consider representative of their best work.

**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. Student language preparation must be sufficient before entrance so that they can take a graduate level course in at least one foreign language during their first year and in the second during the second year. Students must demonstrate a reading knowledge of the third foreign language no later than the beginning of the third year.

Of the three literatures in which a student takes courses, no more than two may be in the same department at Stanford. Literatures written in the same language (such as Spanish and Latin-American) are counted as one in the planning of the student’s program. One of the student’s three literatures will be designated as the primary field; the other two as secondary fields.

Teaching—All Fellows, whatever their sources of financial support, are required to do three quarters of supervised teaching at half-time and one quarter at quarter time. Comparative Literature Fellows must complete what ever pedagogy courses are required by the departments in which they teach.

Minimum Course Requirements—
1. Comparative Literature 369 and three additional seminars (or courses that assign a long paper) of a primarily comparative nature; at least one of these additional seminars must be on literary theory or criticism.
2. At least three graduate courses in each of two literatures other than the student’s native literature.
3. A sufficient number of courses in the student’s primary field to assure his or her knowledge of the basic works in one national literature from its beginnings until the present day.

Minimum course requirements must be completed before the student is scheduled to take the University oral examination. These requirements are kept to a minimum so that students will have sufficient opportunity to seek out new areas of interest. A “course” is an offering of 3-5 units.

Examination—The third and last section is the University oral examination. Each student’s reading lists for the examination must be approved by an examination committee. The examination will consist of the following, each of which takes the form of an oral colloquy between the student and a committee of faculty members with interests in the subject area of the particular section:

1. A literary genre, to consist of (a) 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 (b) 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 Litera-
ture 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 those other aspects of their work—for example, performance in courses, ability to do original research—that predict strong promise for their dissertations and future careers as scholars and critics. 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.

Ph.D. MINOR

Students interested in the minor should apply for admission to the individual departments of literature. They may apply to the Comparative Literature Department for entrance to the minor after they have completed their first quarter of graduate work at Stanford. Requirements are as follows:

1. A knowledge of at least two foreign languages, one of them sufficient for the student to qualify for graduate-level courses in that language, the second sufficient for the student to read a major author in the original.
2. A minimum of six graduate courses, of which three must be in the department of the second literature and three in Comparative Literature, the latter to include a seminar in literary theory or criticism. 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

Courses primarily of a comparative nature are listed below. Check department listings for DR notations.

12. Greek Tragedy: Aeschylus, Sophocles, Euripides—(Enroll in Classics 12, Drama 153.)
4-5 units, Win (McCall)

19A. Introduction to the Germanic Languages—(Enroll in German Studies 19A, Linguistics 75.)
3 units (Robinson) given 1989-90

30. The Novel—(Enroll in English 30; students taking 5 units register for 130.)
Introduction to how a close, sympathetic reading of the construction, narrative technique, and human values of a variety of major novels can increase the student's appreciation of a significant literary genre.
3 units, Win (Fifer) Spr (Packer)

50. Introduction to Drama—(Enroll in Drama 50.)
Introduction to major dramatic forms, concentrating on selected masterpieces to develop theatrical sensibility in reading dramatic texts.
4 units, Spr (Rayner)

50A. Poetry and Poetics—(Enroll in English 50; students taking 5 units register for 150.)
An introduction to the reading of poetry through a variety of poems, emphasizing the ways the meanings of the poems are shaped through diction, imagery, figurative language, and technical elements of verse.
3 units, Win (Lindenberger) Spr (Perloff)

60A. An Introduction to the Medieval Literature of England, France, Germany, and Scandinavia (500-1300) in Translation—(Enroll in German Studies 60A.)
Readings in medieval historiography, heroic epic, romance, saga, and lyric. Designed to follow the medieval segment of Western Culture. Lectures and discussions.
3 units, Aut (Andersson)

61,62,63. Western Thought and Literature—
An introduction to fundamental ideas of the past; lectures, discussions, reading of selected masterpieces.
61. The Ancient Near East, Greece, and Rome—(Enroll in Humanities 61.)
The Hebrew Bible, Homer, Sappho, Aeschylus, Sophocles, Euripides, Plato, Aristotle, Cicero, Epictetus, Virgil, the Gospels.
5 units, Aut (Edwards, Staff)
62. The Middle Ages and the Renaissance
   (Enroll in Humanities 62.) St. Augustine, Boethius, Beowulf, Chaucer, More, Machia-
   velli, Montaigne, Shakespeare, Milton, Vol-
taire.
   5 units, Win (Evans, Staff)

63. The Enlightenment to the Present—(En-
roll in Humanities 63.) Rousseau, Goethe,
Wordsworth, Flaubert, Marx, Nietzsche,
Freud, Virginia Woolf, T.S. Eliot.
   5 units, Spr (Lindenberger)

90. Introduction to the Humanities Honors
Program—(Enroll in Humanities 90.) Basic
themes and issues of the humanities as treated
in important works. Various humanistic disci-
plines. Prerequisites: Completion of the West-
culture requirement and enrollment in the
Humanities Honors Program.
   5 units, Aut (Harvey)
   Spr (Yearley)

91. Traditional East Asian Civilization: China
   (Enroll in Asian Languages 91.) An introduc-
tion to Chinese culture (thought, literature, and
art) set against the backdrop of history.
   5 units, Aut (Van Zoeren)

92. Traditional East Asian Civilization: Japan
   (Enroll in Asian Languages 92.) An introduc-
tion to traditional Japanese culture emphasizing
the relation between intellectual currents and
the arts from the 8th-18th centuries.
   5 units, Win (Hare)

113. Art, Religion, and Society in the Late
Antiquity (284-717 A.D.)—(Enroll in History
113, Classics 107.)
   5 units, Win (MacCormack)

114B. Modern French Novel—(Enroll in French
114B.) Reading and discussion of the leading
novels of modern France: Proust, Cide,
Malraux, Mauriac, Alain-Fournier, Sartre,
Camus. Lectures, readings in English. Read-
ings in French optional.
   4 units, Aut (Cohn)

119Z. Darwinism and Social Ideology of the
19th Century—(Enroll in English 119Z, His-
tory of Science 152A, Philosophy 152A; Oxford
campus.) Darwin’s ideas in terms of knowledge
(i.e., religious belief) and power (i.e., class,
gender, and race).
   5 units, Spr (Dupré, Gagnier)

125. Japanese Women Through Novels and
Films—(Enroll in Anthropology 125, Asian Lan-
guages 125.) In anthropological literature on
Japan, women tend to be relegated to the back-
ground of the social stage. Through analysis
of novels written by Japanese women and feature
films made by Japanese, in conjunction with an-
thropological literature, a new understanding
of the position of women in Japan is presented.
   5 units (Befu) not given 1988-89

131-133. German Culture and Civilization
I-III—Aspects of modern society and culture in
the countries of German-speaking Europe: so-
cial processes and institutions, modernism in
literature and the fine arts, central concerns of
philosophical and social thought. Students may
enroll in any part of the series.
   5 units, Win (Peters)

131. Central Europe: Geography, Institu-
tions, and Society—(Enroll in German 131.)
A survey of geography, people, and institu-
tions of the German-speaking areas of Central
Europe—contemporary situation and histor-
ical origins. Topics: governmental structure
of the BRD, the DDR, Austria, and Switzer-
land; population; stability and migration;
social structure of East and West Germany;
the educational system; communications sys-
tems; urbanization and its consequences
since WW II.
   4 units, Win (Lohnes)

132. The Culture of Modernism in Austria
and Germany—(Enroll in German Studies
132.) The birth of modernism in Vienna at the
turn of the century, and in the Weimar
Republic, emphasizing literature, music,
painting, and architecture. The connections
to broad intellectual and historical develop-
ments. The works of Hofmannsthal, Mahler,
Freud, Schönberg, Kandinsky, Gropius,
Brecht, and Mann.
   4 units, Aut (Wilke)

133. Democracy, Protest, and Political Cul-
ture in German-Speaking Europe—(Enroll
in German Studies 133.) An introduction to
central issues in German thought since 1945
with reference to the political context. "Over-
coming 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.
   4 units, Spr (Wilke)

131A. Chinese Poetry in Translation—(Enroll
in Asian Languages 131.) Readings in tradition-
al Chinese poetry and poetics with emphasis on
genre, theme, and style.
   4 units, Aut (Van Zoeren)

132A. Chinese Fiction and Drama in Transla-
tion—(Enroll in Asian Languages 132.) A survey
of Chinese prose fiction and drama from early
times to the late Ch’ing period, emphasizing
literary and thematic discussions of major repre-
sentative works available in English translation.
   4 units, Win (Wang)
133A. Modern Chinese Literature in Translation—(Enroll in Asian Languages 133.) Readings in representative 20th-century works of fiction, drama, and poetry. 4 units, Spr (Lyell)


136B. European Thought in the 20th Century—(Enroll in History 136B.) 5 units, Win (Robinson)

137. Japanese Fiction in Translation—(Enroll in Asian Languages 137.) An introduction to major works of prose narrative from pre-modern Japan (7th through mid-19th centuries), read in English translation emphasizing the historical, intellectual, and cultural context in which they were written. Works vary each year; course may be repeated for credit with the instructor's permission. 4 units, given 1989-90

138. Modern Japanese Literature in Translation—(Enroll in Asian Languages 138.) An introduction to Japanese poetry, drama, and fiction since 1868. Authors: Tanizaki, Kawabata, Mishima, etc. Knowledge of premodern Japanese literature not required. 4 units, Spr (Veda)

150N. Major Dramatic Texts I: Greek to Renaissance—(Enroll in Drama 150N.) Selected texts from Aeschylus, Sophocles, Euripides, Aristophanes, Plautus, Terence, Seneca, anonymous Medieval playwrights. Marlowe, early Shakespeare. 4 units, Aut (Rayner)

151. Major Dramatic Texts II: Renaissance to Romantic—(Enroll in Drama 151.) Selected texts from Shakespeare, Jonson, Corneille, Racine, Molieres, Eyecherley, Congreve, Sheridan, Goldsmith, Goethe, Schiller, Kleist, Buechner. 4 units, Win (Rayner)

152N. Major Dramatic Texts III: Early Realistic to the Present—(Enroll in Drama 152N.) Selected texts from Hebbel, Ibsen, Chekhov, Strindberg, Brecht, Shaw, Synge, O'Casey, O'Neill, Williams, Miller, Albee, Shepard, Beckett, Ionesco, Genet, Weiss, Duerrenmatt, Osborne, Pinter, Bond. 4 units, Spr (Graver)

155. The Spanish Republic, the Civil War, and the Aftermath—(Enroll in Spanish 155.) The significance of the Civil War for Spanish, European and world history; the International Brigades. The effect of war on the literary and cultural life of the country and the response of writers from Spain (Machado, Lorca, Alberti) and Latin America (Neruda, Guillén, Vallejo). A survey of literary protest during the Franco regime by such figures as Alonso, Aleixandre, Cela, Santos and Goytisolo. 3-5 units (Predmore) alternate years, given 1989-90

157N. Contemporary Black Playwrights—(Enroll in Drama 157N.) The dramaturgy, i.e. thematic issues, styles, and aesthetics of contemporary playwrights in the United States, the Caribbean, and Africa. The concept of an African Diaspora or cultural continuity between Africa and the Americas is the premise; also diversity among the various societies represented. 4 units, Win (Kennedy)

160. Women and Difference: Marginality, Art, and Politics—(Enroll in English 160, Feminist Studies 160.) Women perceived as "different" (spinsters, lesbians, women of color, Jewish women, women with disabilities, women without children) according to prescribed social norms have been designated as freaks, asexual, monsters, marginal. Focuses on the lives and works of women who embraced their differences, making it serve their art, and sometimes art and politics. Virginia Woolf, Lillian Smith, Helen Keller, Annie Sullivan, Agnes Smedley, Frida Kahlo, Billie Holiday, Irena Klepfisz, Audre Lorde, Gloria Anzaldua, Joy Harjo. 5 units, Aut (Rich, Cliff)

161. The Classical Period—(Enroll in German Studies 161.) Introduction to major authors, works, and literary movements of the 18th century in historical context. Emphasis on the ways in which theaters and staging reflect their own cultural and spatial environments. 4 units, Win (Eddelman)

161A. Afro-American Writing, 1945-1970—(Enroll in English 161A.) A range of Afro-
American novels by men and women, in historical context, examines the ways in which Afro-American writers have used and adapted the novel genre to interpret various aspects of the Afro-American experience.

5 units, Win (Drake)

161B. Afro-American Writing, 1970 to the Present—(Enroll in English 161B.)

5 units, Spr (Drake)

161Z. History of the Theater: 19th and 20th Centuries—(Enroll in Drama 161.) The development of theaters and staging as they stylistically evolved during the 19th and 20th centuries. Emphasis on the ways in which theaters and staging reflect their own cultural and spatial environments.

4 units, Aut (Eddelman)


4 units, Win (Mommsen)

162B. Chicano Literature: Creative Writing for Bilingual Students—(Enroll in English 162B, Chicano Studies 162, Spanish 162B.) A basic fiction writing workshop. Working knowledge of Spanish necessary.

5 units, Aut (Islas)

163. Naturalism to the Present—(Enroll in German Studies 163.) Introduction to major literary trends since the end of the 19th century emphasizing the changing status of the author; Naturalism and Aestheticism, Expressionism, Dadaism, etc. Literature in the Weimar Republic; the impact of National-Socialism (1933-1945); exile culture. Developments after WWII. Contemporary authors, especially women, are discussed.

4 units, Spr (Mommsen)

163H. Contemporary Issues in Feminist Theory—(Enroll in English 163H.) Undergraduate seminar on recent developments of feminist theory, from the natural sciences to aesthetics, including political and methodological concerns.

5 units, Win (Gagnier)

163Z. Gender and Class in 19th-Century Fiction—(Enroll in English 163Z, Oxford campus.) The novel in terms of the above issues, including the “Oxford novel.”

5 units, Spr (Dupré, Gagnier)

164A. The Biblical Presence in Modern Poetry—(Enroll in English 164A.) The presence of biblical scripture (its narratives, place names, prophecy, liturgical and lexical elements) in British, American, European, and Israeli poetry.

5 units, Spr (Felstiner)

164C. Medieval Literature of Heroism and Romance—(Enroll in English 164C.) English masterworks with attention to related literature from the Continent.

5 units, Aut (Rowe)

165B. Crime and Punishment in Renaissance Fiction—(Enroll in English 165B.)

5 units, Spr (Gallagher)

165Z. Living in the Past: The American Experience in Europe—(Enroll in English 165Z, Tours campus.)

5 units, Aut (Evans)


3-5 units, Spr (Rufinelli)

178. Performance of Lyric Poetry—(Enroll in Asian Languages 178.) The nexus between author and reader in a literary work has become a major controversy in contemporary critical theory, appropriate for investigation from the perspective of performance. Taking the performance of a literary text as its central task, students prepare performances of a wide variety of lyric texts for class. Recommended: A reading knowledge of a foreign language (classical or modern). Upperclass students have priority. Enrollment limited to 15.

3 units (Hare) given 1989-90


4 units (Matisoff) given 1989-90

181C. From Epic to Romance: Courtly Love and the Heroic Ideal—(Enroll in English 181C.)

5 units, Spr (Steidle)

182C. History of Literary Criticism—(Enroll in English 182C.)

5 units, Spr (Trimpi)

187C. The Avant Garde of the Early 20th Century—(Enroll in English 187C.)

5 units, Win (Perloff)
188P. Seminar: Poetry and Poetics—(Enroll in English 188P.)
5 units, Spr (Felstiner)

194. Literature and the Humanities—(Enroll in Humanities 194.)
5 units, Win (Trabant) Spr (Brooks)

4 units, Aut (Apostolidés)

3-4 units, Aut (Guy)

209. Introduction to Paleography and Codicology—(Enroll in English 209, Classics 177.) Introduction to late antique and medieval manuscripts in Latin, of medieval Latin and vernacular scripts, and the materials and composition of the medieval book.
5 units, Spr (Brown)

210. Studies in Medieval Literature—(Enroll in Spanish 210.)
3-5 units, Win (Zahareas)

212. Psychiatry and Literature—(Same as Psychiatry 212, Modern Thought and Literature 212.)
2 units, Aut (Van Natta) W 7-9 p.m.

4 units (Freidin) not given 1988-89

230. Interpreting Classical Confusian Texts—(Enroll in Asian Languages 230, Religious Studies 212.) The issue of interpretation in texts of early Confucianism and Taoism throughout Chinese history. The critical importance of historical and philosophical issues to interpretation. Prerequisite: Consent of the instructor.
5 units, Win (Ivanhoe)

230A. Russian Formalism and Structuralism—(Enroll in Slavic Languages and Literatures 230A.) 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.
5 units (Brown) not given 1988-89

240. Images of America in Colonial Prose—(Enroll in Spanish 240.)
3-5 units, Aut (Corral)

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: Herder, Hegel, Schiller, Marx, Nietzsche, Freud, Husserl, Wittgenstein, Marcuse, and Adorno. Given in German in alternate years.

241. Deutsche Geistesgeschichte I—(Enroll in German Studies 241.) From Lessing to Romanticism. Delineates the conceptual field within which, from the middle to the end of the 18th century, the problems of human knowledge, history, the nature of man, and art were revolutionized and given a new basis. Readings and detailed interpretations of selected texts by Lessing, Kant, Herder, Schiller, and Fichte.
3-5 units, Aut (Trabant)

242. Deutsche Geistesgeschichte II—(Enroll in German Studies 242.) From Hegel to Nietzsche. The outlines of Hegel’s phenomenology and model of historical development as the becoming-conscious of freedom. 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, Win (Wellbery)

243. Deutsche Geistesgeschichte III—(Enroll in German Studies 243.) From Nietzsche to the present. Texts by Nietzsche, Husserl, Freud, Heidegger, Benjamin, Adorno, and Habermas with emphasis on aesthetic problems and their relationship to social theory, and the development of the Frankfurt School. Shorter essays on aesthetics indicate possible applications to literary theory.
3-5 units, Spr (Wilke)

The literature, thought, and popular cultures of the Caribbean Basin within the context of an overview of its multiple cultural and linguistic worlds.

3-5 units, Aut (González)


3-5 units (Ybarra-Frausto) not given 1988-89

252. Theory of Literature and Culture in Latin America—(Enroll in Spanish 252.) Analysis of themes and problems occurring in Latin American critical writings: acculturation and transculturation, eurocentrism and autonomy, historical periods and genres, literary nomenclature and the concept of America.

3-5 units, Win (Ruffinelli)


4 units (Ueda) not given 1988-89

258. Contemporary Latin American Short Story—(Enroll in Spanish 258.)

3-5 units, Spr (Ruffinelli)

259. Short Novel as Genre in Latin America—(Enroll in Spanish 259.)

3-5 units, Spr (Corral)

260. Research Seminar: Latin American Women Writers of the 19th Century—(Enroll in Spanish 360.) Workshop designed to give advanced graduate students experience in primary research on women, literature, and culture. Assignments focus on a research paper and annotated bibliography.

5 units, Win (Pratt)


5 units (Pratt) given 1989-90

261. Lessing and the Enlightenment—(Enroll in German Studies 261.) Lessing’s literary, theological, and critical writings in the context of the European Enlightenment. The framework is primarily historical: the Enlightenment discourse is analyzed in the context of institutional changes characteristic of the mid-18th century.

3-5 units, Spr (Wellbery)

261A. Ritual Content in Works of West Indian Writers—(Enroll in English 261.)

5 units, Win (Ismond)

263A. Seminar in Feminist Studies—(Enroll in English 263A, Feminist Studies 103/203.) For upper-level undergraduates and graduate students. Selected issues, readings emphasize documentary sources from the women’s liberation movement of the 1970s and 1980s, with continuing attention to race, class, and ethnicity as feminist issues. Enrollment limited to 20. Prerequisite: Feminist Studies 101.

5 units, Aut (Rich)

264B. 19th Century Narrative—(Same as English 264B.) Works by Thackeray, Dickens, Charlotte and Emily Bronte, Flaubert, and others, exploring the transformation of earlier narrative forms, with questions of gender and politics.

5 units, Aut (Parker) MW 11-12:30

264Z. Britain in the 19th Century: In Pursuit of Bread, Knowledge, and Freedom—(Enroll in English 264Z, Philosophy 173; Oxford campus.) Ideology and social conditions, emphasizing class, gender, and race. The relevance of Victorian social and political theory (e.g., Adam Smith, Malthus, Engels, Mill, Ruskin) to the concrete conditions revealed in Victorian autobiographies.

5 units, Spr (Dupré, Gagnier)

265. Knowing the Holocaust: Psychoanalytical and Literary Perspectives—(Enroll in English 265, Psychology 180B.)

4 or 5 units, Spr (Auerhahn)

266. Culture, Authoritarianism, and Resistance in Latin America—(Enroll in Spanish 266.) Latin American cultural production under the restrictive conditions imposed by authoritarian military regimes of the 1970’s and 80’s, especially in Brazil and the Southern Cone. Readings on the language of authoritarianism, the legitimation of state violence, and artistic forms of resistance including poetry, testimonio, film. Reading knowledge of Spanish required. In English.

5 units (Pratt) alternate years, given 1989-90

266A. Surrealism—(Enroll in French 266.) Toward a definition of Surrealism through the manifestos of André Breton and novels, poems, and plays by Breton, Eluard, Aragon, Cocteau, Julien Gracq. Discussion of Surrealist films and painting.

4 units, Spr (Newman-Gordon)
268. The Literature of Decolonization—(Enroll in French 268.) The work of Francophone African and Caribbean writers who have confronted the phenomenon of colonialism and contributed to the struggle of liberation. Readings from Aime Césaire, Leopold Senghor, Frantz Fanon, Albert Memmi, and Jean-Paul Sartre, etc. Discussion in English, reading in French or English translation, at student's option.

4 units, Win (Giraud)

271. Brazil in Film and Fiction—(Enroll in Portuguese 271.)
3-5 units, Spr (Patai)

272. From Existentialism to Structuralism and Post-Structuralism—(Enroll in French 272.) Readings from Heidegger, Sartre, Levi-Strauss, Michel Foucault. An effort is made to define a historical continuity behind the apparent discontinuities of post-war French theory.

4 units, Win (Girard)

274A. Writings of Franz Kafka—(Enroll in German Studies 274A.) Selected readings in translation from the stories and novels (The Trial, The Castle); major themes and enigmas of Kafka's work; his artistic legacy in the context of 20th-century literature.

3-5 units, Win (Gillespie)

276. The German Bildungsroman—(Enroll in German Studies 276.) Concepts and features of the "novel of development" from the second half of the 18th century to Modernism; the testing and elaboration of worldviews in the Bildungsroman. Prospective readings: Wieland's Agathon, Goethe's Wilhelm Meisters Lehrjahre, Novalis' Heinrich von Ofterdingen, Hölderlin's Hyperion, Stifter's Nachsommer, Hesse's Steppenwolf.

3-5 units, Spr (Gillespie)

280. Introduction to Chicano Literature—(Enroll in Spanish 280.) Selected works by major Chicano writers of the 20th century, including poetry, fiction, and drama. Questions of genre and textual interpretation emphasizing the socio-historical and cultural context of Chicano literature.

3-5 units (Ybarra-Frausto) given 1989-90

284C. Literature and Philosophy: The Problem of Time—(Enroll in French 284C.)
4 units, Spr (Serres)


3-4 units, Spr (Dupuy)


4 units, Aut (Girard)

286A. Literature and Politics: The Left and the Right—(Enroll in French 286A.)
2 units, Aut (Serres)

286B. Literature and Politics: Individualism and Social Justice—(Enroll in French 286B.) "Anglo-American Liberalism" from the viewpoint of contemporary French political philosophy. Readings of Smith, the Utilitarians, Rawls, Nozick, and Hayek.

3-4 units, Win (Dupuy)

294A. Feminist Attitudes in France—(Enroll in French 294A.) Significant texts on women's roles in French society, from the Middle Ages to the present, drawn from literature, iconography, politics and journalism.

4 units, Win (Newman-Gordon)

3-5 units, Spr (Patai)

296. Western Views of the Non-West Through the Literature of Travel—(Enroll in Spanish 296.) The western traveler as cross-cultural mediator and interpreter in precolonial and neo-colonial settings; the ideological appropriation and "normalization" of alien contexts as related to developments in world politics and economy, notably European expansion. Readings on the Spanish conquest of America, the "re-opening" of China, and works by contemporary travelers: Graham Greene, V. Naipaul, S. Naipaul, Paul Theroux, Isak Dinesen, etc. In English.

3-5 units (Pratt) given 1989-90

297. Images of Women in Modern Japanese Literature—(Enroll in Asian Languages 297.) Reading and discussion of selected literary works illuminating various aspects of female experience in modern Japan. Prerequisite: 213 or equivalent.

4 units (Ueda) not given 1988-89

298. Translation Workshop—(Enroll in Asian Languages 298.) Discussion of problems involved in translating Japanese into English. Each student produces an original translation of a literary or documentary work from their field of interest.

4 units, Win (Ueda)
298A. Undergraduate Colloquium: Visions of Utopia, Travellers to China—(Enroll in History 298A.)
5 units, Win (Kahn)

300. Graduate Seminar: Theory of Narrative—(Enroll in Slavic Languages and Literatures 300.)
4-5 units, not given 1988-89

303A. Colloquium: Swift, Pope, and Satiric Tradition—(Enroll in English 303A.)
5 units, Aut (Carnochan)

303B. Colloquium: Sexuality and Terror—Gothic and Fantastic Literature of the 18th Century—(Enroll in English 303B.) Classics of Gothic fiction by Walpole, Radcliffe, Lewis, Beckford and others. The role of women in gothic fiction and the genre's treatment of terror and sexuality.
5 units, Win (Castle)

303C. Seminar: The Enlightenment in France and England—(Enroll in English 303C.) Introduction to the history of ideas in the period. Readings of major writers in France (Montesquieu, Voltaire, Diderot, D'Alembert, Rousseau, Holbach, Condorcet) and England (Hume, Gibbon, Boswell, Adam Smith, Goldsmith, Godwin); the relationships between French and English versions.
5 units, Spr (Watt)

305. Colloquium: Literature and Institutions—(Same as English 305.) A theoretical investigation, with practical examples from various historical periods, of authorship, readership, evaluation, and the production and dissemination of literary texts.
5 units, Win (Lindenberger)

306. Colloquium: Modern American Popular Culture and Fiction—(Enroll in English 306.) The ways 20th-century American fiction has reflected themes, techniques, and movements created by practitioners of such cultural modes as humor, sport, film, music, and detective or Western stories. Novelists: Dos Passos, West, Doctorow, Ellison, Berger, Malamud, Oates and Chandler.
5 units, Win (Solomon)

5 units, Win (Sorrentino)

307C. Colloquium: Methods and Materials for the Study of Modern Literature—(Enroll in English 307C.) Some methods of inquiry into post-Enlightenment British and American literature (1750 to the present), and an analysis of the library resources that enable and facilitate them. Emphasis on interdisciplinary approaches that literalize the text's cultural occasion. Short works representative of major period and national circumstances focus on different models of contextual criticism. Topics: the genesis, production, and distribution of texts; the reconstruction of their original semantic, ideological, and literary environments; and the competing philosophies of editing them.
5 units, Spr (McPherson)

310. Discourse and Ideology—(Enroll in Spanish 310.) Creation of meaning as a social process, ways in which ideology is produced, reproduced, and transformed in linguistic interaction, whether and how American competence models can interlock with theories that see language as constituting social reality and self. Readings on the concept of socially determined meaning, discursive practices in the French tradition, British empirical analyses, American sociolinguistics. In English.
4-5 units, Spr (Pratt)

315. Books and Society in Europe, 1400-1800—(Enroll in History 315.)
5 units, Win (Ryan)

3-5 units, Win (Zahareas)

332. Discourses of Desire—(Enroll in Italian 332.) Medieval discourses of desire, secular and sacred. Readings: Troubadour lyrics, Stilnovist poems, courtly romances, the letters of Heloise and Abelard, St. Bernard's sermons on Canticles and Dante's Vita Nuova. Readings are in English.
4 units, Win (Jacoff)

333. Dante's Divine Comedy—(Enroll in Italian 333.)
4 units, Aut (Freccero)

335. Classical Conventions in European Lyric—(Same as Classics 335.) Analyzes and compares a few central rhetorical conventions of the European lyric against the background of their Classical antecedents, also, non-European variants of the conventions. Topics: encomiastic topoi, generic disavowals (recusatio) and the priamel.
5 units, Win (Davis)

337. Dante's Divine Comedy: Paradiso—(Enroll in Italian 337.)
4 units, Spr (Jacoff)
345. Petrarch and Petrarchism—(Enroll in Italian 345.) Readings from the Canzoniere, Epistolae, De Vita Solitaria and Secretum, in relation to later developments in Petrarchan poetics in Italy (Ariosto, Gaspara Stampa, Tasso), Spain (Garcilaso, Quevedo, Gongora), England (Sidney, Shakespeare), and France (Ronsard). Major topics: Petrarch and Dante, Petrarch and the aesthetics of fragmentation, Pietro Bembo and the Petrarchan canon.

4 units, Aut (Ffreccero)

349H. Wilhelm von Humboldt’s Hermeneutic and Language Philosophy—(Enroll in German Studies 349H.)

3-5 units (Mueller-Vollmer) given 1989-90

349K. Kafka: Enigma and Agony—(Enroll in German Studies 349K.) Colloquium on modernist and postmodernist approaches to the artist’s work. Older and newer topics (e.g., Kafka as mystic or existentialist; psychological, sociological, mythological dimensions; Kafkaesque phenomenology; the collapse of the self into writing; labyrinthine discourse; differences in American, German, French, and other critical reception, etc.). Students who have taken 274A may pursue an independent research project upon approval of instructor.

3-5 units, Spr (Gillespie)

349S. Semiotics—(Enroll in German Studies 349S.)

3-5 units, Win (Trabant)

351. Seminar: Representing Self and World in Ricardian Poetry—(Enroll in English 351.) Selected works of Chaucer, Gower, Langland, and the Gawain Poet emphasizing problems of mimesis and subjectivity. How these authors appropriate various discourses (rhetoric, philosophy, science, magic, medicine, etc.) to represent self and world. Readings in other medieval texts (Machaut, Petrarch, Boccaccio, Margery Kempe) and in literary theory; assumes prior knowledge of Chaucer and a working acquaintance with non-Chaucerian Middle English.

5 units, Spr (Wack)


5 units, Spr (Richards)

354. German Literature and Culture IV—(Enroll in German Studies 354.) From Baroque through Enlightenment (c. 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 theater, 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, Win (Gillespie)

354A. Seminar: 20th-Century Visual Aesthetics—(Enroll in Drama 354A.) The visual aesthetics of the theater during the last 25 years. Emphasis on European theater companies and scenography design and on innovative developments in the U.S. and Asia. A conceptual approach is taken in analyzing contemporary theater.

5 units, Aut (Eddelman)


5 units, Aut (Graver)

354C. Seminar: Semiotics of Drama—(Enroll in Drama 354C.) How the sign system of drama, text, set, costumes, gesture, intonation, movement, and music, create meaning in performance in the dramatic media: stage, cinema, and television.

5 units, Win (Esslin)

355. Michelangelo: The Poet and the Artist—(Enroll in Italian 355.)

4 units (Harrison) given 1989-90


5 units, Win (Lyons)

359A. Dario and the Poetics of Modernismo—(Enroll in Spanish 359.)

3-5 units, Aut (Giovato)

360. Giambattista Vico and René Descartes—(Enroll in Italian 360.) The thought of René Descartes in confrontation with Giambattista Vico’s philosophy, which arose as a reaction to Cartesianism. Descartes’ autobiography, Discourse on Method, in relation to Vico’s Autobiography, and New Science as a critique of the metaphysics of subjectivity that began with Descartes’ attempt to ground knowledge in the cogito.

4 units (Harrison) given 1989-90

360A. History of Literary Theory (Ancient)—(Enroll in English 360A.) Graduate level reading and lecture.

5 units, Aut (Trimpí)
360B. History of Literary Theory (Medieval/Renaissance)—(Enroll in English 360B.) A graduate reading and lecture course.
   5 units, Win (Trimpi)

360Z. Latin American Women Writers of the 19th Century—(Enroll in Spanish and Portuguese 360.)
   3-5 units, Win (Pratt)

361. Seminar: The Modern Tradition—(Enroll in English 361.) Conceptualizations of modernity, modernism, and modernization in terms of cultural criticism and social theory. Topics: diachronic designations with reference to tradition and post-modernism; the institutional status of culture; modern identity, and the confrontation with alterity.
   5 units, Aut (Gagnier)

   3-5 units, Win (Ruffinelli)

362A. Seminar on the Italian Baroque—(Enroll in Italian 362.) An interdisciplinary study of the poetics of the Baroque in literature, theater, architecture, sculpture, painting, and music. Attention to the historical context of the counter-Reformation, and to the public and political dimensions of the Baroque aesthetic. Figures studied: Tasso, Marino, Chiabrera, Bernini, Borromini, and Monteverdi.
   4 units, Win (Springer)

363. Interdisciplinary Graduate Seminar/Chicano Culture—(Enroll in English 363, Spanish 352.) How literary texts reflect and interpret aspects of the Mexican-American experience. Texts within the intellectual tradition of the U.S and Mexico are analyzed from this dual perspective.
   5 units, Spr (Islas, Ybarra-Frausto)

367. Seminar: Theology and the Reading of Medieval Literature—(Enroll in English 367.) Major theological texts that influenced medieval literature and the critical interpretation of the literature in the light of these texts: for earlier literature, writings of the Fathers of the Western Church and early medieval exegesis; for the later period, writings of Scholastics.
   5 units, Win (Broun)

367A. Italy as a Literary Symbol—(Enroll in Italian 367.)
   4 units (Allen) given 1989-90

368. Heinrich von Kleist—(Enroll in German Studies 368.) Intensive study of Kleist's work, letters, and journalistic writings; focusing on theoretical questions such as the delimitation of generic boundaries, the constitution of narrative, text and subjectivity, discourse and power, historical contextualization.
   3-5 units, Aut (Wellbery)

368A. Seminar: The Narratives of Augusto Monterroso—(Enroll in Spanish 368.)
   3-5 units, Win (Corral)

369. The Structuralist Paradigm and its Transformation—(Same as English 369, German Studies 346.) The structuralist paradigm in the work of Saussure, Jakobson, and Lévi-Strauss; its redactions in the work of Lacan, Barthes, Althusser; its transformations in post-structuralist writing. Derrida, Foucault.
   5 units, Aut (Wellbery) TTh 1:15-3:05

371. Seminar in Chinese Narrative—(Enroll in Asian Languages 371.) Thorough studies of individual texts emphasizing theoretical applications. May be repeated for credit. Prerequisite: 271 or consent of instructor.
   5 units (Wang) not given 1988-89

375. Dostoevsky and French Literature—(Same as Slavic Languages 375.) Dostoevsky's relations with French literature as a source of inspiration for his own work and as himself inspiring modern French writers. Notes from Underground and Crime and Punishment works by Diderot, Balzac, Gide, Camus and Sartre.
   5 units, Win (Frank) TTh 3:15-5:05

375B. Colloquium: Spenser and Milton in Context—(Same as English 302B.) Selected aspects of The Faerie Queene and Paradise Lost against the background of classical epic and romance, and the foreground of recent feminist and new historicist criticism.
   5 units, Win (Parker) T 3:15-6:05

384A. Joyce, Proust, Mann I—(Enroll in German Studies 384A.) Themes, structures, and mythopoetic dimensions of the novel in the context of Modernism, Joyce, Proust, and Mann as synthesizers and interpreters of the historical situation ("decline of the West," contending-isms, the Great War, etc.), forms of consciousness (Bergson, Nietzsche, Freud, Jung, et al.) and artistic expressions (opera, painting, cinema, etc.) of their age.
   3-5 units, Aut (Gillespie)

385. Fascism and Culture: Seminar on Fascist Modernism—(Enroll in Italian 385.)
   4 units (Schnapp) given 1989-90

385E. Seminar: Ezra Pound and the Problems of Modernism—(Enroll in English 385E.)
   5 units, Aut (Perloff)

391. Humor in Hispanic Literature—(Enroll in Spanish 391.) Manifestations of humor in Peninsular literature from medieval times to the present. Comic poetry is discussed; emphasis is on prose. Primary texts are analyzed in the
light of theoretical works (Bakhtin, Foucault, Bergson, Collie, Levin) to establish a poetics of Hispanic humor.

3-5 units, Aut (Martin)

392. Humor in Latin American Literature — (Enroll in Spanish 392.) Satire and other comic forms of literature as a political force for reform in 19th and 20th century Latin American writings.

3-5 units, Aut (Martin)

393. Seminar: Renaissance Rhetoric, Textual Instances — (Same as English 307B.) Seminar examines, beginning with Erasmus, the discourse of rhetoric in the Renaissance in its theoretical formulations and in particular literary instances from Rabelais to Shakespeare, Cervantes, and others.

5 units, Aut (Parker) M 3:15-6:05


5 units, Win (Parker) M 3:15-6:05

474F. Graduate Seminar on Antonio Gramsci — (Enroll in Italian 474F, offered in Florence.) Readings from Gramsci's Prison Notebooks emphasizing Gramsci as a theorist of culture and politics. Topics: Gramsci's concept of hegemony, Gramsci on the "organic" and "traditional" intellectual, Gramsci as reader (of Dante, Machiavelli, Pirandello), Gramsci and the Risorgimento. Also, supplementary texts by Croce, Foucault, Althusser, Jameson, etc.

5 units, Win (Schnapp)

490F. Pro-Seminar: Allegory, History, Theory, Practice — (Enroll in Italian 490F, offered in Florence.) A three-fold approach to allegory: by surveying a number of major theories in the history of allegorical interpretation in relation to changes in ancient and modern institutions; by examining a variety of theoretical constructions of allegory from the Pauline epistles to Dante to Paul de Man; and by studying several "disfunctional" allegorical texts (Boccaccio's Corbaccio). Possible topics: Philo Judeus's Life of Moses, heretical allegoreses of Scripture (Joachism), psychoanalysis and allegory (dream interpretations), Jameson's Marxist redaction of 4-fold exegesis in The Political Unconscious.

5 units, Aut (Schnapp)

DRAMA

Emeriti: (Professor) Wendell Cole, Martin Esslin, Eleanor Prosser; (Associate Professors) Elisabeth Buckingham, Helen W. Schrader, H. Donald Winbigler; (Adjunct Professor) Evelyn M. Draper; (Assistant Professor) Naomi Wrage

Acting Chairman: Michael Ramsaur

Professors: Charles R. Lyons (Drama and Comparative Literature), Douglas A. Russell, Carl Weber

Associate Professor: William S. Eddelman

Assistant Professors: Alice Rayner, Sandra L. Richards (Drama and Black Performing Arts), John B. Wilson

Associate Professor (Teaching): Michael Ramsaur

Senior Lecturers: Patricia Ryan, Sheila Weber

Lecturers: Alexander Stewart, Connie Strayer

Visiting Professor: Adrienne Kennedy

Visiting Assistant Professor: David Graver

Visiting Lecturer: Richard Seyd

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

The requirements for the degree of Bachelor of Arts with a major in Drama are planned to integrate the critical and historical study of drama with the study and experience of performance. The major provides aesthetic and critical opportunities for students to develop special aptitudes. For example, a student may elect an emphasis in acting, directing, and design, or may combine areas of emphasis. Students are encouraged to declare their major in their sophomore year.

The core program required of all majors is:


2. Literature and Criticism—Drama 50, Introduction to Drama; Drama 150, 151, 152, Major Dramatic Texts.

3. Theater History—Drama 160 or Drama 161, History of the Theater.


5. Drama 170, Introduction to Directing or 134, Stage Management.

6. Performance—Each major must complete a minimum of 8 units in laboratory courses in departmental theater productions to be divided as follows: a minimum of 2 units in Drama 29, 39A, 39B, and 39C.

7. Electives—A program of 15 units of elective courses to be worked out in consultation with the major advisor.

Two years of a college level foreign language are strongly recommended.
HONORS PROGRAMS

DRAMA

For a limited number of students, the department offers a program leading to Honors in Drama. Students accepted for this program, in addition to fulfilling the requirements for the major, will complete an individually designed Honors project. The work for this project will normally begin in Spring Quarter of the junior year and be completed by the end of the senior year. To enter this program, the student must be a Drama major in good standing with an average letter grade indicator (LGI) of "B +" in the student's previous work in drama. The student may do an Honors project in one of the following areas: Acting; Directing; Design or Technical Production; Literature, Criticism or Theater History, or an individually designed program. An Honors essay will be part of both creative and research projects.

Upon successful completion of the project, candidates for Honors will be awarded "Honors," "High Honors," or "Highest Honors."

In order to apply the student must meet the following requirements:

1. Acting—
   a) The student must have completed six courses in acting with an LGI of "A-": Drama 120A, 120B, 120C, two movement classes, and one additional class.
   b) The student must have appeared in a significant role or have prepared a special audition for the performance faculty.
   c) The student must receive the approval of the performance faculty.

2. Directing—
   a) The student must have completed three courses in acting: Drama 170, Directing; Drama 30, 31, 32; and Drama 34 or 134, Stage Management.
   b) The student must have completed at least 4 units of Drama 29 or 39 thereby participating in some aspect of at least two departmental productions.
   c) The student must receive the approval of the directing faculty.

3. Design or Technical Production (D/TP)—
   a) The student must have completed six courses in Design or Technical Production with an LGI average of "A-": Drama 30, 31, 32, and two of three 130 level courses in the specific area of the project plus one other course in another area of D/TP.
   b) The student must have completed work on a significant design project on a Drama Department production or project, or given a special portfolio review by the D/TP faculty.
   c) The student must receive the approval of the D/TP faculty.

4. Dramatic Literature, Criticism, or Theater History—The student must have taken three courses (two for the theater history track) in dramatic literature at the 100 level, one of which may be from another department; one course (two in the theater history track) in theater history (Drama 160 series); and Drama 50, Introduction to Drama with an LGI of "A-" for these courses. The student must have the approval of the dramatic literature faculty.

Students should propose the Honors project and submit it through the Drama Department undergraduate advisor during the third quarter of the junior year. The proposal should include an outline of the courses they have taken and grades received in the area requirements. It should describe in detail the purpose and methods involved in the project; a bibliography if appropriate; and a one- to two-page abstract of the associated Honors essay. This proposal should be a substantial document, prepared in consultation with the primary advisor over a period of time. It is possible for a student to take a tutorial from the advisor, the subject being "Honors Proposal Preparation."

Upon acceptance into the Honors program and approval of the proposal by the student's advisor and the Drama Department faculty, the student will be formally admitted to the program and be assigned a second reader. The Senior Honors project will be accomplished under the guidance of the advisor during the senior year. For each quarter, the student should register in Drama 200, Senior Honors Project. All Honors projects must extend over at least two academic quarters and receive no less than 8 units of academic credit, and up to a maximum of 15 units.

In Acting—Once accepted into the Honors program, the student receives the departmental University Resident Theater Association (URTA) recommendation and faculty support in preparing audition material. Upon recommendation of the faculty, the student will be assigned a major role in a Drama Department production to be produced in the senior year. If no suitable production in the main season is available, it is the duty of the acting faculty to design a project or performance for the student and to coach him or her in it. In addition to performing the role, the student will write an Honors paper on the role to be performed. This paper will be read by the student's advisor and second reader for approval.

In Directing—The student will be assigned a production slot within his or her senior year. The student must submit for approval a produc-
tion plan that includes play selection, budget, schedule, and staff assignments, and a brief statement of concept and casting procedures. An integral part of the directing project is to administer all aspects of the production. In order to properly prepare this production plan, the student should consult early and frequently with the Drama Department production manager. The department supplies materials, supervision, and staff, as available, to assist the mounting of the production. In addition to directing the production, the student must submit a copy of the prompt book and a paper supporting the Honors project. The paper should address the pre-production research, directorial concept, specific problems encountered during the rehearsal period, and a brief retrospective analysis. The paper will be read by the student's advisor and a second reader.

In Design or Technical Production—Once the Honors proposal and an Honors project have been approved, the student receives the departmental URTA recommendation and faculty support in preparing a portfolio showing. Upon recommendation of the faculty, the student will be assigned a design or production responsibility (lighting design, scenery design, costume design or technical director) for a major Drama Department production to be produced in the senior year. If no suitable production in the main season is available, it is the duty of the Design and Technical Production faculty to create an alternative opportunity. In addition to performing the design assignment, the student will write an Honors paper on the project. The paper should critically address the pre-production research, design concept, and specific problems encountered in the production process. This paper will be read by the student's advisor and second reader for approval.

In Dramatic Literature, Criticism, or Theater History—In the Spring Quarter of the junior year, the student must submit a research proposal with the endorsement of an advisor from the drama faculty. The completed Honors essay must be submitted to the advisor and second reader no later than the first week of the final quarter before graduation.

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" in this bulletin for a description of the Honors program. Students enrolled in the Honors Program in Humanities may offer Humanities 61, 62, and 63 in fulfillment of their departmental elective requirement.

GRADUATE PROGRAMS

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 "Humanities Special Programs" section in this bulletin.

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

DIRECTING/CRITICISM

1. A minimum of 72 units of graduate courses and seminars in support of the degree in addition to the doctoral dissertation.
2. Dramatic Critical Theory (300).
3. Theater History and Research Methods (360 and 361).
4. The course sequence in design (230, 231, 232) to be completed by the end of the second year.
6. 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.

7. Two years in the series in directing. Students in criticism/directing must complete the first-year and second-year workshop in directing (370A,B, 371A,B,C) 370P (3 units), 371P (6 units) and a third-year production project (372).

DESIGN/THEATER HISTORY

1. A minimum of 72 units of graduate courses in support of the degree in addition to the doctoral dissertation.
2. Dramatic Critical Theory (300).
3. Theater History and Research Methods (360 and 361).
5. Graduate Directing Workshop sequence (370A,B).
6. Three seminars; two in dramatic literature, one to be taken outside the department (e.g., a seminar in Art or German Studies).
7. Graduate Design Workshop sequence: Design Tutorials (330A,B,C); Design Workshop (331A,B,C); two design projects, one in setting (332A) and one in either costume or lighting design (332B).

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 letter grade indicator 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

DIRECTING/CRITICISM

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, 1870-1945
Contemporary, 1945 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 of the student's choice.

DESIGN/THEATER HISTORY

The candidate must complete all examinations by the end of the 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, 1870-1945
Contemporary, 1945 to present

Students in Design/Theater History will be required to take two examinations in Theater History (Classical to 18th century; 1800 to present); one in dramatic literature in a period of their choice; and a theoretical design project examination. 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 concentra-
tion, 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, the course sequence in design, 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 within five years from the quarter in which candidacy is granted. A candidate taking more than five years will be required to reinstate his or her candidacy by re-passing the written examinations on dramatic literature.

FELLOWSHIPS
The Department of Drama awards a number of fellowships to 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.

COURSES
A special brochure is available providing full details of courses given in the Summer Quarter.

INTRODUCTORY
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.

2. Introduction to Theatrical Style—The development of theatrical style in the major periods of western culture presented through slides, lectures, and discussions. (DR:2) 4 units, Aut (Russell) MWF 1:15

5. Introduction to Black American Drama—The development of Black drama in the United States from 1858 to the present. 4 units (Richards) alternate years, given 1989-90

20. Introduction to Acting—Exercises and improvisations to develop ease, freedom, and expressiveness on stage in preparation for the study of acting fundamentals. Includes a weekly acting seminar taught by the performance faculty. 3 units, Aut, Win, Spr (Staff) MWF 12:45-2 or MTTh 12:45-2

25. Voice and Speech for the Actor—Introduces relaxation exercises, techniques of breathing and alignment, and standard American pronunciation. For both the actor and the general student who wishes to develop physical and vocal awareness. 3 units, Aut (Ryan) MWF 9

27A,B,C. Movement for Actors.
27A. Movement for Actors—(Same as Dance 64.) 2 units, Spr (Cashion, Kramer) TTh 3:15-5:05
27B. Musical Theater Workshop—(Same as Dance 65.) 2 units, Win (Cashion) TTh 3:15-5:05
27C. Movement and Music for Actors—(Same as Dance 66.) 2 units, Aut (Kramer, Watson) TTh 3:15-5:05

28. Make-up for the Stage—Designed for both majors and non-majors. The basic techniques of make-up application; aging, prosthetics, stylization, characterization, animals, and fantasy make-up for the stage. 2 units, Aut (Strayer) W 2:15-4:05

29. Theater Performance: Acting—Students cast in departmental productions may receive credit for their participation as actors; 1 unit for Graduate Directing Workshop projects and 1-3 units for major production (units determined by the instructor). May be repeated. No more than 10 units may be counted by Drama majors toward graduation requirements of 180 units. Prerequisite: Consent of instructor. 1-3 units, any quarter (Staff) by arrangement

30. Introduction to Scenic Design—A lecture-laboratory introducing basic skills of visual communication used in producing stage scenery. Covers design and construction methods. 3 units, Aut (Stewart, Wilson) MWF 11 plus lab by arrangement
31. Introduction to Stage Lighting—A lecture-laboratory introducing the basic theories of stage lighting. The material is approached from a technical and an aesthetic viewpoint.
3 units, Spr (Ramsaur) TTh 10-12

32. Introduction to Costume Design and Construction.
3 units, Win (Russell, Strayer) TTh 10-12

33. Drafting for the Theater—Lecture/laboratory introducing basic mechanical drawing techniques utilized by scenic and lighting designers. Basic pencil techniques through orthographic and isometric drawing, culminating with the technique of drop point perspective.
2 units (Stewart)
alternate years, given 1989-90

34. Stage Management Techniques—Survey lecture introducing the production process and the wide variety of duties and responsibilities of a stage manager within that process.
2 units, Aut (Stewart) MWF 10

35. Sound Design for the Stage—Lecture/laboratory exploring the realm of theater sound. Introduction to basic recording and playback techniques, and acoustics and editing emphasizing analyzing, creating, and implementation of "theatrical" sound effects for the stage.
2 units, Spr (Stewart) TTh 3:15-5:05

36. Scenic Painting Techniques—Basic painting techniques used in the scenic studio to translate scaled designer's elevations into finished scenery. A "hands-on" practicum.
2 units (Wilson)
alternate years, given 1989-90

37. Costume Construction—A "hands-on" course in the crafts of pattern drafting, sewing costumes, millinery work, and the making of costume accessories.
2 units, Spr (Strayer) W 2:15-4:05

38. Sketching and Rendering Techniques for the Theater—Development of freehand sketch methods in various media used by designers to communicate visual ideas in both color and black and white. Weekly assignments.
2 units, Aut (Wilson) by arrangement

39A,B,C. Theater Performance: Crew—Students receive credit for the participation in the design and technical areas of departmental productions. 30 hours of work = 1 unit. Students receive credit for either preparation and construction in any of the areas, or as a member of a "running crew." Normally, 2 units for working on the running crew of a show that runs two weeks, and 1 unit for a show that runs one week. The Master Electrician is usually awarded an extra unit in each case for the added time commitment.
1-5 units, any quarter (Staff) by arrangement
39A. Scenery and/or Property.
39B. Lighting and/or Sound.
39C. Costumes and/or Make-up.

50. Introduction to Drama—Major dramatic forms, concentrating on selected masterpieces in order to develop theatrical sensibility in reading dramatic texts. (DR:2) 4 units, Spr (Rayner) MWF 9

INTERMEDIATE

Course numbers 100-199 are intermediate courses designed primarily for the major but open to all undergraduates who have the necessary prerequisites.

110. Theater Management—A survey of business management in community, resident, and Broadway theater. Emphasis on publicity, promotion, box office technique, house management, production management, and the manager's contribution to the theater operation.
3 units, Spr (Ramsaur)
alternate years, given 1989-90

120A,B,C. Fundamentals of Acting—For those who wish to pursue the study of acting in some depth. Provides the fundamental training of the actor as a theatrical instrument. Exercises and improvisations in basic activity, motivation, concentration, and imagination. Students should take this course in sequence. Prerequisite: Sophomore standing or consent of instructor.

120A. 4 units, Aut (Ryan, Weber)
TTh 10-12, TTh 1:15-3:05, or MW 10-12

120B.—Prerequisite: 120A or consent of instructor.
4 units, Win (Ryan, Weber)
TTh 10-12, TTh 1:15-3:05, or MW 10-12

120C.—Prerequisite: 120B or consent of instructor.
4 units, Spr (Ryan, Weber)
TTh 10-12 or MW 10-12

121A,B,C. Acting Workshop—The following specialized courses are designed for students who have completed the 120 series (A,B,C), unless otherwise designated. May be repeated for credit.

121A. Improvisation—Explore and develops the creative imagination; games and exercises are taught which foster spontaneity and cooperation.
4 units, Aut, Spr (Ryan) MW 2:15-4:05

121B. Advanced Scene Study.
4 units, Spr (Ryan, Weber) MW 10-12
TTh 1:15-3:05
121C. Acting Shakespeare—A practicum in acting Shakespeare, vocal technique, scan-
sion, and delivery.
4 units (Lyons)
alternate years, given 1989-90

123. Audition Techniques—For the advanced actor. Preparation of monologues, cold read-

ings, singing auditions, and preparation of resumés. Prerequisite: 120A,B,C or the equiva-

lent.
4 units, Aut (Seyd) M 1:15-4:05

124. Identity and Role: A Practicum—(Same as Psychology 170.) Topics and concepts at the
interface of psychology and drama: emotion, self, madness, situated identity, status trans-
actions, power, and time perspectives. The exploration is academic and experimental, with
readings, lectures, demonstrations, class exercises, and dramatic presentations. A team proj-
ec on one of the major topics is presented to the class as a videotaped performance. Preference
given to Psychology and Drama majors. Pre-
requisite: Consent of instructors.
4 units, Win (Ryan, Zimbardo) MW2:15-4:05

125. Voice and Diction for the Theater—Ex-
clusively for undergraduate majors and Ph.D.
students in the Department of Drama. Body
work, release from tension, breathing, diction,
voice placement and projection, vocal quality,
and therapy. Effective and healthful use of the
speaking and singing voices and their interrela-
tion emphasizing awareness of damaging vocal
habits. Limited to 10 students. Admission by
advisory audition.
2 units, Win (Draper) T 10-12

127. Dance and Live Art in the 20th Century
—(Same as Dance 160.) A critical history and
analysis of the development of live art in Western
theatrical dance and performance art in the 20th
century. Topics: the body as an art medium, the
interface of dance and art’s idea about structure
and form, autobiography and the self as a sub-
ject.
3 units, Spr (Ross)

130A,B,C. Scenic Design—A series of hands-
on courses concerned with the basic processes
in designing scenery.
130A. Scenery for Proscenium Stages—Vis-
ual concepts appropriate to a proscenium
stage. Drafting and model-building as the
primary means of communicating design
ideas. Interaction with graduate directors.
Prerequisite: 30.
4 units, Win (Wilson) T 1:15-4:05
play lab by arrangement

130B. Advanced Scenic Design—Individ-
ually structured projects in flat-surface com-
munication techniques involving mechanical
perspective and color rendering. Prerequi-
site: 130A.
4 units, Spr (Wilson) W 1:15-4:05

130C. Scenery for Alternative Stages—
Thrust, arena, and environmental staging
techniques in models and freehand sketches
supported by drafting. Interaction with gradu-
ate directors. Prerequisites: 130A and B.
3-4 units (Wilson)
any quarter by arrangement

131A,B,C. Lighting Design.
131A. Stage Lighting Mechanics—Lec-
ture-lab dealing with all practical aspects
of lighting: electricity, light sources, in-
strumentation, control, drafting, plotting,
and the basic design process. Prerequisite: 31.
4 units, Aut (Ramsaur) TTh 10-12

131B. Stage Lighting Aesthetics—Labor-
atory discussion on the aesthetic principles
of lighting design: interpretation, concept,
color, angle and placement. Various design
styles are introduced: dance, rock and roll,
operas, musical comedy, thrust, and arena.
Lighting designers for departmental proj-
ec ts are assigned from this class. Prerequi-
site: 131A.
4 units, Win (Ramsaur) TTh 10-12

131C. Advanced Stage Lighting Design—
Projects in lighting mechanics and lighting
design are resolved through experimenta-
tion, class discussions, and written report. Design projects include dorm shows and
other community productions. Lighting
designers for major departmental produc-
tions are assigned from this class. Prerequi-
sites: 131A and B.
1-4 units, any quarter (Ramsaur)
by arrangement

132. Costume Design—Visual analysis of his-
torical styles of costume design interpreted for
the modern theater and developed by the stu-
dent in various presentational media.
4 units, Aut (Russell) T 10-12

133. Technical Production—Lecture-lab in
basic production practices. The opportunity to
learn and practice the theory and use of stand-
ard tools and materials used in stage scenery
construction. Prerequisite: 30.
4 units, Win (Stewart) MW 10-12
and 4 hour lab by arrangement

134. Stage Management Project—A project
course for students who are stage managing a
Drama Department production.
1-5 units, any quarter (Stewart)

135. Project in Design or Technical Produc-
tion—Project in stage design, costume design,
lighting design, technical production, or stage managing. Prerequisite: Consent of instructor.

136. Project in Technical Production—A project in technical direction or sound engineering for a Drama Department project.

1-5 units, any quarter (Staff)

by arrangement

140. Workshop in Playwriting.

5 units (Lyons) alternate years, given 1989-90

150N. Major Dramatic Texts I: Greek to Renaissance—Selected texts from Aeschylus, Sophocles, Euripides, Aristophanes, Plautus, Terence, Seneca, anonymous medieval playwrights, Marlow, early Shakespeare. (DR:2)

4 units, Aut (Rayner) MWF 9

151. Major Dramatic Texts II: Renaissance to Romantic—Selected texts from Shakespeare, Jonson, Corneille, Racine, Moliere, Wycherley, Congreve, Sheridan, Goldsmith, Goethe, Schiller, Kleist, Buechner. (DR:2)

4 units, Win (Rayner) MWF 9

152N. Major Dramatic Texts III: Early Realistic to the Present—Selected texts from Hebbel, Ibsen, Chekhov; Strindberg, Brecht, Shaw, Synge, O’Casey, O’Neill, Williams, Miller, Albee, Shepard, Beckett, Ionesco, Genet, Duerrenmatt, Weiss, Osborne, Pinter, Bond. (DR:2)

4 units, Spr (Graver) MWF 9

153. Greek Tragedy: Aeschylus, Sophocles, Euripides—(Same as Classics 12.) (DR:2)

3-4 units, Win (McCall)

154N. American Drama, 1920s-1950s—Survey focusing on the development of American drama through an analysis of representative works and stylistic devices. (DR:2)

4 units (Richards)

alternate years, given 1989-90

155N. American Drama, 1960s to Present—Survey examining major playwrights and trends in contemporary American drama. So-called “special interest” dramas, i.e., plays emanating from Black, Chicano, Asian-American, feminist, gay, or lesbian experiences, are integrated into the course to better reflect the actual vitality and diversity of American drama. (DR:2)

4 units (Richards)

alternate years, given 1989-90

156. American Women Playwrights—Survey focusing on plays written by women, designed in part to investigate the extent to which American women’s playwriting does or does not constitute a feminist aesthetic in drama. (DR:2)

4 units, Win (Richards)

alternate years, given 1989-90

157N. Contemporary Black Playwrights—The dramaturgy, i.e., thematic issues, styles, and aesthetics, of contemporary playwrights in the United States, the Caribbean, and Africa. The concept of an African Diaspora or cultural continuity between Africa and the Americas is the premise; also explores diversity among the various societies represented. (DR:2)

4 units, Win (Kennedy) MWF 9

158A. Tom Stoppard—(Same as English 178.) Stoppard, one of the leading playwrights of our time (Rosencrantz and Guildenstern, Jumpers, Travesties), is a master of dialogue that makes ingenious use of literary models from Shakespeare to Agatha Christie.

3 units, Win (Esslin) MW 1:15

158B. Bertolt Brecht—The epic theater in theory and practice. 4 units, Spr (Esslin, Weber) MWF 1:15

159A,B,C. Shakespeare—(Same as English 173A,B,C.) (DR:2)

159A. 5 units, Aut (Rebholz) MTWTh 11

159B. 5 units, Win (Lyons) MTWTh 9

159C. 5 units, Spr (Orgel) TTh 1:15-3:05

160. History of Theater: Classical Greece to the 18th Century—The development of theater architecture and staging as they stylistically evolved from theatrical beginnings to the end of the 18th century. Emphasis on the ways in which theaters and staging reflect their own cultural and spatial environments.

4 units, Win (Esslin) MWF 9

161. History of the Theater: 19th and 20th Centuries—The development of theaters and staging as they stylistically evolved during the 19th and 20th centuries. Emphasis on the ways in which theaters and staging reflect their own cultural and spatial environments.

4 units, Aut (Eddelman) MWF 9

162. History of Costume and Fashion—Lecture-survey on the history of dress in the Western World from ancient times to the present.

4 units, Aut (Russell) MWF 2:15

170. Introduction to Directing—Prerequisites: 120A, B, C, or consent of instructor.

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

190. Special Research—Individual project in the work of a playwright, period, or genre. Prerequisite: Consent of instructor.

1-5 units, any quarter (Staff)

by arrangement

200. Senior Honors Project—See description under Undergraduate Programs. Must be taken twice in sequence. Admittance by application to
the Drama Department faculty during the junior year.

1-5 units, by arrangement

**ADVANCED COURSES**

Courses numbered 200-299 are designed for advanced undergraduates and graduates.

**230. Scene Design for Graduate Directors**—A laboratory-discussion addressing the relationship between designers and directors, and the techniques of visual communication used in that relationship. Consists of a series of discussions and projects involving conceptual thinking, spatial conception, and the use of scale in drafting and model building.

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

**231. Lighting Design for Graduate Directors**—A laboratory discussion concentrating on the aesthetic principles of lighting design. Includes laboratory design projects, conceptual discussions, design assignments, and the drafting of light plots and the accompanying paperwork.

3 units, Spr (Ramsaur) T 1:15 and Th 1:15-3:05

**232. Costume Design for Graduate Directors**—Discussion on projects on style in costume design.

3 units, Win (Russell) T 2:15-4:45

**235. Project in Design or Technical Production.**

1-5 units, any quarter (Staff)

**240. Workshop in Playwriting.**

5 units, Aut (Kennedy)

**250. Major Dramatic Texts I: Greek to Renaissance**—(See Drama 150N.)

4 units, Aut (Rayner) MWF 9

**251. Major Dramatic Texts II: Renaissance to Romantic**—(See Drama 151.)

4 units (Rayner) MWF 9

**252. Major Dramatic Texts III: Early Realistic to the Present**—(See Drama 152N.)

4 units, Spr (Graver) MWF 9

**254. American Drama (1920s-1950s)**—(See Drama 154.)

4 units (Richards) alternate years, given 1989-90

**255. American Drama (1960s-Present)**—(See Drama 155N.)

4 units (Richards) alternate years, given 1989-90

**256. American Women Playwrights**—(See Drama 156.)

4 units (Richards) alternate years, given 1989-90

**257. Contemporary Black Playwrights**—(See Drama 157N.)

4 units, Win (Kennedy) MWF 11

**258A. Tom Stoppard**—See 158A.

**258B. Bertolt Brecht**—See 158B.

**260. History of Theater: Classical Greece to the 18th Century**—(See Drama 160.)

4 units, Win (Eddelman) MWF 9

**261. History of Theater: 19th and 20th Centuries**—(See Drama 161.)

4 units, Aut (Eddelman) MWF 9

**262. History of Costume and Fashion**—(See Drama 162.)

4 units, Aut (Russell) MWF 2:15

**270. Independent Project in Directing**—Prerequisites: 170 and approval of Department of Drama faculty.

2-5 units, any quarter (Weber) by arrangement

**290. Special Research**—Individual project in the work of a playwright, period, or genre.

1-5 units, any quarter (Staff) by arrangement

**GRADUATE**

Courses numbered 300 and above are primarily for graduates but are open to advanced undergraduates with permission.

**300. Drama Critical Theory.**

5 units, Aut (Rayner) MW 2:15-4:05

**330A, B, C. Design Workshop**—Advanced course in design for the theater.

5 units, Aut, Win, Spr (Eddelman, Ramsaur, Russell, Wilson) by arrangement

**331A, B, C. Second Year Design Project**—Design of a full-length production in conjunction with directing project (372).

5 units, Aut, Win, Spr (Ramsaur, Russell, Wilson) by arrangement

**332. Third Year Design Project.**

5 units (Ramsaur, Russell, Wilson)

**350. Seminar in Greek Drama.**

5 units (Lyons) alternate years, given 1989-90

**351A, B, C. Seminar: Shakespeare**—(Same as English 373A.)

5 units, Win (Orgel) M 3:15-6:05

**351B. Seminar: Shakespeare**—(Same as English 373B.)

5 units, Spr (Orgel) M 3:15-6:05


5 units, Spr (Richards) TTh 10-12
Seminar: Faust Plays—Faust, one of the archetypal figures of Western civilization, viewed from Marlowe via Goethe to the present.
5 units, Spr (Esslin) MW 10-12

Seminar: 20th-Century Visual Aesthetics—The visual aesthetics of the theater during the last 25 years. Emphasis on European theater companies and scenography design and on innovative developments in the U.S. and Asia. A conceptual approach is taken in analysing contemporary theater.
5 units, Spr (Esslin) MW 10-12

Seminar: Contemporary Drama—(Same as English 307D.) Avant-garde drama of the early 20th century.
5 units, Aut (Graver) MW 2:15-4:05

Seminar: Semiotics of Drama—How the sign systems of drama (text, set, costumes, gesture, intonation, movement, music) create meaning in performance in the dramatic media: stage, cinema, and television.
5 units, Win (Esslin) MW 10-12

Seminar. 5 units, Spr (Staff) MW 2:15-4:05

Seminar: Shakespeare Criticism: The Last Decade—(Same as English 302B.) The impact of recent critical theory on studies of Shakespeare.
5 units, Win (Lyons) MW 2:15-4:05

Theater History and Research Methods: Classical Greece to the 18th Century.
5 units, Win (Eddelman) MWF 9

Theater History and Research Methods: 19th to 20th Century.
5 units, Aut (Eddelman) MWF 9

Directing Workshop I—The director's approach to works in the realistic tradition. Investigation of basic directorial problems in scenes, using a multi-form theater space, designing actor/audience relationships and composing modular scenic units. Performances limited to class. Prerequisite: Consent of instructor.
370A. 5 units, Aut (Weber) by arrangement
370B. 5 units, Spr (Weber) by arrangement
370P. Project. 3 units, Spr (Weber) by arrangement

Directing Workshop II—Exploration of dramaturgic and directorial methods in working on plays from the classic, Elizabethan, Epic, or Post-Naturalistic theater. Investigation of advanced directorial problems in shorter plays or performance pieces working in a variety of styles, using a multi-form theater space. Public performances.
371A. 3 units, Aut (Weber) by arrangement

Directing Project—Production of full-length play. Public performances.
6 units, any quarter (Weber) by arrangement

Tutorial.
1-4 units, any quarter (Staff) by arrangement

Dissertation Research.
any quarter (Staff) by arrangement

OVERSEAS STUDIES
The following courses are approved for the Drama major and taught overseas at the campus. Students are encouraged to discuss with their major advisors which courses would best meet individual educational needs. Descriptions of these courses can be found in the “Overseas Studies” section of this bulletin or in the Overseas Studies Program office, 126 Sweet Hall.

German Theater—Berlin.
4 units, Aut (Kramer)

Modern British Drama I—Oxford.
5 units, Aut (Worth)

Modern British Drama II—Oxford.
5 units, Win (Worth)

Weimar Culture: Theater, Film, Music, and Drama—Berlin. (DR:2)
4 units, Spr (Eddelman)

Contemporary British Theater—Oxford. (DR:2)
4 units, Spr (Mateer)

Between Art and Politics—Krakow. (DR:2)
3 units, Spr (Orzechowski)

Theater and Politics—Berlin. (DR:2)
4 units, Spr (Eddelman)


CENTER FOR EAST ASIAN STUDIES

**Director:** Lyman P. Van Slyke

**Affiliated Faculty:**

** Anthropology:** Harumi Befu, Thomas Rohlen (in Japan), G. William Skinner (on leave Winter), Robert B. Textor (on leave Autumn), Arthur P. Wolf

** Art:** John La Plante, D. Michael Sullivan (Emeritus), Melinda Takeuchi (on leave Autumn)

**Aston Languages:** Kazuko M. Busbin, Yin Chuang, Albert E. Dien, Thomas W. Hare, Kung-yi Kao, Hiroyasu Kubota, Ian Levy, William A. Lyell, Susan K. Matisoff, Kimie Nishimura Nebrig, Hiroshi Sakamoto, Dorothy Shou, Makoto Ueda, Stephen Van Zoeren, John C.Y. Wang

** Economics:** Masahiko Aoki (on leave 1988-89), John J. Gurley (Emeritus), Lawrence Lau

** History:** Peter Duus, Harold L. Kahn, Jeffrey P. Mass, Lyman P. Van Slyke

** Linguistics:** William J. Poser (on leave Autumn), Peter Sells

** Philosophy:** David S. Nivison (Emeritus)

** Political Science:** Nina Halpern, Nobutaka Ike (Emeritus), John W. Lewis (on leave), Robert North (Emeritus), Daniel Okimoto, Kurt Steiner (Emeritus), Robert E. Ward (Emeritus)

** Religious Studies:** Carl Bielefeldt, Bernard Faure, Philip J. Ivanhoe, Anne Klein, David S. Nivison (Emeritus), Alan Sponberg, Lee H. Yearley

In addition, a number of other Stanford faculty have some teaching or research interests related to East Asia: Takeshi Amemiya (Economics), Walter P. Falcon (Food Research), William B. Gould (Law), Robert D. Hess (Education), Bruce F. Johnston (Food Research), Dudley Kirk (Emeritus, Food Research), Gerald Meier (Business), Ramon Myers (Hoover Institution), Richard T. Pascale (Business), 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 extra curricular 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 National Resource East Asia Language and Area Center sponsors programs which provide opportunities for East Asian Studies faculty and students 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; telephone (415) 723-3362.

**UNDERGRADUATE PROGRAMS**

**BACHELOR OF ARTS**

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 (Student Proposal for a Major in East Asian Studies), not later than the end of the first quarter of the junior year, for approval by the East Asian Studies Subcommittee on the A.B. Program.

Majors are required to complete at least 75 units of coursework treating China and/or Japan. (Courses not limited to East Asia may be counted if at least half of the course content treats China and/or Japan and if the student focuses on one or both countries in any required written work.) Courses to be credited against
major requirements must be completed with a letter grade indicator of "C" or better. 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 for letter grades. Students are encouraged to undertake further language training, but additional language coursework does 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) if taken previous to 1984-85
   - History 192A, 192B, 192C (Chinese History)
   - History 194, 194A, 194B (Japanese History)

3. **Substantive Concentration:** 30 units—Completion of appropriate coursework focused on a disciplinary or topical 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 Essay**—Completion of a paper, approximately 25 typewritten pages in length, to be submitted as a senior essay in East Asian Studies. Insofar as possible, the essay should integrate the substantive concentration. It may be written for one of the courses offered as part of that concentration or in connection with directed individual study with the approval of the student's major advisor. In the latter case, up to 5 units of individual study may be credited toward the substantive concentration.

**HONORS PROGRAM**

Majors with a letter-grade indicator of 3.25 or better in all courses related to East Asia may apply for the Honors program no later than the final quarter of the junior year. Application entails submitting an Honors prospectus to the student's advisor for approval. Admission is granted by the Subcommittee on the A.B. Program, acting on the advisor's recommendation. Honors requirements are satisfactory completion of (1) an Honors thesis of high quality, approximately 40 typewritten pages in length, to be submitted in lieu of the senior essay otherwise required for the major, (2) 5-10 units of directed individual study in connection with the thesis project, and (3) one advanced-level colloquium or seminar treating China, Japan, or both.

**COTERMINAL DEGREE**

The Center for East Asian Studies will admit a limited number of undergraduates to work for a coterminous A.M. in East Asian Studies. Applications for admission to this program should be submitted by Jan 1 of the student's junior 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; scores from the General Test of the Graduate Record Exam; and 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.

**EAST ASIAN STUDIES THEME HOUSE**

EAST House, located at Governor's Corner on campus, is an undergraduate residence which houses 60 students and offers them a wide variety of opportunities to expand their knowledge, understanding, and appreciation of China and Japan. Assignment is made through the regular undergraduate housing draw.

**GRADUATE PROGRAMS**

**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 wish 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, career-oriented students should realize that a master's degree in East Asian Studies alone is often insufficient preparation for work in many professions; they are strongly advised to plan for professional training in addition to 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 assigns faculty advisors to all students. 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, Building 590, Stanford University, Stanford, California 94305. The deadline for applications for admission and financial aid for 1989-90 is January 1, 1989.

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. Language courses taken at Stanford must be for letter grades.

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 beyond 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 Institute for International Studies” section in this bulletin.

**Area Course Requirement**—Students must complete a minimum of nine courses (numbered 100 or above) related to East Asia and totaling at least 36 units beyond the courses used to fulfill the third-year level language requirement. These courses must be taken for a letter grade. An integral part of the program is training in research and a demonstration of research ability in a discipline; three core courses must be within a single department, one of which 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.

**EAST ASIAN STUDIES AND BUSINESS**

This joint program grants an A.M. degree in East Asian Studies and a Master of Business
Administration. Interested students must apply separately to the East Asian Studies A.M. program and the Graduate School of Business and be accepted by both. Completion of this combined course of study requires approximately three academic years (perhaps including summer sessions), depending on the student's background and level of training in Chinese or Japanese language.

RELATED PROGRAMS
EAST ASIAN STUDIES AND FOOD RESEARCH

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 a letter grade indicator (LGI) of "B" or better; and who complete at least 45 units of approved work in courses numbered 100 or above with an LGI 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.

EAST ASIAN STUDIES AND HEALTH SERVICES RESEARCH

The Master of Science degree in Health Services Research (H.S.R.) 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 policy makers. Students concluding their first year of graduate study at Stanford are eligible to apply for the degree which is granted by the Department of Health Research and Policy 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 H.S.R. 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 Asian Studies may apply for University Fellowships at the time of the initial application 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. Recipients must be American citizens. For further information about FLAS Fellowships, contact the Institute for International Studies, Room 200, Lou Henry Hoover Building, Stanford University, Stanford, California 94305.

COURSES

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 bulletin. For a fuller description of the courses below, also refer to the individual departmental listings.

ANTHROPOLOGY

21. The World Outside the West: Change and Tradition Before the Age of European Imperialism.
   5 units, Aut (Fox, Roberts, Van Slyke)
22. The World Outside the West in the Age of European Imperialism.
   5 units, Spr (Abernathy, Van Slyke)
   5 units (Skinner) given 1989-90
121. Japanese Society and Culture.
   5 units (Befu) given 1989-90
### Japanese Economic Organization
5 units (Befu) given 1989-90

### Japanese Woman through Novels and Films—(Same as Asian Languages 125.)
5 units (Befu) given 1989-90

### Comparative Social Organization of China and Japan.
5 units (Skinner) not given 1988-89

### Sociocultural Implications of High Technology.
5 units, Aut (Textor)

### Regional Systems in Agrarian Societies.
5 units (Skinner) given 1990

### Spatial Systems and Social Process.
5 units, Spr (Skinner)

### Ideas and Forms in Asian Art.
4 units, Win (LaPlante, Takeuchi)

### Theme and Style in Japanese Art.
4 units, Spr (Takeuchi)

### Introduction to the Art of Asia (to 600 A.D.).
4 units, Aut (LaPlante)

### Introduction to the Art of Asia (7th Century-13th Century).
4 units, Win (LaPlante)

### Introduction to the Art of Asia (14th Century to the Present).
4 units, Spr (LaPlante)

### Ritual Bronzes of Ancient China.
4 units (LaPlante) not given 1988-89

### Chinese Ceramics.
4 units (La Plante) not given 1988-89

### Buddhist Art in Asia.
4 units, Aut (LaPlante)

### Architecture and Gardens of Japan.
4 units (La Plante) not given 1988-89

### Japanese Ceramics.
4 units (La Plante) given 1989-90

### Seminar on Japanese Art.
4 units, Spr (Takeuchi)

### Colloquium: Japanese Painting in the 18th Century.
4 units, Win (Takeuchi)

### Introduction to Chinese Philosophy—(Same as Philosophy 46, Religious Studies 55.)
Enrollment limited to 80.
4 units, Aut (Ivanhoe) MWF 10

### Traditional East Asian Civilization: China.
5 units, Aut (Van Zoeren) MWTThF 10

### Traditional East Asian Civilization: Japan.
5 units, Win (Hare) MWTThF 10

### Chinese Poetry in Translation.
4 units, Aut (Van Zoeren) MWTThF 1:15

### Chinese Fiction and Drama in Translation.
4 units, Spr (LaPlante) MWF 1:15

### Japanese Drama in Translation.
4 units (Matisoff) not given 1988-89

### Japanese Poetry in Translation.
4 units, Aut (Levy) MWF 1:15

### Japanese Fiction in Translation.
4 units, given 1989-90

### Modern Japanese Literature in Translation.
4 units, Spr (Lyell) MWF 1:15

### Survey of Chinese Archaeology.
4 units, Aut (von Falkenhausen) MWF 11

### Nomad Empires of Inner Asia—(Same as History 193, History of Science 153.)
5 units (Dien) given 1989-90

### China from Earliest Times to the 9th Century — (Same as History 192A.)
5 units (Dien, Kahn) given 1989-90

### Performance of Lyric Poetry.
3 units (Hare) given 1989-90

### Japanese Women Writers.
4 units (Matisoff) given 1989-90

Students registering for the first time in a first- or second-year course must also take a placement test if they have had any training in Chinese before entering Stanford.

### First-Year Modern Chinese.
1. 5 units, Aut (Shou)
   MTWThF 9, 10, or 1:15
2. 5 units, Win (Shou)
   MTWThF 9, 10, or 1:15
5. Intensive First-Year Modern Chinese.  
   12 units, Sum (Staff) MTWThF 8-12

21, 22, 23. Second-Year Modern Chinese.  
21. 5 units, Aut (Chuang) MTWThF 9
22. 5 units, Win (Chuang) MTWThF 9
23. 5 units, Spr (Chuang) MTWThF 9

   12 units, Sum (Staff) MTWThF 8-12

27, 28, 29. Intermediate Conversation.  
27. 2 units, Aut (Shou) TTh 11
28. 2 units, Win (Shou) TTh 11
29. 2 units, Spr (Shou) TTh 11

51. Chinese Calligraphy.  
   1-2 units, Spr (Chuang) TTh 1:15

ADVENTED

101, 102, 103. Third-Year Chinese (Modern).  
101. 5 units, Aut (Chuang) MTWThF 11
102. 5 units, Win (Lyell) MTWThF 11
103. 5 units, Spr (Chuang) MTWThF 11

105. Intensive Modern Chinese.  
   12 units, Sum (Staff) MTWThF 9-12

111. 5 units, Aut (Staff) TTh 2:15-4:05
112. 5 units, Win (Staff) TTh 2:15-4:05
113. 5 units, Spr (Staff) TTh 2:15-4:05

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. 3 units, Aut (Staff) by arrangement
132. 3 units, Win (Staff) by arrangement
133. 3 units, Spr (Staff) by arrangement

200. Directed Reading in Chinese.  
   units by arrangement, Aut, Win, Spr (Staff) by arrangement

201, 202. Proseminar.  
201. 5 units, Win (Dien) W 2:15-4:05
202. 5 units, Spr (Dien) W 2:15-4:05

211, 212, 213. Advanced Modern Chinese.  
211. 5 units, Aut (Staff) by arrangement
212. 5 units, Win (Staff) by arrangement
213. 5 units, Spr (Staff) by arrangement

221, 222, 223. Advanced Classical Chinese.  
221. Philosophical Texts.  
   5 units, Aut (Staff) MWF 1:15
222. Historical Narration.  
   5 units, Win (Dien) MWF 1:15
223. Literary Essays.  
   5 units, Spr (Van Zoeren) MWF 11

230. Interpreting Confucian Classical Texts.  
   —(Same as Religious Studies 212.)  
   5 units, Win (Ivanhoe) TTh 4:15-6:05

241. Short Story.  
   5 units, Aut (Lyell) MWF 2:15
   5 units, Win (Chuang) MWF 11
   5 units, Aut (Lyell) given 1989-90

251. Ritual in Classical China.  
   4 units, Spr (von Falkenhausen TTh 2:15-4:05

260. Introduction to Chinese Poetry.  
   4 units, Win (Van Zoeren) MWF 11

261. Shih-ching and Ch' u-tz'u.  
   4 units (Van Zoeren) given 1989-90

264. Lyric (shih) II.  
   4 units, Spr (Van Zoeren) MWF 1:15

271. Traditional Chinese Fiction.  
   4 units, Aut (Wang) TTh 11:12-15

334. Seminar in Modern Chinese Literature.  
   5 units, Win (Lyell) by arrangement

JAPANESE

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 Japanese before entering Stanford.

1, 2, 3. First-Year Modern Japanese.  
1. 5 units, Aut (Sakamoto, Nebrig, Busbin)  
   MTWThF 9, 10, 11, or 1:15
2. 5 units, Win (Sakamoto, Nebrig, Busbin)  
   MTWThF 9, 10, 11, or 1:15
3. 5 units, Spr (Sakamoto, Nebrig, Busbin)  
   MTWThF 9, 10, 11, or 1:15

   12 units, Sum (Staff) MTWThF 8-12

7/107. 3 units, Aut (Busbin) MWF 9 or 11
8/108. 3 units, Win (Busbin) MWF 9 or 11
9/109. 3 units, Spr (Busbin) MWF 9 or 11

21. 5 units, Aut (Nebrig, Sakamoto)  
   MTWThF 9, 11, or 1:15
22. 5 units, Win (Nebrig, Sakamoto)  
   MTWThF 9, 11, or 1:15
23. 5 units, Spr (Nebrig, Sakamoto)  
   MTWThF 9, 11, or 1:15

   12 units, Sum (Staff) MTWThF 8-12

27, 28, 29. Intermediate Conversation.  
27. 2 units, Aut (Kubota) TTh 1:15
28. 2 units, Win (Kubota) TTh 1:15
29. 2 units, Spr (Kubota) TTh 1:15
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Time</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>101,102,103</td>
<td>Modern Written Japanese</td>
<td>5 units</td>
<td>MWF 11-12:20</td>
<td>Kubota</td>
</tr>
<tr>
<td>105</td>
<td>Intensive Modern Written Japanese</td>
<td>5 units</td>
<td>MWF 11-12:20</td>
<td>Kubota</td>
</tr>
<tr>
<td>111,112,113</td>
<td>Business Japanese</td>
<td>3 units</td>
<td>MWF 2:15-3:30</td>
<td>Kubota</td>
</tr>
<tr>
<td>121,122,123</td>
<td>Advanced Conversation</td>
<td>2 units</td>
<td>TTh 11</td>
<td>Kubota</td>
</tr>
<tr>
<td>200</td>
<td>Directed Reading in Japanese</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Levy</td>
</tr>
<tr>
<td>211,212,213</td>
<td>Advanced Modern Japanese</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Levy</td>
</tr>
<tr>
<td>246,247</td>
<td>Introduction to Classical Japanese</td>
<td>5 units</td>
<td>MW 11-12:15</td>
<td>Ueda</td>
</tr>
<tr>
<td>248</td>
<td>Readings in Classical Japanese</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Ueda</td>
</tr>
<tr>
<td>250</td>
<td>Introduction to Kambun</td>
<td>4 units</td>
<td>TTh 2:15-3:30</td>
<td>Ueda</td>
</tr>
<tr>
<td>251</td>
<td>Graduate Seminar: Japanese Historical Texts</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Mass</td>
</tr>
<tr>
<td>278</td>
<td>Japanese Poetry from Manyōshō to Shinkokinshū (759-1206)</td>
<td>4 units</td>
<td>TTh 2:15-3:30</td>
<td>Levy</td>
</tr>
<tr>
<td>280</td>
<td>Medieval Japanese Narrative and Dramatic Literature</td>
<td>4 units</td>
<td>MW 2:15-3:30</td>
<td>Matisoff</td>
</tr>
<tr>
<td>294</td>
<td>Major Haiku Poets</td>
<td>4 units</td>
<td>TTh 2:15-3:30</td>
<td>Ueda</td>
</tr>
<tr>
<td>296</td>
<td>Readings in Modern Japanese Literature</td>
<td>4 units</td>
<td>MW 2:15-3:30</td>
<td>Ueda</td>
</tr>
</tbody>
</table>

ECONOMICS

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Time</th>
<th>Instructor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>121/221</td>
<td>Economic Development in China—(Same as Food Research Institute 148.)</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Miyazaki, Fung</td>
</tr>
<tr>
<td>124</td>
<td>The Contemporary Japanese Economy</td>
<td>5 units</td>
<td>MW 2:15-3:30</td>
<td>Miyazaki, Fung</td>
</tr>
<tr>
<td>218</td>
<td>Japanese Economic Model</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Ueda</td>
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</tbody>
</table>

HISTORY

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<th>Instructor(s)</th>
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</thead>
<tbody>
<tr>
<td>192B</td>
<td>China from the 9th to the 10th Century</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Kuhn</td>
</tr>
<tr>
<td>192C</td>
<td>Modern China: 19th and 20th Century</td>
<td>5 units</td>
<td>MW 2:15-3:30</td>
<td>Ueda</td>
</tr>
<tr>
<td>194A</td>
<td>Medieval and Early Modern Japan</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Mass</td>
</tr>
<tr>
<td>194B</td>
<td>The Rise of Modern Japan</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Dien</td>
</tr>
<tr>
<td>195</td>
<td>Nomad Empires of Inner Asia</td>
<td>5 units</td>
<td>TTh 2:15-3:30</td>
<td>Dien</td>
</tr>
</tbody>
</table>
290A. Undergraduate Colloquium: Japan Since 1945.  
5 units, Spr (Duus)

292A. Undergraduate Colloquium: Aspects of Chinese Economic History.  
5 units, Aut (Kahn)

297. Undergraduate Colloquium: South Korea’s Emergence in the Postwar International System.  
5 units, Win (Lho)

298A. Undergraduate Colloquium: Visions of Utopia—Travellers to China.  
5 units, Win (Kahn)

390A. Graduate Colloquium: Topics in Late Traditional Chinese History.  
5 units, Aut (Kahn)

390B. Graduate Colloquium: Topics in Late Traditional and Modern Chinese History.  
5 units, Win (Van Slyke)

395A. Graduate Colloquium: Early and Medieval Japan.  
5 units, Aut (Mass)

395C. Graduate Colloquium: Modern Japan.  
5 units, Win (Duus)

5 units, Spr (Mass)

LAW

316. Law in Radically Different Cultures—(Same as Anthropology 157/257, Political Science 152L.)  
2 units, Win plus 3 units, Spr (Barton, Foster-Simons)

LINGUISTICS

277. The Structure of Japanese.  
4 units, Aut (Sells)

632A,B,C. Beginning Tibetan.  
3 units, Aut, Win, Spr (Zhang)

638A,B,C. Beginning Nepali.  
by arrangement

660A,B,C. Beginning Taiwanese.  
by arrangement

686A,B,C. Beginning Cantonese.  
by arrangement

PHILOSOPHY

46. Introduction to Chinese Philosophy —(Same as Asian Languages 46, Religious Studies 55.)  
4 units, Aut (Ivanhoe) MWF 10 sections by arrangement

POLITICAL SCIENCE

20. Introduction to Comparative Politics.  
5 units, Spr (Halpern)

114. Theoretical Approaches to Japanese Politics.  
5 units, Win (Okimoto)

5 units, Aut (Halpern)

139A. Japanese Foreign Policy.  
5 units, Aut (Okimoto)

215A,B. Japan’s Political Economy.  
5 units, Aut, Win (Okimoto)

225. Seminar: The Political Economy of Reform in Socialist Countries.  
5 units, Spr (Halpern)

RELIGIOUS STUDIES

4 units, Win (Klein) MWF 1:15  
Spr (Sponberg) MWF 11 plus sections

18. Zen Buddhism.  
4 units, Spr (Bielefeldt) MWF 1:15 plus section

4 units, Win (Faure) MWF 10

55. Introduction to Chinese Thought—(Same as Philosophy 46, Asian Languages 46.)  
4 units, Aut (Ivanhoe) MWF 10 plus sections

115. Lotus Sutra in East Asian Buddhism.  
5 units, Win (Bielefeldt) MWF 10

5 units (Bielefeldt) not given 1988-89

117. Syncretism and Sectarianism in Chinese Buddhism.  
5 units, Aut (Faure) MWF 11

5 units, Spr (Bielefeldt) MWF 10

158A. Buddhism and the Feminine.  
5 units (Klein) not given 1988-89

212. Interpreting Confucian Texts.  
5 units, Win (Ivanhoe) TTh 4:15-6:05

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

221. Ch’an/Zen Tradition and Popular Religion.  
5 units, Spr (Faure) MW 2:15-4:05

230. Topics in Cha’ and Zen.  
5 units (Bielefeldt) not given 1988-89

236. Buddhist Meditation Texts.  
4 units, Spr (Klein) MW 4:15-6:05

256. Character and the Good Life.  
5 units, Win (Yearley) TTh 2:15-4:05

4 units, Aut (Bielefeldt) by arrangement
ECONOMICS

Chairman: John B. Shoven
Vice Chairman: Timothy Bresnahan
Associate Professor: Timothy F. Bresnahan,
Assistant Professors: Julie L. Anderson, Orazio Attanasio, Gregory Clark, Steven N. Durzlaf, Harry Huizinga, John M. Litwack, Robert W. Staiger, Frank A. Wolak
Courtesy Professors: Brian Arthur (Food Research Institute), David Baron, John Ferejohn (Political Science), David Kreps, A. Mitchell Polinsky (Law School), John Roberts, Thomas Sargent (Graduate School of Business), Robert Wilson (Graduate School of Business)
Courtesy Assistant Professor: Alan Garber (Medical School)
Affiliated Professors: Bruce F. Johnston, Timothy E. Josling (Food Research Institute), Robert H. Keeley (Industrial Engineering and Engineering Management), Henry Levin (School of Education), Reynaldo Martorell, Clark W. Reynolds, Scott R. Pearson (Food Research Institute), James L. Sweeney (Engineering-Economic Systems), Pan A. Yotopoulos (Food Research Institute)
Affiliated Associate Professors: Carl Gotsch, James E. Hodder (Industrial Engineering), Anne E. Peck (Food Research Institute)
Affiliated Assistant Professor: Barry Weingast
Visiting Professors: Martin J. Browning, Jurgen Schroder
Visiting Associate Professors: Jonathan Skinner, Charles Calomiris, Hajime Miyazaki
Visiting Assistant Professors: Diana Hancock, Pok-Sang Lam, Ramon Marimor, Geoffrey Rothwell, Manuel Trajtenberg, Edward Steinmueller
Instructors: Thomas Bowne, John Earle, Steven Tomlinson

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.

The undergraduate program provides an excellent background for those going on to graduate work in the professional schools (e.g., business and law) and also prepares students for a Ph.D. program in economics. The department's curriculum is an integral part of Stanford's programs in International Relations, Public Policy, and Urban Studies, as well as the Food Research Institute.

The Economics Department's Ph.D. program is one of the best in the country. The primary objective of the graduate program is to educate students as research economists. In the process, students also acquire the background and skills necessary for careers as university teachers and as practitioners of economics. The curriculum includes a comprehensive treatment of modern theory and empirical techniques. Currently, we admit roughly 25 students per year.

The faculty represents a wide spectrum of interests, and conducts research on a broad range of topics. Most fields of economics are covered, including microeconomics, and macroeconomics theory, mathematical economics, econometrics, economic history, international trade, alternative economic systems, labor, public finance, and development.

UNDERGRADUATE PROGRAMS
BACHELOR OF ARTS

Undergraduate Economics majors must choose between two programs:

The program in Economic Perspectives and Policies is designed to teach students to think and write about economic problems and issues, using the basic tools of economic analysis without extensive use of mathematics.

The program in Quantitative Economics has a more mathematical orientation and is intended to bring students up to a level of quantitative proficiency necessary to do master's work. Students who have taken Mathematics 43 or who have equivalent preparation are qualified to enter the Quantitative Economics major. Such
students are urged to take Economics 51Q instead of 51, even if they are uncertain as to which major they will eventually elect. A person who has taken 51 is not eligible for the Quantitative Economics major whereas 51Q satisfies either program.

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 specialization in Quantitative Economics is strongly recommended.

COURSE WORK REQUIREMENTS

QUANTITATIVE ECONOMICS

1. Economics 1, 51Q, and 52. Economics 51Q and 52, whenever possible should be completed by the end of the sophomore year.
2. 30 units in courses numbered 100 or above.
   a) Economics 102, 103, and 104 are required and must be taken at Stanford in California.
   b) 15 additional units from economics courses numbered between 100 and 167, excluding 101-104 and 151-152. Economics 185 may be included in the 15 units. A maximum of 10 units of directed reading, 139D and Food Research Institute (F.R.I.) Directed Reading, may be used. Courses 212A,B and 214A,B in Engineering-Economic Systems and courses numbered 205 and above in F.R.I. may be used. Some Stanford overseas economics courses may be counted toward this requirement (see the list in Encina Commons 119).
3. Mathematics 43 or equivalent. Economics 180 may be substituted for Mathematics 43.

ECONOMICS PERSPECTIVES AND POLICIES

1. Economics 1, 51, and 52. Economics 51 and 52, whenever possible, should be completed by the end of the sophomore year.
2. 30 units in courses numbered 100 or above.
   a) Economics 101 is required and must be taken at Stanford in California.
   b) Two courses (10 units) must be chosen from among Economics 102, 111, 118, 141, 145, 148, 157, and 165 and must be taken at Stanford in California.
   c) 15 additional units from economics courses at Stanford numbered above 99 and below 300 excluding 101, 103-104, 151-152, 190-191, and 199-D. A maximum of 10 units of directed reading, 139-D and (F.R.I.) Directed Reading may be used. Courses 212A,B, and 214A,B in Engineering-Economic Systems and courses numbered 205 and above in F.R.I. may be used. Some overseas Economics courses may be counted toward this requirement (see the list in Encina Commons 119.)
3. 15 units of quantitative 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, 172, 180 and 181; any mathematics courses numbered 19 or above; Advanced Placement Math Credit (equivalent to Math 41 and 42); any Operations Research courses; any Statistics courses number 60 or above; Psychology 60; Computer Science 150A, 196A,B, and Industrial Engineering 133. No more than 10 units of accounting courses (Economics 90, 91, Industrial Engineering 133) may be used toward this requirement.
4. Senior Research Paper (3 units). Register for Economics 188 during the quarter in which you write the paper. It should be written after the basic economics and quantitative requirements and most of the upper division courses have been completed. The requirement is for a high quality paper of about 20 double-spaced pages, applying the principles you have learned in your economics courses.

OTHER REQUIREMENTS

At least 25 units applied toward course work requirements (1) and (2) of either of the foregoing programs must be taken at Stanford in California. To use transfer credit in partial satisfaction of the requirements under either program, the student must obtain written permission from the Economics Department’s Associate Director of Undergraduate Studies who will establish the amount of credit to be granted toward completion of the department requirements.

No courses receiving Economics Department credit under either program may be taken pass/no credit. No more than 10 units of course work for requirement (3) of the Economics Perspectives and Policies program may be taken pass/no credit.

An average letter grade indicator of “C” or better must be received for all units at Stanford applied toward requirements (1) and (2) of either program.

No course may be counted more than once in satisfying these requirements.

Students are responsible for seeing that all grades of “incomplete” are cleared within one year after the grade was given.
HONORS PROGRAM

The Honors program is designed to encourage a more intensive study of economics than is required for the normal major, with course and research work of exceptional distinction. It leads to a Bachelor of Arts with Honors in Economics. In addition to the requirements for the A.B. in Economics listed above, the Honors program requires:

1. A letter grade indicator (LGI) in economics courses of at least 3.5. See the departmental Information Book for Economics Majors for further information on this requirement.

2. Submission of an Honors thesis of very high quality. The thesis will be written under the direction of a member of the Economics Department or its affiliated faculty. Honors students may take up to 10 units of Honors Directed Reading (199D) for the purpose of completing the thesis. Units of 199D do not count toward the course work requirements for the basic economics major, or in the computation of the LGI under requirement (1).

Juniors interested in the Honors program are urged to attend an informational meeting scheduled by the departmental Director of the Honors Program each Winter Quarter. Prospective candidates for the Honors program must submit an application to the director no later than the end of the second full week of the third quarter prior to graduation (typically the Autumn Quarter of the senior year). Also required, later in the same quarter, is submission of a three-page thesis prospectus which must be approved by the thesis advisor.

COTERMINAL A.B./A.M. PROGRAM

For admission, a student must have a letter grade indicator in economics courses of approximately one "A" 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 the junior year and must apply prior to the end of the second quarter of the senior year. Application should be made to the Director of Graduate Studies for the Economics Department. Students must satisfy the requirements for the Bachelor of Arts in Economics, and are required to complete the requirements for the Master of Arts as stated below. If the student takes the Honors program, he or she may submit an Honors thesis as one of the alternative two term papers. A student admitted to the cterminal A.M. program is expected to initiate the study plan immediately. A student’s cterminal 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.

GRADUATE PROGRAMS

Graduate programs in economics are designed to insure that students get a thorough grounding in the methodology of theoretical and empirical economics while at the same time providing specialized training in a wide variety of subfields and a broad understanding of associated institutional structures. Toward these ends, the program is structured so that the student has little choice in the curriculum at the outset, but considerable latitude later on.

Students admitted to graduate standing in the department are expected to have a strong background in college level economics and some training in mathematics and statistics. Sufficient (though not necessary) preparation would consist of a college major in economics, a year-long calculus sequence that includes multivariate analysis, a course in linear algebra, and a course in probability and statistics. Students not sufficiently prepared in these areas should anticipate spending time doing remedial work.

MASTER OF ARTS

The department does not admit students who plan to terminate their graduate study with a master’s degree. Students may (but need not) elect this degree in preparation for the Ph.D. degree. A master’s option is also available to co-terminal undergraduate economics majors (see above) and to Ph.D. candidates from other departments.

Admission—Prospective students must have completed the Stanford requirements for a Bachelor of Arts degree in Economics or approximately equivalent training. Since students will be required to take some of the same courses as the Ph.D. candidates, similar preparation in mathematics and statistics generally will be expected. Students seeking admission should submit a proposed program of study to the Director of Graduate Studies at least four quarters before expected completion of the degree.

Requirements—A completed program must satisfy the following criteria:

1. Completion at Stanford of at least 45 units of
credit beyond those required for the bachelor's degree, of which at least 40 units must be in the Economics Department. Courses numbered below 100 may not be counted for this purpose. The economics courses must include at least one each from the graduate microeconomics and macroeconomics series (202-3-4 and 210-11-12), and one other 200 level course. Courses that are listed simultaneously with two numbers (e.g. 51 and 151, 121 and 221) may count towards the 45 units only at the level of the lower number. No seminar courses numbered 300 or above can be counted. Although some latitude may be allowed in substituting courses closely related to economics in some instances, programs lacking strength or coherence will not be approved.

2. Students must demonstrate competence in empirical methodology at the level of Economics 170. Normally, this will be done by including that course in the program of study.

3. Two term papers (or a thesis of sufficient quality) must be submitted. At least one of these papers must be deemed to represent graduate level work. Normally, this will mean that it is written in connection with some 200-level course. A maximum of 10 units credit can be earned for a thesis toward the 45-unit degree requirement.

4. An average letter grade indicator (LGI) of "B" must be maintained for the totality of master's level work. In addition, an LGI of "B-" or better must be earned in each of the two graduate theory courses. All courses must be taken for a letter grade.

DOCTOR OF PHILOSOPHY

Admission to the doctoral program is by written application. It is expected that admitted students will be adequately prepared in calculus, linear algebra, and statistics. When deemed appropriate, a student may be required to complete the necessary background preparation at Stanford. All students take a common core curriculum at the outset and later branch out in the desired fields of specialization. Well prepared students should anticipate spending approximately two years in course work and another two years in seminars, independent study, and dissertation research, with some overlap in each direction. Exceptional progress may make a three-year program feasible, while some types of research programs will require at least five years to complete. The department has a strong commitment to guiding students through the program expeditiously. Questions and petitions concerning the program and the admissions process should be addressed to the Director of Graduate Study, who (as chair of the Graduate Studies Committee) has ultimate responsibility for administering the graduate program.

Specific requirements are best discussed in two stages, the first consisting of requirements for admission to candidacy and the second involving further requirements for earning the degree.

Admission to Candidacy for Ph.D.—A student may apply for admission to candidacy when the following minimal requirements are met:

1. Comprehensive examinations have been passed in "Price and Allocation Theory" (the examination is based on material from Economics 202-3-4) and "Theory of Income and Economic Fluctuations" (the examination is based on material from Economics 210-11-12).

2. Completion of the econometrics sequence, Economics 270-71-72, or equivalent training.

3. Completion of the requirements in two additional fields from the list below or one such field together with a substantial amount of work toward a minor in some related department approved by the Director of Graduate Study. Advanced fields: alternative approaches to economic analysis, econometrics, economic development, economic history, general theory, international economics, labor economics, monetary theory, public finance, structure of industry, theory of choice.

Each field listed above can be satisfied by completing two courses, though students in some fields may be advised to add a third course which can then be counted toward the distribution requirement discussed later. All courses (or comprehensive exams, when offered) must be passed with a letter grade indicator (LGI) of "B" or better. (The student cannot offer both general theory and theory of choice to fulfill this requirement.)

4. Completion of a "second-year paper" normally written in conjunction with one of the special fields selected above.

It is expected that the student will meet (and indeed exceed) the above standard by the end of the second year of residency. When this is not possible for any reason, he or she should consult with the Director of Graduate Study as early as possible during the second year. Once it is deemed that the above standards have been met, the student should complete the University form "Application for Candidacy for Degree of Doctor of Philosophy" and submit it to the
Graduate Studies office. After approval, a candidacy remains valid for five years (although it can be terminated earlier by the department if progress is sufficiently deficient); it can be renewed or extended beyond this period only under unusual circumstances.

Further requirements for the Ph.D. degree:

1. Additional coursework: Four other graduate level courses must be completed. One of these must be from the area of economic history unless that field has already been selected above and, in any event, these courses must be "distributed" in such a way that at least two fields not selected above are represented. In addition, if the special fields consist of econometrics together with one field from mathematical economics, the distribution courses must include at least two from outside these areas. With the approval of the Director of Graduate Study, some of the distribution courses may be drawn from a minor subject, for those choosing that option.

2. Distinction: The student is expected to show "distinction" in some important aspect of his or her graduate program. Generally this is accomplished by earning a letter grade indicator of "A-" or better in one or more of the fields offered. However, distinction can be earned in other ways, e.g., by writing and publishing an article in a professional journal.

3. Teaching Experience: Each student must serve as a teaching assistant for at least one quarter. Normally, this service will occur during the second or third year of residence.

4. Seminar Participation: Each student is expected to participate in at least two distinct research seminars by the end of his or her third year of residence. Normally, participation in a seminar will require one or more oral presentations and the submission of a research paper (which, however, need not be completely separate from dissertation research).

5. Ph.D. Thesis: The process of completing a dissertation involves selecting a topic, choosing an appropriate advisor, submitting a prospectus (signed by the advisor) outlining proposed research, selecting a three member reading committee (usually all members of this committee will be from the Economics Department, although exceptions can be made under certain circumstances), passing an oral examination at which these three faculty (and two other members of the Academic Council) ask questions about the completed research, and submitting a final draft of the work signed by all members of the reading committee. The student is well advised to initiate this process as early as possible.

Ph.D. MINOR

To be recommended for the degree of Doctor of Philosophy with Economics as a minor subject, a student must 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.

JOINT DEGREE PROGRAM

The Department of Economics and the Stanford School of Law offer a joint program leading to the Doctor of Philosophy in Economics and the J.D. degree in Law.

To qualify, the student’s program objectives must clearly justify such a joint program; decisions by the Departmental Graduate Studies Committee will govern. 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. It is expected that dissertation research will cross departmental lines and that members of the dissertation committee will be drawn from both faculties.

Students would normally spend their first year full time either in economics or in law and their second year full time in the other department. After the second year, courses in economics and law could be pursued simultaneously.

Other joint programs may be arranged. For example, the Ph.D. in Economics can be combined with one or two years of study in the Law School, leading either to the non-professional Master of Legal Studies (M.L.S.) degree or the non-professional Master of Jurisprudence (J.M.). See the Law School Bulletin for the requirements for these degrees. Conversely, a student taking the J.D. in the School of Law may apply for a Master of Arts degree in Economics.

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. Some first-year students are awarded full fellowships, including a stipend and tuition. All students whose record justifies continuation in the program may be assured of support for their second through fourth years in the department. Support takes the form of employment as a teaching assistant or research assistant. These half-time appointments provide a stipend and tuition allowance. Entering students are not normally eligible for research or teaching assistantships.

COURSES

Note—Consult the Time Schedule for information about the exact times at which courses will be given.

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. Inflation and unemployment. The role of government: spending, regulation, taxation, monetary and fiscal policy. (DR:5)

5 units, Aut (Taylor) MTWWhF
Win (Fuchs) MTWThFl
Spr (Stiglitz) MTWThF

51Q. Economic Analysis I—(Graduate students register for 151Q.) The nature of economic systems. Methods of allocating economic resources. Theories of production and consumer choice. The role of markets and prices in a decentralized system. Principles of efficient and equitable allocation. Methods of calculus are used to develop theoretical structures most appropriate for doing modern applied economic analysis. Prerequisites: 1, Math 43, or equivalent. (DR:5)

5 units, Aut (Browning) MTWThF
Win (Brown) MTWThF
Spr (Trajtenberg) MTWThF

51. Economic Analysis I—(Graduate students register for 151.) Same as 51Q except that calculus is not used. (DR:5)

5 units, Aut (Rothwell) MTWThF
Win, (Skinner) MTWThF
Spr (Greenstein) MTWThF

52. Economic Analysis II—(Graduate students register for 152.) 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. Prerequisite: 51.

5 units, Aut (Hancock) MTWThF
Win (Huizinga)
Spr (Hall, Attanasio)

90. Introduction to Accounting—(Graduate students register for 190.) An introduction to the principles and concepts underlying financial reports: 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.

5 units, Aut (Moses)
Win (Zollinger)

91. Introduction to Cost Accounting—(Graduate students register for 191.) 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. Prerequisite: 90 or Industrial Engineering 133.

5 units, Aut, (Moses)
Win (Melumad)

100. Economic Theory in Historical Perspective—The historical development of economic theory from several perspectives. Emphasis is on the progress of analytic clarification and elaboration. Also, the influence of contemporary economic and political categories with which different economists worked, and the relation of the development of economic theory to concurrent developments in political and social thought.

5 units, not given 1988-89


5 units, Aut (Starrett)
Win (Fung)
Spr (Clark)

102. Introduction to Econometrics—Probability, random variables, distribution theory, theory of estimation, and hypothesis testing. Introduction to simple and multiple regression analysis. Applications to economics. Students without computer experience should acquire it early in the quarter. Prerequisites: Statistics 60 or the equivalent.

5 units, Aut, Spr (Lau) MTWThF

103. Applied Macroeconomic Analysis—Construction and use of econometric models for analyzing macroeconomic fluctuations, preparing and evaluating forecasts, and appraising qualitative policies for stability and growth. Students complete individual projects and core material. Topics vary with the instructor. Limited enrollment with priority for students enrolled in the “Quantitative Economics” track of the major. Prerequisites: 52 and 102.

5 units, Aut (Lam)
Win (Hickman)
Spr (Attanasio)
104. Applied Microeconomic Analysis—Develops skills in the empirical analysis of microeconomic theory, models, and data. Topics vary with the instructor. Students complete individual projects and core material. Limited enrollment; priority for students in the "Quantitative Economics" track of the major. Prerequisites: 51Q and 102.
5 units, Aut, Spr (Rothwell)
Win (Browning)

105. Economics of the Labor-Managed Firm—The labor managed firm: its democratic organization and recent evidence of productivity advantages relative to traditional enterprises. The theory and practice of the worker-managed or participatory firm in its various forms including producer cooperatives. Codetermination, the Yugoslav version, the Kibbutz, and Swedish experiences under industrial democracy. Emphasis on hiring decisions, internal organization, productivity, factor intensities, finance, and the extensions to worker-managed sectors and economics. Prerequisite: 51.
5 units, not given 1988-89

106. The World Food Economy—(Same as Food Research 103.) The interrelationship between food, population, and economic development. Agricultural and rural development in achieving economic and social progress in low-income nations. Economic and nutritional characteristics of the major types of food and changes in food consumption in Asia, tropical Africa, Mexico, U.S., and Japan. Policy analysis perspective to decision-making related to the design of rural development strategies. Prerequisite: 1 or equivalent understanding of economics.
3 units, given 1989-90

107. Commodity Futures Markets and Prices—(Same as Food Research 105.) The uses and functioning of commodity futures markets: practices; speculation; the evolution of hedging practice; market performance issues and measures; and analysis of the economic effects of futures markets. Prerequisite: 1 for Economics majors.
5 units, Aut (Peck) TTh 9-10:50

109. Macroeconomic Models—(Graduate students register for 232.) Properties and uses of large-scale econometric models. Forecasting and policy analysis. Dynamic properties of models: growth and cycles. Isolating the structural core of large models. Comparative survey of models of the U.S. and other countries. Multicountry models and the international transmission mechanism. Prerequisite: 103 or permission of instructor.
5 units, Aut (Hickman)

111. Money and Banking—Financial processes emphasizing 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, Spr (Huizinga) MTWThF

112. Financial Decisions—(Same as Industrial Engineering 235.) The models and techniques in financial decision-making under uncertainty. Topics: financial analysis and forecasting, decision analysis, portfolio and capital market theories, capital structure and cost of capital, and project evaluation, the effects of taxation and inflation. Prerequisites: Industrial Engineering 133, Engineering 60, Statistics 116, Economics 190, Operations Research 152, and equivalent required. Enrollment during Autumn Quarter limited to Industrial Engineering or Materials Science Engineering majors; in Winter Quarter at discretion of instructor.
4 units, Aut (Hodder) MWF 9
Win (Keeley) MWF 9

113. Technology and Modern Industrial Society—(Same as VTSS 107.) The interplay of technology and the process of economic development from 1750 to the present. Topics: the origins of industrialism, industrialization in 19th-century Britain and the U.S., factors affecting the rate and direction of technological change and diffusion, technology and the growth of large-scale organizations, the spread of industrialization to less-developed countries, late-comers to industrialization (the cases of Japan and the U.S.S.R.), the growth and slowdown in mature industrial countries, and present concerns and future prospects (the influence of technology on employment, civilian "spillovers" from military R&D spending, and coping with technological change). (DR:5)
4 units, Win (Rosenberg)

115. European Economic History—Growth and development in Western Europe from 1750 to WWII. Comparative approach, emphasizing British, French, and German experiences. General theories of growth, the role of the state in economic development, and the response of labor movements to industrialization. Prerequisites: 51 and 52.
5 units, Win (Clark)

116. American Economic History—The history of American economy from colonial times to present, emphasizing the years between the Revolution and WWII. The application of economic analysis to historical issues. Topics: American growth record and its determinants; economies of slavery and the Civil War; industrialization in a land-abundant country; histor-
ical causes of the Great Depression; role of the family in American economic history. Term paper required. Prerequisite: 1.

5 units, Spr (Litwack) MTWThF

117. U.S. Economy in the 20th Century — Contemporary U.S. economy in historical perspective. Topics: productivity growth; economic fluctuations since the Great Depression; changes in labor force and labor markets; the rise of the Sunbelt; and the place of the U.S. in world economy. Term paper required. Prerequisites: 51 and 52.

5 units, not given 1989-90

118. The Economics of Development — The economic problems and policy concerns of Third World countries. Topics: theories of economics' structural transformation during the process of economic development, trade and industrialization policies, inequality and poverty, agriculture and rural development, migration, population growth, education, nutrition, health, domestic and international sources of development finance. The focus is on principles, not case studies. Prerequisite: 51.

5 units, Spr (Velenchik) MTWThF

119. Development and Population Interactions in the Third World — (Same as Food Research 121.) Historical and contemporary examination of the record of economic development and of population growth suggests a diversity of experience. Case studies of specific countries illustrate the systematic components of the experience of economic development and those of population growth with implications in terms of alternative structures of development, the timing of the demographic transition, income distribution, employment, and migration. The interactions and causal effects between economic development and population growth.

5 units, given 1989-90


5 units, Win (Littwack)

121. Economic Development in China — (Same as Food Research 148; graduate students register for 221.) The structure and development of China's economy emphasizing the People's Republic. Topics: the economic legacy of the late Qing and Republican periods; China's development strategy; planning and resource allocation; labor, employment and population, income distribution, foreign trade; and recent reforms. Prerequisite: 1.

5 units, given 1989-90

122. The Theory of Capitalist Development — Theoretical and historical analysis of the process of development of capitalist economies. Emphasis on 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: Classical, Schumpeterian, and Keynesian, focusing on Marxian theory and recent elaborations and extensions of that theory. Relevant historical case studies. Prerequisites: 51 and 52. (DR:5)

5 units, Aut (Harris)

123. Economic Development in Latin America — (Same as Food Research 218; open to advanced undergraduate students, with the consent of instructor.) The historical problems of economic growth and structural change in selected Latin American countries. Emphasis on the application of political economic analysis to problems of accumulation, investment, financial and price behavior, income distribution, innovation, migration, and the rural-urban transition; also, the analysis of interdependence among countries and regions with different economic and social structures, i.e., the U.S., Mexico, Brazil, Central America, and the Caribbean. Seminar with research papers.

5 units, Spr (Reynolds)

124. The Contemporary Japanese Economy — Description and analysis of Japanese contemporary economic institutions and mechanisms: work organization; structures of information; incentives; distribution and governance at the corporate firm; rational contracting between firms and corporate grouping: the role of financial institutions and the government. Comparison with corresponding American institutions. Macroeconomic performance of the Japanese economy and its interaction with the rest of the world.

5 units, Win (Miyazaki) MTWThF
Spr (Fung) MTWThF

127. The Political Economy of Commodity Markets — (Same as Food Research 106; graduate students register for 206.) History, politics, and theoretical analyses of domestic and international markets for basic commodities. Topics: government regulation of private trading, public trading through buffer stocks and marketing boards, international commodity agreements, and the changing views of the social value of private speculation. Examples from 18th century to present.

5 units, Spr (Williams) TTh 9-10:50

128. Marketing, Consumption, and Price Analysis — (Same as Food Research Institute 120.) Analyses of agricultural commodity prices and markets, including consumer demand, spatial and temporal aspects of prices, storage be-
behavior, information expressed in prices, market structure, market integration, and complete commodity models. Recommended: Previous exposure to microeconomics and econometrics.

5 units, Win (Williams) MW 11-12:50

129. Analysis and Management of Development Projects—(Same as Food Research 129.) Contemporary techniques and experiences in appraising, implementing, and managing development projects. Three modules: (1) project planning and scheduling using CPM and PERT methods; (2) theory, calculation, and use of conventional appraisal criteria such as net present value, benefit-cost ratio, and internal rate of return; and (3) development of database systems for project monitoring and evaluation. Partial budgeting techniques compare financial and economic decision criteria. Hands-on exercises with data from LDC agricultural projects. Required use of microcomputers and project planning, spreadsheet and database management software.

5 units, Aut (Gotsch) MW

132. Application of Linear Programming to Agricultural Systems—(Same as Food Research 130.) Develops application skills including exercises in mixed integer, multi-period, quadratic, and risk programming. Producer-consumer models. Computer homework exercises analyze agrarian reform, water resource development, technology choice, and allocation of research resources. Model manipulation and data problems are stressed. Prerequisite: One course in microeconomic theory.

3-5 units, Win (Gotsch) TTh


5 units, given 1989-90

139D. Directed Reading—(Graduate students register for 239D.)

1-10 units (Staff)

140. Introduction to Financial Economics—An introduction to modern portfolio theory and corporate finance. Topics: capital budgeting techniques, consumer behavior towards risk, properties of various financial instruments, and government policy regarding securities markets. Theoretical and institutional material included. Prerequisites: 51, Statistics 60, and at least one course in calculus.

5 units, Aut (Wolak) MTWThF 10

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 (Skinner)

142. Agricultural Policy in Industrial Countries—(Same as Food Research 146.) A comparative study of agricultural policies in developed countries: the European Community, Japan, Australia, and Canada. Links to U.S. agricultural policy where appropriate. Implications of these policies for world markets and for policies in other countries. Other topics: international negotiations on policy effects, measurement of trade impacts on domestic policies, and links between domestic policy choices and international trade rules. Prerequisite: Consent of instructor.

5 units, given 1989-90

144. Economics of American Agriculture: Structure and Policy—(Same as Food Research 144.) American agriculture and its historical and contemporary role in the economy. Topics: the role of agriculture in American economic development, policy toward commercial agriculture, poverty problems in rural America, and the international dimensions of U.S. agriculture. Emphasis on policy alternatives rather than on farm management.

4-5 units, Aut (Falcon) MWF 9


5 units, Win (Pencavel) MTWThF

147. Economics of Human Resources—Investment in human capital, including education, information, health, and on-the-job training. Role of human capital in the analysis of economic growth. Effects of ability, socioeconomic background, and investment in human capital on the distribution of income. Prerequisite: 51.

5 units, not given 1988-89

148. Economics of Urban Problems.—Application of elementary tools of economic policy issues in poverty, employment, education, housing, urban transportation, and the local public sector. Prerequisite: 51.

5 units, not given 1988-89

149. The Modern Firm in Theory and Practice—Theoretical and institutional analysis of modern corporate firms: industrial relational, motivational, financial, information structural, managerial, and legal. Also, the role of various
hybrid institutional forms between the market and the integrated firm: subcontracting, franchising, R&D cooperatives and consortia. Practices in the American, Western European, and Japanese firms. Prerequisites: 51 or 51Q; familiarity with quantitative approach.
5 units, Spr (Milgrom)

150. Economics and Public Policy—(Same as Public Policy 104.) The relationship between economic analysis and economic policies. Economic rationales for public policies; methods and techniques of policy evaluation and the role of benefit-cost analysis; economic models of political processes, and their connection to the analysis of economic policy making; and the relationship of income distribution issues to policy choice. How economic analysis is done, and why the political process regards it as useful but not as necessarily determinative of policy choices. Readings include the theoretical foundations of economic policy analysis and policy decisions, and the analysis of the adoption and implementations of programs in a variety of policy areas. Prerequisites: 51, 52 (52 may be taken concurrently).
5 units, Win (Noil)

151. Economic Analysis I—(See 51.)

152. Economic Analysis II—(See 52.)

154. Economics of Legal Rules and Institutions—How legal rules (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: 51.
5 units, Aut (Polinsky) MTWThF 10

155. Economics of Natural Resources—(Same as Engineering-Economic Systems 155; graduate students register for EES 255.) Economic analysis of natural resource allocation, including clean air and water, pollution, depletable mineral resources, energy, and biological resources. Stock-flow relationships; wealth maximizing choices over time; short-run and long-run equilibrium conditions; depletion/extinction conditions; market failure mechanisms (common-property, public goods, discount rate distortions, rule-of-capture); governmental interventions. Prerequisites: 51 or 51Q. Recommended: Math 43.
5 units, Aut (Sweeney) MWF 1:15-2:30

156. Economics of Health and Medical Care —(Same as Health Services Research 256; graduate students register for 256.) Empirical, institutional, and theoretical analysis of problems of health and medical care. Topics: measurement, valuation, and determinants of health; physicians, hospitals, and the drug industry; financing and organization of medical care; public policy issues. Open to graduate students and undergraduates (seniors, juniors) with training in microeconomics and some background in statistics or mathematics. Prerequisite: 51 or permission of instructor.
5 units, Spr (Fuchs)

157. Theory of Firms and Imperfect Markets—Extends and develops the basic tools of price theory in the context of U.S. industrial market structure. Emphasis on the application of theoretical models and concepts to the behavior of firms and markets when the conditions of perfect competition are not satisfied. Topics: 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: 51.
5 units, Aut (Bresnahan) MTWThF

158. Social Control of Industry—Considers the history, economics, and legal background of the institutions under which U.S. industry is subject to government control. Topics are anti-trust law and economics; the economics and practice of public utility regulation in the communications, transportation, and energy sectors; and the effects of licensing. Emphasis is on application of economic concepts in evaluating the performance and policies of government agencies.
5 units, Win (Steinmueller) MTWThF

160. Game Theory and Economic Applications—A game theoretic perspective on the analysis of conflict resolution in the economic and political spheres. Basic concepts of Game Theory: game description, strategies, the role of information, cooperative vs. non-cooperative games, extensive and normal forms, and coalitions. Exposition of a sample of solution concepts: Minimax, Equilibrium, Core, Bargaining Theory, and Shapley value. Prerequisites: 51 and one course in calculus, or the consent of instructor.
5 units, Win (Marimon)

165. International Economics—Comparative advantages 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, and 52.
5 units, Aut (Huizinga) MTWThF
Win (Attanasio)
166. **International Trade Policy** — (Same as Food Research 166.) Effects of selected government policies affecting international trade. Trade policy, exchange rate policy, and economic welfare, government responses to competition from imports, issues underlying international negotiation of reductions of barriers to trade and special trade arrangements for developing countries. Prerequisite: 165.  
5 units, Spr (Pearson)

167. **European Economic Integration**—Theory of Customs Union and Free Trade Areas; trade creation and trade diversion; origin, development, and working of the European Common Market; the European common agricultural policy; Theory of Optimum Currency Areas and economic integration. A European parallel currency? Origin, development, and working of the European Monetary System (EMS) and relationships to other currency blocs. Prerequisite: 165 or consent of instructor.  
5 units, not given 1988-89

170. **Intermediate Econometrics I**—(Same as 270.)  
5 units, Aut (Amemiya)

171. **Intermediate Econometrics II**—(Same as 271.)  
5 units, Win (Wolak)

172. **Intermediate Econometrics III**—(Same as 272.)  
5 units, Spr (MacCurdy)

180. **Mathematics for Economists**—Training in areas of mathematics which have frequent applicability to economic problems. Preparation for 51Q; intended for students who have had some calculus but lack a strong mathematical background. Topics: functions of several variables; partial derivatives and differentials; first and second order conditions for optimization; elementary matrix algebra, determinants, and characteristic roots; quadratic forms; maximization of a function of several variables subject to equality constraints. Selected applications in economics. Prerequisites: 1, and Mathematics 41 or the equivalent.  
5 units, Aut (Hammond) 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 include static and dynamic theories of the household and the firm, and problems in aggregative planning and control. Prerequisites: 51, 180, or Mathematics 43 or equivalent.  
5 units, not given 1988-89

185. **The Distribution of Income and Wealth**—Basic facts about the distribution of income and wealth in the U.S., with comparisons to other advanced countries. Methods of measuring inequality. Statistical distributions and stochastic models. Economic theories of the distribution of income: neo-classical, Marxist, and neo-Keynesian. The relation between wealth and income distribution. Normative theories of just distribution and the limiting effects of incentives on the redistribution of income (May be taken as 285 by graduate students). Prerequisites: 51 (preferably Q), 102, and one course in calculus.  
5 units, not given 1988-89

187. **Junior Research Workshop**—Introduces economics majors to current research in applied and theoretical economics. Students read, discuss, and present research papers in particular areas. Two topics: social choice and individual values; and the optimal provision of public goods. Also for students in Honors program considering thesis topics in mathematical economics, welfare economics, or public economics. Enrollment limited to 15, with preference given to juniors. Prerequisites: 51Q or 51 and one course in calculus.  
5 units, Spr (Brown)

188. **Senior Research Paper.**  
3 units, Aut, Win, Spr (Durlauf, Fenn)

190. **Introduction to Accounting**—(See 90.)

191. **Introduction to Cost Accounting**—(See 91.)

199D. **Directed Reading**—Honors. An in-depth study of an appropriate question and completion of a thesis of very high quality. Normally written under the direction of a member of the Economics Department (or a member of some closely related department). (See description of Honors program.) Register for at least 1 unit for at least 1 quarter.  
1-10 units, Aut, Win, Spr (Durlauf, Fenn)

**PRIMARILY FOR GRADUATE STUDENTS**

350. **A.M. Thesis.**  
by arrangement.

375. **Research Paper.**  
by arrangement.

400. **Ph.D. Dissertation.**  
by arrangement.

A. **CORE THEORY CURRICULUM**

202. **Price and Allocation Theory I**—Consumer demand theory and the implications of constrained utility maximization. Uses of the
indirect utility and expenditure functions. Models of the firm in competitive markets. Profit and cost functions. Partial equilibrium analysis of the market. Economic behavior under uncertainty. Open to advanced undergraduates with consent of instructor. Prerequisite: A thorough understanding of the elements of differential calculus and linear algebra.

5 units, Aut (Pencavel)

203. Price and Allocation Theory II—Different forms of competitive and monopolistic behavior; their effect on the efficiency of economic organization. Prerequisite: 202.

5 units, Win (Stiglitz)


5 units, Spr (Starrett)


5 units, Aut (Taylor)

211. Theory of Income and Economic Fluctuations II—Infinite horizon optimization models; real business cycles; consumption; investment; asset prices; monetary theory and policy. Prerequisite: 210.

5 units, Win (Stiglitz, Hall)

212. Theory of Income and Economic Fluctuations III—Macroeconomic growth theory with applications to growth accounting, productivity analysis, and measurement of potential output. Use of general equilibrium econometric models for forecasting, business cycle analysis, and policy simulations. Multicountry models, the international transmission mechanism, and the international business cycle. Prerequisite: 211.

5 units, Spr (Sargent)

301A,B,C. Workshop in Microeconomics.
10 units (Staff) by arrangement

310A,B,C. Workshop in Macroeconomics.
10 units (Staff) by arrangement

B. ALTERNATIVE APPROACHES TO ECONOMIC ANALYSIS

To receive credit for this field, students must complete two of the four courses listed below.

200. Topics in the History of Economic Thought — The development of economic thought from the classical school to the first generation of the neoclassical. Survey of the theories of Adam Smith, David Ricardo and his contemporaries, John Stuart Mill, Karl Marx, W. Stanley Jevons, Carl Menger, and Leon Walras. The development of thought in terms of internal development and changing external economic conditions.

5 units, Spr (Arrow)

219. Value, Distribution, and Growth—Conceptual and analytical problems concerning the determination of value, price, distribution, and accumulation in the capitalist economy. Their background in the development of economic thought. Examination of the meaning, significance, and analytic solutions of these problems. Relevant elements of Classical and Marxian economic theory compared with the approaches of Neo-Keynesian and Neoclassical theories.

5 units, Win (Harris)

220. Marxian Economic Theory—Marxian economic theory with regard to the analysis of value and surplus value, prices and profits, the circuits of capital, reproduction, accumulation, technical change, and economic crises. Focus on recent elaborations, extensions, and applications of the theory.

5 units, Spr (Harris)

395 A,B,C. Workshop in Alternative Approaches to Economic Analysis.
10 units (Staff) by arrangement

C. ECONOMIC DEVELOPMENT AND PLANNING

To receive credit in the field, students must complete 215 and either 216 or 217. Students wishing to do research in this field are strongly advised to take both 216 and 217, as well as supporting course work in international economics and the Food Research Institute.

215. Economic Development—Theoretical and empirical analysis of economic phenomena in developing countries. Topics: dual economy models; disguised unemployment and surplus labor; joint farm-household production and consumption decisions; rural labor markets; tenancy and rural credit contracts; rural development policy; rural-urban migration; nutrition and health; inequality and poverty.

5 units, Spr (Lau) TTh

216. Central Planning—Theory of central economic planning with applications to the experience of the Soviet Union. The construction and implementation of central plans in nonmarket economies. Incentive and coordination problems in informationally-decentralized hierarchies. Prices vs. quantities and delegation. A
discussion and analysis of problems and reforms in past Soviet planning procedures.
5 units, Spr (Litwack)

5 units, Win (Calomiris)

218. Japanese Economic Model—Theoretical, historical and empirical analysis of various Japanese economic institutions and mechanisms in comparative perspectives. Topics: the incentive and informational structure of the firm, the nature (objective function) of the Japanese firm and its behavior; the role of corporate groupings and banks; the role of economic planning and macro-economic administration. Emphasis on model analysis and historical development.
5 units, Win (Miyazaki)

315A,B,C. Workshop in Economic Development.
10 units (Staff) by arrangement

D. ECONOMIC HISTORY

The requirements for the field are: (1) A comprehensive exam in Spring Quarter based on material from at least two courses chosen from those listed below, and (2) one research paper on a subject approved by one of the faculty teaching any of the following five courses.

224. Science and Technology in Economic Growth — The roles played by the growth of scientific knowledge and technical progress in the development of industrial societies. Emphasis on the interactions between science and technology, and the organizational factors which have influenced their effectiveness in contributing to productivity growth. Upper division undergraduates may attend with consent of instructor.
5 units, Spr (Rosenberg)

225. Technology, Economy, and Society—Determinants and consequences of technological innovations in the economic history of the West from the 9th to the 19th centuries. Selected “clusters” of technical innovations in production and warfare are 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 primary and second-order economic consequences.
5 units, Spr (David)

226. Problems in American Economic History —The history of the American economy from colonial times to the present, focusing on the period 1790 to 1940. The role of economic history as a distinctive intellectual approach to the study of economics. Topics: slavery and the Southern economy, labor scarcity and technological progress, the Great Depression of the 1930s, and the emergence of the U.S. to economic pre-eminence.
5 units, Win (David)

227. European Economic History—Economic growth and development in Western Europe from the 11th to the 20th centuries emphasizing the Industrial Revolution to WW I. The experiences of Britain, France, Germany, and other continental countries, with that order of emphasis. 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, Aut (Clark)

228. Institutions in Economic History: Form, Function, and Evolution—Concepts from economics, political science, and organization theory as they relate to how institutions affect efficiency and distribution, and how they evolve in response to economic forces. Latent and manifest economic functions of institutions, relating to problems of free-riding and moral hazard, coordination and reinforcement of expectations, transactions costs, bounded rationality, rent-seeking and rent-preservation. Macro- and micro-institutional topics from Western European historical experience.
5 units, given 1989-90

325A,B,C. Workshop in Economic History.
10 units, (Staff) by arrangement

E. MONETARY THEORY AND ADVANCED MACROECONOMICS

Requirements for the field are successful completion of 233 and 234, and the acceptance of a research paper in the areas covered by either 233 or 234. Students who expect to make this field one of their primary research interests are strongly urged to take Economics 232. 217 (Money and Finance in Economic Development) and 265 (International Finance) are recommended.

232. Macroeconomic Models—(See 109.)

233. Monetary Theory and Advanced Macroeconomics I—The theoretical and empirical properties of dynamic stochastic macroeconomic models. Rational expectations models,
and the application of time series and other econometric techniques to macroeconomics. Issues in policy evaluation, time consistency, and credibility of alternative policy regimes.

5 units, Win (Hall, Attanasio)


F. PUBLIC FINANCE

To receive credit for the field, students must complete 241 and 242.

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 (Shoven)
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, 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 (Shoven) by arrangement

354A, B, C. Workshop in Law and Economics.

6 units, Aut, Win, Spr (Polinsky) by arrangement

G. ECONOMICS OF LABOR

To receive credit for the field, students must complete 246 and 247.


5 units, Aut (Pencavel)


5 units, Spr (MaCurdy)

249. Economic Demography—(Same as Food Research 287.) The effects of demographic changes on individual and collective economic welfare; and economic theories of demographic decision making. Topics: overlapping generations models; economic lifecycle analysis; economic implications of changes in fertility and mortality; demography of the labor market; stable population theory; and economic theories of fertility.

5 units, given 1989-90

345A, B, C. Workshop on Economics of Factor Markets.

10 units (Staff) by arrangement

H. ECONOMICS OF INDUSTRY

To receive credit for the field, students must successfully complete 257 and 258, and must submit one research paper, the subject of which has been approved in advance by one of the faculty teaching 257, 258, 259, or 260. Students who expect to make this field one of their primary research interests are strongly urged to take additional courses in the field.

Students expecting to make Economics of Industry their primary research field, and to write a dissertation in it, are required to take either 259 or 260 and one of the workshops.

256. Economics of Health and Medical Care—(See 156.)

257, 258. The Economics of Industry, Regulation, and Firm Organizations I and II—Theoretical and empirical analyses of the determinants of market structure; firm behavior and market efficiency in oligopolies; the theory and practice of procompetitive government policies; the relationship of product quality and technological innovation to market structure; the internal organizations of the firm; choices between contracting and vertical integrating; government regulation of business; public utilities, regulated competition, licensing, product and worker safety, environmental protection; the political economy of business policies.

257. 5 units, Aut (Milgrom)
258. 5 units, Win (Weingast, Noll)

259. Economics of the Firm—Advanced topics in the theory of the firm with reference to internal structure of the modern firm. Topics: information structures of the firm; theories of hierarchies and management allocations; the duality and bargaining game theoretic approach to the theory of firm; the theory of the worker controlled firm; theories of integration and take over.

5 units, not given 1988-89

260. Special Topics in Industrial Organization and Regulation—Focused, in-depth study of
issues of current research and policy interest: empirical tests of oligopoly theories; the dynamics of change in regulatory policy; the theory of economic institutions; the anti-trust status of joint ventures; and the use of capacity, innovation, and product variety as a barrier to entry. Attention to significant research issues that remain unresolved and promising ways to attack them.

5 units, Spr (Noll, Bresnahan)


5 units (Arthur) given 1989-90

262. Experimental Methods of Institutional Analysis—The use and design of laboratory methods to test theories of individual behavior in various institutional settings, including markets, small groups, and political processes. Readings/lectures on the methods of experimental research and the current state of research findings, and individual research projects in which students design and run an experiment.

not given 1988-89


10 units (David, Landau, Rosenberg)

by arrangement

355. Workshop in Industrial Organization, Regulation, and Applied Microeconomics—A working seminar on current research in the field by visitors, presentations by students, and structured discussions of recent papers. Students are required to write an original research paper, make a formal seminar presentation, and lead a structured discussion.

10 units, Aut, Win, Spr (Noll, Bresnahan)

by arrangement

358A,B,C. Workshop in Political Economics and Collective Choice—A multidisciplinary working seminar on current topics in mechanisms of social choice, political processes, and the politics of economic policy. Offered in collaboration with the Graduate School of Business and the Department of Political Science. Participating students are required to undertake an original research project, approved by the instructors.

10 units, Aut, Win, Spr (Baron, Bendor, Ferejohn, Noll)

I. INTERNATIONAL ECONOMICS

To receive credit for the field, students must complete 265 and 266 for which one term paper is required. Students wishing to specialize further are strongly advised to take 267, whose topics may vary somewhat depending on the research interests of the instructor. Further complementary courses are 217 (development finance) and 234 (macroeconomics). Selected courses in Economics of Industry sometimes cover trade-related problems.


5 units, Aut (Schroeder) TTh 11


5 units, Win (Staiger)

267. Special Topics in International Economics—Portfolio models of exchange and interest rate determination under floating exchange rates. Alternative fixed-rate monetary arrangements including the 19th-century gold standard, post-war Bretton Woods, and the European Monetary System. The dollar as an international reserve currency and U.S. monetary policy. The international capital market. Prerequisites: 265 and 266.

5 units, Spr (McKinnon)

365A,B,C. Workshop in International Economics.

10 units (Staff) by arrangement

J. ECONOMETRICS

Students not specializing in this field are required to take 270, 271, and 272.

To receive credit in the econometrics field, students must complete 271, 272, 273, 274, and Statistics 200. Students with sufficient preparation should take 272, 273, and Statistics 200 in
the first year and 273 and 274 in the second. Since Statistics 200 does not cover regression analysis and knowledge of this topic is needed to take 271, students who choose to substitute Statistics 200 for Economics 270 in Autumn Quarter are advised to audit 270 during the last three or four weeks of the quarter if they are unfamiliar with classical regression. Students with insufficient preparation to skip 270 can take Statistics 200 any time during the first year, including Summer Quarter, to satisfy the prerequisites of Economics 273.

While credit for the field is earned with completion of 274, advanced students are encouraged to take 275 and/or 276 when they are offered.

5 units, Aut (Amemiya)

271. Intermediate Econometrics II—Relaxation of classical-regression assumptions; simultaneous equation models; time series analysis. Prerequisite: 170/270.
5 units, Win (Wolak)

272. Intermediate Econometrics III—Continuation of 271. Nonlinear estimation; qualitative response models; limited dependent variable (Tobit) models. Prerequisite: 171/271.
5 units, Spr (MacCurdy)

273. Advanced Econometrics I—Large sample theory; maximum likelihood estimation; nonlinear least squares; generalized least squares. Prerequisites: 272, Mathematics 113.
5 units, Aut (Amemiya)

274. Limited Dependent Variables—Discrete choice models; Tobit models; Markov chain and duration models. Prerequisite: 273.
5 units, Win (Wolak)

5 units, Win (Durlauf)

276. Special Topics in Econometrics—Possible subjects: robust estimation; stochastic control; prediction theory; Bayesian analysis; factor analysis; pooling of time series and cross section data. Prerequisite: 273.
5 units, not given 1988-89

370A,B,C. Workshop in Econometrics.
10 units (Staff) by arrangement

K. MATHEMATICAL ECONOMICS

Field I: Theory of Choice—Requirements are two of the following four courses.

280. Welfare Economics — (Same as Operations Research 367.) Social choice theory and objectives for economic policy. Efficiency theorems with externalities and public goods. The gains from trade. Incentive constraints which arise because economic agents have private information and may make unofficial trades which escape taxation or circumvent other controls. Cost-benefit analysis and evaluating policy reforms.
5 units, Aut (Hammond) MW 11-12:50

281. The Economics of Uncertainty—The implications of uncertainty for microeconomic behavior including: the axioms of choice under uncertainty and the expected utility theorem, optimal static and dynamic portfolio choices, insurance, the effect of uncertainty on savings and production decisions, and general equilibrium and welfare considerations under uncertainty. Prerequisites: 202 and 203, Statistics 116, or equivalents.
5 units, Win (Hammond)

282. Theory of Information and Organization — (Same as Operations Research 363.) The role of information in the design of various economic organizations, including teams and markets; problems of coordination and incentives under incomplete information; search, signaling, and related phenomena.
5 units, Win (Arrow)

283. Contracts and Organizations—Most exchange and production relationships are governed by a mix of contractually specified rights and obligations, and the accepted authority of specific individuals. The nature of efficient supplier contracts and relationships, the nature and relations of the firm, the proper role of bureaucratic rules, the devices by which firms compensate for limited rationality of managers.
5 units, not given 1988-89

Field II: General Theory—Requirements are two courses chosen from 284, 286, and 287.

5 unit, Win (Judd)

285. The Distribution of Income and Wealth —(See 185.)

286. Game Theory and Economic Application —I. Non-cooperative Games: games in extensive and normal form; the minimax theorem; Nash equilibrium and refinements of the equilibrium concept; elements of repeated games.
II. Cooperative Games: the characteristic function and the core; balanced games and relations to Walrasian equilibrium; Shapley value, the von Neumann-Morgenstern solutions; elements of bargaining theory.

5 units, Spr (Kurz)

257. General Equilibrium Theory—Comprehensive treatment of current research in general equilibrium analysis of economies with increasing returns to scale, i.e., nonconvex production possibility sets. Topics: existence, optimality, and computation of equilibria involving marginal and average cost pricing, mark-up pricing and two part tariffs; optimal regulation of natural monopoly; contestible markets and increasing returns to scale. Students required to write original research papers. Prerequisites: 202 and 203.

5 units, Aut (Brown) TTh 9-10:50

290. Incentives—(Same as Business 468.) A review of a selection of current working papers emphasizing methods of game theory and topics in mathematical economics that use game theoretic models. The effects of differences in information, limitations on observability and contracts, etc., on strategic behavior. Prerequisites: Two courses from the Choice Theory/Mathematics Economics sequences, or consent of instructor.

5 units, not given 1988-89

385A, B, C. Workshop in Mathematical Economics.

10 units (Staff) by arrangement

386. Interdisciplinary Workshop on Decision, Conflict, and Risk Analysis—(Same as Business 694, Operations Research 366, Psychology 283.) Addresses problems of decision making, risk analysis, conflict resolution and negotiation from both normative and descriptive perspectives.

1-2 units, Win, sometimes Spr (Arrow, Mnookin, Ross, A. Toersky, Wilson) T4-5:30

387. Interdisciplinary Workshop in Equity and Social Choice Theory—(Same as Philosophy 255, Political Science 267.) Graduate seminar on recent work on social choice theory and related literatures in economics, philosophy, and political science as it concerns the equitable allocation of resources and respect for individual rights. Students receive up to 3 units for presenting their own work or a survey paper.

1-3 units, Win (Hammond, Suppes, Ferejohn) by arrangement

OVERSEAS STUDIES

The following courses are approved for the Economics major and taught overseas at the campus indicated. Students are encouraged to discuss with their major advisors on campus which courses would best meet individual educational needs. Descriptions can be found in the Overseas Studies section of this bulletin or in the Overseas Studies Program office, 126 Sweet Hall.

123X. Efficiency of Capitalist and Socialist Economics and the Polish Crisis—Krakow. 4 units, Spr (Wojtyna)

127X. France and Europe and the Economic Crisis—Tours. (DR:5) 5 units, Win (Leboucher)

128X. Contemporary Problems of Economic Growth—Tours. (DR:5) 5 units, Aut (Leboucher)

159X. The Political Economy of Industrial Change—Florence. 2-3 units, Spr (Bianchi)

165X. International Economics—Oxford. 5 units, Spr (Grant)

ENGLISH

Chair: J. Martin Evans (Winter, Spring) Acting Chair and Vice Chair: Ronald A. Rebholz (Autumn)
Director of Creative Writing Program: John L’Heureux
Director of Freshman English Program: Charles N. Fifer


Associate Professors: Terry Castle, W. S. DiPiero
The Department of English offers work in English and American literature, English philology, creative writing, and expository 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.

UNDERGRADUATE PROGRAMS

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 credit basis at the discretion of the instructor, but students intending to go to graduate school should weigh the fact that a grade of pass will provide little evidence of their abilities.

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. English majors who already possess the necessary language skills are strongly urged to satisfy this requirement by taking an upper division course in a foreign literature read in the original language. Such a course will simultaneously fulfill one of their elective requirements.

Because the English Department recognizes that the needs and interests of literature students vary, 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.

Major in English—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 nine 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). At least one of the courses satisfying the English major must be either an English 180-189 (Seminars for English Majors) or an English 196 (Honors Seminar) or an English seminar offered in the Stanford in Oxford program. Other English courses which are taught in a seminar format and require a substantial amount of critical writing may be approved by the Undergraduate Studies Committee on a case by case basis. Students are urged to satisfy this requirement as early as possible in their program.

A) Language: English 102, 205; Linguistics 1, 70, 73.
C) Renaissance: English 113, 165B, 172, 176, 182C.
Courses taken to satisfy an English area requirement cannot also satisfy Creative Writing requirements. Students must maintain a letter grade indicator of "B" in all Creative Writing classes to graduate with the Major in English with a concentration in Creative Writing.

Major in English with Interdisciplinary Emphasis—This is a major intended for students who wish to combine the study of literature of a broadly defined historical period with an interdisciplinary program of courses relevant to that literature. Students are required to take a total of 15 courses distributed as follows:

1. One course in Area A, to be taken as early as possible in their program of studies.
2. Either one course each in Areas B, C, and D (emphasis in Medieval and Renaissance Literature) or one course each in Areas E, F, G, and H (emphasis in English and American Literature from the Enlightenment to the Present).
3. a) Students electing an emphasis in Medieval and Renaissance Literature must take 111 and 112.
   b) Students electing an emphasis in English and American Literature from the Enlightenment to the present must take 110.
4. Three elective English courses in the area of emphasis.
5. 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, feminist studies, history, modern thought and literature, and political science. These six courses should form a coherent program, and they must be relevant to the historical focus of the courses chosen by the student to meet requirement (2). Each of these six courses must be approved in advance by the student's advisor.
6. In addition, students in the interdisciplinary program must write at least one interdisciplinary paper. This may be a senior Honors essay (197), a senior independent essay (199), and individual research paper (194 or 198), or a paper integrating the material in two courses the student is taking in two different disciplines.

Major in 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 nine courses in English, one from each of the areas A-H, P 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.

**Major in English and Italian Literatures**—This is arranged as in the major in English and French Literatures, requiring the completion of nine courses in English, one from each of areas A-H, P, 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.

**Major in 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 nine courses in English, one from each of the nine areas A-H, P, and a coherent program of four courses in German literature, read in the original, with approval by the departments involved as specified above.

**Major in English and Spanish or Spanish-American Literatures**—Candidates for the A.B. in this major must complete nine courses in English, including one from each of the nine areas A-H, P, and a coherent program of four courses in Spanish or Spanish-American literature, totaling at least 20 units and read in the original. The program of each student must be approved by the departments involved as specified above.

**Major in English and Classics**—Candidates for the A.B. in this major must complete nine courses in English, including one from each of the nine areas A-H, P, and a coherent program of four courses in Classics, totaling at least 20 units and read in the original. The program of each student must be approved by the departments involved as specified above.

**HONORS PROGRAM**

Students who wish to undertake a more extensive program in English literature, including tutorials, a seminar, and independent research, are invited to apply for the Honors program as soon as possible after declaring an English major and, in any case, no later than Autumn Quarter of their junior year. Application consists of completing a form and submitting a sample of critical writing. Admission will be selective. Provisional admission will be announced in early December. Permission to continue in the program is contingent upon successful completion of two tutorials and submission, by June 1, of a Senior Honors Essay proposal with bibliography.

In the junior year students may choose between the following two options: (1) At Oxford, they may take two quarters of the seminar sequence offered by St. Catherine's College, Oxford, or at least 10 units of tutorial work arranged by the Director of the Oxford program. (2) At Stanford, they must take 10 units of tutorial work in the English Department. Students who elect this option will select two regular English Department lecture courses, registering for 3 rather than 5 units. Each course will also take a 5-unit tutorial (196T) on the same or related material with an advanced graduate student.

(Either of the above two options can be used, or the two courses taken in Oxford, or the two courses taken on a tutorial basis at Stanford can be used to satisfy the appropriate area requirements of any track of the English major.)

In the Autumn and Winter Quarters of their senior year, Honors students will complete their senior Honors essays for 10 units under the supervision of a faculty advisor. In the Autumn Quarter, Honors students will take a 5-unit Senior Honors seminar on critical approaches to literature. In the Winter Quarter, they will take a 3-unit essay workshop, normally taught by the Director of the Honors program. The workshop will focus on the process of researching and writing the essay. The deadline for submitting the Honors essay is the end of Winter Quarter, or, with the agreement of the faculty advisor, no later than May 1st.

Students in the Honors program will complete the following:

- **Area Requirements (A-H, P)**—nine courses
- **Two tutorials—10 units**
- **Senior seminar and workshop—8 units**
- **Senior Honors Essay—10 units**

The Director of the Honors Program may, in special cases, modify these requirements.

**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.

**ADDITIONAL ADVANCED WORK**

**INDIVIDUAL RESEARCH**

Students taking 100 or 200 level courses may, with the consent of the instructor, write a follow-up 5 unit paper based on the course material and due no later than the end of the succeeding quarter (register for 194). Only students who have successfully completed the initial course and who have applied for the follow-up course before the end of the quarter in which they took the initial course are eligible. The research paper is written under the direct supervision of the professor; it must be submitted first in a preliminary draft and subsequently in a final version.
INTEGRATED WORK
Students taking (either simultaneously or consecutively) two or three courses which have a clear thematic or historical relationship to each other may, with the consent of the relevant instructors, write one large-scale paper integrating the material in the courses in question.

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 contact an advisor in the department.

HONORS PROGRAM IN HUMANITIES
An Honors Program in Humanities is available for majors of this department who wish to supplement their departmental major by a related and carefully guided program of studies. See the "Humanities Special Programs" section in this bulletin for a description of the Honors program. Students wishing to take the Comparative Literature option within the Honors Program in Humanities should see the "Comparative Literature" section in this bulletin.

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.

GRADUATE PROGRAMS
For University regulations governing advanced degrees see the "Degrees" section 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 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 may earn the master’s degree in English and American literature by satisfying the following requirements:
1. Successful completion with a “B” letter grade indicator (LGI) of nine courses (normally 45 units) 101 and above, including at least two 300-level courses. 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.

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; 18th 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
The program consists of a minimum of 25 units further strengthening their academic preparation. In which the degree is to be granted.

At least four weeks before the close of the quarter, candidates who have a teaching credential or relevant teaching experience and wish to pursue a teaching 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.

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. (Since departmental doctoral requirements are now in the process of minor revision, students should consult the most recent edition of "Informal Notes: Procedures for the Ph.D." Copies are available in the English Graduate Studies Office, room 51L.)

A candidate for the Ph.D. degree must complete three years (nine quarters) of full-time work, or an equivalent, in graduate study beyond the bachelor's degree. He or she will be expected to offer at least 97 units of graduate work in addition to the doctoral dissertation. At least three consecutive quarters of graduate work, and also the last course work in the doctoral program, must be taken at Stanford.

Towards the 97 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 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.

ENGLISH LITERATURE

Requirements are as follows:

1. A 5-unit course in Old English (usually to be 205) and a 5-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 is 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.
graduate seminars. These colloquia and seminars should be from different genres and periods as approved by the advisor.

3. A 2-unit course introducing the new graduate student to the various opportunities and responsibilities of the department and a 5-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, 398, 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 at the end of the Summer Quarter of the first 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).

ENGLISH AND AMERICAN LITERATURE
Requirements are as follows:

1. A 5-unit course in Old English (usually to be 205) and a 5-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 2-unit course introducing the new graduate student to the various opportunities and responsibilities of the department and a 5-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).

ENGLISH AND COMPARATIVE LITERATURE

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 John Freccero, Chairman of the Committee on Comparative Literature.

The requirements 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 10 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 2-unit course introducing the new graduate student to the various opportunities and responsibilities of the department and a 5-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.

ENGLISH AND LINGUISTICS

Requirements are as follows:

1. A 5-unit course in Old English, a 5-unit course in Middle English, and English 102 (History of the English Language) for 5 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 2-unit course introducing the new graduate student to the various opportunities and responsibilities of the department and a 5-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 Linguistics (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 English 101 and Linguistics 120, 130, and 140.

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.

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, Russian or another language relevant to the student's field of study. 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 letter grade indicator (LGI) 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 15, respectively, with an LGI 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 extend 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.

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 "Humanities Special Programs" section in this bulletin.

Ph.D. 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 "Modern Thought and Literature" section in this bulletin and consult Professor John Bender in the English Department.

Courses Numbering System

Freshman Writing Courses: 1-3
Introduction to Literature: 5
Western Culture: 7, 8, 9
English Language Courses: 101-109, 200-209, 308-309
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: 40-45, 140-145, 240-249, 340-349
Poetry: 50-59, 150-159, 250-259, 350-359
Topic Courses: 60-69, 160-169, 260-269, 360-369
Author Courses: 70-79, 170-179, 270-289, 370-389
INTRODUCTORY

Classes designed for students whose major is undeclared or is not in English.

Tutorial Center—A no-credit service to any student, undergraduate or graduate, who wants help with writing. Available through the Freshman English Office.

0 units, Aut, Win, Spr (Staff)

1. Freshman English—The successful completion in proper sequence of 1 and 2 satisfies the University Writing Requirement. Both involve reading texts and reviewing writing techniques. First quarter: students concentrate on finding an appropriate thesis, and developing and organizing ideas. Second quarter: students concentrate on style and diction and on preparing and writing a research paper. A variety of workshops are offered. The primary concern of all the workshops, whatever the nature of the readings, is student writing and its improvement. The readings are intended to serve writing needs and are not studied for their own sakes. (DR:W)

1A, 2A. Writing: Process, Structure, and Style—Focus is directly on student writing, supplemented by a general range of readings. A few sections are conducted as tutorials focusing on individual weekly conferences for each student, in addition to the weekly class meeting.

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

1B, 2B. Social and Contemporary Issues—Writing is largely based on discussion of readings on politics and social matters. (DR:W)

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

1C, 2C. Literature and Related Topics—Writing is generally based on the study of various kinds of literature and other creative activities (film, etc.). These are not designed as conventional literature or film courses. (DR:W)

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

3. Intensified Freshman English—A one-quarter course that fulfills the University Writing Requirement but is offered only for students who have scored a 4 or 5 on the English AP exam. Classes meet twice a week for 75 minutes or three times per week for 50 minutes and each student has individual tutorial sessions with the instructor. Students concentrate on the same writing techniques as those presented in the 1 and 2 sequence. A variety of writing workshops are offered: some organized around a specific subject matter, with much of the writing arising from the readings; others are devoted to writing methods, with readings serving as examples of writing strategies. (DR:W)

4 units, Aut, Win, Spr (Staff)

4. Directed Writing—For students who have completed the Writing Requirement and wish further work in writing. Taught partly by the tutorial method, tailored to the individual student’s needs.

3 units, Aut, Win, Spr (Staff)

7,8,9. Literature and the Arts in Western Culture—This Western Culture sequence emphasizes literature and the creative imagination as part of the western tradition. The lectures explore literature in its cultural context and include sessions on art, music, and drama. Students meet three times weekly for lectures and once weekly in two-hour seminar discussion groups. The course moves chronologically from antiquity to the present day, setting works in their original historical and intellectual perspective. Besides developing critical and analytical skills, this course stresses the techniques and practices of good writing. All seminar instructors are experienced writing teachers, and student essays receive close attention. Students who elect other courses to satisfy the Writing Requirement are eligible to request this Western Culture track for the usual 5 units per quarter. Priority goes to those who take advantage of the opportunity this track offers to fulfill simultaneously both the Western Culture requirement and the Writing Requirement (either English 1 and 2 or 3).

7. Antiquity and the Middle Ages—Begins with the Hebrew Bible and continues to the dawn of the Renaissance, covering Homer, Sappho, Sophocles, Plato, the Beowulf poet, Dante, Marie de France, Boccaccio, and Chaucer. (DR:1)

8 units with English 1, 9 units with English 3, Aut (Steidle, Staff) lectures plus sections

8. Renaissance and Enlightenment—Readings from the Renaissance to the Enlightenment and include texts by Machiavelli, More, Shakespeare, Milton, Swift, Voltaire, and Mary Wollstonecraft. (DR:1)

8 units, with English 2, 9 units with English 3, Win (Rebholz, Staff) lectures plus sections


5 units, Spr (Polhemus, Staff) lectures plus section

10, 11, 12. Masterpieces of English and American Literature—An in-depth study of selected
works by major English and American writers from the medieval to modern periods.

10. Masterpieces of English Literature I: Chaucer, Shakespeare, Milton, and Their Contemporaries—(English majors and other students taking the course for 5 units, register for 110.) An introduction to the works of three of the greatest English writers: Chaucer, Shakespeare, and Milton. (DR:2)
   3 units, Win (Steidle)

11. Masterpieces of English Literature II: From the Enlightenment to the Modern Period—(English majors and other students taking 5 units, register for 111.) An introduction to literary masterpieces written in English between 1700 and the present. Divided about equally between poetry and fiction, with some drama. (DR:2)
   3 units, Spr (B. Gelpi)

12. Masterpieces of American Literature—(English majors and other students taking 5 units, register for 112.) An intensive look at some major North American writers and their work: Hawthorne, James, Twain, Whitman, Dickinson, O’Connor, Fitzgerald, Stevens, and others.
   3 units, Aut (Islas)

30. The Novel—(English majors and others taking 5 units, register for 130.) Introductory attempt to show how a close, sympathetic reading of the construction, narrative technique, and human values of a variety of major novels can increase the student’s appreciation of a significant literary genre. (DR:2)
   3 units, Win (Fifer)
   Spr (Packer)

50. Poetry and Poetics—(English majors and others taking 5 units, register for 150.) An introduction to the reading of poetry through a variety of poems, emphasizing the ways the meanings of the poems are shaped through diction, imagery, figurative language, and technical elements of verse. (DR:2)
   3 units, Win (Lindenberger)
   Spr (Perloff)

65. Medieval Culture: An Interdisciplinary Introduction—(Same as Medieval Studies 65.) An introduction to the development of medieval culture through study of religious, philosophical, literary, artistic, social and political sources emphasizing interrelationships among them. Lectures by faculty from various departments.
   5 units, Spr (Brown, Staff)

90. Fiction Writing—Basic problems of narrative and imaginative writing. Prerequisite: Completion of the writing requirement.
   5 units, Aut, Win, Spr (Becker, Haazelet, MacDonald, McNeal, Spencer)

92. Reading and Writing Poetry—An introduction to the understanding and writing of poetry. Prerequisite: Completion of the writing requirement. (Area P)
   5 units, Aut, Win, Spr (Wasserburg)

Western Thought and Literature—See Humanities 61, The Ancient Near East, Greece, and Rome; 62, Renaissance; 63, The Middle Ages and The Enlightenment to the Present.

BASIC UNDERGRADUATE SURVEYS, SEMINARS, AND WORKSHOPS

Note—Graduate students may receive graduate credit for 3 courses numbered 101-199.

102. The History of the English Language—The evolution of the English language as a medium of literary expression. (Area: A) (DR:4)
   5 units, Win (Brown)

110. Masterpieces of English Literature I: Chaucer, Shakespeare, Milton, and Their Contemporaries—(See 10.)
   5 units, Win (Steidle)

111. Masterpieces of English Literature II: From the Enlightenment to the Modern Period—(See 11.)
   5 units, Spr (B. Gelpi)

112. Masterpieces of American Literature—(See 12.)
   5 units, Aut (Islas)

113, 115. English Literature—A basic survey.

113. The Renaissance—(Area C)
   5 units, Win (Orgel)

115. Survey of 18th-Century Literature—(Area: E)
   5 units, Win (Castle)

119Z. Darwinism and Social Ideology of the 19th-Century—(Same as History of Science 152A, Philosophy 152B; Oxford campus.) Darwin’s ideas in terms of knowledge (vis-a-vis religious belief) and power (vis-a-vis class, gender and race.) (DR:3)
   5 units, Spr (Dupre Gagnier)

121. American Literature and Culture to 1855—(Same as American Studies 150.) (Area: G)
   5 units, Aut (Fliegelman) MTWTh 10

122. American Literature, 1855-1917—(Area: G)
   5 units, Spr (Moser)

124. Identity and Other Enigmas in American Literature, 1850-1900—Readings include Melville’s Pierre, Whitman’s Leaves of Grass, Dick-
inson’s Poems, Chopin’s The Awakening, The Education of Henry Adams, Narrative of the Life of Frederick Douglass. (Area: G)
5 units, Win (Fields)

130. The Novel—(See 30.)
5 units, Win (Rifer)
Spr (Packer)

131A. The 18th-Century British Novel—
(Area: E)
5 units, Aut (Donoghue)

131B. The 18th-Century British Novel—
(Area: E)
5 units, Spr (Castle)

132. The 19th-Century English Novel—(Area: F) (DR:2)
5 units, Win (Polhemus)

133. The 20th-Century English Novel. (Area: H) (DR:2)
5 units, Win (Ruotolo)

5 units, Aut (Packer)

150. Poetry and Poetics—(See 50.) (Area: P)
5 units, Win (Lindenberger)
Spr (Perlaff)

154A. Major Romantic Poets—Introduction to a selection of the poems and most important critical statements of Blake, Wordsworth, Coleridge, Byron, Shelley, and Keats. (Area: F)
5 units, Spr (Perloff)

160. Women and Difference: Marginality, Art, and Politics—(Same as Feminist Studies 160.) Women perceived as “different” (spinsters, lesbians, women of color, Jewish women, women with disabilities, women without children) according to prescribed social norms have been designated as freaks, asexual, monsters, marginal. Focus is on the lives and works of women who embraced their difference, making it serve their art, sometimes their art and politics. Virginia Woolf, Lillian Smith, Helen Keller, Annie Sullivan, Agnes Smedley, Frida Kahlo, Billie Holiday, Irena Klepfisz, Audre Lorde, Gloria Anzaldúa, Joy Harjo. (Area: H)
5 units, Aut (Dekker)

161A. Afro-American Writing, 1945-1970—Aims: to identify central literary and intellectual concerns among Afro-American writers, emphasizing the historical and social context. The emergence of the Civil Rights movement in the 1950’s and its development in the 1960’s; the Black Power/Black Arts movement of the 1960’s; and the emergence of a large number of women writers in the second part of the period. Continuities and changes in the work of individual writers over time. The relation between literary style and the artist’s conception of audience and relation to community. Readings, entire and excerpted, are from novels, essays, poetry. Authors: Richard Wright, Ann Petry, Ralph Ellison, James Baldwin, Lorraine Hansberry, Leroi Jones, Amiri Baraka, Gwendolyn Brooks, Martin Luther King, Jr., Malcolm X. Can be take separately but is planned as a sequence with 161B. (Area: H) (DR:2)
5 units, Win (Drake)

161B. Afro-American Writing, 1970 to the Present—Readings: Toni Morrison, Alice Walker, Baraka, Ralph Ellison, Gloria Naylor, and Toni Cade Bambara. Can be taken separately but is planned as a sequence with 161A. (Area: H) (DR:2)
5 units, Spr (Drake)

162B. Chicano Literature: Creative Writing for Bilingual Students—(Same as Spanish 162B.) A basic fiction writing workshop. Working knowledge of Spanish necessary.
5 units, Aut (Islas)

163H. Contemporary Issues in Feminist Theory—(Same as Feminist Studies 102.) Undergraduate seminar on recent developments of feminist theory, the natural sciences to aesthetics, including political and methodological concerns. (Area: H)
5 units, Win (Gagnier)

163Z. Gender and Class in 19th-Century Fiction—(Oxford campus.) The novel in terms of the above issues, including the “Oxford novel.” (Area: F) (DR:2)
5 units, Spr (Dupré, Gagnier)

164A. The Biblical Presence in Modern Poetry—The presence of biblical scripture (its narratives, place names, prophesy, liturgical and lexical elements) in British, American, European, and Israeli poetr. (Area: H) (DR:2)
5 units, Spr (Felstiner)

164C. Medieval Literature of Heroism and Romance—A survey of medieval English masterworks with attention to related literature from the Continent. (Area: B)
5 units, Aut (Rowe)

165B. Crime and Punishment in Renaissance Fiction.
5 units, Spr (Gallagher)
165Z. Living in the Past: The American Experience in Europe—(Tours campus.)
   (DR:2)
   5 units, Aut (Evans)

171A. Chaucer's Canterbury Tales—(Area: B)
   5 units, Win (Wack)

171B. Chaucer's Troilus and the Dream Poems—(Area: B)
   5 units, Spr (Stork)

172. Milton—(Area: C)
   5 units, Spr (Evans)

173A. Shakespeare—(Same as Drama 159A.)
   As You Like It, The Merchant of Venice, Henry IV: Part One, Henry IV: Part Two, Measure for Measure, Hamlet, King Lear, The Tempest.
   (Area: D) (DR:2)
   5 units, Win (Lyons) MTWTh 11

173B. Shakespeare—(Same as Drama 159B.)
   (Area: D) (DR:2)
   5 units, Win (Orgel) TTh 1:15-3:05

176. Donne and Jonson: Poems—(Area: C)
   5 units, Aut (Trimpi)

177. Virginia Woolf—(Area: H)
   5 units, Spr (Ruotolo)

178. Tom Stoppard—(Same as Drama 158A/258A.)
   Stoppard, one of the leading playwrights of our time (Rosencrantz and Guildenstern, Jumpers, Travesties), is a master of dialogue that makes ingenious use of literary models from Shakespeare to Agatha Christie.
   3 units, Win (Esslin) MW 1:15

180-189. Seminars for English Majors—Seminars on the scholarly and critical study of literary texts; one such seminar (or its equivalent) is required of all English majors. 180-188 satisfy the appropriate area requirements A-H, P (see program for major in English above). The subject matter of 180 is mainly linguistic studies; 181, medieval literature; 182, Renaissance literature, and so on. 189, which can count as one of two required electives (see program for major in English above), is mainly the theory of literary genres. Preference for these seminars is given to English majors. Sign up at the English Department.

181C. From Epic to Romance: Courly Love and the Heroic Ideal—(Area: B)
   5 units, Spr (Steidle)

182C. History of Literary Criticism—(Area: C)
   5 units, Spr (Trimpi)

184A. Representations of Women in 18th-Century Literature—(Area: E)
   5 units, Aut (Castle)

185A. Love in the 19th-Century English Novel—(Area: F)
   5 units, Aut (Polhemus)

185B. Jane Austen—(Area: F)
   5 units, Win (Watt)

185C. Keats and Shelley—(Area: F)
   5 units, Spr (B. Gelpi)

186A. American Autobiography—(Same as American Studies 203.) (Area: G or H)
   5 units, Aut (Fliegelman)

187A. Studies in Afro-American Poetry—(Area: H)
   5 units, Win (Islas)

187B. American Lives—(Same as American Studies 223.) (Area: H)
   5 units, Win (Perloff)

187D. Faulkner and Hawkes—(Area: H)
   5 units, Win (Guerard)

187E. Conrad, Ford, and James—(Area: H)
   5 units, Spr (Moser)

188P. Seminar: Poetry and Poetics—(Area: P)
   5 units, Spr (Felstiner)

190. Intermediate Fiction Writing—May be taken twice. For admission, manuscript must be submitted to Building 50, room 51C. Prerequisite: 90.
   5 units, Aut, Win, Spr (Havazelet, McNeal, Packer)

191. Expository Writing—Advanced composition open to undergraduates and graduates. Taught through tutorials and partly through short lectures and general discussion. General instruction in writing. Each section has a special emphasis.

191A. Writing About Science.
   3 units, Aut (Joly)

191B. Writing About Social Sciences.
   3 units, Spr (W. Brown)

191C. Writing About Business.
   3 units, Win (Hartley)

191D. Writing About Law.
   3 units, Spr (Johnstone)

191E. Advanced General Composition.
   3 units, Win (Emery)

192. Intermediate Poetry Writing—May be taken twice. Prerequisite: 92.
   5 units, Aut, Spr (Wasserburg)
194. Individual Research—(See Undergraduate Programs, Opportunities for Advanced Work, 2. Individual Research.)
5 units, any quarter, by arrangement

195. Ad Hoc Undergraduate Seminars—Undergraduates (at least three) 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 should be submitted to the director of undergraduate advising at least two weeks before the end of the quarter. No more than 5 units of credit is given for 195 and/or 198 in one quarter. 195 may not be used to fulfill departmental area or elective requirements without permission.

any quarter, by arrangement

196A. Honors Seminar: Critical Approaches to Literature—Required of all seniors in the English Honors Program.
5 units, Aut (Donoghue)

196B. Honors Essay Workshop—Required of all English Honors students.
3 units, Win (Staff)

196T. Honors Tutorial.
5 units, Aut, Win, Spr (Staff)

197. Senior Honors Essay.
10 units (during 2 quarters) Aut, Win (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 5 units of credit are given for 198 and/or 195 in any one quarter. 198 may not be used to fulfill departmental area or elective requirements without permission. Group seminars are not considered appropriate to 198.

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 Undergraduate Advisor, room 40-41F, before preregistration in May of their junior year. Each student who is accepted is assigned to an instructor, with whom an appropriate reading list is prepared before the end of the Spring Quarter.

10-15 units (for the entire year)
Aut, Win, Spr (Staff)

ENGLISH 389

SPECIFIC TOPICS AND AUTHORS: FOR UNDERGRADUATE AND GRADUATE STUDENTS

Note—Students in other departments who wish to broaden their programs will find many of these courses useful.

205. Old English—Study of Old English; critical reading of short poems and selected prose in language and literature. Prerequisite for 270A.
(Area: A)
5 units, Aut (Stork)

209. Introduction to Paleography and Codicology—(Same as Classics 177.) Introduction to late antique and medieval manuscripts in Latin, medieval Latin and vernacular scripts, and the materials and composition of the medieval book.
5 units, Spr (Brown)

211. Readings in Middle English—The language and dialects of Middle English and reading in the various genres of prose and poetry.
(Area: B)
5 units, Win (Stork)

213A. Books and Society, 1400 to 1800—(Same as History 215.)
5 units, Spr (Ryan)

262G. The Caribbean-Americas: An Introduction to Their Literature, Thought, and Cultural Worlds—(Same as African and Afro-American Studies 248, Spanish 248.)
3-5 units, Aut (Gonzales)

264B. 19th-century Narrative—(Same as Comparative Literature 264B.) Works by Thackeray, Dickens, Charlotte and Emily Bronte, Flaubert and others, exploring the transformation of earlier narrative forms, with questions of gender and politics.
(Area: F)
5 units, Aut (Parker)

264Z. Britain in the 19th Century: In Pursuit of Bread, Knowledge, and Freedom—(Same as Philosophy 173; Oxford campus.) Ideology and
social conditions emphasizing class, gender, and race. The relevance of Victorian social and political theory (e.g., Adam Smith, Malthus, Engels, Mill, Ruskin) to the concrete conditions revealed in Victorian autobiographies. (Area: F) (DR:3)

5 units, Spr (Dupré, Gagnier)

265. Knowing the Holocaust: Psychoanalytical and Literary Perspectives—(Same as Psychology 180B.)

5 units, Spr (Auerhahn) T 3:15-6:05

270A. Beowulf—Reading and critical analysis of Beowulf. Prerequisite: 205 or its equivalent. (Area: B)

5 units, Win (Porter)

286. William Carlos Williams—(Area: H)

5 units, Spr (Sorrentino)

288. Dickens and His Society—(Area: F)

5 units, Aut (Pope)

290A. Reading and Writing the Novella—Workshop for advanced writing students who want to attempt a longer work in a two-quarter course. Seminar study of novellas by Cather, James, Porter, Kay Boyle, and Andre Dubus. Workshop pursues individual strategies and makes initial attempts at writing student novelas. Prerequisites: 90, 190, and submission of a manuscript to 50-51C.

5 units, Aut (L'Heureux)

291. Generative Devices in Imaginative Writing—Designed on the lines of the OuLiPo (Ouvroir de Litterature Potentielle/Workshop for Potential Literature), the Paris-based writers whose premise is that formal constraints make for artistic liberation. Students work with such restrictive techniques as palindromes, lipograms, heterograms, algorithms, homorphisms, “false” translations, combinatories, etc., and with devices of their own invention. Prerequisite: 190 or 192.

5 units, Win (Sorrentino)

292. Advanced Poetry Writing—(For undergraduates, selected by the instructor.) Promising student poets write poetry in an atmosphere of mutual aid. Manuscripts must be submitted to the Creative Writing secretary by December 1.

5 units, Win (Levertov)

293. Translation Workshop—Members of the workshop present and defend work in progress, prose or poetry, and discuss theoretical and practical questions.

5 units, Spr (Di Piero)

302. Colloquium: Renaissance Poetry—Major poets of the 16th and 17th centuries emphasizing the short poems written by the 17th century poets.

5 units, Spr (Rebholz)

302A. Colloquium: Spenser and Milton in Context—(Same as Comparative Literature 375A.) Selected aspects of The Faerie Queene and Paradise Lost against the background of classical epic and romance and the foreground of recent feminist and new historicist criticism.

5 units, Win (Parker) T 3:15-6:05

302B. Colloquium: Shakespearean Criticism—The Last Decade—(Same as Drama 359.) The impact of recent critical theory on Shakespearean studies.

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

303A. Colloquium: Swift, Pope, and Satiric Tradition.

5 units, Aut (Carnochan)

303B. Colloquium: Sexuality and Terror—Gothic and Fantastic Literature of the 18th Century—Classics of Gothic fiction by Walpole, Radcliffe, Lewis, Beckford, and others. The role of women in Gothic fiction and the genre’s treatment of terror and sexuality.

5 units, Win (Castle)

303C. The Enlightenment in France and England—Introduction to the history of ideas in the period. Readings of major writers in France (Montesquieu, Voltaire, Diderot, D’Alembert, Rousseau, Holbach, Condorcet) and England (Hume, Gibbon, Boswell, Adam Smith, Goldsmith, Godwin); the relationships between French and English versions.

5 units, Spr (Watt)

304. Colloquium: The Romantic Age—The Generation of Wordsworth and Austen—Major poems and prose works of the period 1789-1815 studied in relation to: primitivism in literature and religion, the writer as propagandist for revolution and reaction, the development of distinctively “Romantic” literary genres, the survival of “Augustan” forms and values.

5 units, Win (Dekker)

305. Colloquium: Literature and Institutions—(Same as Comparative Literature 305.) A theoretical investigation with practical examples from various historical periods, of authorship, readership, evaluation, and the production and dissemination of literary texts.

5 units, Win (Lindenberger)

306. Colloquium: Modern American Popular Culture and Fiction—The ways 20th-century American fiction has reflected themes, techniques, and movements created by practitioners of such cultural modes as humor, sport, film, music, and detective or Western stories. Novelist: Dos Passos, West, Doctorow, Ellison, Berger, Malamud, Oates, and Chandler.

5 units, Win (Solomon)
Colloquium: Postmodern Fiction—American and European—Works by writers who have extended the classic modern tradition: William Burroughs, Robert Creeley, Samuel Beckett, Aidan Higgins, Claude Mauriac, Robert Pinget, Italo Calvino, Juan Goytisolo, Julio Cortazar, Nicholas Mosley, and Milan Kundera.

5 units, Win (Sorrentino)

Colloquium: Studies in Poststructuralism—(Same as Comparative Literature 394.) Major developments in poststructuralist theory and criticism, with intensive reading in Derrida, Foucault, and others.

5 units, Win (Sorrentino)

Colloquium: Methods and Materials for the Study of Modern Literature—Some methods of inquiry into post-Enlightenment British and American literature (1750 to the present), and an analysis of the library resources that enable and facilitate them. Emphasis on interdisciplinary approaches that literarize the text's cultural occasion. Short works representative of major period and national circumstances focus on different models of contextual criticism. Topics: the genesis, production, and distribution of texts; the reconstruction of their original semantic, ideological, and literary environments; and the competing philosophies of editing them.

5 units, Spr (McPherson)

Colloquium: Contemporary Drama—(Same as Drama 354B.) Avant-garde drama of the early 20th century.

5 units, Aut (Graver) MW 2:15-4:05

Seminar: Historical Interpretation of Renaissance Drama—Theory and Practice.

5 units, Spr (Riggs)

Seminar: American Renaissance—Major texts by authors of the 19th-century "American Renaissance," Emerson, Whitman, Thoreau, Hawthorne, and Poe; the selection of authors varies each year. Combines close readings with a study of general cultural and historical patterns of the period, with attention to matters of theoretical interest.

5 units, Win (Halliburton)

Seminar: Representing Self and World in Ricardian Poetry—Selected works of Chaucer, Gower, Langland, and the Gawain Poet emphasizing problems of mimesis and subjectivity. How these authors appropriate various discourses (rhetoric, philosophy, science, magic, medicine, etc.) to represent self and world. Readings in other medieval texts (Machaut, Petrarch, Boccaccio, Margery Kempe) and in literary theory; assumes prior knowledge of Chaucer and a working acquaintance with non-Chaucerian Middle English.

5 units, Spr (Wack)

History of Literary Theory (Ancient)—Graduate level reading and lecture.

5 units, Aut (Trimpi)

History of Literary Theory (Medieval/Renaissance)—Graduate level reading and lecture.

5 units, Win (Trimpi)

Seminar: Renaissance Rhetoric, Textual Instances—(Same as Comparative Literature 393.) Seminar examines, beginning with Erasmus, the discourse of rhetoric in the Renaissance in its theoretical formulations and in particular literary instances from Rabelais to Shakespeare, Cervantes, and others.

5 units, Aut (Parker) M 3:15-6:05

Seminar: The Modern Tradition—Inquiry into conceptualizations of modernity, modernism, and modernization in terms of cultural criticism and social theory. Topics: diachronic designations with reference to tradition and post-modernism; the institutional status of culture; modern identity and the confrontation with alterity.

5 units, Aut (Gagnier)

Interdisciplinary Graduate Seminar: Chicano Culture—(Same as Spanish 352.) How literary texts reflect and interpret aspects of the Mexican-American experience. Texts included within the intellectual traditions of the U.S. and Mexico are analyzed from this dual perspective.

5 units, Spr (Islas, Ybarra-Frausto)

Seminar: American Literature and Culture in Antebellum Poems.

5 units, Spr (Fliegelman)

Seminar: Theology and the Reading of Medieval Literature—Major theological texts that influenced medieval literature and the critical interpretation of the literature in the light of these texts: for earlier literature, writings of the Fathers of the Western Church and early medieval exegesis; for the later period, writings of Scholastics.

5 units, Win (Brown)

Seminar: The Structuralist Paradigm and Its Transformations—(Same as Comparative Literature 369, German Studies 346.) The elaboration of the structuralist paradigm in the work of Saussure, Jakobson, and Lévi Strauss; its redactions in the work of Lacan, Barthes, Althusser; its transformations in post-structuralist writing (Derrida, Foucault).

5 units, Aut (Wellbery)

Seminar: Shakespeare—(Same as Drama 351A.) Two-term seminar on Shakespeare concentrating on readings, methodology, and questions of evidence in all aspects of Shake-
speare's work, dramatic and non-dramatic. Approaches are historical, textual, bibliographical, theoretical, and theatrical. Texts: the sonnets, Twelfth Night, Hamlet, Macbeth, and The Tempest. What the nature of a theatrical text was in the Renaissance and what sort of phenomenon theater was in Shakespeare's time; what ends it was designed to serve; what sort of social and political reality it had. What it was as an institution and concept.

5 units, Win (Orgel) M 3:15-6:05

373B. Seminar: Shakespeare—(Same as Drama 351B.) Continuation of 373A. Devoted to projects out of the first term's work, initiated by the participants in the seminar, and hopefully eventuating in the preparation of a serious scholarly paper of publishable quality. Readings and class work are determined by and based on those papers, providing a forum for the work in progress and a critique of it. With the consent of the instructor, a relevant project may be admitted to the second term without having taken the first, but the assumption is that students are enrolling for both terms and that 373A is a prerequisite.

5 units, Spr (Orgel) M 3:15-6:05

394. Independent Study—Preparation for qualifying examination and for the Ph.D. oral examination. Pass/No Credit only.

Sum, by arrangement

395. Ad Hoc Graduate Seminars—Three or more graduate students 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. Graded or Pass/No Credit basis.

any quarter, by arrangement

396. Introduction to Graduate Study—Required for first-year graduate students in English, Modern Thought and Literature, and Comparative Literature who will be teaching in the Freshman English program. Experience leading a section, evaluating essays and examinations, and a broad introduction to the opportunities and responsibilities of graduate study. Meets weekly. Assigned brief readings and a short final paper. Pass/No Credit only.

2 units, Aut (Fifer, Halliburton)

397A. Rhetoric and Teaching Composition—Required for second-year graduate students in English, Modern Thought and Literature, and Comparative Literature who will be teaching in the Freshman English Program. Both a seminar and an apprenticeship. Each student is assigned as an apprentice to an experienced teacher, and sits in on classes, conferences, tutorials; later, may be given responsibility for conducting a class, grading papers, holding conferences. Class meetings are devoted to discussing rhetoric, composition, and teaching of writing. Readings are assigned in rhetoric and pedagogy. Each student designs a two-quarter syllabus in preparation for teaching English 1 and 2. Pass/No Credit only.

5 units, Aut (Fifer)

397B. Teachers Workshop I—A seminar for second-year students teaching composition. (Second-year students are advised, during their first quarter of teaching to take only one literature course.) Strong pragmatic emphasis: discussion of writing assignments, evaluation of essays, coordination of reading and writing, conduct of conferences. Occasionally, experienced teachers of composition are invited to discuss particular problems in teaching. No written work required.

5 units, Win (Fifer) 12-1

397C. Teachers Workshop II—A seminar for second-year students teaching the second quarter of composition, focusing on the syllabus. Students share good assignments, problems, solutions they have encountered in their teaching.

5 units, Spr (Fifer)
398. Research Course—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.

OVERSEAS STUDIES

The following courses are approved for the English major and taught overseas at the campus indicated. Students are encouraged to discuss with their major advisors which courses would best meet individual educational needs. Course descriptions can be found in the "Overseas Studies" section of this bulletin or the Overseas Studies Program office, 126 Sweet Hall.

5 units, Aut (Flint)

119Z. Darwinism and Social Ideology in the 19th Century—Oxford. (DR:3)
5 units, Spr (Dupré, Gagnier)

163Z. Gender and Class in 19th-Century Fiction—Oxford. (DR:2)
3 units, Spr (Gagnier)

165Z. Living in the Past: The American Experience in Europe—Tours. (DR:2)
4-5 units, Aut (Evans)

5 units, Spr (Gagnier, Dupré)

REGULARLY OFFERED BUT NOT DURING 1988-89

5. Introduction to Literature.
40. Drama.

64A. The Biblical Presence in Modern Poetry.
64B. Arthurian Literature.

68. American Indian Mythology, Legend, and Lore.

79. Fitzgerald and Hemingway.

101. Linguistics and Literature.

103. The English Language through American Literature.

104. Language and Literary Theory.

105. Linguistic Approaches to Point of View in Fiction.

117. Romantic and Victorian Literature.

118. Growing Up in Victorian and Early Modern Britain.

119. Modern British Literature.

120. American Historical Novel.

123. American Literature, 1917 to the Present.


128. Reflections on the American Condition.

134C. American Fiction: Romance to Realism.

140. Drama—(See 40.)

142. Medieval and Renaissance Drama.


152. Classic to Romantic: 18th-Century Literature.

153. Visions and Transformations.


161C. Afro-American Literature.


161F. The Harlem Renaissance.

162A. Contemporary Chicano Literature.

162E. Introduction to Caribbean Poetry: English, French, Spanish.

162F. Modern Literature of the Caribbean.

164B. Arthurian Literature—(See 64B.)

165A. Literature of the Holocaust.

165C. The Reciprocal Vision.

166. Modern Literature in English from Africa.

167A. The Literature of Fantasy.

167B. Modern British Comic Fiction.

168. American Indian Mythology, Legend, and Lore—(See 68.)

169B. Toward an Understanding of Modernism.

174. Swift.

175. Johnson and His Contemporaries.

179. Melville.

179A. Fitzgerald and Hemingway—(See 79.)

179B. Faulkner.

180. Undergraduate Seminar: English Language.

182. Undergraduate Seminar: Renaissance Literature.

183. Undergraduate Seminar: Shakespeare.
200A. Introduction to Old Norse-Icelandic.
200B. Advanced Old Norse.
201. Old Saxon.
212A. Medieval to Renaissance: The Development of Literary Forms.
212B. Medieval to Renaissance: The Development of Literary Forms.
239. American Short Fiction.
311. Seminar: Methods and Materials for the Study of Medieval Literature.
312. Seminar: Methods and Materials for the Study of Renaissance Literature.
316A. Seminar: Studies in Romanticism.
320. Seminar: The 90's—American Literature and Culture.
355. Seminar: Shelley and His Circle.
356. Whitman and Dickinson.
360C. Seminar: Neoclassicism, Aestheticism, and Modern Criticism.
370. Seminar in Old English Prose.
374. Seminar: Ben Jonson.
376. Seminar: Milton.
384. Seminar: Jane Austen.
385A. Seminar: Ezra Pound and the Pound Tradition.
385B. Seminar: Melville.
385C. Seminar: Wallace Stevens, Poetry and Influences.
385F. Seminar: Faulkner.
388. British Authors of the 19th and 20th Centuries.
388F. Seminar: Joyce’s Finnegans Wake.

**PROGRAM IN ETHICS IN SOCIETY**

**Faculty Committee:** David Kennedy (Chair), Kenneth Arrow, Barton Bernstein, Michael Bratman, Lawrence Crowley, John Dupre, Arnold Eisen, John Ferejohn, Thomas Grey, Stuart Hampshire, Debra Satz

Visiting Assistant Professor in Ethics and Society and Religious Studies: Mark Cladis
Fellow: Charles Dresser

The Program in Ethics in Society fosters scholarship and teaching that focuses on fundamental issues of personal and public morality. The program is grounded in foundational work in moral and political philosophy, but it will also extend its concerns across a broad range of traditional disciplinary domains and to the study of specific applications in areas such as international relations, public policy, law, medicine, business, and technological regulation.

Students interest in pursuing studies in these areas should consult with a member of the faculty committee.

A standing series of guest lectures is an important part of the program. These include the annual Tanner Lectures in Human Values and the Wesson Lectures in Democratic Theory and Practice.

**COURSES**

For names of instructors and course descriptions, please refer to the relevant department listings elsewhere in this bulletin.

**INTRODUCTORY**

Philosophy 30. Introduction to Political Philosophy.
Philosophy 76. Ethics and Public Policy.
Philosophy 77. Ethics in International Relations.
Philosophy 78. Medical Ethics.
Religious Studies 63. Religion and Contemporary Society.
Religious Studies 164. Morality of Peace and War.
Symbolic Systems 100. Computers and Ethics—(Same as Philosophy 75.)

**ADVANCED UNDERGRADUATE**

Economics 185. The Distribution of Income and Wealth—(Same as 285.)
Philosophy 170. Ethical Theories.
Philosophy 171. Political Philosophy.
Religious Studies 266. Medical and Legal Ethics.
Religious Studies 269. Emile Durkheim as Moral Theorist.

GRADUATE-LEVEL
Economics 280. Welfare Economics.
Economics 285. The Distribution of Income and Wealth—(Same as 185.)
Economics 287. Interdisciplinary Workshop in Equity and Social Choice Theory—(Same as Philosophy 255, Political Science 267.)
French 286C. Individualism and Social Justice—(Same as Political Science 259D.)
Philosophy 271. Graduate Seminar in Political Philosophy.
Philosophy 274. Graduate Seminar in Moral Philosophy.
Philosophy 276. Graduate Seminar on Karl Marx.

FEMINIST STUDIES

Feminist Studies is an interdisciplinary program that investigates the significance of gender differentiation in all areas of human life. Feminist analysis is based on the assumption that gender is a crucial factor in the organization of our personal lives and our social institutions. It focuses on how gender inequality is created and perpetuated. The courses offered by the program utilize interdisciplinary feminist perspectives to expand and reevaluate the assumptions at work in traditional disciplines in the study of individuals, cultures, social institutions, policy, and all other areas of scholarly inquiry.

The Committee on Feminist Studies coordinates the courses offered on women, gender, and feminism throughout the University, and facilitates the Individually Designed major with a concentration in Feminist Studies. In addition, it seeks to encourage feminist analysis and teaching at Stanford, both in courses instituted within the program and those housed within departments. The committee annually compiles a list of courses with feminist emphasis, outlines curriculum for the Individually Designed major, and provides information and advice for graduate work in Feminist Studies. The Committee on Feminist Studies awards...
each year the Michelle Z. Rosaldo prizes for the best undergraduate essays on women, gender, or feminism. The prize is awarded in two divisions: Senior division for entries submitted by currently enrolled juniors or seniors, and Junior division for freshmen and sophomores. Essays should reach the Feminist Studies office by April 15: essays completed during the remainder of Spring Quarter may be submitted for consideration the following year.

UNDERGRADUATE PROGRAM
INDIVIDUALLY DESIGNED MAJOR

The major should normally be declared by the beginning of a student's third year. Individually Designed majors must be proposed to, and approved by the Undergraduate Studies Dean’s Advisory Committee on Individually Designed Majors (see general guidelines under “Dean of Undergraduate Studies Special Programs” section in this bulletin). Further information on Individually Designed majors is available at the Undergraduate Advising Center, Sweet Hall, (415) 723-2426.

The Individually Designed Major in Feminist Studies may be taken as a single major, as one of multiple majors, or as a secondary major. If the student wishes to take the Individually Designed Major in Feminist Studies as one of multiple majors, none of the 60 units counted toward the major in Feminist Studies may overlap with the units counted toward the major in another department or program. But if the student wishes to take the Individually Designed Major in Feminist Studies as a secondary major, then up to 30 of the units counted toward the Feminist Studies major may also be counted toward fulfilling the major requirements in another department or program if that department or program consents.

Students interested in an Individually Designed Major in Feminist Studies should consult with the director of the program several months before submitting a plan of study to the Dean’s Advisory Committee. The Feminist Studies office is at The Institute for Research on Women and Gender, Serra House, (415) 723-2412. Students should choose three faculty advisors, one of whom must be the Chair of the Program, from the list of resource faculty (see above) and may consult with peer advisors. Faculty advisors will work closely with the student in helping design an appropriate program of study.

HONORS CERTIFICATION
FEMINIST STUDIES MAJORS

Admission—The Honors program offers students an opportunity to supplement their program with independent research on a thesis of superior academic quality. The program is open to students who have achieved a letter grade indicator (LGI) of “B+” or better in their coursework in Feminist Studies. Normally, students would apply for Honors certification in the junior year, or, at latest, in Autumn Quarter of the senior year. To apply, students should design a project in consultation with all three of their major advisors, one of whom must be the chair of the program. A written proposal signed by all three advisors, describing the project and including the number of units to be awarded, must be submitted to the academic program coordinator of the Individually Designed Majors Program, who will forward it to the Dean’s Advisory Committee on Individually Designed Majors for final approval. In order for an Honors proposal to be considered during a particular month, it must be turned in at the Undergraduate Advising Center by the first of the month (excluding July, August, and September) by 5 p.m.

Requirements—For approved Honors projects, it is understood that the units will be taken over and above the program already approved for the major, i.e., in addition to those units which will comprise the body of the major.

In addition to completing all the units proposed, the student will submit, in the senior year, two preliminary drafts, and then a final draft of a thesis based on substantial research. For students graduating in June, the first draft is due by the end of January, the second by mid-March, and the final draft by mid-April. In order for Honors to be granted, the student’s three advisors must read the thesis and collectively certify to the Committee on Individually Designed Majors, by means of a letter addressed to the committee and signed by all three of them, that the thesis is of superior academic quality and merits the award of Honors. This written certification must be turned in no later than May 15.

MAJORS IN OTHER DEPARTMENTS

Honors Certification in Feminist Studies for Majors in Other Departments or Programs, as distinguished from Honors for students pursuing an Individually Designed Major in Feminist Studies, is intended to complement study in any major. Students in any field of study who wish to develop an understanding of gender in society through course work and individual research are encouraged to apply.

Admission—Honors Certification is open to students majoring in any field who have com-
completed Feminist Studies 101 and 102 with an LGI of "B +" or better, or who have taken three courses related to the topic of their proposed Honors research. Normally, students would apply for Honors certification in the first quarter of the junior year, but must apply no later than the third quarter of the junior year. To apply, students must first consult the Chair of the Program in Feminist Studies, who will help prepare an application outlining the student's plan for coursework, the rationale for the program, and an Honors project. The chair will act as one of the student's faculty advisors and will help the student select two other faculty advisors to supervise the student's progress. The student's completed application, with the signatures of two faculty advisors and the Chair of the Program, will be reviewed by a subcommittee of the Feminist Studies Committee for final approval.

Requirements—
1. Thirty units of coursework in addition to the units granted for the Honors project are required.
   a) Honors students are required to take the following three courses that constitute the core of the Feminist Studies curriculum:
      103. Seminar in Feminist Studies.
   b) Honors students should select the remaining 15 units of the 30-unit coursework requirement in consultation with their principal advisors from the list of courses approved by the Feminist Studies program. None of the courses selected may simultaneously count toward the student's major.

2. Submission in the senior year of two preliminary drafts, and then a final draft, of a thesis based on substantial research is also required. The thesis must be of acceptable quality on an aspect of Feminist Studies approved by the student's faculty committee. For students graduating in June, the first draft is due by the end of February and the second by mid-April. The final draft must be submitted four weeks before the end of exam week. Students may receive up to 10 units of credit for preparation of the Honors thesis, but these units do not count toward requirement (1).

Honors Certification in Feminist Studies will be recommended for students who have achieved an LGI of "B +" or better in their required coursework in Feminist Studies, and who have submitted a thesis judged to be of superior academic quality by the subcommittee of the Feminist Studies committee charged with making such decisions.

CURRICULUM

For an Individually Designed Major in Feminist Studies, the following course of study is recommended: each student should take a minimum of 12 courses (a core of five plus seven others) for a total of at least 60 units above the 100 level. All seven courses not in the core should be chosen in consultation with the student's advisor. To ensure coverage, intellectual focus and breadth in the program, and practical experience, the 12 courses required for the major should be distributed among the core (five courses), the focus (at least five courses), and a practicum.

CORE

The core consists of five courses. The first three are required and should be taken in sequence, if possible. The remaining two courses should be chosen from the list of Feminist Studies courses. One of these courses should be in the social sciences, the other in the humanities. Also, one of these two courses, either the social science or the humanities one, should offer a cross-cultural perspective.

Required Courses:
1. Introduction to Feminist Studies: Issues and Methods (Feminist Studies 101.)
2. Contemporary Issues in Feminist Theory (Feminist Studies 102).

Courses that fulfill the social science requirement are numbered from 120-149.
Courses that fulfill the humanities requirement are numbered from 150-199.
Courses that offer a cross-cultural perspective include 120, 138, 140, 142, 149, 167, 295, 360A.

FOCUS

Of the seven courses not part of the core, at least five should reflect a particular thematic focus, and all seven should be chosen in consultation with the student's advisor.
1. At least three of the focus courses should be feminist studies courses or courses selected from the list of approved courses in other departments and programs (see below).
2. At least one focus course should be offered by a department or interdepartmental program as an initiation into the practice of study in the field: a major survey, methodology, or theory course.
The following thematic clusters illustrate foci that individual students can design, in consultation with the advisor:

Sex and Gender
Women in Language and Symbol
Race, Class, and Sex
Women and Work
Feminist Perspectives on Science, Health, and the Environment
Women and Society: The 19th Century
Women and Society: The 20th Century

PRACTICUM

The practicum, taken for 2 to 6 units, should involve field research, community action, organizing and teaching a course, or other supervised research. This requirement may be fulfilled by designing a public service internship, an Innovative Academic (IAC) course, an Undergraduate Specials course, or by undertaking supervised work in a department. After completing the practicum, the student must submit a written statement, 3-5 pages long, on the nature of the practicum and its relevance to the major in Feminist Studies.

COURSES

Approved courses in Feminist Studies are divided into (1) courses sponsored directly by the program; (2) courses offered through departments; and (3) courses offered through other programs. Approved courses contain a significant component of attention to gender difference: to the situation of women in Western or non-Western culture, or to the role of sex-gender systems in social organization. Because some courses are planned too late to list in the bulletin, students should check with the Feminist Studies office each quarter to obtain up-to-date listings. Courses with Feminist Studies numbers have been offered by the program a number of times. Courses marked (*) satisfy the requirement of offering a cross-cultural perspective on women's issues.

GROUP 1: FEMINIST STUDIES

101. Introduction to Feminist Studies: Issues and Methods—(Same as History 173C.) How gender inequality is created and perpetuated. Topics: feminist theory, the family, gender and work, sexuality, the politics of health and reproduction, domestic violence, and women's culture. (DR:5)
5 units, Aut (Freedman) MW 1:15-3:05

102/202. Contemporary Issues in Feminist Theory—(Same as English 163H.) Undergraduate seminar on the most recent developments of feminist theory, including political and methodological concerns.
5 units, Win (Gagnier) MW 1:15-3:05

103/203. Seminar in Feminist Studies—(Same as English 263A.) Advanced feminist theory and research exemplifying feminist methodologies in traditional and emerging disciplines. Topics: the politics of sexual identity; race, class, and ethnicity as feminist issues; non-academic literary criticism grounded in movement publications and anthologies. Undergraduate prerequisite: 101 or 102. Graduate students register for 203.
5 units, Aut (Rich) TTh 3:15-5:05

104. Practicum.

105,106. Honors Work.

108. Internship in Feminist Studies—Augments coursework in Feminist Studies with a supervised field, community, or laboratory experience. Law offices, medical research labs and clinics, social service agencies, legislative and other public offices, and local and national women’s organizations are typical placements. To be arranged in advance. Per University guidelines, every unit for which credit is given represents approximately three hours of work per week for the quarter. Upon completion, the student must submit a written, three-to-five page statement on the nature of the internship and its relevance to the major in Feminist Studies.

any quarter, by arrangement

135/235. Women and Organizations—(Same as Business 378, Sociology 167.) A sociological examination of dilemmas faced by women in contemporary American organizations: complex formal organizations such as corporations, universities, and health and welfare institutions, and smaller, less formal groups. Focus is on tradition and change in the definition of women's roles, and on women's styles of management, leadership, decision-making, and communication. Emphasis on the effects of organizational hierarchies, conflicting expectations of appropriate female behaviors, and emerging forms of professionalism. Compares characteristics of women's organizations with mixed gender groups. Readings; students also conduct individual research projects.
5 units, Spr (Krieger) TTh 1-3

GROUP 2: APPROVED COURSES IN DEPARTMENTS

HUMANITIES

ART

Feminist Studies 155. Issues of Women and Gender in Modern Art—(Same as Art 132X.)
The roles and contributions of female artists in modern avant-garde movements, Realism/Impressionism through postmodernism; and societal attitudes about women and gender as reflected or reinforced in the visual work through the portrayal of women in art. Confronts some of the larger problems the traditional canon of art history presents: rigid definitions of what constitutes "art" and standards of quality, and what gets excluded as a result.

5 units, Win (Ortel)

ENGLISH

160. Women and Difference: Marginality, Art, and Politics—(Same as English 160.) Women perceived as "different" (spinsters, lesbians, women of color, Jewish women, women with disabilities, women without children) according to prescribed social norms have been designated as freaks, asexual, monsters, marginal. Focus is on the lives and works of women who embraced their difference, making it serve their art, sometimes their art and politics. Women studied: Virginia Woolf, Lillian Smith, Helen Keller, Annie Sullivan, Agnes Smedley, Frida Kahlo, Billie Holiday, Irena Klepfisz, Audre Lorde, Gloria Anzaldua, Joy Harjo.

5 units, Aut (Cliff, Rich) TTh 11-12:30

161A. Afro-American Writing 1945-1970—(Enroll in English 161A.)

5 units, Win (Drake) MTWTh 1:15

161B. Afro-American Writing 1970-Present—(Enroll in English 161B.)

5 units, Spr (Drake) MTWTh 1:15

177. Virginia Woolf—(Enroll in English 177.) Woolf's fiction and criticism within the context of 20th-century thought. One presumption is that Anarchism, understood as a political and aesthetic movement, informs Woolf's attitude about the form and function of modern literature.

5 units, Spr (Ruotolo) MTWTh 10

184A. Representations of Women in 18th-Century Literature—(Enroll in English 184A.) Survey of images of women that appear in 18th-Century literature and art: virgin, whore, madwoman, monster. Focus on the satiric tradition and on the 18th-century misogynist satirist's attack on women (Swift, Pope in particular) and on prose fiction and some complex representations of female experience that emerge in the new genre of the novel. Also, Wollstonecraft and the appearance at the end of the century of a feminist revision of older stereotypes of female experience.

5 units, Aut (Castle) TTh 11-12:30

185B. Undergraduate Seminar: Jane Austen—(Enroll in English 185B.) A critical reading of Jane Austen's six novels; some of the shorter fiction, biography, and letters; some attention to criticism.

5 units, Win (Watt) MW 11-12:30

303B. Sexuality and Terror: 18th-Century Literature of the Gothic and Supernatural—(Enroll in English 303B.) Themes of terror and the supernatural in 18th-century prose fiction, the classic "Gothic" works of the late 18th century (Walpole, Radcliffe, Lewis, etc.) supplemented with theoretical works (Burke on the sublime; Todorov on the fantastic) and social history (Keith Thomas on magic and supernatural in the 18th century). Emphasis on the encoded "sexual plot" of Gothic fiction, and its meditation on themes of sexuality, sensibility, and the erotic vulnerability of women.

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

FRENCH

294A. Feminist Attitudes in France—(Enroll in French 294A.) Significant texts of women's roles in French society, from the middle ages to the present, drawn from literature, iconography, politics, and journalism.

4 units, Win (Newman-Gordon)

PHILOSOPHY

Feminist Studies 151. Feminism and Political Theory—(Same as Philosophy 177/277.) What various political theories (liberal, Marxist, socialist) say about the role of women, and feminist criticisms of those theories. Also, the political/ethical problems of particular concern to feminists, affirmative action, pornography, abortion.

4 units (Roberts, Dupré) not given 1988-89

RELIGIOUS STUDIES

*158A. Buddhism and the Feminine—(Enroll in Religious Studies 158A.)

5 units (Klein) not given 1988-89

*236. Buddhist Meditation Texts: Gender and Models of Personal Change—(Enroll in Religious Studies 236.) Texts and topics from the Indo-Tibetan tradition, their intellectual context and associated traditions. Analysis in light of current scholarship on gender. Prerequisite: Consent of instructor.

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

SPANISH AND PORTUGUESE


3-5 units, Spr (Patai)

360A. Research Seminar: Latin American Women Writers of the 19th Century—(Enroll in Spanish 360A.) Workshop designed to give advanced graduate students experience in pri-
mary research on women, literature, and culture. Assignments focus on a research paper and annotated bibliography. Conducted in Spanish.

5 units, Win (Pratt)

5 units (Pratt) given 1989-90

SOCIAL SCIENCE

ANTHROPOLOGY

*Feminist Studies 140. Sex Roles and Society—(Same as Anthropology 11.) The diversity of women's and men's roles, experiences, and self-conceptions in a number of human societies provides a critical perspective on contemporary views of the "nature" of women and men, and how women and men are shaped by particular forms of social life. (DR:5*)
3-5 units, Aut (Stockard) MWF 9

*Feminist Studies 142. Women in Cities: A Cross-Cultural Perspective—(Same as Anthropology 145.) Women's experiences in cities throughout the world and the determinants of their similarities and differences. Topics: women and migration, changing forms of the sexual division of labor, changing family and kinship structures, prostitution, and political activism.
5 units, Aut (Yanagisako) given 1989-90

144. Family and Kinship Organization—(Same as Anthropology 244.) Seminar on the major issues anthropologists have confronted in the comparative study of family and kinship. Competing theoretical frameworks are evaluated through an examination descent, marriage, gender, domestic groups, and kinship change. Prerequisite: Graduate standing in Anthropology or consent of instructor.
5 units, Spr (Stockard)

154. Creation/Procreation: A Comparative Study—(Enroll in Anthropology 154.) An alternative to the study of religion and reproduction as distinct categories and separate domains of study. The gendered aspects of cosmological or religious systems and the cosmological significance of gender in terms of their symbolic interrelationships. Anthropological and other literature is used in the examination of these relationships in several cultures and our own. Emphasis on the ways these beliefs are embedded in the practices and structures of social life and on Western categories and meaning and their implications for theorizing.
5 units, Aut (Delaney) TTh 11

EDUCATION

Feminist Studies 127. Feminist Perspectives on Ethics and Education—(Same as Education 276.) Ethics in education from the transformative perspective of feminism. The problems of ethics and evil with emphasis on their significance for education.
4 units, Aut (Noddings) MW 1:15-3:05

HISTORY

*Feminist Studies 120. Middle Eastern Women Through Film—(Same as History 187C.)
5 units, Spr (Beinin) MW 1:15-2:05 and T 7-10 p.m.

Feminist Studies 125. Undergraduate Colloquium: Women in America—(Same as American Studies 209, History 263.) Selected aspects of women's history in the U.S. from the 19th century to the present. Reading material from psychology, sociology, economics, history, and literature.
5 units, Spr (Degler) T 2-4

225. Society and Politics in Early Modern Russia—(Enroll in History 225.) The interaction of state and society in an autocracy; women in Muscovy are a major theme since their situation epitomizes social reality and theory. Focus is on social groups (military elite, townspeople, peasants), social outsiders (slaves, minstrels, religious dissidents), and social values (honor and shame, autocracy and subservience).
5 units, Aut (Kollman) T 2:15-4:05

273A/373A. Childhood in Modern American History—(Enroll in History 273A/373A.)
5 units, Win (Horn) W 2:15

265A/365A. Undergraduate Colloquium: Sexuality in American History—(Enroll in History 265A/365A.) Recent historical studies about sexual behavior, sexual ideology, and sexual politics. Topics: the history of contraception, abortion, prostitution, venereal disease, and homosexuality, combining chronological and thematic approaches to sexual history. For advanced undergraduates and graduate students. Enrollment limited to 15; permission of instructor required.
5 units, Spr (Freedman) Th 1-4

473. Graduate Seminar: Women's Family and Sexual History—(Enroll in History 473.) A research seminar limited to graduate students in U.S. history and, with permission, those with a strong background in this field. (See instructor to propose research topic during Autumn Quarter.)
5 units, Spr (Freedman) M 1:15-4:05

POLITICAL SCIENCE

Feminist Studies 124. Seminar: Political Theory and Feminism—(Same as Political Science 164J.) How traditional theory has dealt with "the woman question" and how contemporary feminist theory has dealt with traditional
theories about women. The parameters of the first are set by liberal, dialectical, and psychoanalytical theory; of the second, by liberal, socialist, and radical feminism. Readings include traditional political theory and contemporary American feminist theory.

3 units, Win (Ring) T 1:15-4:05

PSYCHOLOGY

Feminist Studies 126. The Psychology of Women—(Same as Psychology 116.) Research and theory on the socialization and psychological development of women. The biological, cultural, and social factors that influence gender specific behavior.

3 units, Aut (Carstensen) TTh 10-11:30

Feminist Studies 186. Undergraduate Topical Seminar on the Psychology of Women—(Same as Psychology 198.) In depth coverage of a specified topic related to psychology and women. See Time Schedule for topic.

3 units, Win (Carstensen) T 2:15-4:30

351. Issues in Child Custody—(Enroll in Psychology 351.)

3 units, Aut (Wald) W 4-6

SOCIOLOGY

5. Status, Friendship, and Social Pressure: An Experiential Approach—(Enroll in Sociology 5.) The basic social processes that structure the individual's experience in interpersonal situations, including (1) group pressure on individual choices, (2) social control of deviants, (3) operation of status distinctions (sex and race), (4) formation of friendships and, (5) formation of intimate relationships (love relationships). Enrollment limited. (DR:4)

3-4 units, Win (Berger) MWF 10 plus sections M or T 2:15-4

Feminist Studies 123. Social Psychology of Gender—(Same as Sociology 113A.) The vicious circles that surround women who must make choices as they mature, develop social ties, work, and age.

5 units (Dornbusch) given 1989-90

142A. The Family—(Enroll in Sociology 142A.) Family composition, organization, and processes. Historical and recent trends in Western societies are examined and compared with current situations in developing countries. Topics: marriage and divorce, fertility, illegitimacy, value of children, family size, household composition, and sex roles.

5 units, Aut (Herting) TTh 10-11:30

222. Social Processes and Pathological Outcomes—(Enroll in Sociology 222.) Seminar on abnormal family and group processes resulting in emotional disturbances and behavioral disorders. Topics: the impact of experiences of neglect, abuse, molestation, violence, marital separation and divorce, war and natural disasters on children and adults. Prerequisite: Graduate standing or consent of instructor.

5 units, Spr (Johnston) T 7-10 p.m.

APPROVED COURSES
IN OTHER PROGRAMS

DANCE

160A. Women in Dance—(Enroll in Dance 160.) The lives and works of women in Western theatrical dance from the Renaissance to the present through film, slides, lectures, and discussions. Topics: public attitudes and perceptions and the birth of the Romantic ideal; the image of the ballerina; modern dance and the pioneering matriarchs (Isadora Duncan, Martha Graham, Doris Humphrey, and Mary Wigman); Agnes de Mille and women's innovation in musical theater and the training, career and life-after-performing of women in dance today.

3 units, Win (Ross)

161A. Dance and Live Art in the 20th Century—(Enroll in Dance 161.) A critical history and analysis of the development of live art in Western theatrical dance and performance art of the 20th century. Topics: the body as an art medium; the interface of dance and art's ideas about structure and form; the pull between entertainment and expressionism, and autobiography and the self as a subject. Artists and works covered range from Oskar Schlemmer's Bauhaus "Triadic Ballet" to the Post-Cunningham rebels—Meredith Monk, Robert Wilson and the punk aesthetic.

3 units, Spr (Ross)

HEALTH POLICY AND RESEARCH

237. Women and Health—(Enroll in Medicine 237.) Topics of interest to women as health care consumers and providers. The historical role of women in health care, how women have changed health care programs, and what current and future changes are anticipated. Lecture series, 1 unit. Optional research project for 1 additional unit.

1-2 units, Aut (Grudzen, Hufty) F 12-1

HUMAN BIOLOGY

Feminist Studies 145. Feminist Perspectives on Birth Control—(Same as Human Biology 150C.) In most societies human fertility control responsibility rests predominantly with women. Is this desirable and realistic, or should changes be instituted? Participants in the seminar choose specific aspects of this problem and address themselves, in the form of research papers, to possible answers. Preregistration is essential using special forms available from the
Human Biology office. Limited to 15 seniors. Under exceptional circumstances junior standing considered.

6 units, Aut (Djerassi) TTh 1:15-4:05


4 units, Spr (Matteo)

FOOD RESEARCH INSTITUTE

Emeriti: (Professors) Roger W. Gray, William O. Jones, Dudley Kirk
Director: Walter P. Falcon
Associate Director: Anne E. Peck
Associate Professor: Jeffrey Williams
Assistant Professors: Sandra O. Archibald, A. Meredith John
Affiliated Professor: Juan Martinez-Alier (Latin American Studies)
Visiting Professor: Jere D. Hass
Librarian: Charles C. Milford

OFFERINGS

The Food Research Institute, a research and teaching unit in the School of Humanities and Sciences, was founded in 1921 to study problems of food supply, distribution, and consumption on a world-wide scale. The range of its investigation comprises the world food and agricultural economy, domestic and international trade in primary products, agriculture and economic development, and world population problems.

The Institute's specialized library contains over 75,000 items, including an up-to-date series of periodicals from over 50 countries. It is open for reference use to students and other scholars.

Food Research Institute Studies, published three times a year, reflects the research interests of the Institute.

THE INSTRUCTIONAL PROGRAM

Graduate teaching is an integral part of the Institute's program, in both the Master of Arts or Doctor of Philosophy degree. The program is designed primarily for 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, although certain of its courses may be counted toward majors in other undergraduate programs including economics, sociology, political science, and human biology.

The University requirements for advanced degrees, as set forth under "Degrees" in this bulletin, should be consulted by all prospective graduate students.

UNDERGRADUATE PROGRAMS

COTERMINAL A.B./A.M. PROGRAM

The Food Research Institute offers the coterminous degree for advanced undergraduate students in Economics, Political Science, Human Biology and other departments who are interested in a concentration of coursework in the Institute. For admission, a student must have a minimum letter-grade indicator of 3.2. Prerequisites for admission include Economics 51 and 52 and one course in quantitative methods. Students must seek admission to the program prior to the end of their 11th quarter. Application should be made to the Chair of the Institute's Instruction Committee. In addition to meeting the requirements for the undergraduate degree, students are required to complete the requirements for the Master of Arts as stated below. Students should also consult the University rules for co-terminal degree programs.

GRADUATE PROGRAMS

MASTER OF ARTS

The Master of Arts degree is awarded to students who complete at least 25 units of work in the Food Research Institute and a total of 45 units of approved work with a letter grade indicator (LGI) of "B" or better. All courses must carry a number of at least 100. Advanced language training may not be included in the 45 units, and students are strongly encouraged to concentrate their coursework in two or three areas within the Institute. The master's program is designed to equip students with specific skills, and admission is not encouraged for those desiring a Ph.D.

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 Chair of the 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), and courses in quantitative methods are required. In addition, students prepare for examinations in three elective fields through courses, seminars, and directed reading. Field examinations are taken by the end of the second year. Normally, fields are chosen from the following: Food Consumption and Nutrition; Economics of Production; Commodity Price Analysis; Agricultural Development and Economic Growth; International Agricultural Policy; and Demography. A student wishing to offer a field outside this list or outside the Institute must secure prior approval from the 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 research on the topic 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: (1) by completion with passing grade of an approved course for the language concerned, or (2) by passing a special reading examination, to be given by a qualified member of the Food Research Institute or of the relevant language department.

Students must also satisfy University requirements concerning residency, and standards of progress, as described in the "Advanced Degrees" section of this bulletin.

**Ph.D. MINOR**

Qualified doctoral candidates in other schools and departments may apply for a minor in Food Research. Requirements for this option include successful completion of two Institute fields, plus approval by the Chair of the Instruction Committee of the overall program of work.

**FELLOWSHIPS**

The Food Research Institute has available a limited number of University fellowships for qualified students up to $7,396 a year, plus tuition. Instructions for applying for financial aid are included in the application packet. The financial aid application must be filed by January 1.

**COURSES**

103. The World Food Economy—(Same as Economics 106.) The interrelationships between food, population, and economic development. Agricultural and rural development in achieving economic and social progress in low-income nations. Economic and nutritional characteristics of the major types of food and changes in food consumption in Asia, tropical Africa, Mexico, U.S., and Japan. Policy analysis perspective to decision-making related to the design of rural development strategies. Prerequisite: Economics 1 or equivalent.

3 units, given 1989-90

105. Commodity Futures Markets and Prices—(Same as Economics 107; graduate students register for 205.) The uses and functioning of commodity futures markets: practices; speculation hedging practices, speculation, market performance issues and measures, and analysis of the economic effects of futures markets.

5 units, Aut (Peck) TTh 9-10:50

106. The Political Economy of Commodity Markets—(Same as Economics 127; graduate students register for 206.) History, politics, and theoretical analyses of domestic and international markets for basic commodities. Topics: government regulation of private trading, public trading through buffer stocks and marketing boards, international commodity agreements, and the changing views of the social value of private speculation. Examples from 18th century to present.

5 units, Spr (Williams) TTh 9-10:50

119. Human Nutrition—(Same as Human Biology 120.) Introduction to human nutrition including the function, digestion, absorption, and metabolism of nutrients; dietary recommendations and standards; and an overview of national and international nutrition problems. Prerequisite: Human Biology core or consent of instructor.

4 units, Aut (Bray, Martorell) MWF 10

120. Marketing, Consumption, and Price Analysis—(Same as Economics 128; graduate students register for 220.) Analyses of agricultural commodity prices and markets, including consumer demand, spatial and temporal aspects of prices, storage behavior, information expressed in prices, market structure, market integration, and complete commodity models. Recommended: Previous exposure to microeconomics and econometrics.

5 units, Win (Williams) MW 11-12:50

121. Development and Population Interactions in the Third World—(Same as Economics 119.) Historical and contemporary examina-
tion of the record of economic development and of population growth suggests a diversity of experience. Case studies of specific countries illustrate the systematic components of the experience of economic development and those of population growth with implications in terms of alternative structures of development, the timing of the demographic transition, income distribution, employment, and migration. The interactions and causal effects between economic development and population growth.

5 units (Yotopoulos) given 1989-90

129. Analysis and Management of Development Projects—(Same as Economics 129; graduate students register for 229.) Contemporary techniques and experiences in appraising, implementing, and managing development projects. Three modules: (1) project planning and scheduling using CPM and PERT methods; (2) theory, calculation and use of conventional appraisal criteria such as net present value, benefit-cost ratio and internal rate of return; and (3) development of database systems for project monitoring and evaluation. Partial budgeting techniques compare financial and economic decision criteria. Hands-on exercises with data from LDC agricultural projects. Required use of microcomputers and project planning, spreadsheet and database management software.

5 units, Aut (Gotsch) MW 1:15-3:05

130. Application of Linear Programming to Agricultural Systems—(Same as Economics 132; graduate students register for 230.) Develops application skills including exercises in mixed integer, multi-period, quadratic, and risk programming. Producer-consumer models. Computer homework exercises analyze agrarian reform, water resource development, technology choice, and allocation of research resources. Model manipulation and data problems are stressed. Prerequisite: One course in microeconomic theory.

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


5 units, given 1989-90

137. Human Populations: Birth, Death, and Disease—(Same as Human Biology 137; graduate students register for 237.) The biological factors shaping patterns of fertility, mortality, and disease in human populations. Topics: basic principles of demography, anthropometry, and epidemiology; birth interval dynamics; infant and child mortality; infectious diseases; the impact of nutrition on fertility, mortality, and morbidity.

5 units (John) given 1989-90

138. Introduction to Epidemiology—(Same as Human Biology 106; graduate students register for 238.) Topics: basic techniques of epidemiology, models of transmission of infectious diseases and of epidemic behavior, design of immunization programs, epidemiology of chronic diseases, and the role of health care programs in controlling infectious diseases. Case studies from developed and developing countries. Prerequisites: Human Biology core or Biology core or equivalent, and Mathematics 21 or equivalent.

5 units, Win (John) MW 1:15-3:05

144. Economics of American Agriculture: Structure and Policy—(Same as Economics 144; graduate students register for 244.) American agriculture and its historical and contemporary role in the economy. Topics: the role of agriculture in American economic development, policy toward commercial agriculture, poverty problems in rural America, and the international dimensions of U.S. agriculture. Emphasis on policy alternatives rather than on farm management.

4-5 units, Aut (Falcon) MWF 9

145. U.S. Agriculture: Interaction of Biology and Economics—(Same as Human Biology 153; graduate students register for 245.) Agriculture in the U.S. is shaped by biological and economic influences. Issues: plants and their genetic manipulation, soil and water conservation, pest control, agroecosystems, and food processing and preservation technologies. Focus is on assessing long-run biological, environmental, and economic consequences of agricultural practices, their interactions, and the way in which policy affects these practices.

3 units (Archibald) given 1989-90

146. Agricultural Policy in Industrial Countries—(Same as Economics 142; graduate students register for 246.) A comparative study of agricultural policies in developed countries: the European Community, Japan, Australia, and Canada. Links to U.S. agricultural policy where appropriate. Implications of these policies for world markets and for policies in other countries. Other topics: international negotiations on effects of policy, measurement of trade impacts of domestic policies, and links between
domestic policy choices and international trade rules. Prerequisite: 144 or consent of instructor.
5 units (Josling) given 1989-90

147. Energy, Economics, the Environment and Society—(Same as Human Biology 121, Latin American Studies 147.) Background to current debates on the relationship between human ecology and the social sciences. Comparison between ecological economics; ecological anthropology; and contemporary economics, theoretical and applied. Possibilities for transferring concepts from natural science to social sciences. Examples from Europe, U.S., and Latin America.
4 units, Win (Martinez-Alier) TTh 11-12:50

148. Economic Development in China—
(Same as Economics 121; graduate students register for 248.) The structure and development of China's economy, emphasizing the People's Republic. Topics: the economic legacy of the late Qing and Republican periods; China's development strategy; planning and resource allocation; labor, employment, and population; income distribution; foreign trade; and recent reforms. Prerequisite: Economics 1.
5 units (Staff) given 1989-90

166. International Trade Policy—
(Same as Economics 166; graduate students register for 266.) Effects of selected government policies affecting international trade. Trade policy, exchange rate policy, and economic welfare, government responses to competition from imports, issues underlying international negotiation of reductions of barriers to trade, and special trade arrangements for developing countries. Prerequisite: Economics 165.
5 units, Spr (Pearson) MW 11-12:50

188. Colloquium on Population Studies—
(Same as Human Biology 60, Biology 183; graduate students register for 288.) Series of talks by distinguished speakers, introducing students to a wide variety of topics in population studies.
1 unit, Win (Feldman, John) W 4:10-5:30

FINANCIAL AND PRICE BEHAVIOR, INCOME DISTRIBUTION, TO PROBLEMS OF ACCUMULATION, INVESTMENT, FINANCIAL AND PRICE BEHAVIOR, INCOME DISTRIBUTION, DOMESTIC POLICY CHOICES AND INTERNATIONAL TRADE RULES. PREREQUISITE: 144 OR CONSENT OF INSTRUCTOR.
5 UNITS (JOSLING) GIVEN 1989-90

205. Commodity Futures Markets and Prices
— (See 105.)

206. The Political Economy of Commodity Markets—(See 106.)

218. Economic Development in Latin America—(Same as Economics 123; open to advanced undergraduate students, with the consent of the instructor.) The historical problems of economic growth and structural change in selected Latin American countries. Emphasis on the application of political economic analysis to problems of accumulation, investment, financial and price behavior, income distribution, innovation, migration, and the rural-urban transition. The analysis of interdependence among countries and regions with different economic and social structures, e.g., the U.S., Mexico, Brazil, Central America, and the Caribbean. Seminar with research papers.
5 units, Spr (Reynolds) MW 3:15-5:05

220. Marketing Consumption and Price Analysis—(See 120.)

221. Economics of Production—Production theory emphasizing agriculture. Topics: production, cost and profit functions; technological change; risk and uncertainty in models of production. Readings complemented with problem sets emphasizing econometric estimation of production relationships. Exercises plus a final exam constitute major requirements for the course. Prerequisite: Economics 202, or Business 603, or consent of instructor.
5 units, Spr (Archibald) TTh 11-12:50

224. Economic Development: Theory and Empirical Research—Differences between competing paradigms in economic development, e.g., the orthodox and the structuralist, examined from the choice and applicability of several policy instruments. Theory and empirical research combine to question whether there exist structural characteristics of developing countries that circumscribe the use of specific policy instruments. Among the structural disequilibria examined are trade and exchange disequilibria, disequilibria in the structure of production emphasizing agriculture, and migration disequilibria.
5 units (Yotopoulos) given 1989-90

5 units (Arthur) given 1989-90

5 units (Arthur) given 1989-90
229. Analysis and Management of Development Projects—(See 129.)
230. Applications of Linear Programming to Agricultural Systems—(See 130.)
236. Population Perspectives in the Third World—(See 136.)
237. Human Populations: Birth, Death, and Disease—(See 137.)
238. Introduction to Epidemiology—(See 138.)
244. Economics of American Agriculture: Structure and Policy—(See 144.)
246. Agricultural Policy in Industrial Countries—(See 146.)
247. Seminar: European Agricultural Policy—Seminar on European Community-U.S. agricultural trade relations, particularly the GATT Uruguay Round. Students prepare position papers for a simulated trade negotiation. Software developed for the analysis of policy changes is used for quantitative support of positions and evaluations of options. Prerequisite: 144 or 146, or consent of instructor.
3 units, Spr (Josling) TTh 3:15-5:05
248. Economic Development in China—(See 148.)
250. Nutritional Problems of Developing Nations—(Same as Anthropology 250, Human Biology 110.) The various malnutrition syndromes common in developing countries emphasizing protein-calorie malnutrition, nutritional anemias, and vitamin A deficiency. Methods and techniques of nutritional assessment applicable for use in developing nations. Emphasis on 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. Undergraduate prerequisite: 119 or equivalent.
5 units, Win (Martorell) TTh 9-10:50
266. International Trade and Investment Policy—(See 166.)
267. International Agricultural Policy—The major continuing and contemporary problems in world agricultural trade emphasizing 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 as regards staple food products. Emphasis to issues of food security, trade liberalization, international market regulation, and the role of international institutions. Prerequisite: Economics 51-52, or equivalent.
3 units, Win (Josling) TTh 3:15-5:05
286. Demographic Methods—(Same as Sociology 284.) Population theory and data analysis. Static and dynamic models of population composition and growth. Methods for estimating population parameters from flawed data. Prerequisite: Multivariate calculus, or consent of instructor.
5 units, Win (John) MW 9-10:50
287. Economic Demography—(Same as Economics 249.) The effects of demographic changes on individual and collective economic welfare; and economic theories of demographic decision making. Topics: overlapping-generations models; economic life-cycle analysis; economic implications of changes in fertility and mortality; demography of the labor market; stable population theory; and economic theories of fertility.
5 units, Win (Josling) TTh 3:15-5:05
288. Colloquium on Population Studies—(See 188.)
305. Seminar: Commodity Price Analysis—Students prepare a discussion and paper analyzing some aspect of commodity market and/or price behavior. Prerequisites: 205, 206 or 220, or their equivalent.
3-5 units, Spr (Peck, Williams) by arrangement
321. Seminar: Applications of the Theory of Production—Prepares students for their dissertation in the economics of production.
3 units, Spr (Gotsch, Archibald) by arrangement
324. Seminar: Problems in Economic Development—Focuses on a selected topic each year. Students prepare and present research paper.
3 units, given 1989-90
3 units, Spr (Josling, Pearson) TTh 3:15-5:05
386. Seminar: Demography—Prepares students for comprehensive examination and dissertations in the demography field.
3 units, Spr (John) 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
Emeriti: (Professors) Raymond D. Giraud, Roberto B. Sangiorgi, Leo Weinstein
Chairman: Jean-Marie Apostolidès (on leave Winter, Spring)
Acting Chairman: Brigitte Cazelles
Vice Chairman: John Freccero (Italian Division)

French Division
Professors: Jean-Marie Apostolidès (on leave Winter, Spring), Marc Bertrand (Paris, Autumn, Winter; Tours, Spring), Brigitte Cazelles, Robert G. Cohn (on leave Winter), Jean-Pierre Dupuy, René Girard, Ralph M. Hester, Alphonse Juillard (on leave Autumn, Spring), Pauline Newman-Gordon, Michel Serres
Assistant Professor: James Winchell
Professor (Teaching): John G. Barson
Senior Lecturers: Marguerite Bauer, Clio P. Dorr, Hélène Fredrickson (on leave 1988-89), Nelee Langmuir, Michelle Moran, Jacqueline Ollivier
Lecturers: Mary Jane Parrine (Curator, Romance Languages and Humanities)
Acting Assistant Professor; Danielle Trudeau-Apostolidè (Spring)
Visiting Professor: Jules Brody (Autumn, Winter)

Italian Division
Professor: John Freccero (on leave Winter, Spring)
Associate Professors: Jeffrey Schnapp (Florence, Autumn, Winter, Spring), Carolyn Springer (Undergraduate Advisor; on leave, Autumn)
Assistant Professors: Beverly Allen (Graduate Advisor), Robert Harrison (on leave, Autumn)
Senior Lecturers: Maria Devine, Leda S. Mussio, Annamaria Napolitano (Language Program Coordinator), Leopoldina Viggiano
Lecturers: Carla Riga, Giovanni Tempesta
Acting Assistant Professor: Linda Armao
Visiting Professors: Guelfo Frulla (Autumn), Rachel Jacoff (Winter, Spring)

The French Division offers a variety of programs in French language and linguistics, literature, cultural history, and theoretical studies, courses in which all interested students are welcome to enroll. Undergraduates may obtain the Bachelor of Arts degree with emphasis on literature, language, or French studies. In addition to awarding the Ph.D. degree, the French Division also maintains a Master of Arts program. Doctoral candidates benefit from training which stresses excellence in scholarship, writing and publication of scholarly articles and books, and teaching methodology.

With careful planning, A.B. candidates can pursue one of numerous possible extended majors or a double major with French as one component. Similarly, graduate students can take advantage of the joint Ph.D. option with Humanities, a minor in Comparative Literature or other fields, or, for doctoral candidates from outside the division, a minor in French, in either of the two options described below. (See Graduate Program, specialization.)

The division's educational offerings feature exceptionally strong possibilities for study abroad. The Stanford Program in Tours provides courses in French language, literature, and cultural history in the heart of the Loire chateau region. Open to advanced French majors and graduate students, the Stanford Program in Paris offers the opportunity to study during the Autumn and Winter Quarters at the University of Paris. Students live with Parisian families or in residence halls and work under the supervision of a Stanford faculty member. Stanford and the French Division also enjoy contacts with the Institut d'Etudes Politiques, the Ecole Polytechnique and other prestigious institutions. There is an annual exchange permitting two doctoral candidates in French to study at the Ecoles Normales Supérieures. All students interested in study abroad should contact the department during the Autumn Quarter and may obtain applications and more information from the Overseas Studies office in Sweet Hall.

The division also offers a range of on-campus features to enhance its academic programs. La Maison Française, located at 610 Mayfield, is an undergraduate residence providing numerous opportunities for students to expand their experience of French language and culture. In-house seminars discuss contemporary aspects of French civilization. (Assignments to La Maison
come through the regular undergraduate housing draw.)

A special curator for Romance Languages oversees the extensive collection in French at the Green (graduate) Library. The division also maintains its own reading room in Building 260; the holdings of the Hoover Institution on War, Revolution, and Peace include a wealth of information on 20th-century France.

The division takes pride in its numerous publications: the Stanford French Review and the Stanford French and Italian Series have gained critical attention, while Constructions, edited by graduate students, represents a significant avenue of publication for young scholars. And finally, a distinguished group of visiting professors is a permanent part of the French Division.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

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.

In addition to the first years of language study, all French majors must complete 60 units of additional course work, distributed in accordance with the specialization they have selected. Only upper division courses may count toward the major. Individual work should normally be limited to 4 units. Modifications of the requirements may be granted upon the advisor’s and the chairman’s recommendation.

Students majoring in French are strongly encouraged to participate in the Stanford Program in Paris. The Stanford Program in Tours is recommended for less advanced students. Courses taken at Tours do not automatically count toward the major; interested or returning students should consult the advisor.

Three specializations are available: French Literature, French Language, and French Studies.

SPECIALIZATION IN LITERATURE

This option emphasizes work in all periods of French literature from the Medieval to the Modern. Majors who wish to choose this specialization must fulfill the following requirements:

1. Three advanced language courses: two selected from the courses numbered 123 to 125, and one selected from the courses numbered 200 to 204.

2. Three survey of literature courses (numbered 130 to 132).

3. Five literature courses: one in the Middle Ages or the Renaissance (135 to 139, 213 to 229); one in the 17th century (150 to 159); one in the 18th century (160 to 169); one in the 19th century (170 to 179); and one in the 20th century (180 to 189).

4. Of the 60 units required for the major, the remaining courses may be taken in literature, cultural history, and related fields. They should serve to strengthen an area of specialization and/or the writing of an Honors essay.

Students choosing the literature option should note that most graduate programs in French require proficiency in at least one additional modern language.

SPECIALIZATION IN LANGUAGE

This option emphasizes work in French linguistics and semiotics. Majors who wish to choose this specialization must fulfill the following requirements:

1. Three advanced language courses: 123, 124, and 125.

2. Three survey of literature courses: 130, 131, and 132.

3. Five language and cultural history courses distributed as follows: one in semantics (202) or in translation (205); one in linguistics (201 or 203); one in stylistics (200); one in cultural history (290 or 291); and the course in Methods of Teaching French (293).

4. Of the 60 units required for the major, the remaining courses may be taken in literature, linguistics, and related fields.

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.

Majors who wish to choose this specialization must fulfill two sets of requirements: (1) 32 units of upper division French courses; and (2) 28 units of approved courses outside the division. These requirements are as follows:

1. Two of the three survey of literature courses (130, 131, or 132).

2. Two of the three cultural history courses (290, 291, or 294).

3. Four literature or culture courses: one among the courses numbered 150 to 189; and three among the courses numbered 280 to 289.

4. The 28 remaining course units taken outside the division must have a significant French component and must be structured such that they constitute a coherent program of study.
These courses should be approved by the major advisor.

HONORS PROGRAM

French majors in their junior year may apply to the Honors program if they have already taken five Upper Division courses with a letter grade indicator of "B+". The Honors program student fulfills all regular requirements for the A.B. in French and writes a substantial essay on an aspect of French culture. Preferably in the Spring Quarter of the junior year, the qualified student will submit to the major advisor a detailed outline of the proposed essay. Upon approval of the project by the Faculty Council, the student may receive 9 to 12 units of credit of essay work.

HUMANITIES

For majors who wish to supplement their departmental major by a related program of studies see the "Humanities Special Programs" section in this bulletin.

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 in this bulletin.

GRADUATE PROGRAMS

Applicants should read carefully the general regulations governing advanced degrees in the "Degrees" section in this bulletin. They should have preparation equivalent to an undergraduate major in French with a minimum letter grade indicator 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 (M.A.T.) is offered jointly by the French Division and the School of Education. The degree is intended for candidates who have a teaching credential or relevant teaching experience 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 of this bulletin.

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.

MASTER OF ARTS IN FRENCH (TERMINAL PROGRAM)

The Master of Arts provides a combination of language, literature, cultural history, 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 letter grade indicator of "B", and pass a final examination. To fulfill the requirements in one year, they should enroll for an average of 12 units per quarter.

Candidates for this degree are not eligible for financial aid.

REQUIREMENTS

The basic course program is as follows:

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<th>Units</th>
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<tr>
<td>1. The course in textual analysis (200)</td>
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<td>2. One philology course (202, 204 or 210)</td>
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<tr>
<td>3. One linguistics course (201 or 203)</td>
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<td>4. One cultural history course (290 or 291)</td>
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<td>5. One methodology course (293 or Education 383)</td>
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<td>6. Among the advanced literature courses, two in the early periods (213 to 239); and two in the later periods (240 to 269)</td>
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<td>Total</td>
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EXAMINATION

The examination is administered two weeks before the end of the final quarter of a candidate's program by a committee of three professors of French chaired by the candidate's advisor. It is a one and one-half hour oral examination conducted in French and structured as follows:

1. A half-hour presentation in French of a textual analysis. The passage to be commented on is chosen by the candidate's advisor from a work in the candidate's area of interest. The candidate is informed of the selection and given a copy of the text 48 hours before the examination.

2. A one-hour period of interrogation based on the texts included in a reading list provided all A.M. candidates, with emphasis on periods and authors other than those covered in the candidate's work. Questions will be asked relating to literature, language, and cultural history.

The candidate's success in the examination is decided by a majority vote. In the event of failure, the examination may be taken a second time.

DOCTOR OF PHILOSOPHY

Regardless of their chosen area of specialization (see below), all graduate students must comply with University and departmental regulations. The following requirements, dealing with such matters as residency, teaching, and examinations, may be in addition to the University's basic regulations discussed in the "Degrees" section of this bulletin.

The Master of Arts in French is required of all Ph.D. candidates, who must, therefore, apply for a Master's Degree. The granting of the A.M. or of its equivalent, supposes that the candidate has:

1. Successfully completed a minimum of 36 graduate units (these units must include the required courses specified in the A.M. Terminal Program; see above). This initial coursework constitutes the core curriculum required of all French graduate students.

2. Successfully passed the Ph.D. qualifying examination in the Spring Quarter of the candidate's second year of graduate studies in French.

RESIDENCY AND COURSEWORK

For a graduate student entering with an A.B., the Ph.D. program should normally be completed in four years. The first and second years should be devoted to full-time study, for a total of no fewer than 72 units of graduate work; the third and fourth years to study, teaching, and dissertation work. In accordance with University regulations, candidates for the Ph.D. must complete nine quarters (three years) of full-time work, or their equivalent, in graduate study beyond the bachelor's degree. Of these nine quarters, a minimum of three must be taken consecutively at Stanford.

TEACHING

In addition to training capable and creative scholars, one of the program's primary objectives is to promote the effective teaching of French at all levels. To this end, students are expected, whatever their source of financial support, to demonstrate pedagogical proficiency by teaching under supervision three quarters at one-half time. Students will enroll (normally during their third or fourth year) in the course numbered 293, Methods of Teaching French, or Education 383.

LANGUAGE

It is strongly recommended for the doctoral candidates be competent in Latin and a second Romance language. This choice may vary according to the candidate's period of concentration.

EXAMINATIONS

The Ph.D. qualifying examination consists of a two-hour oral examination to be held in the Spring Quarter 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/her knowledge of the literary, cultural, and social history of the period. For works of the Middle Ages or 20th century, three successive centuries must be represented including that of the candidate's specialization.

The University oral examination is normally taken no later than the end of the third year of studies, following successful completion of the qualifying examination, admission to candidacy, and formation of a Doctoral Committee. The examination is primarily a defense of the dissertation project, which candidates prepare well in advance of the examination date, with the aid of their Doctoral Committee. The examination consists of two parts: (1) a 30-minute analysis of a text related to the dissertation subject, followed by a brief question period; (2)
discussion of aspects of the dissertation project (such as subject, scope, structure, methodology, and bibliography) on the basis of written material submitted one month in advance by the candidate. The examination seeks to assure the scholarly validity of the project and the candidate's ability to complete it successfully. (See the "Degrees" section of this bulletin for graduate school administrative details.)

**DISSERTATION**

The doctoral dissertation which must be written in English (exceptional requests are to be addressed to the Dean of Graduate Studies), 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 division will encourage, in appropriate cases, projects requiring more time for completion. Various kinds of dissertations are acceptable to the division; for example, a historical study of a particular phenomenon, the discussion of one or more representative works of a genre, a comparative study, etc.

**SPECIALIZATION**

Two areas of specialization are available to Ph.D. students: one in French Literature, and the other in Literature, Theory, and Cultural Studies. The common core curriculum of both specializations requires that the student complete 36 graduate units of coursework, as specified in the A.M. Terminal Program, or equivalent. Having thus acquired basic linguistic and cultural competency, the student can specialize in either of the two areas.

**FRENCH LITERATURE**

Students will concentrate on certain areas or centuries, but knowledge of all centuries should be well advanced at the time of graduation. All candidates, regardless of their area of concentration, must take in the department at least 10 literature courses exclusive of directed reading, covering four centuries. (For the purpose of this requirement, the Middle Ages count as a century.)

**LITERATURE, THEORY, AND CULTURAL STUDIES**

This option combines advanced work in literary studies with interdisciplinary and theoretical methods. This broad anthropological approach aims at emphasizing the interactive relations among various processes of interpretation. A primary goal is in-depth understanding of the cross-cultural nature of knowledge. Students must take:

1. Two courses among the 270/370 to 279/379 series.

**ITALIAN DIVISION**

**OFFERINGS**

The Italian Division offers a variety of graduate and undergraduate programs in Italian language, literature, culture, and intellectual history. Its course offerings run the full gamut from small and highly specialized graduate seminars to general courses open to all students on authors such as Dante, Boccaccio, and Machiavelli.

On the undergraduate level, a number of options are available. Students who wish to major in Italian may choose between two concentrations for their Bachelor of Arts degree in Italian, opting for an emphasis on either Italian literature or Italian studies. Also available to Italian majors is an Honors program in the Humanities (see the "Humanities Special Programs" section in this bulletin), an Honors program in Italian, and two extended majors—one in Italian and French literature, and one in Italian and English literature.

On the graduate level, programs of study

2. Three courses among the 280/380 to 289/389 series.
3. Four additional courses in literature, cultural studies, or related fields.

**JOINT DEGREES AND MINORS**

A candidate may also take a joint degree in French and Humanities which is described in the "Humanities Special Programs" section in this bulletin. Minors are possible in Medieval Studies, in Linguistics, in Comparative Literature, in Modern Thought and Literature, 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.

**Ph.D. MINOR IN FRENCH LITERATURE**

The division 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 four centuries of French studies.
leading to the Master of Arts degree and the Doctor of Philosophy degree are offered in Italian literature. Joint programs for the Ph.D. degree with the Graduate Program in the Humanities, Comparative Literature, and Modern Thought and Literature are also available.

Special collections and facilities at Stanford offer the possibility for extensive research in Italian studies and related fields. These include the undergraduate and graduate libraries, and the Hoover Institution for the Study of War, Revolution, and Peace. Collections in Green Research Library are especially strong in the Medieval, Renaissance, and contemporary periods; the Italian section is one of the larger constituents of the Western European collection at the Hoover Library; and the Music Library has excellent holdings on Italian opera.

**STANFORD IN ITALY**

Located in a *palazzo* in downtown Florence, Stanford in Italy affords both undergraduate and graduate students the opportunity for intensive study of Italian language, culture, and literature. Information on the Florence program is available at the Overseas Studies office, room 112, Old Union.

**LA CASA ITALIANA**

The Casa Italiana, located at 562 Mayfield, is an undergraduate residence devoted to developing an awareness of Italian language and culture. It works closely with the Italian Cultural Institute in San Francisco and with other local cultural organizations. It often hosts visiting representatives of Italian intellectual, artistic and political life. A number of departmental courses are regularly taught at the Casa, which also offers in-house seminars. Assignment is made through the regular undergraduate housing draw.

**UNDERGRADUATE PROGRAMS**

**BACHELOR OF ARTS**

The Italian major offers students the opportunity to develop an in-depth knowledge of Italian literature, language, and civilization via a highly flexible program combining coursework in Italian with work in such fields as art history, classics, comparative literature, economics, English, French, history, international relations, music, philosophy, and political science. Irrespective of their concentration, all Italian majors are required to complete the first-year language sequence, taking Italian 1, 2, and 3 (or their equivalent). They must also take two second-year language courses: Italian 51, 52, and/or 53 (or their equivalent taken at the Florence campus). Students considering an Italian major are strongly advised to consult with the Italian undergraduate advisor as early as possible (even before they have completed the language requirement) in order to ensure a maximum of flexibility in designing a course of study suited to their individual needs and cultural interests.

In addition to the five quarters of language study, all Italian majors must complete 60 units of additional coursework, distributed in accordance with the concentration they have selected. Two concentrations are available: Italian literature and Italian studies.

**CONCENTRATION IN ITALIAN LITERATURE**

The literature concentration emphasizes work in all periods of Italian literature, from the Medieval to the Modern. Majors who wish to choose this concentration must fulfill the following requirements:

1. They must complete a minimum of 45 units of Italian courses (selected from courses numbered in the 100's, 200's and 300's).
2. Of these courses, they must take at least one course on Dante, as well as at least one course in each of the following areas: (a) the Middle Ages, (b) the Renaissance, (c) the 18th or 19th centuries, and (d) the 20th century. A Dante course may fulfill the Middle Ages requirement.
3. They must take the intermediate-level survey sequence (Italian 227 and 228).
4. Of the 60 units required for the major, they may take up to 15 units of coursework outside the department in related fields.

**CONCENTRATION IN ITALIAN STUDIES**

The Italian studies concentration is designed for students whose primary interest is in Italian but who have a strong interest in a secondary and related field (such as history, international relations, etc.). It requires less extensive coursework in Italian literature and slightly more work in Italian language and civilization. The requirements for students choosing this concentration are as follows:

1. They must complete a minimum of 32 units of Italian courses (selected from courses numbered in the 100's, 200's, and 300's).
2. Of these courses, they must take the following:
   a) The two quarters of the intermediate-level survey sequence (Italian 227 and 228).
   b) Italian 127, Introduction to Italian History.
   c) One of the advanced language courses, either Italian 114, 115, or 116.
3. Of the 60 total units required for the major, they may take up to 28 units of courses outside the department in related fields. These courses must have a significant Italian component and must be structured such that they constitute a coherent program of study.

Students opting for the Italian studies concentration must formulate their course plans in quarterly consultation with the Italian undergraduate advisor. He or she will help them to design their program of study and advise them on their course selections. The advisor may also approve courses offered at Stanford in Italy.

THE FLORENCE PROGRAM

All Italian majors, whatever their concentration, are strongly encouraged to spend at least one quarter at Stanford in Italy. Many of the courses offered at the Florence center may count toward the fulfillment of requirements for the Italian major. Students are strongly encouraged to consult with the Italian undergraduate advisor before their sojourn in Florence so as to ensure that the courses they have selected meet the Italian Division's requirements.

EXTENDED MAJORS

Requirements for both extended majors are essentially identical to those of the Italian major with a concentration in Italian literature.

ITALIAN AND ENGLISH LITERATURES

In addition to the 45 units required for the A.B. in Italian with a concentration in Italian literature, candidates must complete four English literature courses numbered 100 and above, which are related to their field of concentration in Italian literature.

ITALIAN AND FRENCH LITERATURES

In addition to the 45 units requirement for the A.B. in Italian with a concentration in Italian literature, candidates must complete four French literature courses numbered 100 and above, which are related to their field of concentration in Italian literature.

HONORS PROGRAMS

ITALIAN

Italian majors with a letter grade indicator of "B+" or better in all Italian courses are eligible for departmental honors. In addition to the requirements listed above, each Honors candidate must complete and submit an Honors essay representing 6 to 9 units of academic work. Proposals for Honors essays must be submitted to the Italian faculty by the end of the candidate's junior year. If the proposal is accepted, a member of the Italian faculty will be assigned to serve as the student's advisor for the essay. Students interested in the Honors program should speak to the Italian undergraduate advisor early in their junior year.

HUMANITIES

An Honors program in the Humanities is available for Italian majors who wish to supplement their departmental major by a carefully structured program of humanistic studies. See the "Humanities Special Programs" section of this bulletin for further information.

GRADUATE PROGRAMS

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 letter grade indicator of "B", and pass a comprehensive oral 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:

- Nine graduate courses in Italian. 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 or at the beginning of the following Autumn Quarter. Before taking the exam, a candidate for the Master of Arts degree must submit to the Italian faculty a sample graduate seminar paper representative of the quality of his or her graduate work. On the basis of this paper, the results of the comprehensive examination, and the student's overall progress, the members of the department will then vote for or against the awarding of the Master of Arts degree.

Limited financial aid is available in the form of teaching assistantships.

Applications for admission must be received by May 15.
DOCTOR OF PHILOSOPHY
IN ITALIAN LITERATURE

Stanford's Ph.D. program in Italian offers students the opportunity for advanced work in Italian literature and Italian studies within an unusually flexible interdisciplinary framework. It is fully independent of the Ph.D. program in French and aims to encourage students to bring broader methodological and interdisciplinary concerns to bear on the study of Italian literature. Like conventional Italian Ph.D. programs, it places primary emphasis on developing each student's command of Italian literature as a whole. Unlike conventional Italian Ph.D. programs, it allows students to construct a highly individualized course of study, integrating specialization in a particular literary period with work in such fields as art history, classics, comparative literature, feminist studies, film, French, history, history of science, linguistics, literary theory, Medieval or Renaissance studies, philosophy, and religion. The program is founded on the belief that this sort of balance between period specialization and interdisciplinary breadth is not only desirable, but also essential in a small field such as Italian studies, particularly so given the diversity of the Italian literary canon (extending, as it does, over a wide variety of disciplines).

Students admitted into the Ph.D. program in Italian work closely with their faculty advisor in structuring a plan of study appropriate to their needs and interests. Such a plan will usually involve a mix of courses taken within the Italian program, courses taken in other departments, and of independent work done under the supervision of a member of the Italian faculty. Students are admitted into the program as Italian Fellows on a fellowship plan which integrates independent work at the Stanford campus in courses, pursue dissertation research and do independent work at the Stanford campus in Florence under the supervision of a member of the Italian faculty. The Florence center, located in a palazzo along the Arno, is near the most important Florentine libraries and archives, and the University of Florence. An additional resource is the Stanford Italian Review, a scholarly journal published twice annually by the Department of French and Italian. Advanced students in the Ph.D. program may become involved in the Review in a number of capacities, editorial and other. Graduate students also have at their disposal the resources of the Casa Italiana, a residential theme house which serves as an Italian cultural center and hosts such events as colloquia, lectures, and film series.

ADMISSION TO THE PROGRAM

Although they need not have been undergraduate Italian majors, candidates for admission are expected to be proficient in the Italian language and to have done significant coursework in Italian literature and/or Italian studies on the undergraduate level. Candidates with a broad humanistic and linguistic background are especially encouraged to apply.

In their application for admission, candidates must include the following materials in addition to those required in the application forms:

1. A brief statement of their principal areas of interest (periods, authors, genres, or theoretical issues) in Italian studies.
2. A detailed description of their present degree of proficiency in the Italian language and in other languages they have studied.
3. A copy of one of their undergraduate term papers on a literary topic (preferably Italian) which they consider representative of their best undergraduate work. The paper may be either in English or Italian.

Applicants should arrange to have the results of the Graduate Record Examination sent to the Graduate Admissions Office. They should take both the aptitude and achievement portions of the examination.

REQUIREMENTS

Residency and Coursework—In accordance with University regulations, candidates for the Ph.D. must complete nine quarters (three years) of full-time work, or their equivalent, in graduate study beyond the bachelor's degree. Of these nine quarters, a minimum of three must be taken consecutively at Stanford. A minimum of 72 units of graduate work, in addition to the doctoral dissertation, are required of every student in the Italian Ph.D. program.

Teaching—In addition to training capable and creative scholars, one of the program's
primary objectives is to promote the effective teaching of Italian at all levels. To this end, students are asked to teach a total of four Italian language courses as part of their fellowship program (normally during their third and/or fourth year in the program). During their first term of teaching, students must enroll in Italian 460, Graduate Workshop on Pedagogy, a seminar which permits them to work closely with a master-teacher and involves a regular schedule of class visitations.

Language—As soon as possible, but not later than the end of the third year, the candidates must have passed reading examinations in two additional foreign languages. If the candidate’s period of concentration is earlier than the Romantic period, one of these must be Latin; if Romantic or later, French. Completion of the language requirement is a prerequisite for taking the University oral examination.

Course Requirements—During their first three years of study, graduate students are required to take four courses: Italian 397, The History of the Italian Language; Italian 490, Proseminar on Italian Literary Studies; Italian 460, Graduate Workshop on Pedagogy; and Italian 497, Colloquium on Research Methods in French and Italian Literature. Apart from this requirement, they are granted considerable freedom in structuring a course of study appropriate to their individual needs. During the first year, most of their coursework will usually be done within the Italian Department in order to ensure an adequate preparation for the qualifying examination. In their second and third years, students’ programs will normally consist of a combination of coursework done inside and outside the Italian Department, supplemented by tutorials and independent work pursued under the supervision of Italian faculty.

Qualifying Procedures—Students are admitted into the program on a probationary basis. This probationary period comes to an end once a student is officially admitted to “candidacy” for the Ph.D. as a result of successful completion of the qualifying procedure. The qualifying procedure will take place at the end of the third or fourth quarter of graduate study, at which time the student will: (1) take the oral qualifying exam (equivalent to the master’s exam), and (2) submit to the Italian faculty a sample graduate seminar paper which the student considers representative of the quality of his or her graduate work at Stanford. On the basis of this paper, the results of the qualifying examination and the student’s overall progress, the members of the department will then vote for or against admission to candidacy for the Ph.D. The terminal A.M. degree will be awarded to students who have successfully completed

the oral qualifying exam but who are not admitted to candidacy for the Ph.D.

Examinations—Three examinations are required of candidates for the Ph.D., two oral and one written: the qualifying examination (mentioned above), the departmental written examination, and the University oral examination.

1. The qualifying examination tests the student’s general knowledge of the Italian language and Italian literature. It is to be taken at the end of the third or during the fourth quarter of graduate study. It is composed of two sections, the first consisting of a 20 minute presentation by the candidate, the second of a 70 minute question and answer period on the candidate’s talk and on his or her reading list. The examining committee for the qualifying examination will be made up of the members of the Italian faculty including the student’s faculty advisor, who will chair the examination. While the reading list for the examination must be based on the department’s standard list, it should be amplified in consultation with the student’s advisor so as to reflect each student’s particular areas of interest.

2. The departmental written examination serves as a preparatory examination for the University oral (described below) and involves the same reading list and committee of examiners as the University oral. It is normally taken at the end of the third year of graduate study. The examination lasts six hours and is divided into two sections of equal duration. During the first, the student is asked to write an essay on his or her specialty; during the second, on a more general topic. The reading list for the examination must be established in consultation with the student’s dissertation director, who will chair a committee of examiners (usually three) selected jointly by the dissertation director and the student according to the list’s emphasis. Reading lists for this examination and the University oral will generally cover all periods of Italian literature, with the student’s area of specialization the primary focus of both examinations, covered in great depth. Aside from this general guideline, students are given considerable latitude in establishing a list which reflects their individual scholarly concerns.

3. The University oral examination is to be taken two weeks after successfully passing the departmental written examination. It is divided into four sections. The first, lasting 30 minutes, consists of a formal presentation by the student addressing one of the ques-
tions that he or she will have received the morning of the examination. The second, also lasting 30 minutes, is designated as a question and answer period concerning the student’s presentation. The third, lasting one hour, will take the form of an oral colloquy on the student’s reading list as a whole. The fourth, lasting 30 minutes, is allocated to a defense of the student’s dissertation proposal (a copy of which will have been submitted to the examiners one week in advance of the examination).

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. The committee of readers for the dissertation will ordinarily be drawn from the University oral examining committee. The fourth and (if necessary) fifth years of graduate study are devoted to writing and researching the doctoral dissertation.

JOINT DEGREES AND MINORS
A joint degree program in Humanities and Italian Literature is available (for a description see the "Humanities Special Programs" section of the bulletin). Minors are possible in a wide variety of related fields. Joint degree programs and minors very frequently require 24 additional units of work, making completion of all course requirements in nine quarters difficult if careful advance planning is not done.

Ph.D. MINOR IN ITALIAN LITERATURE
A minor in Italian Literature is offered for students from other departments. The requirements for a graduate minor are: (1) a minimum of 24 units of graduate course work in Italian literature, and (2) a sound reading knowledge of the Italian language.

COURSES
FRENCH DIVISION

Note — Since unavoidable changes often have to be made in course offerings after Courses and degrees has gone to print, students are advised to consult regularly the department bulletin board regarding changes.

Students interested in languages not listed by a specific language department should contact the Special Language Program, Department of Linguistics.

GENERAL
These courses are open to all undergraduate and graduate students, are taught in English, and do not require a knowledge of the French language.

105. The Writings of Albert Camus — Reading and discussion of all the major works: novels, plays, short stories, essays. Lectures, readings in English.
   4 units, Spr (Cohn)
   4 units, Aut (Cohn)
138. Female Saints: The Rhetoric of Religious Perfection — (Graduate students register for 217.) (DR:3)
   4 units, Win (Cazelles)
190. Great French Plays: Tradition and Anti-Tradition — Corneille, Molière, Racine, Marivaux, Beaumarchais, Vigny, Musset, Labiche, Rostand, Jarry, Giraudoux, Sartre, Vian, Ionesco, Godard.
   4 units, Spr (Winchell)
269. The Literature of Decolonization — The work of Francophone African and Caribbean writers who have confronted the phenomenon of colonialism and contributed to the struggle for liberation; readings from Aimé Césaire, Léopold Senghor, Frantz Fanon, Albert Memmi and Jean-Paul Sartre, etc. Discussion in English, reading in French or English translation, at student’s option.
   4 units, Win (Giraud)
272. From Existentialism to Structuralism and Post-Structuralism — Readings from Heidegger, Sartre, Lévi-Strauss, Michel Foucault. An effort is made to define a historical continuity behind the apparent discontinuities of post-war French theory.
   4 units, Win (Girard)
284D. Literature and Philosophy: Complexity and Self-Reference in the Humanities and the Social Sciences — Undecidability, infinite deferment, structural incompleteness, bifurcation and structural stability, the text as a machine, etc. Interdisciplinary approach for students in the humanities and sciences wishing to explore conceptual foundations of modern critical theory. (Topics: deconstruction of structuralism, the logic of mimetic desire. Readings from Lacan, Derrida, Levy-Strauss, Girard.
   3-4 units, Spr (Dupuy)
   4 units, Aut (Girard)
286B. Literature and Politics: Individualism and Social Justice — "Anglo-American Liberal-
**ism** from the viewpoint of contemporary French political philosophy. Readings of Smith, the Utilitarians, Rawls, Nozick and Hayek.

3-4 units, Win (Dupuy)

**Feminist Attitudes in France—Significant texts of women's roles in French society, from the Middle Ages to the present, drawn from literature, iconography, politics and journalism.**

4 units, Win (Newman-Gordon)

**FIRST- AND SECOND-YEAR LANGUAGE**

*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. The test will be given Friday, September 23.*

Language courses with an "X" suffix (1-X, 2-X) normally have the same curricular goals as the corresponding number course (French 1, 2), but are conducted with an experimental teaching and learning component (computer-assisted instruction, use of video, etc.). Entrance and exit testing is conducted for evaluation purposes along with systematic student evaluation of new techniques. These special sections are open to all interested students moving through the first- and second-year language series. Student "+ /No Credit" option is available. For further information regarding specific experimental courses, when offered, consult the instructor.

Auditing is not permitted in participation language courses.

1. **First-Year French (Part 1)—Systematic acquisition of basic French grammar and vocabulary in the immediate reality of the classroom. Only French is used by the instructor and students. Multiple approach: listening-comprehension, oral expression, original oral, and written composition.**

5 units, Aut, Win, Spr (Staff) MTWThF

1R. **First-Year French (Part 1 accelerated)—For students who have some previous knowledge of the language, but who must begin their study of French over again. Equivalent to 1. Language laboratory required.**

3 units, Aut, Win (Staff)

2. **First-Year French (Part 2)—Continuation of French 1. Simple daily vocabulary. Oral and written compositions.**

5 units, Aut, Win, Spr (Staff) MTWThF

2C. **First-Year Conversation—French 2 level. Prerequisite: 1 or equivalent. Course offered on a Pass/No Credit basis only.**

2 units, Aut, Win, Spr (Staff)

3. **First-Year French (Part 3)—Continuation of French 2. Study of elementary grammar and idiomatic expressions. Oral and written composition.**

5-6 units, Aut, Win, Spr (Staff) MTWThF

**Reading of excerpts from literary texts.**

5 units, Aut, Win, Spr (Staff) MTWThF

3C. **First-Year Conversation—French life and culture: theater, movies, travel, etc. Useful information for students going to Tours campus or who plan to travel in France. Prerequisite: 2 or equivalent. Offered on a Pass/No Credit basis only.**

2 units, Aut, Win, Spr (Staff)

5. **Intensive French for Beginners—Accelerated first-year French in which either 2 or 3 quarters of French may be covered. Offers preparation in speaking, writing, and reading the language. An all in French method is used. Written exercises, compositions, conversational drills, and daily work in the language laboratory. See Summer Session Bulletin for details. (No auditors permitted.)**

8-12 units, Sum (Staff)

10. **Reading French—An accelerated course specifically for the acquisition of reading ability. For graduate students seeking to meet the University reading requirement for advanced degrees. Also open to seniors. No auditors permitted.**

4 units, Aut (Staff)

20C. **Second-Year Conversation—Prerequisite: 3 or equivalent. Offered on a Pass/No Credit basis only.**

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

21R. **Grammar Review—Basic French grammar emphasizing written expression with some training in speaking. For students with previous training in French either in high school (3-5 years) or in other universities, whose progress would be best served by a concentrated review of first-year material.**

3 units, Aut (Staff) MWF

22. **Second-Year French (Part 1)—Study of literary texts, basic grammar. Discussions.**

4 units, Aut, Win, Spr (Staff) MTWTh

23. **Second-Year French (Part 2)—Continuation of 22. Discussion of reading excerpts grouped by themes. Continuation of grammar study.**

4 units, Aut, Win, Spr (Staff) MTWTh

24. **Second-Year French (Part 3)—Reading and discussion of complete works (novels, plays, poetry). Grammar. Extra unit for individual project.**

4-5 units, Aut, Win, Spr (Staff) MTWTh

26. **Intensive Intermediate French—(Equivalent to 22 and 23.) A complete grammar review in conjunction with reading of selected French texts. Classroom discussions, entirely in French, focus on the reading material and on
topics of current interest. Written exercises, oral reports, written compositions, and work in the language laboratory. Prerequisite: One year of college French or equivalent preparation. No auditors permitted.

6-8 units, Sum (Staff) MTWTh

29. Business French—(Graduate students register for 129.) For students interested in business who need to acquire the necessary skills to function and communicate in the French-speaking business world. Readings and acquisition of specialized vocabulary, discussions, written work, including translations and business letters. Prerequisite: 22, or equivalent.

3-4 units, Aut (Morran)

30C. Conversation and Culture—France as seen through the writings of French and foreign authors. Oral presentations and discussions. Prerequisite: 23 or equivalent. May be repeated once for credit after an interval of two quarters. Offered on a Pass/No Credit basis only.

2 units, Aut, Win, Spr (Staff)

50. French on Line—Maison Frangaise-based beginning French conversation using computer assisted learning and networking. Primarily for (but not limited to) French House residents with little or no background. Three hours, including one hour table française. First organizational meeting, Wednesday, September 28, Maison Française.

3 units, Aut (Barson) by arrangement

38. French Culture—Maison Française.

3 units, Aut (Staff)


4 units, Win (Staff)

40. French Theater Workshop.

3 units, Spr (Staff)

UPPER DIVISION COURSE NUMBERING SYSTEM

Only courses numbered above 120 qualify as Upper Division courses.

Advanced Language: 120; 123-125; 129; 200-204; 210, 211; 293

Undergraduate Literature, Survey Courses: 130 to 132

Undergraduate Literature, Genres: 150-189

Advanced Undergraduate and Graduate Literature, Authors and Themes: 213/313 to 269/369

Advanced Undergraduate and Graduate Literature, Culture and Theory: 270/370-298/398

Special Topic Courses: 219/319; 229/329; 239/339; 249/349; 259/359; 269/369; 289/389

Individual Work: 199; 399

ADVANCED LANGUAGE

120. Advanced Conversation—Conversation and discussion centered on contemporary problems and based on French newspapers, magazines or films. Prerequisite: 24 or equivalent. May be repeated once for credit after an interval of two quarters.

3 units, Aut, Win, Spr (Staff)

121. Pronunciation and Phonetics—(Graduate students register for 201.)

4 units, Win (Juilland)

123. Advanced Grammar and Syntax—Oral and written language, grammar, textual analysis. Prerequisite: 24 or equivalent.

4 units, Aut, Win (Staff)

124. Advanced Stylistics and Composition—Designed to achieve a high level of proficiency in written French. In-depth textual analysis of excerpts from various literary genres (novels, poems, essays); creative writing centered on specific subject matters; introduction to literary criticism. In French. Prerequisite: 123 or equivalent.

4 units, Win, Spr (Staff)

125. Contemporary French Usage, Spoken and Written—Prerequisites: 123 and 124 or equivalent.

4 units, Spr (Staff)

126. Language and Context—(See Overseas Studies, Paris Program.)

5 units, Aut (Bertrand)

129. Business French—(See 29.)

3-4 units, Aut (Morran)

SURVEY COURSES

130. French Literature I: Middle Ages and Renaissance—Introduction to the literature and culture of France from the 11th to the 16th century. Readings from the epics (the Song of Roland) medieval romances (Yvain by Chrétien de Troyes), post-Petrarchan poetics (Du Bellay, Ronsard) and prose humanists (Rabelais, Montaigne). In French. Prerequisite: 24 or equivalent. (DR:2)

4 units, Aut (Cazesles)

131. French Literature II: 17th and 18th Centuries—Introduction to the literature of the classical age and of the Enlightenment. Representative masterworks by Corneille, Molière, Racine, Mme de La Fayette, Voltaire, Marmontel, Prévost, Rousseau. Prerequisite: 24 or equivalent. (DR:2)

4 units, Win (Weinstein)
132. French Literature III: 19th and 20th Centuries—Representative readings from romantic, symbolist and post-modernist poets, and from 19th- and 20th-century novels (Victor Hugo, Baudelaire, Apollinaire, Michaud, Ponge, Flaubert, Balzac, Gide, Proust, N. Sarraute.) Prerequisite: 24 or equivalent. (DR: 2)

4 units, Spr (Newman-Gordon)

LITERATURE

Note—Prerequisites for the following courses are normally 130, 131, or 132, or equivalent.

105. See under “General Courses.”

114B. See under “General Courses.”

138. See under “General Courses.”


4 units, Aut (Hester)

159. 17th Century French Moralists—A study of the binary mœurs/morale (custom/character, culture/nature) as it is seen to inform the writing of Montaigne, Descartes, Pascal, La Boëce, La Fontaine, Sévigné, La Bruyère, Saint-Simon.

4 units, Aut (Brody)


Selected theoretical and genre studies including Todorov, Freud, Sibers, and Rank.

4 units, Win (Winchell)

174. French Romantic Theater from Melodrama to Naturalism—Diderot, Pixérécourt, Hugo, Dumas père, Musset, Vigny, Balzac, Dumas fils, Bécque, Rostand.

4 units, Win (Winchell)


4 units, Win (Neuman-Gordon)

182. Contemporary French Theater—See Overseas Studies, Paris program.

4-6 units, Win (Bertrand)


4 units, Aut (Apostolidès)

198. Language Specials—With special permission of the department only.

1-5 units (Staff)

199. Individual Work—Open only to majors in French and with special permission of the department. Normally limited to 4-unit credit toward the major. See instructor for section number.

1-4 units (Staff) by arrangement

ADVANCED UNDERGRADUATE AND GRADUATE LANGUAGE

200. Textual Analysis.

4 units, Aut (Hester)

200B. Textual Analysis—(See Overseas Studies, Tours program.) Flaubert and Michel Tournaire.

4 units, Spr (Bertrand)

201. Pronunciation and Phonetics—Theory study and corrective work: articulation, intonation, rhythm, phonetic alphabet, etc.

4 units, Win (Juilland)


4 units, Spr (Staff)

210. Old French—Introduction to Old French poems and prose texts emphasizing the early period.

4 units, Aut (Cazelles)

LITERATURE

223. Montaigne—Analysis of key essays to describe the philological and rhetorical (vs. the biographical and ideological) features of Montaigne’s discourse. Emphasis on style, imagery, lexical clusters, redundancies, intertextual strategies.

4 units, Win (Brody)

238. Molière—(Graduate students register for 338.)

4 units, Aut (Brody)

239. Racine—The tragedies of Racine, as well as Les Plaideurs, read with attention to the author’s use of his Greek sources.

4 units, Win (Girard)


4 units, Aut (Winchell)

259A. Dostoevski and French Literature—(Enroll in Slavic Languages 375.) Notes from Underground, Crime and Punishment, and works by Diderot, Balzac, Gide, Camus and Sartre.

5 units, Win (Frank)
266. Surrealism—Toward a definition of Surrealism through the manifestos of André Breton and novels, poems and plays by Breton, Eluard, Aragon, Cocteau, Julien Gracq. Discussion of Surrealist films and painting.
4 units, Spr (Newman-Gordon)

268. See under “General Courses.”

269. The Individual and Society in the Contemporary Novel—(See Overseas Studies, Tours program.)
4 units, Spr (Bertrand)

274. See under “General Courses.”

4 units, Spr (Serres)

284D. See under “General Courses.”

285. Literature and Politics.
285A. The Left and the Right.
2 units, Aut (Serres)

286B. See under “General Courses.”

294A. See under “General Courses.”

GRADUATE LITERATURE

314. Vengeance in Chrétien de Troyes—Chrétien’s romances as foundation myths addressing the question of contemporary violence. Topics: the ideology of law and order; love and the self; the quest for power; morality and legality; pursuit and persecution; the Order of the Sword. In English.
4 units, Win (Cazelles)

323. Montaigne—(See 223.)

338. Molière—(See 238.)

339. Racine—(See 239.)

366. Surrealism—(See 266.)

LITERATURE, THEORY, AND CULTURAL STUDIES

372. From Existentialism to Structural and Post-Structuralism—(See 272.)

GENERAL GRADUATE STUDIES

293. Methods of Teaching French—(Same as Education 293.) Approaches, methods and procedures in relation to foreign language acquisition theory; teaching practice regularly observed in demonstration class.
4 units, Spr (Hester)

397. Colloquium on Research Methods in French and Italian Studies—Acquaints graduate students with general and specialized resources for French and Italian studies. Emphasis on overall strategy for research, but provides an opportunity to explore bibliographical sources in the particular fields of interest to each student.
4 units, Aut (Parrine)

398. Tutorials—Initiated by a professor. Tutorials are intended for three or 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.
1-12 units, any quarter (Staff) by arrangement

ITALIAN DIVISION

Note—Because changes in literature course offerings are sometimes necessary after Courses and Degrees has gone to print, students are advised to consult the department bulletin board on a regular basis.

GENERAL

These courses are open to all undergraduates and graduate students, are taught in English, and do not require a knowledge of the Italian language.

233. Dante’s Divine Comedy—(Graduate students register for 333.) Intensive study of Dante’s poem in relation to the culture and history of Medieval Europe. Topics: Dante and pre-Modern theories of autobiography; theology and poetics in the Comedy, Dante and the Natural Sciences, Dante’s Christianization of Classical epic (Virgil, Lucan, Statius), the Comedy and Dante’s minor works. Open to all students, including freshmen. (DR:2)
4 units, Aut (Freccero)

233F. The Literature of the City: Dante’s Commedia—(Offered in Florence.) Dante’s theory of the city via a close reading of the Divine Comedy and of excerpts from his political treatise (On Monarchy) and from Virgil’s Aeneid. Emphasis on the links between Dante’s Florence and contemporary Florence, on the political crises of 13th- and 14th-century Italy, and on the intersection between issues of politics, poetics, and language in Dante’s poem. All texts read in dual-language editions. A discussion section is offered in Italian for students wishing to perfect their linguistic skills. (DR:2)
4 units, Aut (Freccearo)

234. Guicciardini—(Graduate students register for 334.) Introduction to the biographer of Italian Renaissance princes. Ricordi and Storia d’Italia are studied as outstanding documents of a time of crises and change. Comparison with
with the writing of Machiavelli and the different conclusions reached by these analysts of power in the political arena.

4 units, Aut (Frulla)

240. Boccaccio's *Decameron*—(Graduate students register for 340.) Boccaccio's masterpiece studied with attention to its representation of the political arena. The writing of Machiavelli and the different conclusions reached by these analysts of power in the Middle Ages, Boccaccio's relation to Dante and Petrarch, Medieval literature and play. Open to all students, including freshmen.

4 units (Harrison) given 1989-90

250. The Italian Renaissance—(Graduate students register for 350.) An interdisciplinary course on Renaissance Humanism in Italy from the 14th-17th centuries emphasizing the interaction of literature, theater, music, architecture, and the visual arts. Topics: the Renaissance city and Renaissance pastoral, Castiglione and the Renaissance Courtier, Machiavelli and the Renaissance Prince, the value of classical antiquity in the Renaissance, Renaissance debates on poetics and on language. Principal authors: Petrarch, Castiglione, Machiavelli, Ariosto, Cellini, Sannazaro, Michelangelo. Open to all students, including freshmen.

4 units, Win (Harrison)

257F. The Discourse of the City—(Offered in Florence.) Italian and Florentine political theory from the Middle Ages to the late 19th century studied against the background of Greek theories of the *polis* (Aristotle, Plato) and Roman and Christian theories of *civitas* and *imperium* (Cicero, Augustine). Authors: Virgil, Dante, Petrarch, Guicciardini, Machiavelli, Vico and Mazzini. Topics: rhetoric and power, utopias and dystopias, the country and the city, urban typologies, city and empire, the historical development of the Italian city in relation to Italian political theory. Discussion section is offered in Italian for students wishing to perfect their linguistic skills. (DR:5)

4 units, Win (Schnapp)

267. Italy as a Literary Symbol—(Graduate students register for 367.) The symbolic impact of Italy in the travel journals, fiction, poetry, and the drama of non-Italian writers: Goethe, Stendahl, Turgenev, Gogol, Byron, Keats, Shelley, Henry James, Henry Adams, Hawthorne, D. H. Lawrence, Thomas Mann, E. M. Forster, Mark Twain, Edith Wharton, W. H. Auden, Ezra Pound, and Harold Pinter. Open to all students, including freshmen.

4 units (Allen) given 1989-90

FIRST- AND SECOND-YEAR LANGUAGE

Note—Students registering for the first time in a first or second year course must see their Italian instructor for proper placement if they have had any prior training in Italian.

1. First-Year Italian (First Quarter)—An introduction to the Italian language with emphasis on speaking and oral comprehension.

3 units, Aut, Win, Spr (Staff) MTWThF plus work in the language laboratory

2. First-Year Italian (Second Quarter)—As above with emphasis on the development of reading and writing skills, and on Italian culture. Prerequisite: 1 or equivalent.

5 units, Aut, Win, Spr (Staff) MTWThF plus work in the language laboratory

2A. Italy Today—An accelerated course providing a general introduction to contemporary Italian life (Italian politics, popular culture, media, film, literature, and art) through readings and lectures. Prepares students for study at the Florence center. May be taken concurrently with 2 or 3. Prerequisite: 1 or equivalent.

5 units, Win, Spr (Staff) MWF

3. First-Year Italian (Third Quarter)—As above with additional cultural and literary readings. Prerequisite: 2 or equivalent.

5 units, Aut, Win, Spr (Staff) MTWThF plus work in the language laboratory

5. Intensive First-Year Italian—An accelerated course in which two or three quarters of First-Year Italian may be covered. 5A counts for 8 units and covers Italian 1 and 2 in 5\(\frac{1}{2}\) weeks. 5B represents 4 additional units and covers Italian 3 in 2\(\frac{1}{2}\) weeks.

8-12 units, Sum (Staff) MTWThF 9-11:50 plus work in the language laboratory

7A, B, C. Individualized First-Year Italian—Covers the materials of 1 (7A), 2 (7B) and 3 (7C), and is designed for graduate and undergraduate students who, having conflicts with normally scheduled courses, wish to complete 5 to 15 units at their own pace in regular consultation with the instructor. Students who wish to take Individualized Italian must submit an application to the instructor and the coordinator of the Italian language program during the first week of classes.

1-15 units, Aut, Win, Spr (Staff)

10. Reading Italian—An accelerated course designed for the acquisition of reading skills in Italian. Open to advanced undergraduates (upon approval of the instructor); primarily intended for graduate students seeking to fulfill University foreign language requirements for advanced degrees. No auditors.

3 units, Win (Springer) MW
who wish to improve their spoken Italian. 30A is for students who have completed, or are in the process of completing, their first year of Italian. 30B is for students returning from the Florence program and/or who have completed one quarter of second-year Italian. Subject matter varies each term; 30A or 30B may be repeated up to two times for credit. Offered on a Pass/No Credit basis only. Prerequisite for 30A: 2 or equivalent. Prerequisite for 30B: 51 or equivalent.

2 units, Aut, Win, Spr (Staff)

51. Second-Year Italian (First Quarter)—Comprehensive review of Italian grammar combined with further study of advanced grammar and Italian culture through literary texts. Prerequisite: 3 or equivalent.
3-4 units, Aut, Win (Devine) MWF

52. Second-Year Italian (Second Quarter)—As above with emphasis on translation, stylistics and composition. Prerequisite: 51 or equivalent.
3-4 units, Win, Spr (Mussio) MWF

53. Second-Year Italian (Third Quarter)—Continuation of 52. Prerequisite: 52 or equivalent.
3-4 units, Spr (Napolitano) MWF

70, 80, 90. Intensive and Accelerated Italian—Offered only at the Stanford Florence Center (consult the Overseas Studies catalogue).
3 or more units, Aut, Win, Spr (Staff)

198. Language Specials—With special permission of the department only.
1-5 units (Staff)

ADVANCED LANGUAGE AND CIVILIZATION

114. Advanced Stylistics and Composition—Designed to achieve a high level of proficiency in written and spoken Italian. Readings of literary and non-literary texts with in-depth textual and grammatical analysis in class, oral reports, and frequent writing assignments. In Italian. Prerequisite: 52 or consent of the instructor.
4 units, Aut (Viggiano)

115. Economic and Business Italian—For graduates and undergraduates interested in acquiring the necessary language skills and vocabulary to function and communicate effectively in the Italian-speaking business world. Emphasizes readings from the print media and journals, Italian-English and English-Italian translation, the preparation of business letters, and vocabulary building. In Italian. Prerequisite: 52 or consent of the instructor.
4 units, Win (Viggiano)

116. Translation—The translation of Italian literary and non-literary texts from the Middle Ages to the present, emphasizing the analysis of syntax, morphology, and style. Regular exercises in Italian to English translation. Prerequisite: 52 or consent of the instructor.
4 units, Spr (Viggiano)

122. Italian Cinema—Aspects of the political, social, and cultural history of 20th-century Italy studied via the major monuments of the post-war cinema. In Italian. Prerequisite: 3 or equivalent.
3 units, Spr (Mussio)

127. Introduction to Italian History—Italy's historical and cultural background approached via the study of specific events, movements, figures, and artifacts. In Italian. Required of all Italian majors who select the Italian studies concentration. Prerequisite: 3 or equivalent.
3 units, Spr (Napolitano)

197. Reading Course on the History of the Italian Language—(Graduate students enroll in 397.) Its lexical, morphological, and syntactical evolution from the 11th century to the present, with emphasis on the philological analysis of literary texts. Students sign up under the sponsorship of a faculty member. Recommended: Some background in Latin. Prerequisite: 52 or consent of the instructor.
3 units, Aut, Win, Spr (Staff)

INTERMEDIATE-LEVEL LITERATURE

227. Italian Literature I: The Middle Ages and the Renaissance—Reading of selected works from the stilnovisti, Dante, Petrarch, and Boccaccio through Machiavelli, Ariosto, and Tasso. Required of all Italian majors. In Italian. (DR:2)
4 units, Aut (Armao)

228. Italian Literature II: From Mannerism through the Modern—Reading of selected works from Marino, Campanella, Tesauro, Galileo, Vico, Goldoni, Alfieri, Leopardi, Foscolo, Manzoni, Verga, and Pirandello. Required of all Italian majors. In Italian. (DR:2)
4 units, Win (Alkn)

233. Dante's Divine Comedy—(See "General Courses.")
4 units, Aut (Freccero)

234. Guicciardini—(See "General Courses.")
4 units, Aut (Frulla)

240. Boccaccio's Decameron—(See "General Courses.")
4 units (Harrison) given 1989-90

250. The Italian Renaissance—(See "General Courses.")
4 units, Win (Harrison)

267. Italy as a Literary Symbol—(See "General Courses.")
4 units (Allen) given 1988-89
330. The Beginnings of Italian Literature—The origins of vernacular literature in Medieval Italy, including the poetry of the Sicilian School, the *stilnovisti*, Guido Cavalcanti, the chronicles (Villani), the mystico-religious lyric (Jacopone, S. Caterina), vernacular preachers (Giordano da Rivalto), Brunetto Latini and vernacular learning, ribald verse (tenzoni), and the young Dante.

4 units (Schnapp) given 1989-90

332. Discourses of Desire—Explores a variety of medieval discourses of desire, secular and sacred. Readings from troubador lyrics, *stilnovisti* poems, and courtly romances; also the letters of Heloise and Abelard, St. Bernard’s sermons on Canticles, and Dante’s *Vita Nuova.* Readings in English.

4 units, Win (Jacoff)

333. Dante’s Divine Comedy—(See “General Courses.”)

4 units, Aut (Freccero)

334. Guicciardini—(See “General Courses.”)

4 units, Aut (Frulla)

335-338. Advanced Courses on Dante—Advanced study of Dante’s works in light of recent developments in the field. Emphasis on Medieval theories of language and interpretation and questions of textualty and intertextuality in Medieval literature. Prerequisite for undergraduates: 233 or special permission from the instructor.

335. Dante’s Divine Comedy: Inferno—Intensive study of the first canticle of Dante’s masterpiece.

4 units (Freccero) given 1989-90


4 units (Freccero) given 1989-90

337. Dante’s Divine Comedy: Paradise—Intensive study of the third and final canticle of Dante’s masterpiece.

4 units, Spr (Jacoff)

340. Boccaccio’s Decameron—(See “General Courses.”)

4 units (Harrison) given 1989-90

THE RENAISSANCE

345. Petrarch and Petrarchism—Readings from the *Canzoniere*, *Epistolae*, *De Vita Solitaria*, and *Secretum* studied in relation to later developments in Petrarchan poetics in Italy (Ariosto, Gaspara Stampa, Tasso, Spain (Garcilaso, Quevedo, Gongora), England (Sidney, Shakespeare), and France (Ronsard). Topics: Petrarch and Dante, Petrarch and the aesthetics of fragmentation, Pietro Bembo and the Petrarchan canon.

4 units, Aut (Freccero)

350. The Italian Renaissance—(See “General Courses.”)

4 units, Win (Harrison)

355-359. Special Seminars on the Italian Renaissance—These seminars provide an interdisciplinary approach to selected topics in the field of Renaissance studies.

355. Michelangelo: The Poet and the Artist—Interdisciplinary examination of Michelangelo’s poetry in relation to his artistic production. Covers the crisis in Christian faith which lends his work its intensity of expression and the neoplatonic theories of eros and beauty which are dramatized in Michelangelo’s poems and his art work. Readings: Plato’s *Symposium*, Michelangelo’s *Poems*, and writings by Panofsky. Open to all students.

4 units (Harrison) given 1989-90

FROM THE BAROQUE TO THE MODERN

360. Giambattista Vico and René Descartes—Comparative course, bringing the thought of René Descartes into confrontation with Giambattista Vico’s philosophy, which arose as a reaction to Cartesianism. Reading of Descartes’s autobiography, *Discourse on Method*, in relation to Vico’s *Autobiography*, and Vico’s *New Science* as a critique of the metaphysics of subjectivity that begins with Descartes’s attempt to ground knowledge in the cogito.

4 units (Harrison) given 1989-90

362. Seminar on the Italian Baroque—An interdisciplinary study of the poetics of the Baroque in literature, theater, architecture, sculpture and painting. Attention to the historical context of the counter-Reformation, and to the public and political dimensions of the Baroque aesthetic. Figures studied: Tasso, Marino, Chiabrera, Bernini, Borromini, and Arcimboldo.

4 units, Win (Springer)

363. The Italian Theater from Goldoni to Pirandello—The development of Italian theater from the mid-18th century to WW II. Topics: Goldoni and the reform of the *Commedia dell’Arte*; Alfieri and the politics of neoclassical tragedy; Italian opera in the age of the *Risorgimento*; Pirandello and the crisis of bourgeois realism.

4 units (Springer) given in 1989-90

367. Italy as a Literary Symbol—(See “General Courses.”)

4 units (Allen) given 1989-90

4 units, Spr (Allen)

370-379. Specialized Seminars on Major 19th-and 20th-Century Authors and Literary Movements—In-depth critical study of the work of a single author or of a literary movement. Past seminars have included Giacomo Leopardi, Ugo Foscolo, Gabriele D'Annunzio, Luigi Pirandello, Hermeticism, Eugenio Montale, and Italo Svevo.

372. Italo Calvino: Neo-Realism to Metafiction—Calvino's development as a writer, analyzing the increasing complexity of his experiments with narrative structure and literary language, and the enduring component of fantasy in all of his narrative works.

4 units, Spr (Harrison, Jacoff)

373. Filippo Tommaso Marinetti and Italian Futurism—Marinetti's literary career in relation to the historical trajectory of the Futurist movement. Themes: theory and literary practice in Futurist writing, Marinetti's poetics of war, the manifesto as a literary genre, Futurist performance, Futurism and early Fascism.

4 units (Schnapp) given in 1989-90

382. 20th-Century Italian Poetry—The development of modern Italian poetry in relation to developments in literary theory and the field of poetics. Authors: Pascoli, D'Annunzio, Montale, Ungaretti, Quasimodo, Luzi, Zanotto.

4 units, Spr (Allen)


4 units, Aut (Allen)

385. Fascism and Culture: Seminar on Fascist Modernism—The problem of Fascist modernism approached from within an interdisciplinary/comparatist framework (1) as a problem in the relation of politics and ideology to modern culture; (2) in relation to contemporary theories of the avant-garde; (3) as an issue in 20th-century poetics, mythology, and narratology; and (4) in relation to the larger problem of interpreting the Fascist movement as a whole. Topics: Nietzsche, D'Annunzio and Fascism, Fascist "style" and rhetoric, Fascist myths of the individual and the mass subject, Fascism and Futurism, Fascism and Decadence, Fascist hermeticism, and the Fascist ritualization of violence.

4 units (Schnapp) given 1989-90

397. Reading Course on the History of the Italian Language—The Italian language in its lexical, morphological, and syntactical evolution from the 11th century to the present, emphasizing the philological analysis of literary texts. Students sign up under the sponsorship of a faculty member. Recommended: Some background in Latin.

3 units, Aut, Win, Spr (Staff)

399. Individual Work—Open to undergraduates who are working on a special project (an Honors essay) in the field of Italian studies. May be repeated for credit. See instructor for section number.

1-15 units, Aut, Win, Spr, Sum (Staff) by arrangement

460. Graduate Workshop on Pedagogy—An introduction to the theory and practice of teaching Italian, with frequent observations of a demonstration class taught by the master teacher, and regular class visitations.

2 units, Aut (Staff)

474F. Graduate Seminar on Antonio Gramsci—(Offered in Florence.) Readings from Gramsci's Prison Notebooks emphasizing Gramsci as a theorist of culture and politics. Topics: Gramsci's concept of hegemony, Gramsci on the "organic" and "traditional" intellectual, Gramsci as reader (of Dante, Machiavelli, Pirandello), Gramsci and the Risorgimento. Also, supplementary texts by Croce, Foucault, Althusser, Jameson, and others.

5 units, Win (Schnapp)

490F. Proseminar: Allegory, History, Theory, Practice—(Offered in Florence.) Seminar offers three-fold approach to the question of allegory: (1) by surveying a number of major crises in the history of allegorical interpretation in relation to changes in ancient and modern institutions; (2) by examining a variety of theoretical constructions of allegory from the Pauline epistles to Dante to Paul de Man; and (3) by studying several "disfunctional" allegorical texts (Boccaccio's Corbaccio. Topics may include: Philo Judeus's Life of Moses, heretical allegoreses of Scripture (Joaichism), psychoanalysis and allegory (dream interpretation), Jameson's Marxist redaction of four-fold exegesis in The Political Unconscious.

5 units, Aut (Schnapp)
497. Colloquium on Research Methods in French and Italian Studies—Acquaints graduate students with general and specialized resources for French and Italian studies. Emphasis on overall strategy for research, but provides an opportunity to explore bibliographical sources in each student's particular field of interest. Required of all first year graduate students.

2 units, Aut (Parrine)

498. Ad Hoc Graduate Seminars—Initiated by a group of three or more graduate students, ad hoc seminars can be set up under the sponsorship of an interested faculty member to study a subject or an area not covered by the department's regular course offerings. Arrangements must be made at least one term in advance.

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

by arrangement

499. Individual Work—For graduate students engaged in work on a special project in the field of Italian studies. May be repeated for credit. See instructor for section number.

1-15 units, Aut, Win, Spr, Sum (Staff)

by arrangement

500. Dissertation Research—Exclusively for graduate students in Italian working on dissertations.

1-12 units, Aut, Win, Spr, Sum (Staff)

by arrangement

OVERSEAS STUDIES

The following courses are approved for the Italian major and taught overseas at the campus indicated. Students are encouraged to discuss with their major advisors which courses would best meet individual educational needs. Course descriptions can be found in the "Overseas Studies" section of the bulletin or in the Overseas Studies Program office, 126 Sweet Hall.

3F. First-Year Italian, Third Quarter—Florence.

5 units, Aut, Win, Spr (Staff)

51F. Second Year Italian—Florence.

3-4 units, Aut, Win, Spr (Staff)

52F. Second-Year Italian—Florence.

3-4 units, Aut, Win, Spr (Staff)

198F. Italian Language Specials—Florence.

1-5 units, Aut, Win, Spr (Staff)

by arrangement

233F. The Literature of the City: Dante's Commedia—Florence. (DR:2)

4 units, Aut (Schnapp)

242F. Contemporary Art in the Italian Pictorial Tradition.

3 units, Aut, Spr (Rowe)

257F. Discourse of the City—Florence. (DR:5)

4 units, Win (Schnapp)

474F. Graduate Seminar on Antonio Gramsci—Florence.

5 units, Win (Schnapp)


5 units, Aut (Schnapp)

GERMAN STUDIES

Emeriti: (Professors) Helmut R. Boeninger, Gertrude L. Schuelke; (Adjunct Professor) Gertrude Mahrolz

Chairman: Orrin W. Robinson III


Associate Professor: Russell A. Berman (on leave)

Assistant Professor: Sabine Wilke

Senior Lecturers: William E. Petig, Kathryn Strachota

Lecturers: Peter Frank, Brigitte Turneare

Consulting Professor: J. Alan Pfeffer

Visiting Professors: Edgar Morscher (Universität Salzburg) Winter, Spring; Jürgen Trabant (Freie Universität Berlin) Autumn, Winter, Spring

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 coterminous programs for the A.B. and A.M. degrees in German Studies, and joint programs for the Ph.D. degree with the Graduate Program in Humanities, Comparative Literature, Modern Thought and Literature, and Linguistics.

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 Theresia and Joseph II, the Napoleonic wars, and the Revolution of 1848), and the Stanford Collection of German, Austrian, and Swiss Culture. The Hoover Institution 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, and 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 Federal Republic of Germany. Both of these professorships rotate on a yearly basis through several departments.

Haus Mitteleuropa, the German theme house at 620 Mayfield, is an undergraduate residence which is devoted to developing an awareness of the culture of Central Europe. A number of departmental courses are regularly taught at the house, and there are in-house seminars and conversation courses. Assignment is made through the regular undergraduate housing draw.

The department also houses the Institute for Basic German (J. Alan Pfeffer, Founding Director). The Institute holds a unique corpus of data on the contemporary German language, which is available for research to graduate students and faculty. Currently, the Institute is engaged in a major computer-based research project.

**UNDERGRADUATE PROGRAMS**

**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 22 or equivalent), except in the area of German Culture 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.

**German Language and Linguistics**—Students choosing this area of concentration must take 203 (History of the German Language), 211 (Syntax of Modern German), and 212 (Linguistics and the Analysis of German). Further coursework may fall into any one of the following fields or a combination of them: (1) contrastive linguistics and language pedagogy (teaching methods, curricular problems, error analysis); (2) historical German and Germanic linguistics (Introduction to the Germanic Languages, Old High German, Middle High German, Old Saxon, Old Norse, etc.); or (3) 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.

**German Literature**—Students concentrating in German Literature must take 150 and at least three approved courses at the 160 level. 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 course or a seminar in literature on the 200 level.

**German Thought**—Students who are concentrating in German Thought should take 150 and must take the Geistesgeschichte series (241-243) and normally one seminar. 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.

**German Culture 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: (1) at least 30 units of German courses beyond the 22 level, including at least four approved courses at the 130 and 160 level (130 may not be counted toward this requirement); and (2) 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

Majors with a minimum letter grade indicator of "B+" in German courses are eligible for departmental Honors. In addition to requirements listed above, each Honors candidate will submit an essay representing 6 to 9 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 "Department of English" section of this bulletin.

MULTIPLE MAJORS

Students can combine a major in German Studies with a major in any other field. By carefully selecting their courses in such disciplines as history, international relations or economics, students can prepare themselves exceptionally well in the area of Central Europe. Multiple majors are especially recommended for students spending one or more quarters at the Stanford Center in Berlin.

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 center in Berlin is given in the bulletin Overseas Studies. This program covers a great variety of courses in language, literature, culture, and other fields of Central European studies. Most credits earned in Berlin can be applied to the undergraduate major in German Studies. For courses offered in Berlin see the "Overseas Studies" section of this bulletin. Students with the equivalent of two years of German are eligible to take courses at the Free University in Berlin.

STANFORD TÜBINGEN GRADUATE EXCHANGE

Annually one or two Stanford graduate students in German Studies are accepted as exchange students by the University of Tübingen, and their counterparts from Tübingen participate in academic programs at Stanford.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the "School of Education" section of this bulletin or inquire at the Degrees Program office, School of Education.

CERTIFICATION OF PROFICIENCY IN GERMAN

In accordance with standards developed by the American Council on the Teaching of Foreign Languages and the Educational Testing Service, the department will certify a student's proficiency in German on three levels: intermediate, advanced, and superior. This certification is not tied to the number of courses taken, but is a measurement of a student's proficiency in listening comprehension, speaking, reading, writing, and culture. Detailed information is available in the department office.

GRADUATE PROGRAMS

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 normally includes:

201 and 202. Language and Style
211/311. Syntax of Modern 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 Culture studies should choose these related courses in the Central European field, in such departments as Political Science, Economics, Anthropology, or History.

All A.M. candidates must take an individual oral examination toward the end of their last quarter.

MASTER OF ARTS IN TEACHING

The degree of Master of Arts in the Teaching of German is offered jointly by the School of Education and this department. The program includes 25 units of German in courses selected in consultation with the departmental advisor. For a statement of requirements other than
German see the "School of Education" section in this bulletin.

DOCTOR OF PHILOSOPHY

The requirements for the Ph.D. include: (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, normally French; (3) a master's oral examination, unless the student already has an A.M. upon entering the program; (4) a qualifying paper; (5) a qualifying examination; (6) the University oral examination; (7) a dissertation. Students in medieval studies must also have a reading knowledge of Latin.

The first year of work, which leads to the A.M. degree, is designed to introduce each student to the three major areas of study. During the Spring Quarter of their first year of study, all students, except those admitted with a master's degree, must take an oral A.M. examination. During the examination, which lasts one hour, the student is questioned by three examiners, chosen by the student, on work undertaken in specific graduate courses.

During the summer following their first year of graduate study, students will research and write a qualifying paper. This paper, although ordinarily not meant to represent an original contribution to scholarship, should demonstrate the candidate's ability to grasp complex subject matter with sufficient competence, to organize materials, and to present arguments in a clear and concise manner commensurate with scholarly standards. After completion of the paper before the beginning of the fourth quarter of study, it is to be submitted to the department chair, who will pass it on for approval by the student's faculty advisor and a second reader appointed by the chair in consultation with the advisor.

Students who enter the program with a master's degree from another institution will submit, in lieu of a qualifying paper, their master's thesis or a major research paper as evidence of their ability to pursue advanced scholarly work.

At the end of the sixth quarter of study (and only if the qualifying paper has been accepted), the student will take a one-hour oral qualifying exam with two examiners, the student's chosen advisor and another faculty member appointed by the chair. The purpose of this examination is to demonstrate a broad familiarity with the literature of the major periods, movements, and some major figures. The department will not attempt to legislate a canonic list. Instead, each student should, on consultation with faculty members, compose a list that will allow him or her to display broad coverage of the material. The length of this examination list will vary, but 50 items of various sorts (novels, poems, philosophical excerpts, etc.) might serve as a target figure. Together the qualifying paper and the qualifying exam make up the departmental qualifying procedure. Only after successful completion of the qualifying procedure will the department approve the student's admission to candidacy.

A student who fails the qualifying examination may retake it once at the beginning of the seventh quarter. Students with heavy minor requirements (or in joint-degree programs such as Graduate Program in Humanities may postpone their qualifying examination from the end of the sixth to the beginning of the seventh quarter, thereby gaining an additional summer of reading time.

The University oral examination in the Department of German Studies consists of an area examination; on consultation with the four prospective examiners, the student will prepare a specialized list of relevant literature from an area of concentration, as well as appropriate secondary literature. The area of concentration will be considerably broader than a dissertation topic but will nevertheless allow for intensive work. Examples of areas of acceptable scope are: a 100-year period with some thematic emphasis, problems emerging from a particular genre in various contexts, a major literary movement, institutional setting, or discursive structure.

Well, in advance of the examination date (at least two weeks), the student will distribute the definitive version of the bibliography as well as a "position paper," approximately 25 pages in length, addressing some major issue in the area of study. The examination will consist of questions regarding this paper and the area bibliography. The examination lasts at least two hours, permitting each of the four examiners a 30 minute question period and reserving an optional 10 minutes for questions from the chair of the examination.

Within three months of the successful completion of the University oral, the student must submit a dissertation proposal to the department, approved by all members of the reading committee. The topic of the dissertation will normally be directly related to the area of concentration in the University oral.

All students, regardless of their future field of concentration, are expected to acquire native proficiency in German and a thorough knowledge of the grammatical structure of German. Students are strongly urged to take 311,
Syntax of Modern 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.

The department expects all Ph.D. candidates to demonstrate research skills appropriate to their special areas of study. The research requirement can be fulfilled in the capacity of either a University Fellow or a Research Assistant.

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 3 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.

For basic University requirements see the "Degrees" section of this bulletin.

AREAS OF CONCENTRATION
FOR THE Ph.D.

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
- 311. Syntax of Modern German
- 313. Transformational Grammar of German or 314. Phonology of German

Three courses in German Literature and in German Thought, with at least one course in each.

Literature—Course requirements are a minimum of two courses or seminars per quarter for at least four of the six quarters following the first year. Lecture courses and colloquia will require final examinations but not term papers. Seminars, of which the student is expected to take a minimum of two after the first year, will require research papers.

During the first year, students normally take the following program:

- 201 and 202. Language and Style
- 208A. Introductory Middle High German
- Two courses in German Literature, preferably in the 350-series. One seminar in German Literature.
- Two courses in German Thought, preferably Geistesgeschichte I and II
- One course in German Language and Linguistics.

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. Transformational Grammar of
- German
- 241. Deutsche Geistesgeschichte I
- 242. Deutsche Geistesgeschichte II
- 243. Deutsche Geistesgeschichte III
- 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).

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 "Humanities Special Programs" section in this bulletin.

Students may work toward a Ph.D. in German Studies with minors in such areas as comparative literature, modern thought and literature, medieval studies, linguistics, or German history. Students who are obtaining a Ph.D. in such combinations may require additional training.

COURSES

OVERVIEW

General Courses (given in English)
Introductory Courses (1-99)
Intermediate Courses (100-199)
Language (100-119)
Culture (130-139)
Literature (150-179)
Courses for Advanced Undergraduates and Graduates:
  Language: Skills and older dialects (201-210, 302-310). 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)
Courses for Advanced Graduate Students (400-499):
  Seminars and colloquia on special topics
  Interdepartmental courses
Independent Study:
  Undergraduates (199)
  Graduates (298)
  A.M.-level qualifying paper (301)
  Dissertation research (400)

GENERAL

(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 75.) 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. External history and internal relationships. (DR:4)

3 units (Robinson) given 1989-90

31A-33A. German Culture and Civilization I-III—(See also 131-133.) 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. Students may enroll in any part of the series.

31A. Central Europe: Geography, Institutions, and Society —A survey of geography, people, and institutions of the German-speaking areas of Central Europe—contemporary situation and historical origins. Topics: 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 WW II. (DR:3)

3 units, Win (Lohnes)

32A. The Culture of Modernism in Austria and Germany —The birth of modernism in Vienna at the turn of the century, and in the Weimar Republic, emphasizing literature, music, painting, and architecture. The connections to broad intellectual and historical developments. The works of Hofmannsthal, Mahler, Freud, Schönberg, Kandinsky, Gropius, Brecht, and Mann. (DR:2)

3 units, Aut (Wilke)

33A. Democracy, Protest, and Political Culture in German-Speaking Europe —Introduces the 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:3)

3 units, Spr (Wilke)

60A. An Introduction to the Medieval Literature of England, France, Germany, and Scandinavia (500-1300) in Translation—Readings in medieval historiography, heroic epic, romance, saga, and lyric. Designed to follow the medieval segment of Western Culture. Lectures and discussions. (DR:2)

3 units, Aut (Andersson)

174A/274A. Writings of Franz Kafka—Selected readings in translation from the stories and novels (The Trial, The Castle); major themes and enigmas of Kafka’s work; his artistic legacy
in the context of 20th-century literature. Open to non-majors.
3-5 units, Win (Gillespie)

284A/384A. Joyce, Proust, Mann—Themes, structures, and mythopoetic dimensions of the novel in the context of Modernism. Joyce, Proust, and Mann as synthesizers and interpreters of the historical situation ("decline of the West," contending -isms, WWI, etc.), forms of consciousness (Bergson, Nietzsche, Freud, Jung, et al.) and artistic expressions (opera, painting, cinema, etc.) of their age.
3-5 units, Aut (Gillespie)

390A. Seminar: The Modern Tradition— (Same as English 361.)
5 units (Berman) given 1989-90

INTRODUCTORY

First- and second-year language courses are under the direction of Walter F. W. Lohnes.

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

1,2,3. German Language and Culture—A comprehensive, balanced introduction to listening and speaking, and reading and writing.
5 units, Aut, Win, Spr (Staff)

2C. Conversational German—Enables the student to understand, and to express himself in, simple spoken German. Especially for students going to Berlin. Prerequisite: At least one quarter of first-year German.
3 units, Aut, Win, Spr (Staff) MWF 10

1P,2P,3P. Individually Programmed Beginning German—For those who wish to complete more or less than 5 units a quarter, or have a spotty background in German, or have scheduling conflicts, or prefer to work independently. Students proceed at their own pace, working on their own with the text and tapes. The instructor is available for consultation on a regular basis. Conversation classes may be attended for listening and speaking practice.
1-15 units, Aut, Win, Spr (Staff)

4. Review of First-Year German—For those who need to solidify their basic command of the language and/or have not had contact with the language for a considerable period of time.
3 units, Aut (Petig) MWF 12

5. Intensive First-Year German—Equivalent of 1, 2, and 3 combined. Enrollment limited.
12 units, Sum (Staff) MTWThF 8-9:30 and 10:30-12

10. Elementary German for Seniors and Graduate Students—Intensive course design-
ed 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.
4 units, Win (Petig) MTWTh 9
Sum (Petig) MTWThF 9

Students should consult with the coordinator of Special Language Programs in Linguistics for the following courses:

640. Beginning Danish.
642. Beginning Norwegian.
644. Beginning Swedish.

HAUS MITTELEUROPA

20A. Beginning Conversation.
1 unit, Aut, Win, Spr (Staff)

20B. Singrunde.
1 unit, Aut, Win, Spr (Staff)

20C. Advanced Conversation.
1 unit, Aut, Win, Spr (Staff)

20M. Filmkunst aus Mitteleuropa.
1 unit, Aut, Win, Spr (Staff)

Other in-house courses will be announced.

SECOND-YEAR

21. Intermediate German I—Continues the balanced approach of 1, 2, and 3. Including the systematic review of German structure, and the reading and discussion of short prose texts. Prerequisite: 3 or 4.
3 units, Aut, Win, Spr (Staff)

21C. Intermediate Conversation—Builds on the skills developed in 2C. Students are encouraged to develop fluency in expressing their own thoughts in German. Suggested continuation: 100C.
3 units, Aut, Win, Spr (Staff)

21C. Intermediate Conversation—Builds on the skills developed in 2C. Students are encouraged to develop fluency in expressing their own thoughts in German. Suggested continuation: 100C.
3 units, Aut, Win, Spr (Staff)

22. Intermediate German II—Continuation of 21, with greater emphasis on reading and writing skills. It is the final course in the introductory sequence. Prerequisite: 21. Suggested continuation: 21C, 101, 130, or 150 series.
3 units, Aut, Win, Spr (Staff)

52A-F. Readings in other Disciplines—For students with a knowledge of German (one year or equivalent) who want to acquire reading proficiency in various disciplines. Reading materials include excerpts from scholarly works and professional journals. Students may introduce material they need to read for their course work or research. Some departments accept the course in lieu of the Ph.D. reading exam. Open to undergraduate and graduate students.

52A. Readings in Economics.
3-4 units (Staff) alternate years, given 1989-90
52B. Readings in History. 3-4 units (Staff) alternate years, given 1989-90
52C. Readings in Art History—(Same as Art 190X.) 3-4 units (Staff) alternate years, given 1989-90
52D. Readings in Political Science and International Relations—(Same as Political Science 112D.) 3-4 units, Aut (Staff)
52E. Readings in Music and Music History. 3-4 units, Win (Staff)
52F. Readings in Philosophy and Religious Studies—(Same as Religious Studies 52F.) 3-4 units, Spr (Staff) MWF 12

55. Business German — Reading and discussions in German of texts dealing with the business world, i.e., economics, banking, stock market, import-export trade, Common Market. Includes a review of basic German structures. Prerequisite: 3 or the equivalent of one year of college German. 3-4 units (Petig) given 1989-90

70,80,90. Intensive German—Given only in Berlin. See “Overseas Studies” section in this bulletin. Aut, Win, Spr, Sum

INTERMEDIATE

100C. Advanced Listening and Speaking Skills—Increases fluency and precision in speaking and builds listening comprehension. Audio- and videotapes, discussions, presentations, vocabulary building exercises, interviews with native speakers. May be taken twice for credit. Prerequisite: 21C or equivalent. 3 units, Aut, Win, Spr (Staff) MWF 10

101. Reading and Writing Modern German I—Short fictional and expository texts are read and discussed. Students write short essays. Exercises cover important points of grammar, idiomatic usage, and vocabulary building. 3 units, Win, Spr (Turneaure) TTh 9

102. Reading and Writing Modern German II—Continuation of 101. 3 units, Spr (Turneaure) TTh 10

118. Introduction to German Dialects—(Same as 218, Linguistics 176.) Introduction to the major dialects of German-speaking Europe through texts, tapes, lectures, and presentations by native speakers; also, an introduction to dialect geography. (DR:4) 3 units, Win (Robinson)

119. Introduction to the Germanic Languages—(Same as 19A, Linguistics 75.) (DR:4) 3 units (Robinson) given 1989-90

130. German Newspapers—Articles of current interest in German newspapers read and discussed in German. May be taken twice for credit. Prerequisite: 22 or equivalent. 3 units, Aut (Strachota) Spr (Turneaure)

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 131, 132, or 133 and participate in a supplementary section in which further material is read and discussed in German. Students who have received credit for 31A-33A may not repeat courses in this sequence for credit.

131. Central Europe: Geography, Institutions, and Society—Prerequisite: 22 or consent of instructor. (DR:5) 4 units, Win (Lohnes)

132. The Culture of Modernism in Austria and Germany—Prerequisites: 22 or consent of the instructor. (DR:2) 4 units, Aut (Wilke)

133. Democracy, Protest, and Political Culture in German-Speaking Europe—Prerequisite: 22 or consent of the instructor. (DR:3) 4 units, Spr (Wilke)

150. Introduction to German Literature—Texts (short prose, poetry, and drama) ranging from the classical to the modern period. Introduction to key concepts of major literary periods and of literary criticism. Readings by Lessing, Goethe, Schiller, Hölderlin, Hoffmann, Eichendorff, Büchner, Heine, Nietzsche, Thomas Mann, Kafka, Brecht, and Christa Wolf. (DR:2) 4 units, Win (Turneaure)

151-157. The 150 series introduces the student to German literature in various genres. Prerequisite: 22 or equivalent.

153. Contemporary German Drama—Study of selected plays representative of major authors and trends in German theater since 1945. Readings of Brecht, Dürrenmatt, Frisch, Weiss, Handke, Kroetz, and PLENzDorf. Performances, films, tapes, and videotapes. (DR:2) 4 units, Spr (Strachota)

154. Modern Short Prose—Readings by Aichinger, Andersch, Bachmann, Bobrowski, Böll, Brecht, Frisch, Hofmannsthal, Kafka, Kunert, Mann, Nietzsche, Seghers, Wolf, and others. (DR:2) 4 units, Aut (Turneaure)

158B. Bertolt Brecht—(Same as Drama 158B.) The epic theater in theory and practice. 4 units, Spr (Esslin) MWF 1:15
advances undergraduate and graduate

201. Language and Style I—Writing exercises on different levels of style; discussion of grammatical problems; introduction to literary stylistics. Prerequisite: Qualifying examination.
2 units, Win (Lohnes)

202. Language and Style II—Continuation of 201.
2 units, Spr (Lohnes)

203. History of the German Language—(Same as Linguistics 276.) Introduction to the phonological and syntactic development of modern German from the Germanic parent language. The analysis of selected texts and the consultation of linguistic works on the subject.
3 units, Spr (Robinson)

208A. Introduction to Middle High German—Emphasis on basics of grammar and rapid reading.
3-5 units, Aut (Andersson)

208B. Advanced Middle High German II—Readings in courtly epic and romance.
3-5 units, Win (Andersson)

211. Syntax of Modern German—(Same as 311.) Contrastive analysis of English and German syntax.
3-5 units, Spr (Lohnes)

213. The Syntactic Development of German—Overview of the development of modern German syntactic patterns from the Germanic parent language. Emphasis on similarities to and differences from developments in the history of English.
3-5 units, Aut (Robinson)

218. Introduction to German Dialects—(Same as 118, Linguistics 176.)
3 units, Win (Robinson)

241-243. The history of German thought from 1750 to the present and its significance for an understanding of modern culture. Authors: Herder, Hegel, Schiller, Marx, Nietzsche, Freud, Husserl, Wittgenstein, Marcuse, and Adorno. Note: This series is given in German in alternate years (1988-89).

241. Deutsche Geistesgeschichte I—From Lessing to Romanticism. Delineates the conceptual field which, from the middle to the end of the 18th century, the problems of human knowledge, of history, of the nature of
man, and of art were revolutionized and given a new basis. Centered on readings and detailed interpretations of selected texts by Lessing, Kant, Herder, Schiller, and Fichte.

3-5 units, Aut (Trabant)

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, Win (Wellbery)

243. Deutsche Geistesgeschichte III — From Nietzsche to the present. Texts by Nietzsche, Husserl, Freud, Heidegger, Benjamin, Adorno, and Habermas emphasizing aesthetic problems and their relationship to social theory. The development of the Frankfurt School. Shorter essays on aesthetics discussed to indicate possible applications to literary theory.

3-5 units, Spr (Wilke)

251-259. German Literature and Culture I-IX — (Same as 351-359.) The major periods of German literature from the early Middle Ages to the present. Open to undergraduates by consent of instructor only.

254. German Literature and Culture IV—
(Same as 354.) From Baroque through Enlightenment (circa 1600-1750).

3-5 units, Win (Gillespie)

260-269. Major Authors—In-depth study of a major writer in his literary creativity, relation to his age, or special achievements and significance. Writers include Walther von der Vogelweide, Grimmelshausen, Wieland, Lessing, Goethe, Novalis, Tieck, Kleist, Fontane, Nietzsche, Hofmannsthal, Thomas Mann, Kafka, Brecht, etc.

3-5 units (Staff)

261. Lessing and the Enlightenment—
(Same as 361.) Lessing's literary, theological, and critical writings in the context of the European Enlightenment. The framework is primarily historical: the Enlightenment discourse is analyzed in the context of institutional changes characteristic of the mid-18th century.

3-5 units, Spr (Wellbery)

263. Rilke: Duino Elegies and Modernist Tradition—
(Same as 363.) An in depth study of Rilke's poems within the context of European modernism.

3-5 units (Mueller-Vollmer) given 1989-90

264 The Essential Goethe—
(Same as 364.) Goethe's creative genius and thought with examples of his lyrical poetry, dramatical works, narrative prose, and scientific writings. Emphasis on his views about politics, social conditions, environmental problems, women's rights, religion and his concept of "Weltliteratur."

3-5 units, Aut (Mommsen)

268. Heinrich von Kleist—
(Same as 368.) Intensive study of Kleist's work, letters, and journalistic writings, focusing on theoretical questions such as the delimitation of generic boundaries, the constitution of narrative, text and subjectivity, discourse and power, historical contextualization.

3-5 units, Aut (Wellbery)

270-279. Genres—The development, content, and formal characteristics of such kinds of writing as lyric poetry, epic, drama, novel, Novelle, tale, short story, essay, etc., in various authors or periods. Focuses on such matters as medieval drama, baroque "metaphysical" poetry, the diary as a literary form, autobiography.


3-5 units, Spr (Gillespie)

283. Goethe, Faust: A Tragedy, Second Part—
(Same as 383.)

3-5 units, Win (Mommsen)

290-299. Special Subjects and Problems—Variable topics.

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

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 (Petig)

303. Curricular Problems—Given on request only.

3 units (Lohnes) by arrangement

304. Gothic—
(Same as 204.)

5 units, Win (Anderson)
311. Syntax of Modern German—(Same as 211.)
3-5 units, Spr (Lohnes)

346. Seminar: The Structuralist Paradigm and its Transformation—(Same as Comparative Literature 369, English 369.) The elaboration of the structuralist paradigm in the work of Saussure, Jakobson, and Lévi-Strauss; its redactions in the work of Lacan, Barthes, Althusser; its transformations in post-structuralist writing (Derrida, Foucault).
5 units, Aut (Wettbery)

349H. Wilhelm von Humboldt’s Hermeneutic and Language Philosophy—(Same as 449H.)
3-5 units (Mueller-Vollmer) given 1989-90

349K. Kafka: Enigma and Agony—(Same as 449K.) Colloquium on modernist and postmodernist approaches to the artist’s work. Older and newer topics (e.g., Kafka as mystic or existentialist; psychological, sociological, mythological dimensions; Kafkasque phenomenology; the collapse of the self into writing; labyrinthine discourse; differences in American, German, French, and other critical reception, etc.) Students who have taken 274A may pursue an independent research project upon approval of instructor.
3-5 units, Spr (Gillespie)

349S. Semiotics.
3-5 units, Win (Trabant)

349T. Semiotics of Drama—(Same as Drama 354C.)
5 units, Win (Esslin) MW 10-12

350. Methods of Teaching Literature—Students may enroll for practice in literature teaching on a voluntary basis.
1-3 units, Aut, Win, Spr (Staff) by arrangement

351-359. German Literature and Culture I-IX—(Same as 251-259.) The major periods of German literature from the early Middle Ages to the present. The developing traditions that have shaped German literature. Focusing on a specific period, the literary and non-literary (cultural, social, political, philosophical) contexts are established within which individual authors, works, and movements are situated.

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 theater, 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 Enlighten-

360-369. Major Authors—In-depth study of a major writer in his literary creativity, relation to his age, or special achievements and significance, i.e. Walther von der Vogelweide, Grimmelshausen, Wieland, Lessing, Goethe, Novalis, Tieck, Kleist, Fontane, Nietzsche, Hofmannsthal, Thomas Mann, Kafka, Brecht.

361. Lessing and the Enlightenment—(Same as 261.)
3-5 units, Spr (Wellbery)

362. Seminar: Faust Plays—(Same as Drama 352.) Faust is one of the archetypal figures of Western civilization. Treatment of the subject from Marlow via Goethe to the present.
5 units, Spr (Esslin) MW 10-12

363. Rilke: Duino Elegies and Modernist Tradition—(Same as 263.)
3-5 units (Mueller-Vollmer) given 1989-90

364. The Essential Goethe—(Same as 264.)
3-5 units, Aut (Mommsen)

365. Seminar: Christa Wolf—Her works in relationship to the literature of the German Democratic Republic, women’s literature, the feminist debate about aesthetics, her reading of Romanticism, classical aesthetics and the relationship between literature and politics.
3-5 units, Win (Wilke)

366. Heinrich von Kleist—(Same as 266.) Intensive study of Kleist’s work, letters, and journalistic writings focusing on theoretical questions such as the delimitation of generic boundaries, the constitution of narrative, text and subjectivity, discourse and power, historical contextualization.
3-5 units, Aut (Wellbery)

370-379. Genres—The development, contents, and formal characteristics of lyric poetry, epic, drama, novel, Novelle, tale, short story, essay, etc., in various authors or periods. Focusses on medieval drama, baroque “metaphysical” poetry, the diary as a literary form, and autobiography.

383. Goethe, Faust: A Tragedy, Second Part—(Same as 283.) An introduction to Goethe’s most complex drama in historical context emphasizing its genesis and unity. Following the sequence of the acts and scenes, topics discussed are Goethe’s scientific views about cosmogony, his relationship to the world of the ancient Greeks and their mythology, his aesthetic ideals, his personal religious convictions, his views on women, his criticism of social, political and cultural conditions around
him including his criticism of academic life and institutions, the role of the Church, etc.

3-5 units, Win (Mommsen)

390-399. Special Subjects and Problems.

ADVANCED GRADUATE

400. Dissertation Research—Exclusively for graduate students in German working on dissertations.

1-12 units, Aut, Win, Spr, Sum (Staff)

by arrangement

449. Seminars.

449H. Wilhelm von Humboldt’s Hermeneutic and Language Philosophy—(Same as 349H.)

3-5 units (Mueller-Vollmer) given 1989-90

449K. Kafka: Enigma and Agony—(Same as 349K.)

3-5 units, Spr (Gillespie)

OVERSEAS STUDIES

The following courses are approved for the German major and taught overseas at the campus indicated. Students are encouraged to discuss with their major advisors which courses would best meet individual educational needs. Course descriptions can be found in the “Overseas Studies” section of this bulletin or in the Overseas Studies Program office, 126 Sweet Hall.

60. Special Intensive German—Berlin.

10 units, Aut (Staff)

70. Intensive German—Berlin.

6 units, Aut, Win, Spr (Staff)

80. Intermediate German—Berlin.

4 units, Aut, Win, Spr (Staff)


2 units, Aut, Win, Spr (Staff)

90. Advanced German—Berlin.

4 units, Aut, Win, Spr (Staff)


2 units, Aut, Win, Spr (Staff)

129B. Psychoanalysis and Social Theory in Modern Europe—Berlin.

5 units, Spr (Wolf)

129E. Modernism and Metropolis—Berlin.

(DR:2)

4 units, Spr (Schutte)

129F. Political Culture and Social Change in Modern German—Berlin.

5 units, Spr (Schultze)

179B. Split Images: German Film Culture, East and West—Berlin. (DR:2)

5 units, Win (Kramer)

HISTORY

Emeriti: (Professors) William C. Bark, Claude A. Buss, Gordon A. Craig, Don E. Fehrenbacher, John J. Johnson, George H. Knolles, John C. Miller, Peter Paret, Wayne S. Vucinich, Gordon Wright; (Associate Professor) Rixford K. Snyder

Chairman: James J. Sheehan


Assistant Professors: Joel Beinin, Stephen H. Haber, Nancy S. Kollmann, Richard Roberts

Courtesy Professors: Paul David, Michael Jameson, Susan M. Treggiari

Affiliated Professor: Albert E. Dien (on leave Autumn)

Senior Lecturer: Joseph J. Corn

Modern Europe Lecturers: Jessica Coope, Michael Curtin, Ronald K. Delph, Marc J. Sortor, Mary N. Wessling

Lecturers: Gordon Chang, Margo Horn, Philip J. Ethington, David R. Gress, Michael Ryan

Visiting Professor: Daniel T. Orlovsky (Autumn, Winter)

Visiting Associate Professors: Detlef Brandes (Autumn, Winter), Mary Gluck (Spring), Merry E. Wiesner-Hanks (Autumn)

Visiting Assistant Professors: Samuel Amaral, E. Wayne Carp (Autumn), Paul F. Jankowski, William Worger

Visiting Lecturers: Robert Kleiman (Winter), Kevin K. Lho

Mellon Fellow: Christopher M. Waters

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 historical fields but also to equip the student for duties as a citizen, and to give instruction which will aid in law, in journalism, in library work, in local, state, and national public service, and in business.
UNDERGRADUATE PROGRAMS

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, if possible, in the department for six quarters (counting the quarter in which the registration takes place); (2) must complete an introductory seminar; (3) must complete at least two additional small-group courses—undergraduate colloquia (reading and discussion involving an explicit historical research) or undergraduate seminar (research and writing on an explicit historical topic); and (4) must complete at least 10 courses in history with a minimum of 3 units each, and passed with a letter grade indicator of "C" or higher. The capacity to write with ease and to express oneself with lucidity is an important skill and to gain that skill requires practice; therefore, it is required that each major do a substantial amount of writing (8-10 pages at a minimum) in at least six of the courses taken toward the fulfillment of major requirements. 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 10 required courses in history and are given only for Pass/No Credit, unless such courses are part of the Honors project.

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: (1) Western Europe (including Britain), and North America (especially the colonial and national history of the present United States), all since 1700; (2) Africa and the Middle East, Asia, Latin America, Russia, and Eastern Europe; and (3) 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.

In order to encourage students to achieve some measure of expertise and to give the major a focus, it is required that a concentration of at least four courses be taken within one of the following areas and/or temporal divisions: (1) Africa, (2) Asia, (3) Eastern Europe and Russia, (4) Europe before 1700, (5) Europe since 1700, (6) Latin America, (7) the United States, or (8) a thematic subject treated comparatively, such as war and revolution, work, family history, popular culture/high culture, etc. The proposed concentration must be approved by the major advisor; a proposal for a thematic concentration must have the approval of both the advisor and the Departmental Committee on Undergraduate Studies.

History majors are required to demonstrate proficiency in a foreign language (or take specified courses in computer science and statistics in lieu of it). "Proficiency" means that the student is able to read at least at the level of facility expected in second year college level courses in a foreign language. The requirement may be fulfilled by passing a fourth-quarter foreign language course or by demonstrating equivalent knowledge.

All students planning to major in history must enroll at the History Department office, where detailed information on requirements is available.

HONORS PROGRAM

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 mid-May of senior year. Students take 12 to 15 units of Honors work, excluding the colloquium, to be distributed as best fits their program. 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, and must enroll in the Spring Quarter Honors seminar. An exception to the latter requirement may be made for those going overseas Spring Quarter of their junior year, but such prospective Honors students should consult with the Director of the Honors Program, if possible, prior to going overseas. Under exceptional circumstances, students will be admitted to the program in the Autumn Quarter of their senior year. 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 a letter grade indicator of at least "B +" in the student's previous work in history. 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.
SECONaD (HISTORY) 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

The department admits each year a limited number of undergraduate History majors to work for a coterminous 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 Admissions Committee. Students must complete 15 full-time quarters (or the equivalent), or three 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 PROGRAMS

ADMISSION

All applicants for admission to graduate work are required to take the General 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 "Guide to Graduate Admission" which is available from the Graduate Admissions office.

Students who have been admitted to graduate standing do not automatically become candidates for a graduate degree. With the exception of students in the Terminal A.M. program, they are admitted with the expectation that they will be working toward the Doctor of Philosophy degree, and may become candidates to receive the Master of Arts degree after completing three quarters of work.

MASTER OF ARTS

The department requires the completion of nine courses (totaling 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 letter grade indicator of "A," "B," or "C+.

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.

A.M. 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 the "School of Education" section in this bulletin. For certain additional requirements made by the Department of History, contact the department office. Candidates must possess a teaching credential, or relevant teaching experience.

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. Applicants for the doctoral program must proceed by two steps: First, students must apply for admission to the Ph.D. program. Those seeking admission to the program should file application during their second quarter of enrollment in graduate work at Stanford. In the Winter Quarter of their
Second year, 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.

**REQUIREMENTS**

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
   - Jewish History
   - Russia
   - Eastern Europe
   - Middle East
   - East Asia before 1600
   - East Asia since 1600
   - Africa
   - Britain and the British Empire before 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: (1) a field selected from the list below; (2) 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; (3) 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
   - Jewish History: Ancient and Medieval
   - Jewish History: Modern
   - 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
   - The History of Science

The secondary field may be satisfied by completing two graduate courses relevant to the field. The student must complete these required courses before taking the University oral examination.

5. Each student, in consultation with his or her advisor, defines a tertiary field. This requirement may be satisfied by taking two courses outside the Department of History related to the student’s training as a professional historian.

6. Each student, before the Ph. D. is conferred, is required to satisfy the department’s teaching requirement.

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. Certification of competence in commonly taught languages (i.e., German, French, Spanish, Portuguese, Russian, and Latin) for candidates seeking to fulfill the language requirement in this fashion will be done by the appropriate language department of the University. Certification of competence in other languages will be determined in a manner decided upon by faculty in the major field. In either case, certification of language competence must be accomplished before a student takes the University oral examination.

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 inde-
pendent 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 "Humanities Special Programs" section in this bulletin.

RESOURCES

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 Department of Special Collections in the Field Room of the Green Library, 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.

COURSES

See the Time Schedule for changes in course offerings each quarter. The department also maintains a bulletin board with updated information.

INTRODUCTORY

1,2,3. Europe: From the Middle Ages to the Present — This sequence fulfills the Western Culture Requirement. It explores the interrelationships between the literary and philosophical masterpieces of Western culture and political, social, and economic developments in Europe since the Middle Ages. Emphasis is 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. Meets three hours a week with lecturers from the regular history faculty and two hours a week for colloquia in small groups led by postdoctoral fellows. Enrollment is limited; students intending to apply the sequence toward their Requirement are given priority.

1. Europe: Late Antiquity, the Middle Ages, and the Renaissance—The development of Western society and culture from the fall of the Roman Empire and rise of Christianity to the advent of the discovery of the New World and the Reformation. Emphasis is on the impact of the rediscovery of classical texts and thought during the Middle Ages and the Renaissance. The texts include selec-
tions from Aristotle, Virgil, Augustine, Marie de France, Dante, Chaucer, Petrarch, Machiavelli, and Erasmus, and from the Bible. (DR:1; three-quarter se-
quence)

5 units, Aut (Wiesner-Hanks) lectures plus a two-hour colloquium

2. Europe and Beyond, 1500-1789—A survey of the intellectual and social currents of the 17th and 18th century in the West. From the Reformation to the American Revolution. (DR:1; three-quarter sequence)

5 units, Win (Lougee)

2. Europe: 1789 to the Present—European history since 1789 has been a persistent attempt to come to terms with the promise and perils of the great revolutions of the 18th century. Emphasis is on the impact of industrialization and democracy on Europe's politics, society, and culture, from the fall of the Bastille to the present. (DR:1; three-quarter sequence)

5 units, Spr (Sheehan, Staff)

21. The World Outside the West: Change and Tradition before the Age of European Imperialism—(Same as Anthropology 21). A comparison of the cultural heritages and dynamics of change in three non-Western societies before extensive contact with Western Europe. Physical environment, economy, social and political structures, and religious and ethical values in China, Nigeria, and Mexico. (DR:5*; also satisfies Area 3 when taken in sequence with History 22.)

5 units, Aut (Fox, Roberts, Van Slyke)

22. The World Outside the West in the Age of European Imperialism—(Same as Anthropology 22, Political Science 22). Confrontation and accommodation as non-European societies respond to Western Europeans, and to Western institutions and ideas, from the early 19th century to the present. Changes in production and trade, in social and political structures, and in religious and ethical values in Mexico, China, and Nigeria. Recommended: Anthropology/History 21. (DR:5*; also satisfies Area 3 when taken with 21.)

5 units (Abernethy, Van Slyke, Staff) given 1989-90

80. Culture, Politics, and Society in Latin America—(Same as Latin American Studies 80, Anthropology 100.) An interdisciplinary survey of the interaction of Amerindian, African, and European cultures in the creation of the New World societies from 1500 to the present. A basic introduction to the Latin American courses within several departments. (DR:5*)

5 units, Aut (Collier, Delaney, Phillips)

SEMINARS

These are specifically intended to introduce the undergraduate major or prospective major to the processes of historical investigation and interpretation by which archival material becomes narrative description and explanation, and by which interpretation itself becomes open to disagreement and revision. The object is to take the beginning student into the historian's workshop and to provide first hand experience in interpreting documents, in constructing a coherent story from them, in interpreting their larger implications, and in discovering why it is possible to agree on the facts but to disagree on what they mean. These courses are numbered 1 through 99 followed by the letter "S".

78. Introductory Seminar: Joan of Arc.
5 units, Win (Langmuir)

5 units, Spr (Brown)

33S. Introductory Seminar: Nationalism.
5 units, Spr (Jankowski)

5 units, Aut (McClendon)

5 units, Spr (Seaver)

44S. Introductory Seminar: Popular Culture and the Working Class in Britain.
5 units, Win (Waters)

5 units, Aut (Swett)

47S. Introductory Seminar: Black Political Thought in Africa.
5 units, Win (Worger)

5 units, Aut (Matthews)

76S. Introductory Seminar: Frontiers, Migration, and Creation of New Societies in the New World.
5 units, Win (Wirth)

5 units, Win (Van Slyke)

98S. Introductory Seminar: The Institutions of Medieval Japan.
5 units, Win (Mass)
ADVANCED UNDERGRADUATE
Courses numbered 100 through 199 are primarily lecture courses.

THE ANCIENT WORLD
See Classics, Ancient History section, for descriptions of the following courses, all of which are accepted for credit toward a major in History.

101. History of Greece—(Enroll in Classics 101.) (DR:5)
   4-5 units, Aut (Cherry)

102. Greek and Roman History from Alexander to Caesar—(Enroll in Classics 102.)
   (DR:5)
   4-5 units, Win (Cherry)

103. History of the Roman Empire—(Enroll in Classics 103.) (DR:5)
   4-5 units, Spr (Cherry)

MEDIEVAL AND RENAISSANCE EUROPE

108. The Christianization of Western Europe, 500-1350—How the Europeans came to believe in Christ; why the thought and conduct associated with that belief changed so radically; why different forms of religiosity and dramatic conflicts developed; how religious beliefs affected social organization; and how social changes modified religiosity.
   5 units, Aut (Langmuir)

110. The Age of the Reformation—(Same as Religious Studies 126.) 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 territorial and national states. (DR:3)
   4-5 units, Win (Spitz) MTWTh 11

113. Art, Religion, and Society in Late Antiquity (284-717 A.D.)—(Same as Classics 107.)
   A turning point in world history. Why did the Roman empire fall? Invaders shattered the political unity of the empire, while Christianity transformed its religion and culture. Yet, by constructing a series of tensions between old and new, secular and sacred, this “decline” created concepts and images which shaped European thinking for centuries. Visual and literary documentation. (DR:5)
   5 units, Win (MacCormack)

116A. The History of Biological Thought—
   (Same as History of Science 62; Philosophy 62; Values, Technology, Science, and Society 127.)
   4 units, Aut (Lenoir)

HISTORY OF TECHNOLOGY

115. History of Technology in Western Society, 1500-1918—(Same as History of Science 121, VTSS 121.) The interplay of technological change, and social and cultural developments from the late Middle Ages through WWI. Focus is on Europe and the U.S., with attention to contemporary technological developments in the non-western world and to the consequences there of western technologies. Topics: the mechanization and the labor process, the changing relationship of technology to science, the industrialization of warfare, technology and imperialism, and the cultural implications of new communications technologies.
   5 units, Win (J. Corn) TWTh plus section

115A. The Science/Technology Relationship: Historical Problems—(Same as History of Science 134; Values, Technology, Science and Society 134.)
   4 units, Spr (Hevly)

EASTERN EUROPE AND RUSSIA

119. Aristocracy and Absolutisms: Eastern Europe, 1300-1800—The societies and cultures of East Europe (Poland, Ukraine, Belorussia, Bohemia, Hungary) in the late medieval and early modern periods. The conflict of aristocratic parliamentary governments with absolutist states (Russia, Prussia, Austria-Hungary). Eastern Europe’s close relationship with West European social, economic and intellectual development is contrasted to the Russian historical experience.
   5 units, Spr (Kollmann)

120C. Russia in Revolution, 1861-1930—Russian history from the abolition of serfdom to the first Soviet Five-Year Plan and the collectivization of agriculture. The Russian Revolution of 1917 considered in this broader context. (DR:5)
   5 units, Win (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, and alternative futures. (DR:5)
   5 units, Win (Dallin)

123A. The Soviet Union: Politics and Society Since 1917—Major trends and events: political leadership, political process, social change and stratification, legitimacy and dissent, major conceptual frameworks used to explain the Soviet experience; alternative approaches and conflicting points of view. (DR:5)
   5 units, Win (Orlovsky)

126. Modern Poland, 1918-Present—Polish history from the revival of an independent Polish state to the 1920s.
   5 units, Aut (Emmons)
126B. History of the Czechs and Slovaks, 1848-1918.
   5 units, Win (Brandes)

127B. History of Modern Germany.
   5 units, Win (Cress)

   5 units, Spr (Jankowski)

HISTORY OF SCIENCE

133. The Darwinian Revolution—(Same as History of Science 152; Human Biology 152; Philosophy 152; Values, Technology, Science, and Society 130.)
   4 units, Win (Lenoir)

133A. The Rise of Scientific Medicine—(Same as Human Biology 151, History of Science 154; Values, Technology, Science, and Society 128.)
   4 units, Spr (Lenoir)

133B. The Sociology of Scientific Knowledge—(Same as Anthropology 158; History of Science 155; Philosophy 155; Sociology 140; Values, Technology, Science, and Society 138.)
   4 units, Spr (Lenoir)

136B. European Thought in the 20th Century—The important European thinkers and intellectual movements of the 20th century. (DR:3)
   5 units, Win (Robinson)

   4 units, Win (Galison) TTh 2:30

139. Scientific Revolution—(Same as History of Sciences 145, Philosophy 145, VTSS 125.) Social, intellectual, and institutional background of the 17th century period that established modern science. Theories of matter and motion, Descartes, Galileo, Newton, Boyle, Bacon. Historical controversies: Yates' thesis on hermeticism and magic; Merton on Protestantism and science; Hessen on the economic basis of scientific change. Readings from era texts and modern historical studies. Considers interpretations of the revolution and what is meant by science and revolution. (DR:3)
   5 units, Aut (Galison) TTh 11-12:15

139A. History and Philosophy of 20th-century Physics—(Same as Philosophy 168, History of Science 169, VTSS 126.) The philosophical questions raised by historical developments in 20th-century physics. Late 19th-century reductionist world-views leading to special and general relativity. Einstein's response. How did early workers in quantum mechanics attack the wave-particle duality? The problem of scientific realism in quantum mechanics. Nuclear fission, the bomb, and the growth of large-scale experimental high-energy physics. What is meant by "unified" field theories in contemporary physics? Readings: Scientific, historical, and philosophical texts. (DR:3)
   4 units, Win (Galison) TTh 11-12:15

BRITAIN

142. Stuart England, 1603-1688—An analysis of the conditions that led to the first of the modern revolutions, the collapse of the Stuart regime, the mid-century republican experiments, and the attempted return to royal absolutism in the Restoration era. (DR:5)
   4-5 units, Aut (Seaver)

AFRICA

147B. The History of South Africa.
   5 units, Aut (Worger)

148C. Africa in the 20th Century—Transformation of African societies during colonial rule. Resistance to colonial conquest; decline of the old elite and rise of the new one; conflicting ideologies and consciousness; nationalism; decolonization. (DR:5)
   5 units, Spr (Roberts)

149C. Introduction to African and Afro-American Studies—(Same as African and Afro-American Studies 105, Anthropology 105.)
   5 units, Aut (Staff, Jackson)
THE UNITED STATES

154. Peace Studies—(Same as Political Science 133, Psychology 142, Sociology 108, VTSS 143.) Theoretical approaches to war and peace; peace and the modern state; and morality and peace-making. Topics: conceptions of conflict and cooperation, the processes of conflict resolution, the creation of enemies, the connections between war and the development of the modern state, the policies of deterrence, conflicts between peace and justice, the moral conduct of nations, the activities of peace movements, types of pacifism and anti-war sentiment, and the relationships of war and peace to the economy and to educational institutions.
5 units, Spr (Bernstein, Drekmeier, Ross, Moses)

158. History of Education in the United States—(Same as Education 201.) Analysis of selected turning points in education in relation to religion, political socialization, race relations, gender, immigration, urbanization, and educational reform.
3 units, Spr (Tyack)

158B. American Education and Public Policy—(Same as Education 105, Political Science 186K.)
3 units, Aut (Kirst, Tyack) MW 2:15 and by arrangement

163. America and the 'Bomb': Politics, Diplomacy, and Culture in the Nuclear World, 1939-Present—(Same as History of Science 163, VTSS 164.) Issues of nuclear weapons, emphasizing their development and use on Japan; their impact on culture and society, military planning and diplomatic leverage and threats; handling of nuclear crises; efforts at disarmament and arms control; disputes over nuclear testing and fallout; development of deterrence and its critics; roles of scientists and defense intellectuals; and activities of peace movements. Readings: Vonnegut, Brodie, Oppenheimer, Teller, Stimson, JFK, and declassified files.
4-5 units, Spr (Bernstein) MTWThF 1:15

163A. Transformation of American Thought and Culture (1865 to Present)—(Same as American Studies 151.)
5 units, Win (Gilliam)

165A, B.C. United States History from the Revolution to the Present — An articulated general sequence with attention to political, social, and institutional history. The series is designed to give a broad foundation in U.S. history on which to base further work in history, literature, economics, political science, religious studies, art history, etc. Though the three parts form an integrated whole, any portion may be taken independently.

165A. 18th-Century America—(DR:5)
5 units, Aut (Carp)

165B. 19th-Century America—(DR:5)
5 units, Win (Degler)

165C. 20th-Century America—(DR:5)
5 units, Spr (Kennedy)

172A. America Since 1945—Analysis emphasizes foreign policy and politics, and deals with social themes and intellectual history. (DR:5) 4-5 units, Win (Bernstein)

173C. Introduction to Feminist Studies: Issues and Methods—(Same as Feminist Studies 101.)
5 units, Aut (Freedman)

LATIN AMERICA

177. Modern Latin America—Latin America since the early 19th century, concentrating primarily on Mexico, Brazil, Argentina, and Cuba. Emphasis is on Latin America's role in the world economy and the effect that this has had on economic growth, social structure, and politics.
5 units, Aut (Haber)

181. The Agrarian History of Latin America.
5 units, Spr (Amaral)

187A. The Middle East, 570-1718—From the rise of Islam to the decline of the Ottoman absolutism. Emphasis on the organic relationship between the Middle East and Europe throughout this period. (DR:3*)
5 units, Aut (Whelan)

187B. The Modern Middle East: 1718-Present—From the emergence of regional Arab entities and the commercial penetration of Europe to the present. (DR:5*)
5 units, Win (Beinin)

187C. Middle Eastern Women Through Film—(Same as Feminist Studies 120.) A survey of women's roles in the modern Middle East. Topics: work, religious expression, politics, and family life. Format: one film showing per week with associated lecture and discussions.
5 units, Spr (Beinin) MW 1:15-2:05
T 7-10 p.m.

188A, B. C. Jewish History from the Biblical Period to the Present—These courses are designed as a sequence, but each one may be taken independently.
not given 1989-90

188A. Jewish History from the Biblical Period to 1492—The social, political, institutional, and cultural history of the Jews from...
earliest times to the Arab conquest of Palestine in the middle of the 7th century; the conquest and settlement of Canaan, the period of the Judges, the First and Second Commonwealths, the Jews in the Hellenistic and Roman periods, the Babylonian Exile, the Mishnaic and Talmudic periods, and Jewish society in Palestine in the first half-millennium after the destruction of the Second Temple; the social, political, institutional, and cultural history of the Jews in the Islamic world, Spain, and medieval Europe; the expulsion from Spain.

5 units, Aut (Man call) MT WThF 9

188B. Jewish History from 1492 to the Present—The Jewish world in the Renaissance and Early Modern Western and Central Europe; Jewish communities in Palestine, Asia, Africa, and the New World; the Jewish world of Eastern Europe and its social and intellectual movements; the Emancipation, the Jewish Enlightenment, and the growing crisis of the East European Jewish world; modernization and westernization; the "Jewish Problem" and its solutions: assimilation, emigration, Socialism, Zionism; the Hebrew revival; Yiddish popular and intellectual culture in Eastern Europe; the American Jewish community; France and the North African Jews; Fascism, Nazism, and WWII; Palestine and the State of Israel; the crisis of Jewish identity and cohesion in the contemporary world.

5 units, Win (Man call) MT WThF 9

189C. Jewish History from the Partition of Poland to the Present—Emancipation, the Jewish Enlightenment, and the growing crisis of the East European Jewish world; modernization and westernization; the "Jewish Problem" and its solutions: assimilation, emigration, Socialism, Zionism; the Hebrew revival; Yiddish popular and intellectual culture in Eastern Europe; the American Jewish community; France and the North African Jews; Fascism, Nazism, and WWII; Palestine and the State of Israel; the crisis of Jewish identity and cohesion in the contemporary world.

5 units (Man call) given 1989-90

EAST ASIA

192B. China from the 9th to the 19th Century—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. Recommended: 192A. (DR:5*)

5 units, Win (Kahn)

192C. Modern China: 19th and 20th Centuries—The social and political setting from about 1800 to 1911 and the overthrow of the last imperial dynasty, the Republican period to 1949, and the Peoples' Republic of China to the present. Structured around political history. Attention to social, economic, and cultural cur-

RENTS. Recommended: 192A, 192B, or Political Science 115. (DR:5*)

5 units, Spr (Van Slyke)

193. Science and Technology in Traditional China—(Same as Asian Languages 153, History of Science 153.) The technological achievements and scientific undertakings of traditional China, and the ideological and social factors which aided or hindered such enterprises. (DR:5*)

5 units (Dien) given 1989-90

194A. Medieval and Early Modern Japan, 1336-1600—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 the "medievalism." Attention to socio-economic change and political developments. (DR:5*)

5 units, Win (Duus)

194B. The Rise of Modern Japan—Japanese history from 1840 to the present. The Meiji Restoration and its background; building a modern state; industrialization of the economy; emergence as an imperialist power; the re-orientation of postwar Japan; the "economic miracle." Attention to socio-economic change and political developments. (DR:5*)

5 units, Win (Duus)

195. Nomad Empires of Inner Asia—(Same as Asian Languages 152.) (DR:5*)

4 units, Spr (Dien)

UNDERGRADUATE SEMINARS AND COLLOQUIA

A number of colloquia are offered for undergraduate History majors, each consisting of reading and discussion on an explicit historical theme. Short papers, reports, and a final examination may be required. Undergraduate seminars, which differ from colloquia by their concentration on materials and methods of historical research, rather than on reading and discussion of a given body of historical literature, are also offered. The student, in writing a research paper based to a substantial degree upon original sources, has 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 a 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 involves permission of the instructor.
200A, B, C. Senior Honors.
units by arrangement (Staff)

200H. History Honors Colloquium.
3 units, Spr (Naimark)

200W. Undergraduate Directed Reading.
units by arrangement (Staff)

200X. Undergraduate Directed Research.
units by arrangement (Staff)

Directed Research: Martin Luther King, Jr. Papers Project—(Register under 200X-65.)

208. Undergraduate Colloquium: The Church-State Problem in the Middle Ages.
5 units, Spr (Langmuir)

5 units, Win (Langmuir)

211S. Undergraduate Seminar: Kant’s Critiques and the History of Science—(Same as History of Science 141S.) The way in which Kant’s critiques, especially the first and third, reflect the history of science and philosophy of science in the 17th and 18th centuries. Continuous in class text reading and interpretation.
5 units, Win (Funkenstein)

5 units, Spr (MacCormack, Ryan)

212S. Undergraduate Seminar: Kant’s Critiques and the History of Science.
5 units, Spr (Funkenstein)

213. Undergraduate Colloquium: Renaissance Humanists and Reformers—(Same as Religious Studies 141.)
5 units, Aut (Spitz)

214. Undergraduate Colloquium: The Roman Imperial Army and Frontiers—(Same as History 314, Classics 185.)
4 units, Aut (Cherry)

5 units, Spr (Cherry)

215S. Undergraduate Seminar: Jewish History—(Same as Religious Studies 225.) Selected texts from different periods and methods for their interpretation. The text is chosen from a different period each year.
5 units, Win (Funkenstein)

216S. Undergraduate Seminar: Jewish History—(Same as Religious Studies 226.)
5 units, Spr (Funkenstein)

217S. Undergraduate Seminar: The Lands and Peoples of Historical Russia.
5 units, Win (Kollmann)

5 units, Aut (Brandes)

5 units, Win (Dallin)

219S. Undergraduate Seminar: Science, Technology, and Soviet Society—(Same as VTSS 140.)
5 units, Aut (Becker)

5 units, Spr (Gluck)

224S. Undergraduate Seminar: Eastern Europe Since World War II.
5 units, Win (Naimark)

225. Undergraduate Colloquium: Society and Politics in Early Russia.
5 units, Aut (Kollmann)

226S. Undergraduate Seminar: Russian Social History Since 1861.
5 units, Aut (Orlovsky)

236B. Undergraduate Colloquium: 20th Century Political Movements.
5 units, Aut (Jankowski)

239A. Undergraduate Colloquium: The Second World War.
5 units, Spr (Craig)

243D. Undergraduate Colloquium: Empire and Race—The Decline and Fall of the British Empire in India and South Africa—Concentrating on the 19th and 20th centuries, examines in comparative perspective the heritage of conquest, economic change, "orientalism," nationalism, apartheid, and colonization.
5 units, Win (Worger)

245. Undergraduate Colloquium: Current Debates and Issues in British Social History, 1830-1914—Extensive reading of secondary works which define and contribute to current debates in Victorian historiography. Debates include: the aims and objectives of the Chartists; the social role of the labor aristocracy; the usefulness of the concept of "social control"; the interpretation of sexuality and gender roles; and the construction and representation of "Englishness" and popular patriotism.
5 units, Spr (Waters)

246A. Undergraduate Colloquium: Big Business and Race in South Africa.
5 units, Spr (Worger)

248A. Undergraduate Colloquium: Empire and Race in South Africa and the Americas.
5 units, Win (Roberts)

248D. Undergraduate Colloquium: Law in Colonial Africa.
5 units, Spr (Roberts)
249A. Undergraduate Colloquium: Africa Since 1945.
  5 units, Spr (Jackson)

250S. Undergraduate Seminar: Photographs as Historical Documents—(Same as American Studies 220, Art 231A.)
  5 units, Aut (J.Corn, W. Corn) TTh 3:15

252. Undergraduate Colloquium: Technology and American Culture—(Same as American Studies 221; Values, Technology, Science, and Society 157.)
  5 units, Spr (J. Corn) T 3:15

  5 units, Win (Kleiman)

255B. Undergraduate Colloquium: Topics in the Social and Political Transformation of American Cities, 1800-1980—Competing theories of power and social change in the study of urban America in the 19th and 20th centuries. Linking current issues of immigration, migration, homelessness, and neighborhood redevelopment to the long-term structural patterns in the creation and undoing of ethnic and racial urban communities. The urban transformation of women's work and lives, reform movements, geographic and economic mobility, the urban labor market, class formation, and the structure and distribution of power among the various groups and classes in the city.
  5 units, Win (Ethington) MW 1:15

257B. Undergraduate Colloquium: American Society in the 1960s.
  5 units, Aut (Carson)

258. Undergraduate Colloquium: Modern America in Historical Perspective—(Same as American Studies 211.) Contemporary American society in historical perspective. Topics: changes in political culture; race relations; the position of women; the condition of the family; immigration and ethnicity; America's international role; the economy; and alleged recent changes in American values.
  5 units, Win (Kennedy)

260S. Undergraduate Colloquium: The American 1960's—Thought, Protest, and Culture—(Same as American Studies 214.)
  5 units, Aut (Gillam)

261S. Undergraduate Seminar: The American Character—(Same as American Studies 200.)
  5 units, Aut, Spr (Gillam)

263. Undergraduate Colloquium: Women in America—(Same as American Studies 209, Feminist Studies 125.)
  5 units, Spr (Degler)

265A. Undergraduate Colloquium: Sexuality in American History—(Same as American Studies 213.)
  5 units, Spr (Freedman)

267A. Undergraduate Colloquium: Topics in Asian-American History.
  5 units, Spr (Chang)

270A. Undergraduate Colloquium: The Early Nuclear Age, 1939-1953.
  5 units, Spr (Bernstein)

273A. Childhood in Modern American History.
  5 units, Win (Horn)

277B. Undergraduate Colloquium: The Dilemma of Argentine Development.
  5 units, Aut (Amaral)

280A. Undergraduate Colloquium: The Economic History of Latin America.
  5 units, Win (Haber)

288. Undergraduate Colloquium: Palestine and the Arab-Israeli Conflict.
  5 units, Win (Beinin) W 2:15-4:05
  second T 2:15-4:05

290A. Undergraduate Colloquium: Japan Since 1945.
  5 units, Spr (Duus)

292A. Undergraduate Colloquium: Aspects of Chinese Economic History.
  5 units, Aut (Kahn)

297. Undergraduate Colloquium: South Korea's Emergence in the Postwar International System.
  5 units, Win (Lho)

298A. Undergraduate Colloquium: Visions of Utopia—Travellers in China.
  5 units, Win (Kahn)

GRADUATE

300W. Graduate Directed Reading.
  units by arrangement (Staff)

304C. Graduate Core Seminar in Latin American Studies—(Same as Latin American Studies 250.) An introduction to Spanish-American civilization.
  5 units, Aut (Bowser) M 2:15-4:05

  5 units, Spr (MacCormack, Ryan)

313. Graduate Colloquium: The Renaissance.
  5 units, Win (Brown)

314. Graduate Colloquium: The Roman Imperial Army—(Same as Classics 185/285.)
  4 units, Aut (Cherry)

  5 units, Win (Ryan)

319. Graduate Colloquium: Humanism and the Reformation.
  5 units, Aut (Spitz)
319A. Graduate Colloquium: Major Problems in Soviet History and Politics—(Same as Political Science 226C.)
5 units, Win (Dallin)
320A. Graduate Colloquium: Major Problems in Early Russian History.
5 units, Spr (Kollmann)
322B. Graduate Colloquium: Soviet Foreign Policy Since 1917.
5 units, Win (Dallin)
323. Graduate Colloquium: Intellectual and Cultural History of Eastern Europe—19th and 20th Centuries.
5 units, Spr (Gluck)
323A. Graduate Colloquium: Topics in Russian History.
5 units, Aut (Emmons)
5 units, Win (Orlovsky)
331D,E,F. Graduate Core Colloquium on Modern Europe.
15 units, Aut, Win, Spr (Sheehan, Jankowski, Robinson)
339A. Graduate Colloquium: The Second World War.
5 units, Spr (Craig)
341A. Graduate Colloquium: Topics in the Culture and Society of Early Modern England.
5 units, Aut (Seaver)
345. Graduate Colloquium: Current Debates and Issues in British Social History, 1830-1914.
5 units, Spr (Waters)
348A. Graduate Colloquium: The End of Slavery in Africa and the Americas.
5 units, Win (Roberts)
348C. Graduate Colloquium: Problems in the Economic History of West Africa.
5 units, Spr (Roberts)
348D. Graduate Colloquium: Law in Colonial Africa.
5 units, Spr (Roberts)
349. Graduate Colloquium: History and Anthropology.
5 units, Win (Jackson, Rosaldo)
349A. Graduate Colloquium: Africa Since 1945.
5 units, Spr (Jackson)
351A,B,C,D,E,F. Graduate Core Colloquium in American History.
30 units, Aut, Win, Spr (Carp, Degler, Carson, Freedman, Kennedy, Bernstein)
352. Graduate Colloquium: Decision-Making in International Crisis.
4-5 units, Win (Bernstein)
353. Graduate Colloquium: American-European Relations Since 1945.
5 units, Win (Kleiman)
365A. Graduate Colloquium: Sexuality in American History.
5 units, Spr (Freedman)
373A. Graduate Colloquium: Childhood in Modern American History.
5 units, Win (Horn)
376. Graduate Colloquium: Modern Latin America—Recent Trends in Historiography.
5 units, Aut (Wirth)
379. Graduate Colloquium: 19th-Century Historiography of Latin America.
5 units, Win (Amaral)
381. Graduate Colloquium: Comparative Economic History—Agrarian Structures and Agrarian Change in Europe and Latin America.
5 units, Win (Haber)
390A. Graduate Colloquium: Topics in Late Traditional Chinese History.
5 units, Aut (Kahn)
390B. Graduate Colloquium: Topics in Late Traditional and Modern Chinese History.
5 units, Win (Van Slyke)
395A. Graduate Colloquium: Early and Medieval Japan.
5 units, Aut (Mass)
395C. Graduate Colloquium: Modern Japan.
5 units, Win (Duus)

ADVANCED GRADUATE

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)
410. Graduate Seminar: Topics in Renaissance and Reformation Europe.
5 units, Win (Spitz)
411. Graduate Seminar: Kant’s Critiques and the History of Science.
5 units, Win (Funkenstein)
412C. Graduate Seminar: Kant’s Critiques and the History of Science.
5 units, Spr (Funkenstein)
415. Graduate Seminar in Jewish History.
5 units, Win (Funkenstein)
416. Graduate Seminar in Jewish History.
5 units, Spr (Funkenstein)
5 units, Aut (Brandes)
5 units, Aut (Becker)
420. Graduate Seminar: Topics in Modern East European History.  
  5 units, Spr (Naimark)
421A. Graduate Seminar: Topics in Russian History.  
  5 units, Win (Kollmann)
421B. Graduate Seminar: Topics in Russian History.  
  5 units, Spr (Emmons)
422A. Graduate Seminar: Introduction to Graduate Research on Soviet History and Politics (I).  
  5 units, Spr (Dallin)
424. Graduate Seminar: Eastern Europe Since World War II.  
  5 units, Win (Naimark)
426. Graduate Seminar: Russian Social History Since 1861.  
  5 units, Aut (Orlovsky)
433A. Graduate Seminar: 19th Century Europe.  
  5 units, Aut (Sheehan)
  5 units, Aut (Kennedy)
473. Graduate Seminar: Women's Family and Sexual History.  
  5 units, Win, Spr (Freedman)
479A. Graduate Seminar: Modern Mexico.  
  5 units, Spr (Haber)
480A. Graduate Seminar: Economic History of Brazil, Argentina and Uruguay.  
  5 units, Spr (Amaral)
  5 units, Spr (Mass)

OVERSEAS STUDIES

The following courses are approved for the History major and taught overseas at the campus indicated. Students are encouraged to discuss with their major advisors which courses would best meet individual educational needs. Course descriptions can be found in the Overseas Studies section of this bulletin or in the Overseas Studies Program office, 126 Sweet Hall.

109V. The Age of the Renaissance—Florence. (DR:5)  
  5 units, Aut (Brown)
120V. History of Eastern Europe—Krakow.  
  4 units, Spr (Baran)
130V. Survey of French History, 1715 to the Present—Tours. (DR:5)  
  5 units, Aut (Green)
135V. U.S. and Western Europe After World War II—Florence. (DR:5)  
  4 units, Win (Maminarella)

144V. British Empire and the Commonwealth—Oxford. (DR:5)  
  4 units, Spr (Rizvi)
216V. The Structure of the City—Florence. (DR:5)  
  5 units, Win (Brown)
227V. Introduction to German History: 900-1870—Berlin. (DR:5)  
  4 units, Win (Neckenig)
230B. Berlin: Its History, Politics, and Culture—Berlin. (DR:5)  
  4 units, Aut (Neckenig)

PROGRAM IN THE HISTORY OF SCIENCE

Associate Professors: Peter Galison, Wilbur Knorr, Timothy Lenoir
Committee in Charge: (Co-chairs) Peter Galison (Philosophy and Physics), Wilbur Knorr (Classics and Philosophy); James Adams (Engineering), Barton Bernstein (History), Nancy Cartwright (Philosophy), John A. Dupré (Philosophy, teaching overseas, Spring), Francis Everitt (Physics), Marcus W. Feldman (Biological Sciences), Alexander Fetter (Physics), Burton Richter (SLAC), James J. Sheehan (History)
Affiliated Faculty: Raymond Clayton (VTSS), Joseph J. Corn (VTSS), Albert E. Dien (Asian Languages, on leave Autumn), Amos Funkenstein (History), Henry Lowood (Bibliographer Stanford Libraries)
Visiting Scholar: Bruce Hevly

The Program in the History of Science serves as a focus for activities at Stanford relating to the historical and contemporary aspects of science. This includes sponsoring a series of colloquia in which speakers from history of science and technology, history, philosophy, medicine, and the sciences address current problems in the history of science. Further, the program collaborates with the University library's special collections in the history of science and cooperates with other departments and programs in the administration of undergraduate and graduate majors. History of Science courses at the graduate and undergraduate level are offered covering the period from antiquity through the 20th century. Instruction is designed to accommodate a wide range of students' preparations in the humanities, social sciences, and sciences.

The structure of the program will require students to define and pursue their own areas of investigation according to the rubrics of an indi-
Individually designed major under the administration of the Dean of Undergraduate Studies' Advisory Committee on Individually Designed Majors. It is also possible for students with philosophical interests to concentrate in history and philosophy of science as a sub-major of Philosophy (see the "Philosophy" section of this bulletin).

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, Bldg. 200, room 33.

COURSES

60. The Growth of Scientific Knowledge—(Same as Philosophy 60.) Introduction to the philosophy of science, especially the nature of scientific theory change, and the idea of scientific progress. Readings by prominent 20th-century philosophers (Hempel, Popper, Kuhn, Lakatos, and others). Case studies of actual historical scientific/philosophical debates. A writing focus course. (DR:3)

5 units, Win (Dupré) MWF 11

62. History of Biological Thought—(Same as Philosophy 62, History 116A, VTSS 127.) A survey from ancient times to the present treating the growth and changing nature of biological thought in historical context as represented through classic controversies: teleological versus mechanistic explanations, vitalism, reductionism, the units and levels of biological organization, the origins of life, development, inheritance, and evolution.

4 units, Aut (Lenoir) MWF 11

113. Plato's Cosmology—(Same as Philosophy 113, Classics/Greek 155.) The system of world order and creation that Plato elaborates in Timaeus. His debt to earlier thinkers: materials from the Presocratic natural philosophers, and the Hippocratic medical writers. The impact of Plato's system: discussions from Aristotle (On the Heavens, Metaphysics), and Lucretius (On the Nature of Things). Issues: Is the world unique? Is it finite or infinite? Was it created, or is it eternal? Does the order in the world result from natural necessity or intelligent design? For additional credit, with appropriate preparation in Greek language, an extra weekly section is offered on passages from the Greek texts.

4-5 units, Spr (Knorr) TTh 10 plus section Th 2:30

121. History of Technology in Western Society, 1500-1918—(Same as History 115, VTSS 121.) The interplay of technological change, and social and cultural developments, from the late Middle Ages to WWI. Focus is on Europe and the U.S. with attention to contemporary technological developments in the non-Western world and to the consequences there of western technologies. Topics: the mechanization and the labor process, the changing relationship of technology to science, the industrialization of warfare, technology and imperialism, and the cultural implications of new communications technologies. Discussion section mandatory for VTSS majors.

4-5 units, Win (J. Corn) TTh 10 plus optional section Th 3:15-5:05

134. Science/Technology Relationship: Historical Problems—(Same as History 115A, VTSS 134.) Seminar on the development of science/technology relationships in rhetoric and practice, from early 19th-century organizations for the advancement of science in Germany, Great Britain, and the U.S. to the creation of the postwar concept of "basic research," and from chemical research underlying the dye industry to quantum electronics. Identifies the mutual influences of rhetoric and practice, and of science and technology.

4 units, Spr (Hevly) TTh 11-12:15


138A. Ancient Period—(DR:3; also satisfies Area 6 when taken in sequence with 138B or 138C.)

4 units, Aut (Knorr) MWF 2:15

138B. Middle Ages to Newton—(DR:3; also satisfies Area 6 when taken in sequence with 138A or 138C.)

4 units, Win (Knorr) MWF 2:15

138C. Newton to Einstein—(DR:3, also satisfies Area 6 when taken in sequence with 138A or 138B.)

4 units, Spr (Magnus) MWF 2:15

140. Topics in the History of Mathematics: From Antiquity to the 17th Century—(Same as History 138D, Philosophy 140.) Origins and development of concepts and techniques in their social and philosophical context. Emphasis on ancient Greek geometry, its adoption of the idea of proof and interaction with early philosophy, its application in optics and mechanics, its significance and limitations.

3 units, Win (Knorr) TTh 2:30
141. Kant's Critiques and the History of Science—(Same as History 211.) Undergraduate/graduate seminar. The way in which Kant's critiques, especially the first and third, reflect the history of science and philosophy of science in the 17th and 18th centuries. Continuous text reading in class and interpretation.

10 units, Win, Spr (Fundkenstein) W 2:15-4:05

145. Scientific Revolution—(Same as History 139, Philosophy 145, VTSS 125.) The social, intellectual, and institutional background of the 17th-century period that established modern science. Theories of matter and motion, Galileo, Descartes, Bacon, Boyle, and Newton. Historical controversies: Yates' thesis on hermeticism and magic; Merton on Protestantism and science; Hessen on the economic basis of scientific change. Readings from era texts and modern historical studies. Considers interpretations of the revolution and what is meant by science and revolution. (DR:3)

5 units, Aut (Galison) TTh 11-12:15

147. Science in the Enlightenment—Scientific ideas and institutions in Europe during the 18th century, from Newtonianism to criticisms of Enlightenment science based on romanticism and historicism. The expression of the "analytic spirit" in rational mechanics, chemistry, geology, and systematic biology, including interactions with philosophy and literature. Relationship of science to the Industrial Revolution. The social diffusion of science through academies, societies, popularization, and new publishing forms; the Encyclopédie and the moral weeklies. Enlightened absolutism and the cameral sciences in Germany. Readings from 18th-century texts and recent historical studies (Hankins, Hahn, Baker, Darnton, Gillispie, Paul, Hufbauer). (DR:3)

4 units, Win (Lowood) MWF 10

152. The Darwinian Revolution—(Same as Philosophy 152, History 133, Human Biology 152, VTSS 130.) The conceptual developments leading to the establishment of the major unifying paradigm of biological science, the theory of evolution by natural selection. Biological thought before Darwin, 1750 to 1836. The formation of Darwin's thought in terms of its broader intellectual and social context; attention to the Origin of the Species. The difficulties the theory had to overcome and their resolution in the union of evolutionary biology and population genetics.

4 units, Win (Lenoir) MWF 9

152B. Darwinism and Social Ideology in the 19th Century—(Same as Philosophy 152A, English 119Z, Oxford campus.) Darwin's ideas and influence in terms of scientific knowledge (vis-à-vis religious belief) and power, (vis-à-vis class, race, and gender).

5 units, Spr (Dupré, Gagnier)

153. Science and Technology in Traditional China—(Same as Asian Languages 153, History 193.) The technological achievements and scientific undertakings of traditional China, and the ideological and social factors which aided or hindered such enterprises. (DR:5*)

5 units (Dien) given 1989-90

154. The Rise of Scientific Medicine—(Same as History 133A, Human Biology 151, VTSS 128.) The intellectual, social, and institutional dimensions of the rise of scientific medicine in the 19th century. How did medicine become "scientific"? What differences did it make to the physician? Why did scientific medicine display other approaches to medicine? Focus is on developments in France, Germany, and England from 1750 to 1912, and in the U.S. from 1890-1912. The development of experimental physiology and biomedical technology and their claimed contributions to the medical revolution of the 19th century. The concrete relationships of scientific developments in physiology, pharmacology, and bacteriology to changes in medical practice and therapy. The patterns of professionalization of medicine in different national contexts. Were the forces driving the professionalization of medicine in these contexts the same or different? How the institutional structure of the medical profession differed according to its local context.

4 units, Spr (Lenoir) MWF 9

155. The Sociology of Scientific Knowledge—(Same as Anthropology 158, Philosophy 155, History 133B, Sociology 140, VTSS 138.) Some of the classical problems in the sociology of knowledge as represented in the writings of Marx, Durkheim, and Mannheim. Recent work in the social construction of scientific knowledge. Emphasis on recent studies in the historical sociology of experimental science and laboratory practice. Using detailed case studies and drawing on anthropological approaches in the works of Mary Douglas, Pierre Bourdieu, etc., a theory of practice and a critique of historically situated practical reasons is explored as the foundation for the sociology of scientific knowledge.

4 units, Spr (Lenoir) MWF 11

159. Neurosciences, Technology, and Values—(Same as VTSS 148.) Historically based discussion on the neurosciences in relation to the concept of human personality. Emphasis on the emergence of modern views of the structure and function of the brain, related diagnostic and
psychotherapeutic technologies, and the implications of these developments for human values. Limited enrollment, consent of instructor.

4 units, Spr (Clayton) MWF 1:15-2:05

163. America and "The Bomb": Politics, Diplomacy, and Culture in the Nuclear World, 1939-Present—(Same as History 163, VTSS 164.) Nuclear weapons, their development and use on Japan, their impact on culture and society, military planning and diplomatic leverage and threats, handling of nuclear crises, efforts at disarmament and arms control, disputes over nuclear testing and fallout, development of deterrence and its critics, role of scientists and defense intellectuals, and activities of peace movements. Readings: Vonnegut, Brodie, Oppenheimer, Teller, Stimson, JFK, and declassified files.

4-5 units, Spr (Bernstein) MTWThF 1:15

168. History and Philosophy of 20th-Century Physics—(Same as Philosophy 168, History 139A, VTSS 126.) The philosophical questions raised by historical developments in 20th-century physics. Late 19th-century reductionist world-views leading to special and general relativity. Einstein’s response. How did early workers in quantum mechanics attack the wave-particle duality? The problem of scientific realism in quantum mechanics. Nuclear fission, the bomb, and the growth of large-scale experimental high-energy physics. What is meant by “unified” field theories in contemporary physics? Readings: scientific, historical, and philosophical texts. (DR:3)

5 units, Win (Galison) TTh 11-12:15

237A,B,C. Graduate Colloquium: Methods in History and Philosophy—(Same as Philosophy 237A,B,C.) Contemporary methodological and historiographical problems in the history of science based on readings from the history of physics, biology, chemistry, and medicine. Diverse approaches: “internal,” philosophical, institutional, Marxist, sociological, and anthropological. Guest lecturers from a variety of specialties. After an introduction of core material, students pursue an individual research topic in consultation with the instructor.

3 units each quarter, Aut, Win, Spr (Cartwright, Galison) Th 4:15-6:05

OVERSEAS STUDIES


4 units, Spr (Guarnieri)
with each other and with their environments. Knowledge gained from such considerations gives students an appreciation and understanding of the problems and process in the development, analysis, and implementation of public policy.

The program offers excellent preparation for advanced study in specific natural and social science disciplines and related professions such as medicine, law, and education, but it also is a superb broad, liberal arts education for responsible citizens and those who plan to pursue careers in public policy.

**OFFERINGS**

The curriculum is designed for those students who desire a knowledge of the science of biology integrated with an understanding of the behavioral and social sciences. The program draws its faculty from the various departments and schools of the University. To complete the requirements for the major, students must take courses from the offerings of the program and from the course listings of other academic departments of the University. The program culminates in an A.B. in Human Biology.

There is no graduate program in Human Biology at Stanford, but students are well prepared to enter advanced training in biology, the behavioral and social sciences, medicine, law, education, or public policy, depending on their choices of upper division courses. Undergraduates in Human Biology can enter co-terminal master degree programs in a number of other departments of the University.

A computer facility for the use of majors is housed in Building 80, Inner Quad. Additional information about the major can be obtained from the program offices.

### UNDERGRADUATE PROGRAMS

**BACHELOR OF ARTS**

The degree of Bachelor of Arts in Human Biology requires a minimum of 83 units in the major divided between 4 different levels of courses:

1. **Introductory Level**—At least 35 units at the introductory level, to be taken as follows:
   - Human Biology Core .................. 24
   - Statistics ........................ 3-5
   - Policy Course ..................... 3-5
   - Human Biology 197 ................. 4
   
   Courses which satisfy the statistics requirement are: Statistics 60, Psychology 60, or Biological Sciences 141. A list of courses which will satisfy the policy requirement can be obtained from the department offices.
   
   The internship requirement (Human Biology 197) is an independent field experience project which should be planned in consultation with the Director of Internships.
2. **Foundation Level**—Foundation coursework (20-unit minimum). These courses will vary depending on the exact program designed by the student and will be selected in consultation with a faculty advisor.
3. **Area of Concentration**—The area of concentration consists of a minimum of five courses totaling at least 20 units. This in-depth area of study should enable the student to focus on his/her educational and post-baccalaureate goals. All but one course in the area of concentration must be courses which are listed by or cross-listed with other academic departments of the University. In select cases, up to 5 units of Honors units may be included. Final approval of the area of concentration rests with the student’s faculty advisor. All area of concentration courses must be taken for a grade.
4. **Upper Division Courses**—Students are required to take three Human Biology upper division courses. Students are expected to enroll in courses not directly related to their area of concentration. One upper division course may be taken Pass/No credit. Any upper division course used to fulfill the program’s policy course requirement may not be used in the student’s foundation, area of concentration, or as one of the three required upper division courses.

A prospective major should consult with the student advisors to obtain more detailed information about the program and to obtain guidance in the development of an individual course of study. At the time the major is declared, the student must submit a brief written statement of academic and long-term goals and a proposed roster of courses which will satisfy the requirements for the major. The proposal will be reviewed by the student advisors who will then help the student select an appropriate faculty advisor. Final approval of the student’s proposed course of study rests with the faculty advisor.

Students who plan to pursue graduate work should be aware of admission requirements of the schools to which they intend to apply. Early planning is advisable to guarantee completion of requirements of the major as well as those of graduate schools.

The Honors program provides majors with an opportunity to do individual research and write a thesis for which up to 15 units of credit can be earned (see 198 under “Courses”).

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 internship. The Honors thesis is to be submitted by the middle of Spring Quarter graduation year.

COURSES

INTRODUCTORY

The Human Biology Core courses (2A and 2B, 3A and 3B, and 4A and 4B) are a sequence 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. Any deviation from the core sequence must have the consent of the Program Chairman. Freshmen are not permitted to enroll in the core. In order to fulfill requirement for DR:4, 5, and 7, the entire core (2A, 2B, 3A, 3B, 4A, 4B) must be completed.

All the components of the fundamental program, the core, a public policy course, and a statistics course, are to be taken for a grade by majors with the exception of the internship (197) which is taken Pass/No Credit exclusively.

2A,B. Genetics, Evolution, and Ecology—2A is an introduction to basic principles of Mendelian genetics, evolutionary theory, and population biology. Topics: population genetics, population dynamics, and community ecology. Emphasis is on genetics of the evolutionary process with applications to human populations. 2B is an introduction to the evolutionary study of human diversity. Hominid evolution, the origins of social complexity, and contemporary cultural diversity. Emphasis is on the concept of culture and its influence on human differences.

2A. Genetics, Evolution, and Ecology—(DR:7; entire sequence 2A, 3A, 4A must be completed.)
4 units, Aut (Durham, Staff) MWF 9

2B. Culture, Evolution, and Society—(DR:4 and 5; entire sequence 2B, 3B, 4B must be completed.)
4 units, Aut (Wolf, Staff) MWF 10

3A,B. Properties of the Individual: Adaptation and Development of Social Processes—3A: the basic principles of the biology of cells, including the biochemistry of energetics and metabolism, the nature of membranes and organelles, molecular genetics and the mechanisms of gene expression. Also, human developmental biology, emphasizing principles. 3B: adaptation and maladaptation during infancy, childhood, and adolescence. Concepts from social and developmental psychology, and sociology are introduced as individual, institutional, and societal contributors to adaptation. Prerequisite: 2A,B.

3A. Properties of the Individual—(DR:7; entire sequence 2A, 3A, 4A, must be completed.)
4 units, Win (Bernfield, Staff) MWF 9

3B. Adaptation and the Development of Social Processes—(DR:4 and DR:5; entire sequence 2B, 3B, 4B must be completed.)
4 units, Win (Feldman, Staff) MWF 10

4A,B. The Human Organism, Adaptation and Social Control—4A: organ system physiology, beginning with coverage of basic principles of neurobiology and endocrinology, and the functions of the organs of the body. The understanding of neurobiology and endocrinology leads to discussion of mechanisms of control, regulation, and integration of organ systems function. 4B: defense mechanisms and adaptation at the level of the individual and social controls at the institutional and social levels. The interaction between 4A and 4B is illustrated by physiological and behavioral homeostasis, relationships between hormones and behavior, policies of drug regulation, and issues of health care.

4A. The Human Organism—(DR:7; entire sequence 2A, 3A, 4A must be completed)
4 units, Spr (Heller, Staff) MWF 9

4B. Adaptation and Social Control—(DR:4 and DR:5; entire sequence 2B, 3B, 4B must be completed.)
4 units, Spr (Kitchadourian, Staff) MWF 10

ADDITIONAL OFFERINGS

1. Genes, Culture, and Human Diversity—(Same as Anthropology 2.) Introduction to genetic and cultural evolutionary theory as applied to the analysis of human diversity. A case study approach illustrates general principles of evolution and emphasizes similarities and differences between genetic and cultural change. Introduces Mendelian genetics, molecular biology, Darwinian theory, the modern synthesis, concepts of culture, cultural diversity, marriage and kinship, and cultural evolution. Recommended for those considering the Human Biology Core. (DR:5* or DR:7*)
3 or 5 units, Spr (Durham)

3 units, Win (Katchadourian)
40. Public Decisionmaking Regarding Human Health— (Same as Health Research and Policy 220.) The goals: understand the role of health care and disease prevention in maintaining health; to develop a working knowledge of the organization, financing, and regulation of health care in the U.S.; to learn to carry out analyses of health policies and assess the validity of analyses carried out by others; and to understand the logical basis for decision making in health policy. Overview of health policy formulation from several perspectives. Social, ethical, political, legal, and economic implications. A group research project is a major part of the course. Small sections meet weekly. Prerequisite: Human Biology Core. 4 units, Spr (Bunker) MWF 11

41. Public Decisionmaking Regarding the Human Environment—Introduces and sensitizes the class to the complexity of public decisionmaking in the national and international environmental arena; how biological information is accommodated in policy- making and how technically-trained people contribute to the policy process. Required section exercises and policy research projects. Prerequisite: Human Biology Core. 4 units, not given 1988-89

60. Colloquium on Population Studies— (Same as Biology 183, Food Research 188/288.) Series of talks by distinguished speakers, introducing students to a wide variety of topics in population studies. 1 unit, Win (Feldman, John) W 4:10-5:30

ADVANCED

Advanced courses are open to non-majors with the proper prerequisites. Human Biology majors have preference when enrollment must be restricted.

101. Medical and Social Impact of Disease— Lectures, discussions, and student projects explore the medical, emotional, and societal costs of eight common diseases selected from etiologic groups: infectious, traumatic, metabolic, degenerative, toxic, neoplastic, drug induced, and genetic. Readings from current and historical primary medical, psychological, economic, and policy literature supplement lectures and projects. Prerequisites: Human Biology Core and upper division status. Recommended: Background in Human Physiology. 4 units, Spr (Lavry, Staff)

102. Evolutionary Ecology— (Same as Biology 115.) The fundamental concepts of evolutionary ecology. Topics: population growth equations; foraging; reproductive and life history strategies; predator/prey, competitive and mutualistic interactions among species; and basic principles of biogeography. Discussion sections consider the application of concepts to contemporary environmental and agricultural problems. Prerequisites: Human Biology Core, Biology Core, or equivalent; calculus through Mathematics 20 or 41 or equivalent; or consent of the instructor. Limited to 75. 4 units, Win (Martorett) TTh 9-10:50

104. Psychosocial Aspects of Aging—Survey on common stressors of middle age and later life, and coping strategies employed to address them. Depression and dementia: how they are manifest, what is known about etiology and treatment, and what the research gaps are at present. Students are exposed to successful interventions used with individuals patients and/or family members to reduce burden and stress. Also, the interface between physical and mental health through topics (e.g., nutrition) by guest lecturers. Issues in long term care (alternatives to nursing home placement for those in need of extensive physical and emotional support). Hypotheses why some middle aged and older adults develop significant psychosocial problems while others with the same kinds of stressors, do not. Field work optional. 3 units, Spr (Gallagher) MW

106. Introduction to Epidemiology— (Same as Food Research 138.) Topics: basic techniques of epidemiology, models of transmission of infectious diseases and of epidemic behavior, design of immunization programs, epidemiology of chronic diseases, and the role of health care programs in controlling infectious diseases. Case studies from developed and developing countries. Prerequisites: Human Biology core or Biology core or equivalent, and Mathematics 21 or equivalent. 5 units, Win (John) MW 1:15-3:05

110. Nutritional Problems of Developing Nations— (Same as Food Research 250, Anthropology 250.) The various malnutrition syndromes common in developing countries, emphasizing protein-calorie malnutrition, nutritional anemias, and vitamin A deficiency. Methods and techniques of nutritional assessment applicable for use in developing nations. Also, 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. Prerequisites: Human Biology 120 or equivalent. 5 units, Win (Martorell) TTH 9-10:50

111. Human Physiology— (Same as Biological Sciences 112.) The functioning of organ systems emphasizing mechanisms of control and regulation. Topics: structure and function of the endocrine and central nervous systems, cardiovascular
112. Educational Policy—Factors which influence the decision-making process at the local, state, and federal levels of American public and private education. A writing intensive course; students utilize peer review and collaborative techniques to develop papers which confront contemporary issues. Students plan and participate in a simulated, video taped, professional conference. Lectures/discussion. Prerequisite: Human Biology Core.

3 units, Win (Morgan)

113. Biology and Evolution of Language—(Same as Anthropology 5, Linguistics 5.) Lecture on the biology, function, and evolution of the organs of speech and the brain. Topics: animal communication; non-verbal communication; language structure; the biology and physics of speech; speech disorders; color terminology and color vision; biological influences from language universals and acquisition. (DR:4)

5 units (Fox) not given 1988-89

114. Evolutionary Anthropology—(Same as Anthropology 181.) Seminar on the relationships between genetic and cultural evolution in human populations. Reviews major new works relating genes, culture, and human diversity (including sociobiology, cultural transmission theory, Darwinian culture theory, and coevolution) emphasizing theoretical issues and empirical case studies. Teams of students conduct original research projects and report to the class. Prerequisite: Human Biology 1 or consent of the instructor.

4 units (Durham) not given 1988-89

115. Humans and Viruses—Human virology and selected topics illustrate important concepts in biology and the social sciences. Main foci on vaccination and the eradication of disease, AIDS, herpes viruses, cancer viruses, and viral evolution. Perspective is broad: e.g., molecular biology of genetic shift and drift in influenza virus, cellular tropism of HIV (AIDS virus), development biology or virally induced birth defects, clinical aspects of infantile diarrhea, social aspects of the common cold, policy issues of blood antibody tests, cultural factors in the transmission of kuru. Prerequisite: Human Biology Core or consent of the instructor.

3 units, Win (Siegel)

116. Eye and Implications of Vision—Seminar on the workings of the eye, and how vision influences human endeavors. Compares the human eye to the specialized eye of animals. Visual illusions and influences of the eye on visual physiology in art, history, and literature. Prerequisite: Human Biology Core, Biology Core, or consent of the instructor. (Non-science majors welcome.)

3 units, Win (Marmor)

117. Development of Science Education Policy—Controversial topics in science education (e.g., teaching of evolution, teleology and anthropomorphism, gender bias, text selection, recruiting and retraining qualified teachers, goals of science teaching for different populations). The substance and style of formulating policy for science education in the U.S., now and in the recent past. Emphasis on current issues for local, state, and federal authorities, particularly appropriate governmental roles in the selection of content, the improvement of teaching, and research. Attention to primary, secondary, and the undergraduate programs, and also the use of museums and the media in a comprehensive program to improve science education. International comparisons where appropriate.

3 units, Win (Atkin)

120. Human Nutrition—(Same as Food Research 147, Latin American Studies 147.) Introduction to human nutrition including the function, digestion, absorption, and metabolism of nutrients, dietary recommendations and standards, and a general overview of national nutrition problems. Prerequisite: Human Biology core or consent of instructor.

4 units, Aut (Martorell, Bray) MWF 10


4 units, Win (Martinez-Alter)

123. Biological and Policy Aspects of Abnormal Fetal Development—Human development and some social and legal implications, and governmental interventions relevant to these issues. Topics: chromosomal abnormalities; aspects of pre-implantation development, in vitro fertilization and embryo transfer; post-implantation development, emphasizing neural tube effects and teratogens; screening for inherited diseases, including prenatal diagnosis, therapeutic abortion; biological and social determinants of low birth weight, and means for
its prevention. Lectures/discussion. Limited to juniors and/or seniors. Limited to 24 students. Prerequisite: Human Biology Core or Biology Core, or consent of instructor.

4 units, Spr (Bernfield)

125. Legal and Political Perspectives on Biology and Technology—(Same as VTSS 150.) How legislatures, courts, and regulatory agencies deal with contemporary issues related to biology and technology. Issues: computers and privacy; carcinogens and legislation; tobacco and the law; risk-benefit analysis and politics; the workplace issues of equal pay and job safety; and government and corporate accountability in a time of rapid technological and scientific change. Introduction to the workings of law, politics and regulation. Emphasizes student research, finding data, library and live, analyze it, understand how the government works and why interests compete, and use the skills of written and oral presentation to educate and persuade. Limited to 40 students.

4 units, Spr (McBride) TTh 3:15-4:45

128. Biosocial Aspects of Sexually Transmitted Diseases—The evolution of policy and research in the field of sexually transmitted diseases (STDs). The term "venereal disease" was limited to a few conditions, including gonorrhea and syphilis; new STDs number in the 20's, and include chlamydia, herpes, and AIDS. The historical, legal, and psychological implications of these diseases and syndromes provides a perspective on the current political and social problems of STDs. The basic understanding of the biology, epidemiology, and impact on health of STDs is necessary for intelligent discussion. Leaders in their fields present their perspectives on STD policy, research, history, anthropology, sociology, law, special populations, or diseases. Format is lecture, or debate, with discussion following to present areas of active controversy in strategies for control and research. An in-depth understanding on one interface between social policy and the biology and epidemiology of a disease by writing and presenting a policy-oriented research paper is required. Evening sessions may be required. Limited to 25 students. Prerequisite: Human Biology Core or consent of instructor.

5 units, Spr (McBride) TTh 3:15-4:45

131. The Great Neglected Diseases of Mankind—Ancient diseases are the major cause of disability and death in the Third World in spite of advances in modern medicine resulting in unprecedented improvement of human health and longevity in the developed world. Commitment to obtain permanent solutions for eradication requires multidisciplinary approaches including scientific research and public policy issues of cultural and socio-economic conditions of developing nations. Course participants are scientists, historians, public servants, government officials, private sector, and physicians dedicated to the improvement of world health.

3 units, Spr (Heller, Staff)

134. Ecological Anthropology—(Same as Anthropology 164.) Seminar on ecological analysis in anthropology emphasizing patterns of covariation between social systems and ecosystems. Sample societies from diverse habitats (arctic, desert, tropical rainforest, ocean islands, mountain tops) motivate the exploration of theoretical topics including cultural evolution, adaptation, optimal foraging, resource management, population dynamics, resource competition, warfare, and social stratification.

3 or 5 units, Aut (Durham)


5 units, given 1989-90

137. Human Populations: Birth, Death, and Disease—(Same as Food Research Institute 137; graduate students register for 237.) Biological factors shaping patterns of fertility, mortality, and disease in human populations. Topics: basic principles of demography, anthropology, and epidemiology; birth interval dynamics; infant and child mortality, infectious diseases; the impact of nutrition on fertility, mortality, and morbidity.

5 units (John) given 1989-90

142. The Impact of AIDS—AIDS as a viral infection, in terms of disease pathology and the spread of the virus. This provides a solid foundation for understanding the impact of the AIDS upon biology, medicine, and society and provides the tools for thinking of ways to stop the transmission of the AIDS virus, emphasizing education. The cultural aspects of AIDS with perspectives from sociology, law, economics, and politics. Students help teach elementary and high school students about AIDS as part of a student speakers bureau. Prerequisite: Human Biology Core or consent of the instructor. (Non-science majors welcome.)

3 units (Siegel) not given 1988-89

143. Early Experience—(Same as Psychology 190A.) Experimental literature related to the effects of pre- and postnatal environmental factors on development and adult function.
Animal and human research, and behavioral and physiological function. Prerequisite: Human Biology Core or consent of instructor.

3 units (Levine) not given 1988-89

148. Environmental Policy—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 on the U.S.; international perspective is used when appropriate. Main points: definition and description of environment 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 discussion hours per week. Enrollment limited to 15 Human Biology seniors. Prerequisites: Human Biology Core and 40 or 41, or with consent of the instructor.

3 units, Spr (Ehrlich, Anne)

150A. Biosocial Aspects of Birth Control—(Same as Chemistry 137A.) The introduction of a new, practical birth control agent or procedure involves legal, political, cultural, and economic factors in addition to purely biological ones, and illustrates how components enter into major policy decisions. Deals with a critical evaluation of the logistic aspects of human fertility control and on "hardware" and "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. First half: lectures, selecting the population groups and task forces: and individual discussions with each task force. Part II: library and field work, the completion of written task force reports and oral presentations to the class. The selection of students is based on the desire to create a multidisciplinary student group (divided between males and females) with different undergraduate backgrounds (Pre-Medicine, Pre-Law, Biological Sciences, Anthropology, Chemistry, Economics, Political Science, Psychology, etc.). Focus is on logistic aspects of a common topic in the birth control field. Limited to 35 students. Pre-registration is essential using questionnaires available from the Human Biology office. Prerequisite: At least junior standing.

6 units (Djerassi) not given 1988-89

150C. Seminar: Feminist Perspectives of Birth Control—(Same as Feminist Studies 145.) In most societies human fertility control responsibility rests predominantly with wom-
en. Is this desirable and realistic, or should changes be instituted? Participants in the seminar choose specific aspects of this problem and address themselves, in the form of research papers, to possible answers. Preregistration is essential using special preregistration forms available from the Human Biology office. Limited to 15 seniors. Under exceptional circumstances junior standing considered.

6 units, Aut (Djerassi) TTh 1:15-4:05

151. The Rise of Scientific Medicine—(Same as History of Science 154, History 133A, VTSS 128.) The intellectual, social, and institutional dimensions of the rise of scientific medicine in the 19th century. How did medicine become "scientific"? What differences did it make to the physician? Why did scientific medicine displace other approaches to medicine? Focus is on developments in France, Germany, and England from 1750 to 1912, and the U.S. from 1890-1912. The development of experimental physiology and biomedical technology and their claimed contributions in the medical revolution of the 19th century. The concrete relationships of scientific developments in physiology, pharmacology, and bacteriology to changes in medical practice and therapy. The patterns of professionalization of medicine in different national contexts. Were the forces driving the professionalization of medicine in these contexts the same or different? How the institutional structure of the medical profession differs according to its local context.

4 units, Spr (Lenoir) MWF 9

152. The Darwinian Revolution—(Same as History of Science 152, Philosophy 152, History 133, VTSS 130.) The conceptual developments leading to the establishment of the major unifying paradigm of biological science, the theory of evolution by natural selection. Biological thought before Darwin 1750 to 1836. The formation of Darwin’s thought in terms of its broader intellectual and social context; attention to the Origin of the Species. The difficulties Darwin’s theory had to overcome and their resolution in the union of evolutionary biology and population genetics.

4 units, Win (Lenoir) MWF 9

153. U.S. Agriculture: Interaction of Biology and Economics—(Same as Food Research 145.) Agriculture in the U.S. is shaped by biological and economic influences. Issues: plants and their genetic manipulation, soil and water conservation, pest control, agroecosystems, and food processing and preservation technologies. Focus is on assessing long-run biological, environmental, and economic consequences of agricultural practices, their interaction, and the way in which policy affects these practices.

3 units (Archibald) given 1989-90
154. The Biosocial Aspects of Cancer—(Same as Radiation Oncology 154.) Aspects of cancer as a biological phenomenon and as a clinical, emotional, and societial problem. The diagnosis and treatment of human neoplasms, their psychosocial and economic impact, and the organization of cancer care and research. Emphasis on specific control mechanisms operative in vitro and/or in vivo and delineation of their influence in an attempt to characterize differences between normal and malignant growth. Prerequisite: Human Biology Core or consent of instructor. Limited to 30 students.

4 units, Aut (Staff)

159. The Social Impact of the New Biology—Focus is on the biological principles underlying genetic engineering (recombinant DNA, monoclonal antibodies, etc.) and exploration of social issues raised by this 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 public regulatory agencies, relationship between science and morality emphasizing genetic engineering. Enrollment limited to 20. Prerequisite: Human Biology Core or consent of instructor.

3 units, Aut (Rae-Venter)

160. Primate Biology—The factors that shaped the evolution and behavior of non-human primates. Emphasis on the diverse ecological niches, social adaptations, and reproductive strategies of living primates. The unique features of the primate brain and endocrine system with respect to physiological basis of behavior. Approaches to conserving and breeding primates for the future. Prerequisite: Human Biology Core or consent of the instructor.

3 units, Aut (Hayashi)

162. The Ecology of Mental Health Care—The environmental influences on the process of diagnosing and treating mental illness. Psychological, political, philosophical, and legal dimensions of problems. 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.

3 units (Spiegel) not given 1988-89

163. Introduction to Psychopharmacology—Molecular, cellular, and systematic psychopharmacological mechanisms integrated with principles of human neurophysiology, the diagnosis and treatment of common neuropsychiatric disorders and the social problems of drug use and dependency. Prerequisite: Human Biology Core or consent of instructor.

3 units, Aut (Lawry)

166. Cardiovascular Disease Prevention and Epidemiology—Epidemiological, biological, and behavioral perspectives of cardiovascular disease and the assessment and modification of risk factors relating to it. The potential for disease prevention examined within the context of the major preventive trials. Public policy ramifications. Topics: weight control, smoking, Type-A behavior, and exercise. Enrollment limited to 35. Prerequisite: Human Biology Core or consent of instructor.

4 units, Aut (King)

167. Molecular Biology of Central Nervous System Development—Molecular events underlying the development of the mammalian central nervous system. Topics: embryogenesis and morphogenesis of the CNS, neuronal development lineage and pluripotential of developing neurons and molecular controls which determine CNS development. Control of biochemical events taking place in neurons as development unfolds. Genetic diseases in animals and humans illustrate the critical role of heredity in CNS maturation. Draws heavily on the principles of regulatory biochemistry, neurobiology, and molecular biology. Recommended: Biology 153 and/or 154; prior coursework in cell biology, biochemistry, neurobiology, and molecular biology. Prerequisites: 3A, 4A or Biology 31, 32.

5 units, Spr (Claramello, Wong)


4 units, Spr (Matteo)

171. Adolescence—Adolescence viewed from anthropological, sociological, psychological, and psychiatric perspectives. Topics: physical, physiological, and cognitive development, identity, peer group, parent/child relations, impact of school and college, vocational development, and problem outcomes. Prerequisites: Human Biology Core or Psychology 111, and a statistics course.

4 units, Spr (Feldman)

172. Adulthood—(Same as Education 299X.) The biological, psychological, and social perspectives on adulthood as a phase of life. Topics: the concept of adulthood, stage theories and longitudinal studies; biological aspects of development to adulthood; consolidation of psychosocial and gender identity, interpersonal rela-
173. Medical Ethics—(Same as Philosophy 78.) Philosophical analysis of moral dilemmas in healthcare from the perspective of the health care professional and the concerned layman (patient, family member, or observer). Traditional insights about rights, compassion, respect for persons, and other moral matters illuminate such issues as euthanasia, informing vs. lying to seriously ill patients, treatment of deformed newborns, and the just allocation of scarce lifesaving therapies.

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

174. Child, Family, and State—An introduction to family law issues examining how law distributes power and responsibility among the child, family, and the state. The moral, philosophical, and legal issues relating to newborns, child abuse, and neglect; and problems relating to divorce, child custody, and child support; adolescent’s rights emphasizing policy issues relating to teenage pregnancy, contraception, and abortion: Prerequisite: Human Biology Core or consent of the instructor.

3 units, Aut (Cohon) MWF 11

175. Child, Family, and the State. The moral, philosophical, and psychological changes at midlife. Lectures followed by discussion sections. Prerequisite: Human Biology Core or consent of instructor for other undergraduates. Preregistration required.

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

176. Child, Family, and State—An introduction to family law issues examining how law distributes power and responsibility among the child, family, and the state. The moral, philosophical, and legal issues relating to newborns, child abuse, and neglect; and problems relating to divorce, child custody, and child support; adolescent’s rights emphasizing policy issues relating to teenage pregnancy, contraception, and abortion: Prerequisite: Human Biology Core or consent of the instructor.

3 units, Aut (Cohon) MWF 11

177. Undergraduate Seminar: Social Psychology of Physical Deviance and Disability—(Same as Psychology 177.) The issues faced by the disabled and the physically deviant. Focus is on interaction problems (short term and long term). Emphasis on the data needed to formulate policy changes. Enrollment limited by application process.

3 units, Aut (Hastorf) W 1:15-3:30

178. Aging: From Biology to Social Policy—(Same as Anthropology 140.) The ranks of the elderly. What can we expect when we get there? What are the biological processes that contribute to aging? Are these processes the same across all populations and cultures? What is the interaction between the biological processes of aging and the social status of the elderly in our and other cultures? What are the cultural, social, and economic consequences of a large population of elderly people? What implications do they have for social policy? These questions are addressed through readings, lectures, films. Students are assisted in carrying out research projects and working with the elderly. Those with strong clinical interests should enroll in Medicine 210.

3-5 units, Win (Barnett)
instructor, and taken from areas of current importance and activity in neurochemistry. Judicious selection of topics and articles will be at the cutting edge of neuroscience and offers a unique opportunity to watch the progress of a rapidly moving field. Emphasis on critical reading and evaluation of current literature, and coherent presentation of topic material. Limited to eight Human Biology seniors. For students with a prior background in neurochemistry. Prerequisites: Permission of the instructor and either 167 or Biochemistry 200, and Neurobiology 200. 

3 units, Spr (Ciaranello)

197. Internship in Human Biology—Required of all program majors. Offers the opportunity to augment formal course work with a supervised field, community, or laboratory experience of their own choosing. To be arranged in advance and initiated at least three quarters prior to graduation. Limited to majors in Human Biology. Course graded pass/no credit exclusively.

4 units (Sutton) by arrangement

198. Honors Program—In-depth research on a question that needs to be answered or a problem that needs to be solved. Students explore research interests and available opportunities with their faculty advisor and the Director of the Honors Program when they declare the major. Two sponsors, one a member of the Human Biology faculty, are required to approve a project and the written proposal. Students attend periodic seminars. At the conclusion of the project, a final paper providing evidence of rigorous research, fully referenced, and written in an accepted scientific style is submitted to the program. An Honors Symposium is in early May, when each student gives a 20-minute oral presentation followed by a brief question and answer session. A maximum of 15 units may be awarded.

1-15 units (Morgan)

199. Directed Reading/Special Projects—Independent study. Students must consult with Program’s Academic Assistant for explicit requirements.

(Staff) by arrangement

HUMANITIES SPECIAL PROGRAMS

Emeriti: (Professors) John W. Dodds, Paul H. Kocher, Lawrence V. Ryan
Chairman: Paul Robinson
Professor: Kurt Mueller-Vollmer (German Studies and Humanities, on leave 1988-89)
Program Coordinator and Lecturer: Helen Brooks

Honors Program Committee in Charge:
P. Robinson (Chairman); Beverly Allen, Helen Brooks, Gregory Freidin, Marsh McCall

Graduate Program Committee in Charge: Paul Robinson (Chairman); Theodore Andersson, Denise Boling, Eckart Förster, Sabine MacCormack, Eden Quainton, Jürgen Trabant

Honors Program Committee in Charge:

1. Honors Program in Humanities
2. Graduate Programs in Humanities
   a) Master of Arts
   b) Joint Ph.D.
3. American Studies. (See the “American Studies” section in this bulletin.)
4. Medieval Studies. (See the “Medieval Studies” section of this bulletin.)

HONORS PROGRAM

The Humanities Honors Program aims to heighten the student’s sense of the relations among various humanistic disciplines, and to increase awareness of the basic humanistic values—intellectual, aesthetic, literary, historical, social, and ethical.

ADMISSION

Freshmen and sophomores interested in the program should obtain information from the program office. Application to the program 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.

Students who are admitted to the program may enroll as Humanities majors:

1. If they choose a major in Humanities concentrating in Comparative Literature (see the “Comparative Literature” section in this bulletin).
2. If they choose a major in Humanities concentrating in Modern Thought and Literature (see the “Modern Thought and Literature” section in this bulletin).
3. If they are granted permission, through petition to 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 should 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

1. Completion of the Western Culture Requirement: 15 units, freshman year, with a letter grade indicator (LGI) of at least “B” and an “A-” or better in at least one quarter of the sequence. Students who think that they may wish to enroll in the program are urged to select Humanities 61, 62, 63 to fulfill the Western Culture Requirement. (A student who has not completed Humanities 61, 62, 63 may be required to take one or more additional courses as specified by the committee in charge of the program.)

2. Humanities 90: 5 units, sophomore year.

3. Unless students have strong intellectual reasons for doing otherwise, they should choose their non-Western required courses from Areas 2 or 3.

4. Two different Humanities Seminars in the series 190-199: 10 units, junior year.

5. Honors Essay: A critical essay on a topic of general importance and approved by the Committee (2 units Spring Quarter, junior year; 5 units Autumn Quarter, and 5 units Winter Quarter, senior year). An LGI of at least “B” is required on the essay for graduation with Honors in Humanities.

GRADUATE PROGRAMS

MASTER OF ARTS

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 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 304-306 (the remaining three courses in “The Western Traditions”), 353, 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 20 or 24 units during the second year, for a total of 40 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 by noting the field in the “Statement of Purpose” 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 chairman, specifying the courses that will be used to fulfill the requirement of three seminars or proseminars in an established field.

Each A.M. program will be approved 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 reading knowledge 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.

JOINT Ph.D.

The Graduate Program in Humanities supplements the Ph.D. programs of certain Stanford students, especially in the Departments of Classics, Drama, Education, English, French and Italian, German Studies, History, Modern Thought and Literature, Philosophy, Religious Studies, Slavic Languages and Literatures, and Spanish and Portuguese, with an interdepartmental program devoted to the study of the Western tradition. Although the program draws upon the important texts and ideas which have traditionally been of common concern and interest to all humanistic disciplines, each seminar usually focuses on specific topics or sets of problems and then attempts to strike its own balance between historical, literary, philosophical, and other possible orientations. 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 chairman; 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 six successive quarters, but no particular pattern is enforced.

Graduate students who are not members of the program may enroll, by consent of the chairman, in offerings whose enrollments are not filled by members of the program. Limits: 25 in 301-305; 18 in 306.

REQUIREMENTS
1. Continued satisfactory work in the student's major field, in accordance with departmental requirements.
2. Completion of the six historical seminars (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. Completion of 353, Theory of the Humanities and the Functions of the University.
4. At least one quarter of teaching for the Humanities Department, normally as a teaching internship in the third or fourth year, though other interdisciplinary teaching 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 chairman, 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 chairman.

COURSES
See the Time Schedule each quarter for changes in listings.

61, 62, 63. Western Thought and Literature — An introduction to fundamental ideas of the past. Emphasis is on the interconnection of literature, the arts, and philosophical and social thought in shaping the Western cultural traditions from the ancient to the contemporary world.

HUMANITIES SPECIAL PROGRAMS

61. The Ancient Near East, Greece, and Rome—The Hebrew Bible, Homer, Sappho, Aeschylus, Sophocles, Euripides, Plato, Aristotle, Cicero, Epictetus, Virgil, the Gospels. (DR:1; three-quarter sequence)
5 units, Aut (Edwards, Staff) MTW 11 plus 2 hours by arrangement

62. The Middle Ages and the Renaissance—St. Augustine, Boethius, Beowulf, Chaucer, More, Machiavelli, Montaigne, Shakespeare, Milton, Voltaire. (DR:1; three-quarter sequence)
5 units, Aut (Evans, Staff) MTW 11 plus 2 hours by arrangement

63. The Enlightenment to the Present—Rousseau, Goethe, Wordsworth, Flaubert, Marx, Nietzsche, Freud, Virginia Woolf, T.S. Eliot. (DR:1; three-quarter sequence)
5 units, Spr (Lindenberger) MWF 11 plus two hours by arrangement

90. Introduction to the Humanities Honors Program—Basic themes and issues of the humanities as treated in important works from various humanistic disciplines. Prerequisites: Completion of the Western Culture requirement and enrollment in the Humanities Honors program. Enrollment restricted to students in the Humanities Honors program. (DR:2 or DR:3)
5 units, Aut (Harvey) TTh 2:15-4:05
Spr (Yearley) MW 3:15-5:05

175. Individual Work—For students in the Humanities Honors program with definite objectives not met by current course offerings.
2-5 units, any quarter (Staff) by arrangement

190-197. Interdepartmental Seminars on the Nature of the Humanities—Students in the Humanities Honors program are required to complete two of these seminars; other students may enroll in them only by consent of the director. Prerequisite: 90.

191. History and the Humanities.
5 units, Aut (Wilke) MW 1:15-3:05

192. The Arts and the Humanities.
5 units, Aut (Robinson) T 1:15-4:05
Th 1:15-3:05

193. Philosophy and the Humanities.
5 units, Win (Moravcsik) TTh 1:15-3:05

194. Literature and the Humanities—The critical study of major texts; theory and practice of criticism.
5 units, Win (Trabant) by arrangement
Spr (Brooks) TTh 2:15-4:05

197. Modernism and the Humanities.
5 units, Win (Harrison) M 2:15-5:05
Spr (Freidin) F 1:15-4:05
464 SCHOOL OF HUMANITIES
AND SCIENCES

200A, B, C. Honors Essay—A critical essay of about 15,000 words. Limited to Humanities Honors students.

200A. 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. Honors Essay: Continued Study and Writing—Regular meetings with tutor. Prerequisite: 200A.
5 units (Staff) by arrangement

200C. Honors Essay: Conclusion—Regular meetings with tutor; submission of complete first draft to tutor by end of quarter. Prerequisite: 200B.
5 units (Staff) by arrangement

GRADUATE

275. Directed Reading.
2-5 units (Staff) by arrangement

299. Internship.
1-3 units (Staff) by arrangement

301-306. 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 Greek Period.
4 units, Aut (McCall) TTh 4:15-6:05

302. The Roman Period.
4 units, Win (MacCormack) TTh 4:15-6:05

303. The European Middle Ages.
4 units, Spr (Andersson) TTh 4:15-6:05

304. From Renaissance and Reformation to the Enlightenment.
4 units, Aut (Trabant) MW 4:15-6:05

305. From Enlightenment to Modernism: The 18th and 19th Centuries.
4 units, Win ( Förster) MW 4:15-6:05

306. The 20th Century—Normally taken after completion of 301-305.
4 units, Spr (Perloff) MW 4:15-6:05

353. Theory of the Humanities and the Functions of the University—The history and character of the several branches of the humanities; their methods and approaches; their relation to one another and to the other human studies, especially the social sciences; the articulations of these disciplines in modern universities and learned societies; analysis of the humanities today at Stanford University and their relation to University policies, governance, and administration. Prerequisites: Completion of two or more seminars in the sequence, 301-306, and advance consent of the instructor.
2 or 4 units, Spr (Halliburton) by arrangement

INTERNATIONAL POLICY STUDIES

Chair: Barton J. Bernstein

The Master of Arts Program in International Policy Studies (IPS) is administered by Ms. Barbara Burwick, Bldg. 200, room 17. Telephone: (415) 725-0715.

GRADUATE PROGRAM

MASTER OF ARTS

The program is an interdisciplinary curriculum designed for both a liberal education and preparation for an internationally oriented career in either the private sector or in government. This program presupposes the completion during the student's undergraduate career of an unusual number of specifically prescribed courses essential for graduate work. Students seeking admission to the program from schools other than Stanford must, therefore, supply a description of coursework to be considered in connection with their application for admission to this program.

The IPS program is designed to provide an understanding of the historical processes that gave rise to the contemporary world scene; training in economics and political science to analyze the international activities and policies of governments and important private interests; and work in greater depth on the culture of one major world area such as East Asia or Latin America or, alternatively, on a major topic or world problem such as economic development. Training in accounting and computer science; and proficiency in one modern foreign language are further components of the program.

IPS requires the completion of 45 units of approved courses (which may include accounting and computer science but not course credit for a foreign language), at least 25 units of which must be at the graduate level.

ADMISSION

New enrollment in the program is limited annually to about 15 students. Admission to the program requires a letter grade indicator average of 3.5 or higher in the major and overall.

Students may enter the program in two different ways:

Early Admission for Stanford Undergraduates—Because of the extensive undergraduate preparation which the program requires, undergraduates at Stanford may apply for admission during their senior year. Such applicants are in effect regarded as participants in a coterminal degree program involving their undergraduate major department and this program. For these students, admission to the
program requires an up-to-date transcript, two letters of recommendation from university-level instructors, a 10-12 page research course paper, and a statement of relevant personal, academic, and career plans and goals. Application is made through the International Relations office, Bldg. 200, room 17. Prior to making formal application, students should review a statement entitled "The Master of Arts Program in International Policy Studies," available from this office. Thereafter, they should obtain a "Petition for Admission to the Coterminous Degree Program," and the "Coterminous Degree Program Sheet," complete these items, have them approved by both their undergraduate departmental representative and the International Relations office, and file the completed petition, the Program Sheet, and a transcript with the Graduate Program office, Bldg. 590, room 104. The closing date for filing applications and supporting credentials for admission is November 14 of the senior year.

Admission at the Graduate Level—Applicants for admission to the program at the graduate level from schools other than Stanford or applicants from Stanford who did not apply in their senior year should submit the form entitled "Application for Admission to the Graduate Division" to the Office of Graduate Admissions and provide the credentials and information required by that office including a statement setting forth relevant personal, academic, and career plans and goals. Applicants will be expected to have an A.B. or B.S. degree from an accredited school. Applications for admission to the graduate level are accepted only for the Autumn Quarter, and must be filed together with supporting credentials, including among other materials, one paper of at least seven pages and three recommendations, by the preceding January 1.

DEGREE REQUIREMENTS

The degree of Master of Arts in International Policy Studies will be awarded to students in the program who have fulfilled the following requirements:

1. Met satisfactorily all departmental, University, and program requirements for their A.B. degree. It is expected that most participants in the program will be undergraduate majors in international relations, political science, or economics. While other backgrounds are possible and acceptable, it seems improbable that they would supply any very substantial amount of the prescribed undergraduate preparation. In such cases, it would be necessary for the student to make up the missing undergraduate work, and the time required to qualify for the A.M. degree would increase correspondingly.

2. Completed satisfactorily all requirements for the A.M. degree in International Policy Studies. These are described in detail in the aforementioned statement on International Policy Studies, and set forth in "Degree Requirements: Field and Courses." The requirements involve specified courses and seminars normally to be completed in the space of five years (four undergraduate and one graduate). Forty-five of these units must be completed while enrolled for three terms with graduate standing at Stanford with 25 units at the graduate level. These are normally taken during a student's fourth or fifth year. Students entering the program at the graduate level, however, can receive degree credit for these 25 units only if the work has been done during their graduate enrollment at Stanford.

3. Completed and filed their "Program Proposal for the Master's Degree" before the last day of classes of the first quarter of enrollment as a graduate student. When completing this form, students should list no more than 45 of the most appropriate course units. Coterminous students must be sure to list 45 unduplicated units, that is units for courses not counted toward the undergraduate degree.

Undergraduate financial aid is not normally available for coterminous students completing their fifth year. University-based financial aid is not available for graduate students entering the IPS Program.

INTERNATIONAL RELATIONS

Committee in Charge: Barton J. Bernstein, Chair (History); Peter Duus (History), Nina Halpern (Political Science), Terry Karl (Political Science), Stephen Krasner (Political Science), Daniel Okimoto (Political Science), Scott Pearson (Food Research Institute)

Affiliated Faculty: Elie Abel (Communication), David Abernethy (Political Science), Orazio Attanasio (Economics), Joel Beinin (History), Barton J. Bernstein (History), Bruce Bueno de Mesquita (Sociology), George Collier (Anthropology), Alexander Dallin (History and Political Science), Larry Diamond (Sociology), Albert Dien (Asian Languages), Sanford Dornbusch (Sociology), Peter Duus (History), Terence Emmons (History), Richard Fagen (Political Science), Amos Funkenstein (History), Alexander George (Political Science), Geoffrey Garnett (Political Sci-
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 citizens who will be sensitive to the complexities of relations among different cultures, sophisticated in their ability to think about world affairs, and capable of doing 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, International Politics. After that, prospective majors will develop their own programs, in conjunction with advisors, as outlined below.

UNDERGRADUATE PROGRAMS
BACHELOR OF ARTS

The degree of Bachelor of Arts in International Relations requires the completion of at least 50 units in the major, including both Political Science 35, International Politics, and one course in American foreign policy. In addition, each student is required to demonstrate proficiency in a language other than English, equivalent to at least two years of university-level instruction. All majors in International Relations are expected to have an overseas study experience (as in the Stanford Overseas Studies Program) or its equivalent. International Relations majors are also required to take at least two courses from the Economics Department. Two may be in Cluster C, or one in Cluster C and one in "related" work (Economics 51 or 52). One course within the major may be taken for a pass/no credit grade. Finally, International Relations majors are required to complete a minimum of 10 units either in social science or history courses dealing with the student's geographical or topical area of concentration, or in economic analysis (Economics 51, 52, or both).

Other course requirements will depend on the cluster which the student chooses as the focus for his or her program. Cluster A encompasses courses that emphasize political and historical aspects of international relations. It is strongly recommended that at least one course on security issues be taken in Cluster A. Cluster B focuses on humanistic aspects of relations among national cultures, and Cluster C constitutes a set of policy-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 a faculty advisor. Students must declare the International Relations major before the senior year by submitting an acceptable proposal to the chairman of the program. Double majors or students fulfilling International Relations as a secondary major also are required to file a proposal before the senior year.

Students who have already been accepted as majors in the program may petition for credit for courses not listed in this section of the bulletin or in the updated course lists in the International Relations office. 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 more than half the course work deals with international materials. ("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.)

Extradepartmental courses and freshman and sophomore seminars 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.
HONORS PROGRAM

The International Relations Honors program offers qualified students the opportunity to conduct a major independent research project under faculty guidance. Such a project requires a high degree of initiative and dedication, significant amounts of time and energy, and skill in research and writing.

In their junior year, students consult with prospective Honors advisors, choose the courses that will provide academic background in their area of inquiry, demonstrate an ability to conduct independent research, and write a formal thesis proposal. In their senior year, students write the thesis with a first draft due early in the Spring Quarter. Seniors are also expected to discuss their research methods, problems, and findings with other students in the program, and with faculty sponsors, in a series of informal discussion sessions.

Prerequisites for participation in the Honors program include: a 3.5 letter grade indicator in International Relations courses, an overall strong academic record, successful experience in writing a research paper, and submission of an acceptable thesis proposal. Normally, students receive 15 units of credit for their Honors project, spread out over three quarters. Five of these units may count toward the required 50 units in the major; an additional 5 may be used to fulfill the requirement of 10 units of related coursework. Further details of the International Relations Honors program are available from the program office.

GRANTS

The International Relations program invites its undergraduate students, particularly juniors, to apply for funds to finance research or intensive study on forces that transcend national borders. These grants are intended primarily for use during the summer between the junior and senior year by students writing senior 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 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 creativity and intellectual promise of the project and the preparation of the student are major considerations in awarding these funds.

GRADUATE PROGRAMS

MASTER OF ARTS

It is possible for students majoring in International Relations to work simultaneously for a coterminal master's degree in a number of related fields. Coterminal students should consult advisors in both departments or programs to make sure they will fulfill the degree requirements in both fields. For information on the A.M. program in International Policy Studies, see the "International Policy Studies" section in this bulletin.

COURSES

It should be noted that course offerings at Stanford often change after this bulletin's copy is sent to the printer. Students are advised to check each quarter's Time Schedule carefully. See departmental listings for (DR) notations.

Political Science 35, International Politics, counts as a Cluster A course and is a required course for all majors.

CLUSTER A: POLITICAL-HISTORICAL EMPHASIS

22. The World Outside the West in the Age of European Imperialism—(Enroll in Anthropology 22, History 22, Political Science 22.) Confrontation and accommodation as non-European societies interact with Western Europe from the 19th century to the present. Changes in economy, social and political structures, and religious and ethical values in Peru, China, and Nigeria. Recommended: Anthropology 21/History 21. 5 units (Staff) given 1989-90

25. Colonialism and Nationalism in the Third World — (Enroll in Political Science 25.) A comparative historical analysis of European exploration, conquest, and colonial rule in Latin America, the Caribbean, Africa, and Asia. Factors affecting the timing, character, and effectiveness of nationalist movements in the Third World. Impact of colonialism on post-colonial political and economic systems. (DR:5*) 5 units, Aut (Abernethy)

35. International Politics—(Enroll in Political Science 35.) A variety of approaches to the study of world politics including realism, idealism, Marxism, and bureaucratic politics. WW I, the nuclear arms race, and international economic relations. The normative and policy implications of different theories. Enrollment limited to 450. (DR:5) 5 units, Aut (Krasner)

52D. Readings in Political Science and International Relations—(Enroll in German Studies
52D, Political Science 112D.) For students with a knowledge of German (one year or equivalent) who want to acquire reading proficiency in international relations. Reading materials include excerpts from scholarly works and professional journals. Students may introduce material they need to read for their course work or research. Open to undergraduates and graduate students.

3-4 units, Aut (Lohnes)

90S. Introductory Seminar: The Korean War—Watershed in Asia—(Enroll in History 90S.)
5 units, Win (Van Slyke)

113A. Politics and Development in Latin America—(Enroll in Political Science 113A.)
Survey of the major political systems in Latin America, the patterns of economic and social development associated with them, and their historical and international contexts, usually Brazil, Mexico, Cuba, and Argentina. (DR:5)
5 units, Spr (Packenham)

115. Politics in the People’s Republic of China—(Enroll in Political Science 115.)
5 units, Aut (Halpern)

116. European Politics and Society (II)—(Enroll in Political Science 116B.)
The rebuilding of bourgeois Europe and the rise of Fascism and National-Socialism following WW I, and the national reconstruction and regional integration in the aftermath of WW II. Emphasis on the rise of the modern welfare state and its consequences. Substantial reading required. Recommended: Political Science 118A.
5 units (Schmitter) given 1989-90

116A. European Politics and Society (I)—(Enroll in Political Science 116A.)
First of a two-quarter series introducing diversity and complexity in European politics from the 16th century to WW I: Italian city-states and cantonal Switzerland, Republican France, the German Reich, and British constitutional monarchy. Emphasis on the interrelated processes of capitalist development, nation building, state formation, and democratization. The state: how this form of political organization emerged in Western Europe and how the system of unequal competing states conditioned economic, social, and political outcomes up to its collapse in WW I. Substantial reading required.
5 units (Schmitter) given 1989-90

117R. The Role of the Military in Politics—(Enroll in Political Science 117R.)
The interaction between military and political leaders in western-industrial, communist, and developing states. The questions of military professional-ism, the role of the military in political processes, and the problem of the allocation of resources to defense. Diverse cases include the U.S., the U.S.S.R., and countries of the developing world.
5 units, Aut (Rice)

118B. Politics of Race and Class in Southern Africa—(Enroll in Political Science 118B.)
The political history of the region’s 10 countries, emphasizing relations among racial and ethnic groups. Diplomatic, economic, and military interactions among these states. The impact of movement, corporations, and international organizations based outside the region. Attention to domestic politics and foreign policy of South Africa. (DR:5*)
5 units (Abernethy) given 1989-90

119. Socialism in Latin America—(Enroll in Political Science 119.)
Socialist experiences in Latin America. The interrelationships between political, economic, and cultural change. Emphasis on historical and international contexts relevant in each case. (Counts for either Cluster A or C.) (DR:5)
5 units (Pagen) given 1989-90

120. Aristocracy and Absolutism: Eastern Europe, 1300-1800—(Enroll in History 120.)
The societies and cultures of East Europe (Poland, Ukraine, Belorussia, Bohemia, and Hungary) in the late medieval and early modern periods. The conflict of aristocratic parliamentary governments with absolutist states (Russia, Prussia, Austria-Hungary). Eastern Europe’s close relationship with West European social, economic and intellectual development is contrasted to the Russian historical experience.
5 units, Spr (Kollman)

120Z. Seminar: The Israeli Society—(Enroll in Political Science 120Z.)
Historical development of the Zionist movement as a reaction to assimilation and antisemitism; the conflicting aims of the Zionist enterprise; the structure of the Zionist movement and organizations; basic history of the State of Israel; crisis and achievements; the next 40 years.
5 units, Win (Segre)

124. Seminar: Latin American Dependency—(Enroll in Political Science 124.)
Basic concepts and theoretical frameworks, single country case studies, and research and political strategies regarding dependency and development in Latin America. (Counts for either Cluster A or C.) (DR:5)
5 units, Win (Packenham)

126. Seminar: Politics in Eastern Europe—(Enroll in Political Science 126.)
The eight East European political systems in terms of their historical development, their policy-making processes, their system maintenance and adapt-
tion. Eastern Europe as a region in world politics.

5 units, Aut (Triska)

130. Introduction to International Law—(Enroll in Political Science 130.) Theories, development, present state, and propensities of international law as a policy process in various critical arenas of international interaction.

5 units (Triska) given 1989-90

131. Causes of War and Peace—(Enroll in Sociology 131.) The theoretical and historical circumstances that give rise to war or to peace. Emphasis on trying to use theoretical tools to forecast actual foreign policy decisions regarding trouble spots around the world. Also, strategies for promoting or sustaining peace.

5 units (de Mesquita) given 1989-90

132D. Political and Ethical Aspects of Foreign Aid—(Enroll in Political Science 132D.) General and case study materials examine the characteristics of bilateral and multilateral "official development assistance"; trends in its volume and composition; the complex relationship between aid providers and recipients; ethical problems posed in the allocation, monitoring, and evaluation of development assistance. Also, international disaster relief operations. (Counts for either Cluster A or B.)

5 units, Spr (Abernethy)

133. Peace Studies—(Enroll in History 154, Political Science 133, Psychology 142, Sociology 108, VTSS 143.) Purpose is to make faculty, staff, and student participants more aware of the challenges to the development of a more peaceful world, the lack of understanding of the processes that prevent war, and the barriers to developing a more informed public. Students and teachers come out with a better understanding of the fundamental questions that need answering. Atmosphere is one of intellectual exchange. Outstanding scholars lecture to provide a common underpinning for individual comprehension and mutual discussions.

3 units, Spr (Dornbusch, Bernstein, Moses, Drekmeier, Ross, Worth)


5 units, Spr (Sagan)

136. Soviet Foreign Policy—(Enroll in Political Science 136.) Foreign and domestic determinants of policy; intentions and capabilities; continuity and change since 1917; institutions and person-

nel; war and peace; perceptions, priorities, and attitudes; alternative futures.

5 units, Win (Dallin)

138. Seminar: Sociocultural Implication of High Technology—(Enroll in Anthropology 138, VTSS 159.) (Counts for either Cluster A or C.) (DR:5)

5 units, Aut (Textor)

138A. Arms Control—(Enroll in Political Science 138A.) International security relations since 1945, the impact of nuclear weapons, the arms competition, and efforts at arms control and disarmament. The political, technological, and conceptual faces of national policies and arms control security. Negotiations on the limiting of military forces: SALT, START, INF, space-based weapons, etc. Taught by an interdisciplinary faculty.

5 units, Win (Holloway)

138B. Seminar: Arms Control—(Enroll in Political Science 138B.) The substantive and procedural aspects of arms control negotiations. Core faculty are assisted by guest speakers with negotiating experience. Limited enrollment. Prerequisite: 138A.

5 units, Spr (Staff)

139A. Japanese Foreign Policy—(Enroll in Political Science 139A.) The postwar evolution of Japan's foreign policy: historical background, external environment, and domestic institutions.

5 units, Aut (Okimoto)

140Z. Seminar: The Arab-Israeli Conflict—(Enroll in Political Science 140Z.) Deals with the basic elements of the conflict; the decolonization of the Arab world and the rise of Arabism and Moslem fundamentalism; the clash of Arab-Jewish "Zionisms"; attempts at solutions; obstacles to peace.

5 units, Win (Segre)


5 units (Staff) given 1989-90

147B. History of South Africa—(Enroll in History 147B.)

5 units, Aut (Worger)
148C. Africa in the 20th Century—(Enroll in History 148C.) Transformation of African societies during colonial rule. Resistance to colonial conquest; decline of the old elite and rise of the new one; conflicting ideologies and consciousness; nationalism; decolonization. (DR:5)
5 units, Spr (Roberts)

152. Social Structure of World Society—(Enroll in Sociology 152, Education 231, VTSS 155.) A sociological analysis of human society on a world-wide basis. Competing models of the emerging world order and its dynamics. 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. (Counts for either Cluster A or C.)
5 units (Inkeles) given 1989-90

153. America in Depression and War, 1929-1945—(Enroll in History 153.) The Great Depression, the New Deal, and WW II constitute the most powerful determinants of the character of modern America. The causes and consequences of the depression; the sources of Franklin Roosevelt's New Deal and its long-term impact on American economic, political, and social life; the culture of depression-era America; the international role of the U.S. in the 1930s and early 1940s; the military and geopolitical history of WW II; and the wide-ranging transformations in American society set in motion by the war.
5 units (Kennedy) given 1989-90

163. America and "The Bomb", Politics, Diplomacy, and Culture in the Nuclear World, 1939-Present—(Enroll in History 163, History of Science 163, VTSS 164.) Nuclear weapons: their development and use on Japan; their impact on culture and society, military planning and diplomatic leverage and threats, handling of nuclear crises; efforts at disarmament and arms control; disputes over nuclear testing and fallout; development of deterrence and its critics; roles of scientists and defense intellectuals; and activities of peace movements. Readings: Vonnegut, Brodie, Oppenheimer, Teller, Stimson, JFK, and declassified files.
4-5 units, Spr (Bernstein)

172A. America Since 1945—(Enroll in History 172A.) Analysis emphasizes foreign policy and politics, and deals with the intellectual history and social themes. (Fulfills the American foreign policy requirement.) (DR:5)
4-5 units, Win (Bernstein)

176. International Communication: Structures and Issues—(Enroll in Communication 176.) National media systems and the policy issues arising from the existing imbalances between developed and developing countries. How the new technologies 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)

177. Modern Latin America—(Enroll in History 177.) Latin America since the 1820s, concentrating on Brazil, Mexico, Argentina, and Cuba. How Latin America's role in the world economy has changed over time and how this has affected the region's political organization and social structure.
5 units, Aut (Haber)

179C. The German Democratic Republic: A Closer Look—(Enroll in German Studies 179C.) Briefly, the principles of Marxism-Leninism. Major aspects of the German Democratic Republic (G.D.R), its economy, political life and system, culture, and history. Is the G.D.R. a Soviet satellite? Is the G.D.R. actually the "first German Workers' and Peasants' State" that it claims to be? How do people live in the G.D.R.?
4 units, Win (Hamrdla)

187A. The Middle East 570-1718—(Enroll in History 187A.) From the rise of Islam until the decline of the Ottoman absolutism. Emphasis is on the organic relationship between the Middle East and Europe throughout this period. (DR:3*)
5 units, Aut (Whelan)

187B. The Modern Middle East: 1718-Present—(Enroll in History 187B.) From the emergence of regional Arab entities and the commercial penetration of Europe to the present. (DR:5*)
5 units, Win (Beinin)

188A. Jewish History from the Biblical Period to 1492—(Enroll in History 188A.) The social, political, institutional and cultural history of the Jews from earliest times to the Arab conquest and settlement of Canaan, the period of the Judges, the First and Second Commonwealth, the Jews in the Hellenistic and Roman periods, the Babylonian Exile, the Mishnaic and Tal-
mudic periods, and Jewish society in Palestine in the first half-millennium after the destruction of the Second Temple. (Counts for either Cluster A or B.)

5 units, Aut (Mancall)

188B. Jewish History from the Arab Conquest to the Partition of Poland—(Enroll in History 188B.) The social, political, institutional and cultural history of the Jews in the Islamic world and Spain; migrations and the growth of Jewish communities in Medieval, Renaissance, and Early Modern Western and Central Europe; Jewish communities in Palestine, Asia, Africa, and the New World; the Jewish world of Eastern Europe and its social and intellectual movements. (Counts for either Cluster A or B.)

5 units, Win (Wasilewski)

188C. Jewish History from the Partition of Poland to the Present—(Enroll in History 188C.) Emancipation, the Jewish Enlightenment, and the growing crisis of the East European Jewish world; modernization and westernization; the "Jewish Problem" and its solutions: assimilation, emigration, Socialism, Zionism; the Hebrew revival; Yiddish popular and intellectual culture in Eastern Europe; the American Jewish community; France and the North African Jews; Fascism, Nazism, and WWII; Palestine and the State of Israel; the crisis of Jewish identity and cohesion in the contemporary world. (Counts for either Cluster A or B.)

5 units (Mancall) given 1989-90

189. Zionism and the State of Israel—(Enroll in History 189.) The condition of the Jews in the 19th century, the origins and development of the Zionist movement and alternatives to it, the Jewish settlement in Palestine, and the foundation and growth of the State of Israel. The relationship of ideology and action.

5 units (Mancall) given 1989-90

195. Nomad Empires of Inner Asia—(Enroll in History 195, Asian Languages 152.) Inner Asia as an arena of conflict between agricultural and nomadic societies and the traces of cultural diffusion. (DR:5*)

5 units, Spr (Dien)

218S. Undergraduate Seminar: Resistance Movements In Eastern Europe, 1939-45—(Enroll in History 218S.)

5 units, Aut (Brandes)

219. Undergraduate Colloquium: Major Problems in Soviet History and Politics—(Enroll in History 219.)

5 units, Win (Dallin)

219W. Power Elite Recruitment in East European Communist Countries—(Enroll in Political Science 219W.) Focuses on broadly understood recruitment processes of the power elite in Eastern Europe. Data from Poland, Yugoslavia, Hungary, and the U.S.S.R. is analyzed. Includes (a) general rules of selection of elite members on regional and national levels; (b) social determinants of attaining elite positions; (c) career patterns. Some comparisons to Western political systems.

5 units, Win (Wasilewski)

222G. Seminar: Problems in Contemporary European Politics—(Enroll in Political Science 222G.)

5 units, Spr (Garret)

222P. Seminar: Democratization East and West—(Enroll in Political Science 222P.) Comparison of political changes possibly leading to more democratic institutions in Eastern and Southern Europe, with reference to Latin America and perhaps Asia: differences in previous regimes and economic systems; in levels of development and international context; in modes of demise and efforts at reform; in eventual institutions and practices. Open to advanced undergraduates and graduate students.

5 units, Win (Schmitter)


5 units, Win (Holloway)

239A. The Second World War—(Enroll in History 239A.)

5 units, Spr (Craig)

243. Seminar: International Relations Theory—(Enroll in Political Science 243; graduate students only.) The causes of conflict and cooperation in international politics. Contemporary theories and approaches and the work of earlier writers (Thucydides, Hobbes, Clausewitz). Issues: the causes of war and peace, the conditions furthering political and economic cooperation among nations, and the role of ethics in international relations.

5 units, Aut (Sagan)

243D. Undergraduate Colloquium: Empire, Race, and Nationality—The Decline and Fall of the British Empire in India and South Africa—(Enroll in History 243D.)

5 units, Win (Worger)

244R. The Politics of Alliances—(Enroll in Political Science 244R.) Role of political-mili-
tary alliances in the international system. Theories of alliance formation and behavior, and issues of alliance utility and the role of alliances in the propagation of conflict. Cases from the 19th and 20th centuries, including NATO and the Warsaw Pact. Prerequisite: Political Science 35 or consent of instructor.

5 units, Win (Rice)

247. Seminar: Democracy in Developing Countries—(Enroll in Sociology 247.) The conditions related to the emergence, institutionalization, and consolidation of democratic government, and the factors making for instability and breakdown. The theoretical and empirical literature on the relationship between political democracy and social structure, culture, economic development, constitutional structure and the international environment weighed against the historical experiences with democratic, semi-democratic, and authoritarian government of numerous countries in Asia, Africa, Latin America, and the Middle East. Open to advanced undergraduates with background in political sociology, political development, or international relations. Major research paper required.

5 units, Spr (Diamond)

249A. Africa Since 1945—(Enroll in History 249A.) Africa's political and economic evolution since WWII; nationalism and decolonization.

5 units, Spr (Jackson)

253. Undergraduate Colloquium: American-European Relations Since 1945—(Enroll in History 253.)

5 units, Win (Kleiman)

270A. Undergraduate Colloquium: The Early Nuclear Age, 1939-1953—(Enroll in History 270A.)

5 units, Spr (Bernstein)

288. Undergraduate Colloquium: Palestine and Arab-Israeli Conflict—(Enroll in History 288.)

5 units, Win (Beinin)

290A. Undergraduate Colloquium: Japan Since 1945—(Enroll in History 290A.)

5 units, Spr (Duus)

297. Undergraduate Colloquium: South Korea's Emergence in the Postwar International System—(Enroll in History 297.)

5 units, Win (Lho)

CLUSTER B: HUMANITIES EMPHASIS

77. Ethics in International Relations—(Enroll in Philosophy 77.) The possibility of and theo-retical basis for an international morality: Are there moral norms governing relations between states? If so, what are they and what are their philosophical foundations? Focuses on specific moral issues in contemporary international affairs: nuclear warfare and deterrence, world hunger and economic justice, and environmental pollution. Readings from classical and contemporary sources.

4 units, Aut (Satz)

80. Culture, Politics, and Society in Latin America—(Enroll in History 80, Latin American Studies 80, Anthropology 100.) Interdisciplinary survey of the interaction of Amerindian, African, and European cultures in the creation of the New World societies from 1500 to the present. This is a basic introduction of Latin American courses within several departments. (DR:3)

5 units, Aut (Collier, Delaney, Phillips)

108. The Christianization of Western Europe: 500-1350—(Enroll in History 108.) How the Europeans came to believe in Christ; why the thought and conduct associated with that belief changed so radically; why different forms of religiosity and dramatic conflicts developed; how religious beliefs affected social organization; and how social changes modified religiousity.

5 units, Aut (Langmuir)

114A. Peoples and Cultures of Mainland Southeast Asia—(Enroll in Anthropology 114.) Examines processes of sociocultural persistence and change by selectively surveying peoples of the area at the band, tribe, and state levels of sociocultural complexity. Topics: cultural demography; subsistence technology and land tenure; kin group and community organization; religion and world view; cultural dominance; corruption; and the social power of women. International and intercultural relations stemming from British and French colonialism, and from American and Japanese postcolonial influence. Lecture and discussion contrasts contemporary approaches to economic development, e.g., Thailand's guided market economy approach vs. Laos' planned approach; and political unification (e.g., use of Brahmanical-Buddhist symbolism in Thailand vs. Islamic symbolism in Malaysia). Case histories illustrate governmental attempts to encourage cultural persistence (e.g., Burma's prohibition of the import of modern technology) and to force radical cultural change (e.g., Kampuchea's abolition of money, cities, religion, and schools.)

5 units (Textor) given 1989-90

126F. Seminar: Politics and the Novel—(Enroll in Political Science 126F.) An examination of "realist" 20th-century works of fiction that deal with key political issues of our time. American and European novels are read with a view
to understanding the conditions which produced them and their impact. Open only to juniors and seniors. Preference given to Political Science and International Relations majors. 5 units, Win (Fagen)

130B. Paris and New York: Transatlantic Exchange in Early Modernism—(Enroll in Art 130B.) The artistic and cultural exchange between Paris and New York in the early decades of the 20th century. The Franco-American circles around Gertrude Stein, Alfred Stieglitz, and Walter Arensberg; movements such as Cubism, Expressionism, and Dadaism. 4 units (W. Corn) given 1989-90

132D. Political and Ethical Aspects of Foreign Aid—(Enroll in Political Science 132D.) General and case study materials examine the characteristics of bilateral and multilateral "official development assistance"; trends in its volume and composition; the complex relationship between aid providers and recipients; ethical problems posed in the allocation, monitoring, and evaluation of development assistance. Also, international disaster relief operations. (Counts for either Cluster A or B.) 5 units, Win (Abernethy)

136B. European Thought in the 20th Century—(Enroll in History 136B.) The important European thinkers and intellectual movements of the 20th century. (DR:3) 5 units, Win (Robinson)

166. The Reciprocal Vision—(Enroll in English 165C.) How Americans and Europeans have perceived and portrayed each other from the end of the 18th century to the middle of the 20th. 5 units (Evans) given 1989-90

188A. Jewish History from the Biblical Period to the Arab Conquest—(Enroll in History 188A.) The social, political, institutional, and cultural history of Jews from earliest times to the Arab conquest and settlement of Canaan, the period of the Judges, the First and Second Commonwealth, the Jews in the Hellenistic and Roman periods, the Babylonian Exile, the Mishnaic and Talmudic periods, the Jewish society in Palestine in the first half-millennium after the destruction of the Second Temple. (Counts for either Cluster A or B.) 5 units, Aut (Manoall)

188B. Jewish History from the Arab Conquest to the Partition of Poland—(Enroll in History 188B.) The social, political, institutional, and cultural history of Jews in the Islamic World and Spain; migrations and the growth of Jewish communities in Medieval, Renaissance, and Early Modern Western and Central Europe; Jewish communities in Palestine, Asia, Africa, and the New World; the Jewish world of Eastern Europe and its social and intellectual movements. (Counts for either Cluster A or B.) 5 units, Win (Mancall)

188C. Jewish History from the Partition of Poland to the Present—(Enroll in History 188C.) Emancipation, the Jewish Enlightenment, and the growing crisis of the East European Jewish world: modernization and westernization, the "Jewish Problem" and its solutions: assimilation, emigration, Socialism, Zionism; the Hebrew revival; Yiddish popular and intellectual culture in Eastern Europe; the American Jewish community; France and the North African Jews; Fascism, Nazism, and WWII; Palestine and the State of Israel, the crisis of Jewish identity and cohesion in the contemporary world. (Counts for either Cluster A or B.) 5 units, Spr (Mancall)

200. Post-Modern Terrorism in the International World: Cultures and Perspectives—How individual cultures and international contexts define, represent, and react to "terrorism"; issues of national identity, borders, and international discourse related to the criminalization of political violence. Films, novels, poetry, and autobiographic, journalistic and historiographic accounts. 5 units (Allen) given 1989-90

215S. Undergraduate Seminar: Jewish History—(Enroll in History 215S, Religious Studies 225.) Selected texts from different periods and methods for their interpretation. The text is chosen from a different period each year. 5 units, Win (Funkenstein)

216S. Undergraduate Seminar: Jewish History—(Enroll in History 216S, Religious Studies 226.) Medieval Jewish biblical interpretations. Prerequisite: Knowledge of Hebrew. 5 units, Spr (Funkenstein)

222. Jewish Literature and Society—(Enroll in History 222.) 5 units (Mancall) given 1989-90

223. Undergraduate Colloquium: Intellectual and Cultural History of Eastern Europe—19th and 20th Century—(Enroll in History 223.) 5 units, Spr (Gluck)

266. Culture, Authoritarianism, and Resistance in Latin America—(Enroll in Spanish 266.) Latin American cultural production under the restrictive conditions imposed by the authoritarian military regimes of the 1970s and '80s, especially Brazil and the southern Cone. Readings on the language of authoritarianism and the legitimation of state violence, and forms of resistance literature including poetry, testimonio, film. Reading knowledge of Spanish required. 5 units (Pratt) alternate years, given 1989-90
296. Western Views of the Non-West Through the Literature of Travel—(Enroll in Spanish 296.) The western traveler as cross-cultural mediator and interpreter in pre-colonial and neo-colonial settings; the ideological appropriation and "normalization" of alien contexts as related to developments in world politics and economy, notably European expansion. Readings on the Spanish conquest of America, British exploration in Africa, the rise of scientific travel, and works by contemporary travelers: Graham Greene, V. Naipaul, S. Naipaul, Paul Theroux, Isak Dinesen, and others.
3-5 units (Pratt) given 1989-90

298. Undergraduate Colloquium: Visions of Utopia—Travellers in China—(Enroll in History 298A.)
5 units, Win (Kahn)

CLUSTER C: POLITICAL-ECONOMIC ISSUES AND POLICY ANALYSIS

106. The World Food Economy—(Enroll in Food Research 103, Economics 106.) The inter-relationship between food, population, and economic development; the role of agricultural and rural development in achieving economic and social progress in low-income nations, the economic and nutritional characteristics of the major types of food and changes in food consumption in Asia, tropical Africa, and Mexico, U. S. and Japan. Policy analysis perspective to decision-making is related to the design of rural development strategies. Prerequisite: Economics 1 or equivalent understanding of economics.
3 units, given 1989-90

114K. The Political Economy of Development—(Enroll in Political Science 114K.) An introduction to major theories of development emphasizing the interplay between economic and political processes and national and international factors from Latin America and also Africa and Asia. Cases include Brazil, China, Cuba, El Salvador, India, Taiwan, Nigeria, and Venezuela.
5 units, Win (Karl)

116. The Economics of Development—(Enroll in Economics 116.) Economic problems and policy concerns of less developed countries, and the tools of analysis and measurement. Topics: theoretical perspectives, poverty and inequality, agriculture and rural development, industrialization and trade, rural-urban migration and unemployment, human resource development, planning, domestic and international development finance. Prerequisites: Economics 51 and 52.
5 units, Spr (Anderson)

118. Development and Population Interactions in the Third World—(Enroll in Economics 119, Food Research 121.) Historical and contemporary examination of economic development and population growth suggests a broad diversity of experience. Case studies of specific countries illustrate the systematic components of the experience of economic development and of population growth. Implications in terms of alternative structures of development, the timing of the demographic transition, income distribution, employment, and migration. The interactions and causal effects between economic development and population growth.
5 units (Yotopoulos) given 1989-90

119. Socialism in Latin America—(Enroll in Political Science 119.) Socialist experiences in Latin America, the interrelationships between political, economic, and cultural change, and the historical and international contexts relevant in each case. (Counts for either Cluster A or C.) (DR:5)
5 units (Pagan) given 1989-90

122. The Theory of Capitalist Development—(Enroll in Economics 122.) Theoretical and historical analysis of the process of capitalist development: economies; the 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. Theoretical approaches to the analysis are examined, including Classical, Schumpeterian, and Keynesian, focusing on Marxian theory and recent elaborations and extensions of that theory. Relevant historical case studies. Prerequisites: Economics 51 and 52.
5 units, Aut (Harris)

123. Economic Development in Latin America—(Enroll in Economics 123, Food Research 218; open to advanced undergraduates with consent of instructor.) The historical problems of economic growth and structural change in selected Latin American countries. Emphasis on the application of political economic analysis to problems of accumulation, investment, financial and price behavior, income distribution, innovation, migration, and the rural-urban transition and analysis of interdependence among countries with different economic and social structures, i.e., U.S., Mexico, Brazil, and the Caribbean. Prerequisites: Economics 51 and 52.
5 units, Spr (Reynolds)

124. Seminar: Latin American Dependency—(Enroll in Political Science 124.) Basic con-
cepts and theoretical frameworks, single country case studies, and research and political strategies regarding dependency and development in Latin America. (Counts for either Cluster A or C.) (DR:5)

5 units, Win (Packenham)

126K. Seminar: The United States and Central America—(Enroll in Political Science 126K.) The crisis of development in Central America and the challenge it poses for U.S. policy towards Latin America. Emphasis on the historic roots of the crisis and the emergence of specific policy dilemmas in the issue areas of democratization, national security, and human rights. (Counts for either Cluster A or C.) (DR:5)

5 units, Win (Karl)

135G. Introduction to International Political Economy—(Enroll in Political Science 135G.)

5 units, Win (Garret)

138. Sociocultural Implications of High Technology—(Enroll in Anthropology 138/238, VTSS 159.) Lecture/discussion, in cultural terms, on the development, diffusion, and utilization of technology emphasizing the high technology developed around Stanford: biogenetics, microelectronic information technology and super conductors. How such technological innovations enable or drive profound changes in a sociocultural systems symbolic values and belief systems, and its social and economic organization. Also, unintended human damage such technological innovations have produced; and implications for appropriate technological design, and for public and educational policy. Case studies from non-Western cultures of varying levels of sociotechnical complexity, and a section on modern Japan. (Counts for either Cluster A or C.)

5 units, Aut (Textor)

140A, B, C. Ethics of Development in a Global Environment (EDGE)—(Enroll in Anthropology 133A, B, C, Engineering 297A, B, C, Political Science 140A, B, C.) A series of speakers on current development issues emphasizing the problems of the poorer nations. Autumn Quarter: world resources—energy, food, housing, population, and environment; Winter Quarter: the role of institutions affecting the transfer of technology, political systems, World Bank, transnationals; Spring Quarter: the role and responsibilities of the individual who wants to affect development. Speakers present widely differing case studies from their own experiences. (Up to 4 units may be credited toward Cluster C for course sequence.)

1 unit (4 units with workshop) each quarter, Aut, Win, Spr (Fagen, Lusignan, McWhorter, Siegel)

142. Agricultural Policy in Industrial Countries—(Enroll in Food Research 146, Economics 142.) A comparative approach to the study of agricultural policies in developed countries: the European Community, Japan, Australia, and Canada. Links to U.S. agricultural policy where appropriate. Implications of these policies for world markets and for policies in other countries. Also, international negotiations on policy effects, measurement of trade impacts of domestic policies, and links between domestic policy choices and international trade rules. Prerequisites: Economics 51, 52, and Food Research 144, or consent of instructor.

5 units (Josling) given 1989-90

152. Social Structure of World Society—(Enroll in Education 231, Sociology 152, VTSS 155.) A sociological analysis of human society on a world-wide basis. Competing models of the emerging world order and its dynamics. 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. (Counts for either Cluster A or C.)

5 units, Win (Inkeles) given 1989-90

165. International Economics—(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. Prerequisite: Economics 1, 51, and 52.

5 units, Aut (Huizinga)

Win (Attanasio)

166. International Trade Policy—(Enroll in Economics 166, Food Research 166.) Effects of selected government policies affecting international trade. Trade policy and economic welfare, government responses to competition from imports, issues underlying international negotiation of reductions of barriers to trade, multination commodity agreements and cartels, and special trade arrangements for developing countries. Prerequisite: Economics 165.

5 units, Spr (Pearson)

191. Undergraduate Seminar in United States-Mexico Relations—(Enroll in Latin American Studies 191.) The principal problem areas in the complex relationship between the U.S. and Mexico. A survey of U.S.-Mexico economic and social relations, trade problems, the foreign debt crisis, foreign investment, agriculture, energy policy, and the migration issue (immigration policies and labor markets). Enrollment limited to 12. Prerequisite: Latin American Studies 91, or consent of instructor.

5 units, Aut (Smith)
5 units, Aut, Win (Okimoto)

5 units, Aut (Schmitter)

225. Seminar: The Political Economy of Reform in Socialist Countries—(Enroll in Political Science 225.) The nature of the Stalinist and post-Stalinist politico-economic systems in the U.S.S.R., Eastern Europe, and China. Focuses on their selected reform efforts, analyzing the interaction of political, economic, and social factors in producing the reform efforts and conditioning their success or failure.
5 units, Spr (Halpern)

267. International Agricultural Policy—(Enroll in Food Research Institute 267.) Continuing and contemporary problems in world agricultural trade, emphasizing economic analysis of such problems and the variety of proposed and possible solutions. The implications of the domestic policies of the major trading countries on agricultural markets as regards staple food products. Emphasis to issues of food security, trade liberalization, and international market regulation and to the role of international institutions. Prerequisites: Economics 51, 52, or equivalent.
5 units, Win (Josling)

280A. Undergraduate Colloquium: The Economic History of Latin America—(Enroll in History 280A.) The economic growth of Latin America in the 19th and 20th centuries. Study of various schools of thought on the nature of economic growth in Latin America and of the economic history of selected countries, primarily Mexico, Brazil, Peru, and Argentina. 20-page paper is required. Consult with instructor prior to class sign-up.
5 units, Win (Haber)

INDEPENDENT STUDY

197. Directed Study in International Relation.*
3-5 units, any quarter (Staff)

198A, B, C. Honors Thesis—Open only to declared International Relations majors with approved Honors thesis proposals.*
3-5 units, any quarter (Staff)

OVERSEAS STUDIES

More detailed descriptions of courses listed may be found in the Stanford University Bulletin for Overseas Studies, 1988-89.

BERLIN
East-West Relations—(Enroll in Political Science 135X.) Cluster A.
5 units, Win (Jacobsen)
Introduction to German History: Politics and Culture from the Middle Ages in the Unification of Germany, 900-1870—(Enroll in History 125.) Cluster A.
4 units, Win (Neckenig)
The German Question—(Enroll in Political Science 118X.) Cluster A.
5 units, Win (Klinger)
The Federal Republic of Germany in the International System—(Enroll in Political Science 141X.) Cluster A.
4-5 units, Spr (Gortemaker)

FLORENCE
The Political Economy of Industrial Change: Italy and Europe in a Global System—(Enroll in Economics 159X.) Cluster C.
3 units, Spr (Bianchi)
U.S. and Western Europe After World War II—(Enroll in Political Science 121X.) Cluster A.
4-5 units, Win (Mammarella)
Contemporary European Politics—(Enroll in Political Science 125X.) Cluster A.
4 units, Spr (D'Alimonte)

KRAKOW
Efficiency of the Capitalist and Socialist Economies and the Polish Crisis—(Enroll in Economics 123X.) Cluster C.
4 units, Spr (Wojtyna)
Comparative History of Eastern Europe—(Enroll in History 120V.) Cluster A.
4 units, Spr (Baran)
Understanding Eastern European Politics—(Enroll in Political Science 124X.) Cluster A.
4 units, Spr (Palecki)

* Obtain section number from International Relations office.
<table>
<thead>
<tr>
<th>Course</th>
<th>Enrollment Details</th>
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<tbody>
<tr>
<td>International Economics—(Enroll in Economics 165X.) Cluster IC.</td>
<td>5 units, Spr (Grant)</td>
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<tr>
<td>The Political Economy of the European Economic Community—(Enroll in Political Science 131X.) Cluster C.</td>
<td>5 units, Win (Allen)</td>
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<tr>
<td>The British Empire and Commonwealth—(Enroll in Political Science 132X.) Cluster A.</td>
<td>4 units, Spr (Rizvi)</td>
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<tr>
<td>British Foreign Policy and International Relations, 1935-1985—(Enroll in Political Science 138X.) Cluster A.</td>
<td>4-5 units, Aut (Holmes)</td>
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<td>TOURS</td>
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<tr>
<td>France and Europe and the Economic Crisis—(Enroll in Economics 127X.) Cluster C.</td>
<td>5 units, Win (Leboucher)</td>
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<tr>
<td>Contemporary Problems of Economic Growth—(Enroll in Economics 128X.) Cluster C.</td>
<td>5 units, Aut (Leboucher)</td>
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<tr>
<td>Living in the Past: the American Experience in Europe—(Enroll in Overseas Studies/Tours 165Z.) Cluster B.</td>
<td>4-5 units, Aut (Evans)</td>
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<tr>
<td>L'Amerique: America in the French Imagination—(Enroll in Overseas Studies/Tours 11.) Cluster B.</td>
<td>4-5 units, Aut (Evans)</td>
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<tr>
<td>Introduction to the Political Economy of Food: French Policy in the European Community and the World—(Enroll in Overseas Studies/Tours 13.) Cluster C.</td>
<td>4 units, Spr (Desjeux, Carfantar)</td>
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<tr>
<td>French Foreign Policy—(Enroll in Political Science 120X.) Cluster A.</td>
<td>5 units, Aut, Spr (Billard)</td>
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<tr>
<td>France and the Third World—(Enroll in Political Science 140X.) Cluster A.</td>
<td>5 units, Win (Billard)</td>
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<td>COURSES</td>
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<tr>
<td>1,2. Hebrew: Beginning, Intermediate.</td>
<td>Aut, Win, Spr (Kolerstein)</td>
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<tr>
<td>4. Seminar in Jewish History—(Enroll in History 215S/415.) Win (Funkenstein)</td>
<td>5 units, Win (Funkenstein)</td>
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<tr>
<td>5. Seminar in Jewish History—(Enroll in History 216SD/416.) Spr (Funkenstein)</td>
<td>5 units, Spr (Funkenstein)</td>
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<tr>
<td>9. Judaism—(Enroll in Religious Studies 23.) Aut (Eisen)</td>
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<tr>
<td>10. Hebrew Bible—(Enroll in Religious Studies 121.) Spr (Falk)</td>
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<tr>
<td>12. The Biblical Presence in Modern Poetry—(Enroll in English 164A.) Spr (Felstiner)</td>
<td>5 units, Spr (Felstiner)</td>
</tr>
<tr>
<td>17. Contemporary Jewish Thinkers—(Enroll in Religious Studies 260.) Aut (Eisen)</td>
<td>5 units, Spr (Falk)</td>
</tr>
</tbody>
</table>
25. Knowing the Holocaust—(Enroll in English 265, Psychology 180B.)
   Spr (Auerhahn)

26. State and Society in Israel—(Enroll in Sociology 133.)
   Spr (Ben-Eliezer)

27. Introduction to Jewish Mysticism—(Enroll in Religious Studies 135.)
   Win (Matt)

28. Jewish History from the Biblical Period to 1492—(Enroll in History 188A.)
   Aut (Mancall)

29. Jewish History from the Arab Conquest to the Partition of Poland—(Enroll in History 188B.)
   Win (Mancall)

31. Jews and Judaism in America—(Enroll in Religious Studies 153, Sociology 151.)
   Spr (Eisen)

32. Medieval Jewish Biblical Interpreters—
   (Enroll in Religious Studies 232.)
   Win (Matt)


6. Jewish Intellectual History: Medieval Period—(Enroll in History 106A.)
   (Funkenstein)

7. Jewish Intellectual History: Modern Period—(Enroll in History 106B.)
   (Funkenstein)

8. Encounters Between Modern Philosophy and Judaism—(Enroll in Religious Studies 281.)
   (Eisen)

13. Literature of the Holocaust—(Enroll in English 165A.)
   (Felstiner)

14. Zionism and the State of Israel—(Enroll in History 189.)
   (Mancall)

15. Jewish Literature and Society—(Enroll in History 222.)
   (Mancall)

   (Eisen)

18. Genesis of Anti-Semitism.
   (Langmuir)

19. Religions of Abraham.
   (Berman)

20. Founders in Myth and History—(Enroll in Religious Studies 131.)
   (Berman)

21. Mystics and Intellectuals—(Enroll in Religious Studies 122.)
   Spr (Berman)

22. Introduction to Jewish Law.


30. Jewish History from the Partition of Poland to the Present.
   (Mancall)

**NOT OFFERED 1988-89**


6. Jewish Intellectual History: Medieval Period—(Enroll in History 106A.)
   (Funkenstein)

7. Jewish Intellectual History: Modern Period—(Enroll in History 106B.)
   (Funkenstein)

8. Encounters Between Modern Philosophy and Judaism—(Enroll in Religious Studies 281.)
   (Eisen)

13. Literature of the Holocaust—(Enroll in English 165A.)
   (Felstiner)

14. Zionism and the State of Israel—(Enroll in History 189.)
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   (Eisen)

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   (Langmuir)

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   (Berman)

**LANGUAGE LABORATORIES**

Director: Andrew Lisac

The Language Laboratory program is an academic support service designed to provide faculty and students with a variety of resources outside the classroom which enhance the acquisition of foreign languages. Resources range from foreign language dictionaries to the most sophisticated video immersion and computer programs.

Situated on the first floor of the Meyer Library building, the laboratories comprise three rooms equipped with drill and practice cassette recorders which students may use for intensive classroom preparation, and one multi-media room. Instructional audiotapes and accompanying lab manuals are available in roughly 80 languages from around the world.* Students listen and record their responses to exercises in grammar, pronunciation, and typical conversation, replaying the relevant portions for the purpose of comparison, self-evaluation, and correction.

In addition, the language lab houses a collection of foreign language video programs, computer software programs, lectures, and shortwave radio broadcasts, along with the international standard equipment with which to utilize them. These resources provide the student with a particularly inclusive context for developing comprehension of a language as it is spoken in authentic cultural settings.

The lab works in cooperation with the faculties of the foreign language departments, the English as a Second Language Program, and the Special Languages Program. Experts work together to coordinate the use of lab resources with classroom needs, forming an integral instructional effort, and developing new resources based on recent advances in educational technology.

The laboratories are open daily when classes are in session. They are closed during intersessions.
Chairman of the Committee and Director of the Center: George A. Collier (on leave Winter, Spring)

Affiliated Faculty:

Anthropology: Clifford Barnett, George Collier (on leave, Winter, Spring), Jane Collier (on leave), William Durham, James Fox, John W. Rick (on leave Autumn), Renato Rosaldo, Verena Stoeckle (Tinker Visiting Professor), Stefano Varese (Autumn)

Classics: Gregson Davis

Communication: Elie Abel, Steven Chaffee

Economics: Julie Anderson (on leave), Donald Harris, Ronald McKinnon

Education: Martin Carnoy

English: Sandra Drake, John Felstiner, Shirley B. Heath (on leave)

Food Research Institute: Juan Martinez Alier (Tinker Visiting Professor), Bruce Johnston, Reynaldo Martorell, Clark Reynolds

History: Samuel Amaral, Frederick Bowser (on leave Winter, Spring), Albert Camarillo (on leave), Stephen Haber, Sabine MacCormack, John D. Wirth (Autumn)

Linguistics: Gregory Guy

The Center for Latin American Studies coordinates the University's teaching, research, and extracurricular activities related to Latin America. Field research, language training, and interdisciplinary approaches are stressed in the Latin American Studies Program at Stanford, which draws on the strength and diversity of its nationally recognized faculty affiliates and substantial library holdings on Latin America. These resources are enhanced by the Tinker Visiting Professorship in Latin American Studies, which brings one or more distinguished Latin American academics to teach at Stanford each year. The Stanford Berkeley Joint Center for Latin American Studies provides opportunities for Latin Americanist faculty and students on the two campuses to meet and work with each other.

The principal academic programs administered by the Center for Latin American Studies (the bachelor's degree, summer field research programs, the master's degree, and joint degree programs with Law, Medicine, and Education) are described below. For further information please contact the Center for Latin American Studies, Bolivar House, 582 Alvarado Row, Stanford University, Stanford California 94305, or call (415) 723-4444.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

The purpose of the A.B. degree is to allow a small number of undergraduates to design individualized, interdisciplinary Honors programs concentrating on Latin America. 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. To declare a major in Latin American Studies, a student must apply to the center's Subcommittee on the Undergraduate Major. Students accepted for
the major will share in the designation of a faculty advisor to supervise their work.

The student must fulfill the following requirements for the major:

1. Completion of a coherent interdisciplinary program of at least 55 units, based on an individualized plan of study achieved in consultation with the student's advisor and approved by a faculty advisory committee. This program will ordinarily include:
   a) At least two courses surveying Latin America comprehensively, whether historically, from the perspective of a discipline, or in an explicitly interdisciplinary frame. Appropriate courses are Anthropology 104; Economics 123; History 176 and 177; Latin American Studies 80; Political Science 113A. (Other courses for this requirement must be proposed for approval by the Subcommittee on the Undergraduate Major.)
   b) At least 25 units focused on a theoretical problem or disciplinary approach, usually within a single base discipline.
   c) Up to 15 units may be devoted to work on the senior research paper (see 3, below).
   d) The remaining units should be in 100-level courses or higher, focused directly on Latin America or closely related topics.

First or second year language courses may not be counted toward the 55 units. Only 10 units of Pass/No-Credit work may be counted towards the major.

2. Demonstration of language competency in either Spanish or Portuguese at least equivalent to one course in grammar and composition at the third-year level of university training, or any course taught in Spanish at the third-year level of university training. Alternatively, a certification from the Department of Spanish and Portuguese of oral language proficiency at the advanced level in the scale of the American Council for the Teaching of Foreign Languages. Portuguese 109, Portuguese for Students of Spanish, is strongly recommended for those students demonstrating competency in Spanish.

3. 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 15 units may be given for preparation of the senior paper.

Honors in Latin American Studies—will be recommended for students who have completed a strong and well-designed program, have achieved a letter grade indicator of "B+" or better in coursework for the major, and submitted a senior research paper judged to be of Honors quality by the Subcommittee on the Undergraduate Major.

HONORS CERTIFICATION FOR MAJORS IN OTHER DEPARTMENTS OR PROGRAMS

As distinguished from Honors for Majors in Latin American Studies, Honors Certification in Latin American Studies is intended to complement study in any conventional major. The aim of Honors Certification is to enable the student to broaden study within a particular discipline through interdisciplinary coursework on Latin America while deepening disciplinary study through the undertaking of an Honors project focusing on an aspect of Latin America.

The Honors Certification program will be of particular interest to students in any discipline who plan for further study or for a career with an international or foreign-area focus. Students in the humanities, social sciences, or natural sciences may wish to enrich their studies by acquiring a first-hand understanding of a related aspect of Latin American life.

ADMISSION

Honors Certification is open to students majoring in any field. Interested students should apply for acceptance for Honors Certification no later than the Autumn Quarter of their junior year. The first step is to consult with the Program Coordinator of the Latin American Center, who will assist in the preparation of an application which should outline plans for coursework and an Honors project. The application will be reviewed through the center's Subcommittee on the Undergraduate Major, which will assist those accepted for Honors certification in establishing a faculty committee to supervise their work.

REQUIREMENTS

1. Coursework, in addition to an Honors project, including at least 25 units consisting of:
   a) At least one course surveying Latin America comprehensively, whether historically, or from the perspective of a discipline, or in an explicitly interdisciplinary frame. Appropriate courses are Anthropology 104; Economics 123; Latin American Studies 80; History 176 and 177; Political Science 113A. (Other courses for this requirement must be proposed for approval by the Subcommittee on the Undergraduate Major.)
   b) At least 20 additional units in 100-level courses or higher focusing directly on Latin America or closely related topics.
2. Demonstration of language proficiency in either Spanish or Portuguese at least equivalent to one course in grammar and composition at the third-year level of university training, or any course taught in Spanish at the third-year level of university training. Alternatively, a certification from the Department of Spanish and Portuguese of oral language proficiency at the advanced level in the scale of the American Council for the Teaching of Foreign Languages.

3. 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 15 units may be given for preparation of the senior paper, but these units do not count toward requirement (1).

Honors Certification in Latin American Studies will be recommended for students who have achieved a letter grade indicator of "B+" or better in their coursework for Latin American Studies and have submitted a senior research paper judged to be of Honors quality by the Subcommittee on the Undergraduate Major.

SUMMER FIELD RESEARCH

Each summer the center sponsors a small number of juniors who 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, Latin American Studies (L.A.S.) 152, is required the Spring Quarter before departure and an extensive written report is submitted the following Autumn Quarter for the independent research seminar, L.A.S. 153. Students from all departments are eligible to apply.

GRADUATE PROGRAMS

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. Applicants whose native language is not English and who have not studied in an English-speaking institution for at least one and a half years must take the Test of English as a Foreign Language (TOEFL). Deadline for submission of applications for admission and financial aid is January 1. Admission is normally granted beginning in the Autumn Quarter only.

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:

1. Ten courses with a minimum of 40 units. At least eight of the 10 courses must be basically Latin American in content. Courses are distributed as follows:
   a) Core Seminar (L.A.S. 250, 251, 252)—an interdisciplinary course required of all A.M. candidates in Latin American Studies. Fifteen units; five units per quarter.
   b) Latin American Bibliography (L.A.S. 260) required of all A.M. candidates in Latin American Studies. Three units.
   c) Three or four courses that qualify as graduate level in a single base discipline.
   d) Two or three courses distributed among other disciplines. (Relevant courses may be found in the listings for the participating departments.)

2. Demonstration of language competency in either Spanish or Portuguese at least equivalent to one course in grammar and composition at the third-year level of university training, or any course taught in Spanish at the third-year level of university training. Alternatively, a certification from the Department of Spanish and Portuguese of oral language proficiency at the advanced level in the scale of the American Council for the Teaching of Foreign Languages. Portuguese 109, Portuguese for Students of Spanish, is strongly recommended for those students demonstrating competency in Spanish.

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. All requirements for the A.M. degree are
normally completed in three academic quarters as a full-time student.

JOINT DEGREE PROGRAMS

LAS /Law—The Center for Latin American Studies (L.A.S.) 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 “School of Education” section 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 departments offering a Ph.D. with an emphasis on Latin America.

SUMMER FIELD RESEARCH

Stanford doctoral students having a Latin American area of concentration may apply to the Committee on Latin American Studies for summer grants for pre-dissertation research, ordinarily after their second year of graduate study.

COURSES

In addition to the courses listed here, the faculty affiliated with the center regularly offer over 60 courses related to Latin America in their base departments. Please consult the quarterly Time Schedule for current course offerings, or contact the Center for Latin American Studies.

80. Culture, Politics, and Society in Latin America—(Same as Anthropology 100, History 80.) An interdisciplinary survey of the interaction of Amerindian, African, and European cultures in the creation of New World societies from 1500 to the present. A basic introduction to the Latin American courses within several departments. (DR:5*)
5 units, Aut (Collier, Delaney, Phillips)

135. Workshop on Grass-Roots Development in South America—An intensive two week workshop exploring the role and activities of grass-roots organizations in South America, emphasizing The Andean Region, including the role of non-governmental organizations, the issues of empowerment and self-management, the role of women and the “new social actors,” and the relationship between grass-roots development and local power.
3 units, Aut (Remirez-Grossman)
W Oct. 19 through F Oct. 28, 7-9 p.m.

4 units, Win (Martinez-Alter) TTh 11-12:50

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—(Graduate students enroll in 269.) For students engaged in special interdisciplinary work that cannot be arranged by department.
1-5 units, Aut, Win, Spr (Staff) by arrangement

191. Undergraduate Seminar: Problems in United States-Mexico Relations—Overviews problem areas in the relationship between the U.S. and Mexico. A historical survey of U.S.-Mexico economic and social relations is followed by trade problems, the foreign debt crisis, foreign investment, agriculture, energy policy, immigration policies, and labor markets. Prerequisite: Consent of the instructor by application at Bolivar House. Enrollment limited to 15.
5 units, Aut (Smith) W 7-9 p.m.

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
through examination of an interdisciplinary Latin American research topic. Restricted to A.M. degree students, except with permission of instructor.

5 units, Aut (Bowser) M 1:15-3:05
Win, Spr (Staff) M 1:15-3:05

260. Latin American Bibliography—Introduction to research use of Stanford library collections on Latin American topics. Open to all graduate students.

3 units, Aut (Breedlove) Th 12-1:15

287H. Popular Culture and Rites of Subordination in Colonized Societies—(Same as Anthropology 287H.) The applicability of the “Annals School” approach to popular culture, focusing on Mesoamerica, the Andes, and Brazil. Goal: to find approaches to understanding multi- or inter-cultural rites through which subordinated peoples and developing nation-states are articulated. Topics: Brazilian Candomble and Umbanda, the Mexican cult of Guadalupe, Carnival in Brazil, Bolivia, and elsewhere, and regional and national pilgrimage rites in Latin America.

5 units, Spr (Abercrombie)

LINGUISTICS

Emeriti: (Professors) Clara N. Bush, Charles A. Ferguson, Joseph H. Greenberg, Dorothy A. Huntington
Chairman: William R. Leben
Vice-Chair: Ivan A. Sag
Professors: Joan Bresnan, Eve V. Clark, Shirley Brice Heath (on leave 1988-89), Martin Kay, Paul Kiparsky, Will Leben, P. Stanley Peters, Ivan A. Sag, Elizabeth C. Traugott, Tom Wasow
Associate Professor: John Rickford
Assistant Professors: Gregory Guy, William J. Poser (on leave Autumn, Winter)
Affiliated Faculty: Jon Barwise, Herbert H. Clark, James A. Fox, Kung-Yi Kao, Mary L. Pratt, Orrin W. Robinson, III, Richard D. Schupbach
Senior Lecturers: Beverley McChesney, Frieda N. Politzer
Acting Assistant Professors: K. P. Mohanan, Peter Sells
Consulting Professor: Lauri Karttunen
Consulting Associate Professors: Philip Cohen, Ronald M. Kaplan
Consulting Assistant Professors: Jared Bernstein, Annie Zaenen
Visiting Emeritus Professor: Dwight Bolinger
Visiting Professor: Arnold Zwicky (Winter)

English for Foreign Students
Director: Beverley McChesney
Senior Lecturers: Beverley McChesney, Frieda N. Politzer

Lecturers: Philip Hubbard, Michelle Marincovich
Lecturer in Arabic: Khalil Barhoum
Lecturers in African Languages: Staff
Special Language Program Coordinator: Marya Teutsch-Dwyer

Linguistics concerns itself with the fundamental questions, what is language, and how is it related to the other human faculties? In answering these questions, linguists consider language as a cultural, social, and psychological phenomenon, and seek to determine what is unique in languages, what is universal; how people learn language; how they use it; and how it changes. Linguistics is, therefore, one of the cognitive sciences; it provides a link between the humanities and social sciences, and also with education, and hearing and speech sciences.

The department offers courses at the undergraduate and graduate levels in the areas central to linguistic theory and analysis: phonetics, phonology, morphology, syntax, semantics, pragmatics, and language change. It also offers particularly strong areas of specialization in language acquisition, theoretical (including computational) linguistics, sociolinguistics, and philosophy of language.

A variety of open forums are provided for the discussion of linguistic issues, including the linguistics colloquium, and weekly lunch hour meetings in theoretical issues in natural language. A number of postdoctoral fellows in the Cognitive Science Group and the Center for the Study of Language and Information, which consists of linguists, philosophers, psychologists, and computer scientists, participate extensively in the activities of the department.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

The undergraduate program in Linguistics stresses the study of language both as a fundamental human faculty, and as a changing social institution. At the core of the program is a set of Linguistics Department courses on the nature of human language; in addition, the program draws on courses offered in other areas of 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 departments as Anthropology, Communication, Computer Science, Education (Language Arts and Language Teaching), Hearing and Speech Sciences, Lan-
guages, Law, Linguistics, Philosophy, and Psychology.

Requirements for the A.B. include at least 45 units of coursework in linguistics and related fields, and study of a foreign language. No more than two courses may be taken for a " + " grade, neither of which can be a core course.

1. Courses—A total of 45 units is required including 110, 120, and 130 (100-level courses will be waived if 200-level courses in the same area are taken), and a course in historical linguistics or the history of a language. Other courses must form a coherent program within one of the following areas of specialization, and must be approved by the Undergraduate Studies Advisor. Specific requirements vary with each area. Detailed information is available from the Department of Linguistics (Bldg. 100).

   a) General Linguistics—This area is intended for students wishing to specialize in the traditional core areas of linguistic study; phonetics, phonology, syntax, semantics, and historical linguistics.

   b) Linguistic Theory—Concerns the development of mathematical models of linguistic structure. Subspecializations are possible in syntax, semantics, phonology, or computational linguistics. Designated courses may be selected in philosophy, computer science, and mathematics.

   c) Linguistics and Cognitive Science—Cognitive science seeks to understand the mind, specifically the nature of cognitive systems like language, the way language is represented in the mind, and the procedures by which language is learned and utilized. Designated courses in psychology, computer science, anthropology, and philosophy may be selected.

   d) The Linguistics of a Particular Language or Language Family—This specialization, which provides a suitable preparation for foreign language teaching, translating or graduate study, may be arranged in any language or language family offered at Stanford (e.g., French, Spanish, Germanic, Chinese, Indo-European or African linguistics). Specific requirements are determined by the undergraduate advisor in consultation with the appropriate language department.

   e) Sociolinguistics—Sociolinguistics is the study of language as a social and cultural phenomenon. It includes such topics as the language of social class, ethnicity, nation, sex, religion; languages in contact, multilingualism, language and the law; non-verbal communication and conversational analysis; social factors in linguistic variation and change. Designated courses in anthropology, sociology, education, and communication may be selected.

   f) Individually Designed Area—An individually designed area of specialization different from any of the areas above can be arranged in consultation with the undergraduate studies advisor.

2. Language—Majors must have competence in a modern foreign language. This 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. The requirement may be modified in the case of certain areas of specialization, in consultation with the undergraduate studies committee.

3. Honors Program—Students majoring in linguistics who plan to apply for graduate studies in linguistics or fields related to linguistics should seek departmental Honors. 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 a letter grade indicator of "B+" or better in the courses required for the major.

   Honors students will take a total of 55 units. These will include 110, 120, and 130, a course in historical linguistics or the history of a language, an area of specialization as above, and an Honors essay based on research conducted with a member of the Linguistics faculty (normally fulfilled by 98, Honors Research, 2 units, in Autumn Quarter, 4 units, in Winter Quarter). The essay must be submitted in final, acceptable form no later than six weeks before the date of intended graduation.

GRADUATE PROGRAMS

The following requirements are in addition to the basic University requirement for the degree sought (see the "Degrees" section of this bulletin).

MASTER OF ARTS

1. Candidates must demonstrate their ability to read a foreign language in which a substantial linguistic literature is written, with sufficient facility to understand and to interpret linguistic research in that language.

   2. Courses—Candidates must complete a minimum of 40 units of graduate work in linguistics including four from among the
following: 135, 205, 206, 207, 220A and B, 230, a course in historical linguistics or the history of a language, and at least three courses in the student's area of specialization. Individual programs should be worked out in advance with the Linguistics Graduate Studies Advisor. A letter grade indicator of at least "B" must be maintained for all degree program course work.

3. Thesis—A.M. candidates are expected to present either a formal A.M. thesis, fulfilling the University requirements specified in the "Degrees" section of this bulletin, or a research paper of A.M. scope (normally fulfilled by up to 6 units of Linguistics 398, Directed Research).

DOCTOR OF PHILOSOPHY

Candidates should review departmental “Guidelines for Ph.D. Degrees” for further particulars concerning these requirements.

1. Language—Candidates must demonstrate the ability to read at least one foreign language in which a substantial linguistic literature is written, 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 A.M., 40 units exclusive of dissertation units. This includes:
   a) In the first year, the following central courses (135, 205, 206, 207, 220A and B, 230), as well as some breadth and depth courses.
   b) Three breadth courses, one each in the areas of psycholinguistics, sociolinguistics, and language change (normally 240, 250, 260); and four advanced linguistics depth courses, in any area, and, during the second year, 395A and B, and the proseminar, 200.
   c) One course in methods (one of 285, 286, 287, 288, 290).

Candidates must achieve a letter grade indicator of "B" or better in each of these courses.

3. Research—Completion of two substantial research papers during the second year, one to be turned in by the end of Winter Quarter, the other by the end of May. Their subject matter must be clearly distinct though they may be related. Fulfilled by Linguistics 395A,B, Research Workshop (2 units in Autumn Quarter, 2 units in Spring Quarter), and evaluation by a committee of three or four faculty members, selected by the student, and by the faculty.

4. Teaching—At least two quarters serving as Teaching Assistant in a linguistics course.

5. Colloquia—Two oral presentations exclusive of the oral presentation of the dissertation proposal (see 6b below). This requirement is satisfied by class presentations, conference papers, or talks in the Linguistics Colloquium. Both should normally be given during the first three years of study.

6. Dissertation—
   a) A written dissertation proposal.
   b) Oral presentation of the dissertation proposal in the Linguistics Colloquium.
   c) Approval of dissertation topic and appointment of a dissertation committee by the chairman.
   d) Successful passing of a University oral examination on the dissertation project and related areas.
   e) Dissertation (up to 15 units of 399).

Ph.D. MINOR

1. Courses—Candidates must complete 30 units of course work in linguistics at the 100 level or above, including 110, 120, and 130 (100-level courses will be waived if 200-level courses in the same area are taken), and at least three courses related to the student’s area of specialization. Courses submitted for the minor must be incremental units beyond those used to satisfy the major. Individual programs should be worked out in advance with the student’s advisor and approved by the Ph.D. minor advisor in linguistics.

2. Research project (optional) — Candidates may elect to present a paper which integrates the subject matter of linguistics into the field of specialization of the candidate.

3. The linguistics advisor or designee 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.

COGNITIVE SCIENCES

Linguistics is participating along with the Departments of Computer Science, Philosophy, and Psychology in an interdisciplinary program in Cognitive Science. The program is intended to provide students with an interdisciplinary education as well as a deeper concentration in linguistics. Doctoral students are eligible to participate in the Cognitive Science Program. Students who complete the require-
ments within Linguistics and the Cognitive Science requirements will receive a special designation in Cognitive Science along with the Ph.D. in Linguistics. To receive this field designation, students must complete 30 units of approved courses, 18 of which must be taken in two disciplines outside of linguistics. The list of approved courses can be obtained from the Cognitive Science program located in the Psychology Department.

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 listed below.

COURSES

LINGUISTICS

Courses with two-digit numbers are primarily designed for undergraduates. Courses with 100-level numbers are designed for advanced undergraduates and A.M. and Ph.D. minor candidates in Linguistics. 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:

- 00-04 General
- 05-19 Phonetics, Phonology, and Morphology
- 20-39 Syntax, Semantics and Pragmatics, Mathematical and Computational Linguistics
- 40-49 Language Acquisition and Psycholinguistics
- 50-59 Sociolinguistics
- 60-69 Language Change, Language, and Culture
- 70-84 Linguistic Analysis of a Language
- 85-94 Methods
- 95-99 Directed Work, Theses, Dissertations

1. Introduction to Linguistics—The nature of human language and the methods of modern linguistics. Topics: principles of the structure of human language, comparisons between human language and animal communication, how children acquire language, language change, universals, regional and social dialects, and the application of linguistic science to social, educational, and engineering problems. (DR:4)

4 units, Win (Clark, Sag)

4. Language and Culture—(Same as Anthropology 4.) The ethnography of communication and theories of language and culture. Analysis of linguistic repertoire; rules of use, semantics, speech acts, discourse, and poetic structure, language and identity, and linguistic models in anthropology. (DR:4)

5 units, Aut (Fox)

5. Biology and Evolution of Language—(Same as Anthropology 5, Human Biology 113.) The biology, function, and evolution of the organs of speech and the brain. Topics: animal communication, nonverbal communication; language structure; the biology and physics of speech; speech disorders; color terminology and color vision; biological influences from language universals and acquisition. (DR:4)

5 units (Fox)

alternate years, not given 1988-89

16. Writing and Literacy—(Same as Anthropology 18.) The origins, evolution, and diffusion of writing, its relationship to speech, and its roles in various cultures and civilizations. Topics: archaeological decipherment, scribal practice, and current issues and problems in literacy.

5 units, Spr (Fox)

35. Computers and Language—(Same as Computer Science 75.) A basis for understanding computer uses dealing with language and implications of computer systems in everyday life situations. Introduces basic principles of computing and linguistics through lectures, films, discussions, and demonstrations of existing systems. Term paper required. Computer background not required. (DR:4 or DR:8)

5 units, Spr (Staff) MWF 11


4 units, alternate years, given 1989-90


4 units, alternate years, given 1989-90

60. Language, Past and Present—Change and diversity as the natural state of language. Language as a window on prehistory, exemplified by the reconstruction of Indo-European culture. The techniques of comparative historical linguistics and why they work. Language change; the role of structure, acquisition, production and perception; implications for rational language policy in multilingual societies. (DR:5)

4 units, Spr (Denning)
The Structure of English Words—The analyzing of English vocabulary words to determine their meanings. Two goals: to increase the student's vocabulary; and, by enumerating the principles behind changes in pronunciation and meaning, to take the mystery out of the processes that have made English vocabulary what it is today. (DR:4)

4 units, Aut (Denning)

Black English—Survey of the the English vernacular spoken by Black Americans 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 (in soundin', and rappin'), and its educational implications. (DR:4)

4 units, Win (Rickford)

Introduction to the Germanic Languages—(Same as German Studies 19A/119.) Survey of the oldest attested stages of the Germanic language family, Gothic, Old Norse, Old Saxon, Old English, Old High German, Old Dutch, Old Frisian. External history and internal relationships. (DR:4)

3 units (Robinson) given 1989-90

Indigenous Languages of North and South America—(Same as Anthropology 172.) Survey of American Indian languages, their history, classification, structure, and possible Old World relationships. The relationship between American Indian languages and the development of anthropological and linguistic theory. Native American writing systems. Problems of language, culture, and world view.

5 units, alternate years, given 1989-90

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. Each student serves as a tutor to an individual who is learning to speak English.

3 units, Win (McChesney)

Practicum in TEFL—Workshop for volunteer teachers currently active in area TEFL programs or planning to teach English abroad. Includes demonstration teaching, discussion of teaching problems, and evaluation of classes observed. Prerequisite: 85 or equivalent.

2-3 units, Spr (Hubbard)

Research in Linguistics—Introduction to research goals and methods in linguistics and related disciplines. Assigned readings and presentations by different faculty members.

4 units, Aut (Rickford)
discussed include W. V. Quine and Donald Davidson. Lectures presuppose acquaintance with the philosophy of language.

4 units, not given 1988-89

139. Computational Linguistics—(Same as Symbolic Systems 150.) Introduction to computing for linguistics emphasizing good programming style. Data and functional abstraction, procedural and declarative formulations, deterministic and nondeterministic algorithms, computational complexity, and fundamental processes in the lexicon, phonology, morphology and syntax. The programming language used is Lisp or Prolog (Lisp in 1988-89).

4 units, Aut (Kay) TTh 8:45-10

145. Language and Thought—(Same as Psychology 146.) The psychology of language, including production and understanding of utterances, from speech sounds to speaker’s meaning, children’s acquisition of their first language, and psychological bases for language systems. Language functions in natural contexts and their relation to the processes by which language is produced, understood, and acquired. Prerequisite: 1 or Psychology 1. (DR:4)

4 units, Aut (H. Clark) MWF 1:15

150. 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 is to train students in the systematic observation of speech; some practice in participant-observation, interviewing, and recording of conversations. Prerequisite: 1 or its equivalent.

4 units, Win (Ferguson)

151/251. Pidgins and Creoles—(Same as Anthropology 177.) The formation of simplified contact languages 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. Other simplified languages and registers. Prerequisite: An introductory course in linguistics or anthropology or consent of instructor.

4 units, Win (Rickford)

155. Multilingualism—Linguistic, social, and psychological dimensions of language contact and multilingualism. Topics: interlanguage phenomena, language convergence and divergence, and attitudes toward language. Prerequisite: An introductory course in linguistics.

4 units, Spr (Ferguson)


3-4 units, Aut (Guy)

165/265. The Study of Language Variation—Theoretical and methodological issues in the study of language variation. Location variation in the grammar; categorical vs. variable properties of language, incorporating dynamic dimensions in linguistic theory. Quantitative methods in linguistics, including probabilities and statistics for linguistics. Variable rule analysis, implicational scaling, significance. No prior background in statistics or mathematics required.

3-4 units, Spr (Guy)

175. Linguistics and the Analysis of German—(Same as German Studies 212/312.) An introduction to linguistic theory and analysis emphasizing the analysis of modern German.

alternate years, given 1989-90

176. 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, an introduction to dialect geography. (DR:4)

3 units, Win (Robinson)

189/289. Linguistics and the Teaching of English as a Foreign/Second Language—(Same as Education 282.) Linguistic aspects of the problems of teaching English to speakers of other languages and standard English to speakers of other dialects. 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.

4-5 units, Aut (Staff) MW 1:15-3:05

200A,B,C. Foundations of Linguistic Theory—Readings in theories that have shaped 20th-century linguistics; comparison analysis of selected categories across languages.

2 units, Aut (Kiparsky) Win (Mohanan) Spr (Rickford)

205. Phonetics—Introduction to phonetics emphasizing general scientific interest and its relationship to phonology. Anatomy and physiology of the articulatory apparatus, survey of human speech sounds including practice in transcription and discussion of feature systems, acoustic properties of speech sounds, speech
perception, relationship between phonology and phonetics.

4 units, Aut (Guy)

206. Phonology—The types of phenomena that occur in phonological systems; the phonology of English, and other languages. The types of theoretical devices used for describing regularities involving the distribution of phonemes, the distribution of phones, and phonological alternations.

4 units, Win (Leben)


4 units, Spr (Kiparsky)


4 units, Aut (Leben)

209. Issues in Phonological Theory II—Issues in phonological theory and their resolution is restrictive theory of lexical phonology. Levels of representation: phonology and phonetics, the phoneme, abstractness of lexical representations. The role of formal and substantive principles in explaining the typology of natural phonological rules and systems.

4 units, Win (Staff)


4 units, Spr (Poser)

215. Instrumental Phonetics—Techniques of instrumental research in speech perception and production. Theory and instrumentation for analysis and manipulation of speech signals. Laboratory course. Prerequisite: Consent of instructor.

4 units, Aut (Staff)

220A,B. Syntactic Theory—Intensive two-quarter introduction to syntactic argumentation through detailed analysis of data from English and other languages. The major phenomena central to issues in contemporary syntactic theory, constituent structure, lexical structure, grammatical functions, complementation, control, long distance dependencies, and binding. Discussion and evaluation of treatments of these in grammatical frameworks. Prerequisite: Consent of instructor.

4 units, Aut, Win (Mohanan, Wasow)

221. Information-Based Syntax—A synthesis of ideas from contemporary syntactic theories: generalized phrase structure grammar (GPSG), categorial grammar, and LFG. Examination of an integrated approach to syntactic and semantic analysis, Head-driven Phrase Structure Grammar (HPSG), with respect to linguistic phenomena central to current theoretical debates: subcategorization, semantic role assignment, local and unbounded dependencies, control, agreement, anaphora, and the structure of the hierarchical lexicon. Prerequisites: 220A,B, and some knowledge of elementary logic.

4 units, Win (Sag)


4 units, Aut (Bresnan)

223B. Lexical Functional Grammar II—Continuation of 223A, emphasizing theory construction and the evaluation of leading theoretical ideas. Prerequisite: 223A or permission of instructor.

4 units, Win (Bresnan)

224. Advanced Syntactic Theory—Topics in control and binding in a variety of frameworks. Issues: the nature of control constraints (restrictions on the interpretation of unexpressed subject arguments), co-reference constraints, reflexive and pronominal "binding" and unbounded dependencies (e.g., filler-gap constructions). Prerequisite: Some background in syntax and semantics.

4 units, Win (Sag, Sells)


4 units, Win (Kiparsky)
227. Computational Linguistics II—(Same as Computer Science 275.) Computational methods in the linguistics (phonology, morphology, syntax, semantics, etc.) and applications (translation, expert systems, question answering, etc.). Individually, or in small groups, students complete a programming project involving a substantial amount of linguistic theory. The programming language used is either Lisp or Prolog (Lisp in 1988-89). Prerequisites: 120, Computer Science 21 (or 22 depending on the programming language being used).

4 units, Win (Kay)

230. Semantics and Pragmatics—Fundamental issues in the semantic and pragmatic analysis of human language and of their incorporation into the fragment of English grammar developed in 221. Topics: speech acts, conversational implicature, binding phenomena (quantifiers, unbounded dependency constructions, pronouns and reflexives), discourse representation theory and pragmatic inference. Prerequisite: 221.

4 units, Spr (Peters)

231. Semantics and the Logic of Natural Languages—(Same as Philosophy 285.) Treats a substantial fragment of English: presentation and justification of a detailed syntactic analysis, justification of a semantic analysis within situation semantics, presentation of detailed rules assigning meanings to the expressions in the fragment, development of the logic of the fragment under the given semantic analysis, presenting rules of inference. Prerequisite: Consent of instructor.

4 units, Aut (Peters)

232. Topics in Cognitive Science: The Resolution Problem for Language Processing—Seminar on the resolution of ambiguities and types of interpretational uncertainty in real-time language processing. (1) New linguistic tools for characterizing the relevant phenomena. (2) What experimental results now reveal about the real-time resolution processes. (3) New computational techniques for developing resolution architectures in language processing systems. Prerequisite: Some background in linguistics theory, psycholinguistics, or artificial intelligence.

4 units, Aut (Sag, Hobbs, Clark)


4 units, not given 1989-89


3 units, Aut (Winograd) MWF 10

238A. Topics in Semantics and Pragmatics—Topics: lexical semantics and aspectual classes with an emphasis on montague semantics.

4 units, Win (Sells)

240. Language Acquisition I—(Same as Psychology 240.) Survey of present knowledge of processes of language acquisition from a linguistic point of view. Recent and past literature. Prerequisite: 1 or 120, or consent of instructor.

4 units, Aut (Clark) MW 2:15-3:30

241. Language Acquisition II: Acquisition of Syntax—(Same as Psychology 241.) Proposals about and evidence for syntactic rules on meaning acquisition.

4 units, Win (Clark) by arrangement.

246. Psycholinguistics—(Same as Psychology 214.) Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Spr (H. Clark) MW 1:15-2:30

250. Sociolinguistic Theory and Analysis —The kinds of problems with which sociolinguists deal, and the theories, models, and methods of analysis which they have developed. Emphasis on what general linguistics might gain from the sociolinguistic approach to problems of linguistic theory and description, and linguistic change. Prerequisite: Graduate standing in Linguistics or consent of instructor.

4 units, Win (Guy)

255. Linguistic Anthropology—(Same as Anthropology 277.) Seminar devoted to intensive reading and discussion of major works on the relationships between language and culture. Prerequisite: An introductory course in linguistics or consent of instructor.

given 1989-90

256. Topics in Linguistic Anthropology—(Same as Anthropology 278.) Seminar devoted to a key issue in the relationships between language and culture.

5 units (Fox)

alternate years, not given 1989-90

264. Historical Phonology—The nature of phonological change. Internal and comparative
reconstruction. The role of language acquisition and use in the explanation of diachronic processes.


4 units, Spr (Kiparsky)


3 units, Aut (Traugott)

269. Readings in Linguistic Anthropology—(Same as Anthropology 274.) Workshop: reading and discussion of key monographs and articles on a specific topic or geographic area, or by a specific author, on the relationships between language and culture. 

2 units (Fox) not given 1988-89

271. Structural Typology of the Slavic/Balkan Languages. 

3 units (Ivanof) by arrangement

271A,B. Indian Linguistics—Some theoretical themes related to the stucture of Indian languages. A general framework for the discussion of issues in Indian linguistics with detailed analysis of some topics. Students make class presentations and produce a paper. 

4 units, Win, Spr (Mohanan)

276. History of the German Language—(Same as German 203.) Introduction to the phonological and syntactic development of Modern German from the Germanic parent language. The analysis of selected texts and the consultation of linguistic works on the subject. 

3 units, Spr (Robinson)


4 units, Aut (Sells)

278. The Structure of Modern Chinese—(Same as Asian Languages 291.) Prerequisite: Asian Languages 23 or equivalent. Recommended: A general introductory course in linguistics. 

alternate years, given 1989-90

287. Field Methods—Analysis of the structure of an unknown language using data gathered during interaction with a native speaker; exploration of basic field techniques, and issues such as researcher-informant relationships, selection and maintenance of equipment, survival strategies for the field linguist. 

4 units, Spr (Staff)

288. Research Methods in Phonetics—Experimental design, statistics, exploratory data analysis; presentation of results, and pitfalls in obtaining and analyzing instrumental data. Includes critical reading of published research for methodological soundness and exercises in analysis of data and presentation of results. Prerequisite: 205. 

4 units, Spr (Staff)

395A,B. Research Workshop—Student presentations of research toward qualifying papers. Designed for second year students in the doctoral program. 

2 units, Aut (Staff) 
Spr (Sag)

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 predissertation level. 

1-6 units, any quarter (Staff) 
by arrangement

399. Dissertation Research. 

1-15 units, any quarter (Staff) 
by arrangement

REGULARLY OFFERED BUT NOT DURING 1988-89

45. Introduction to Language and Speech Disorders.

51. Language Minorities in Modern Nations.

72. Linguistic Approaches to Point of View in Fiction.

100. Typology and Universals of Language.

115. Speech Perception.

116. Physiology of Speech.

160. Languages in Contact.


212. Metrics.

218. Topics in Phonetics.

219. Topics in Phonology, Morphology.

222. Topics in Information-Based Linguistics.

228. Topics in Syntactic Theory.


239. Topics in Computational Linguistics.
245. Language and Speech Disorders.
247. Psycholinguistic Theories of Parsing.
248. Topics in Developmental Psycholinguistics.
251. Sociolinguistics and Pidgin/Creole Studies.
253. Language Planning and Public Policy.
254. Literacy: Social and Historical Perspectives.
255. Linguistic Anthropology.
259. Topics in Multilingualism.
260. Language Change.
261. Phonological and Morphological Change.
262. Syntactic Change.
263. Semantic Change.
268. Topics in Language Change.
270. The Structure of Hausa.
273. The Structure of Finnish.
275. Germanic Syntax.
286. Sociolinguistic Field Methods.

FOREIGN LANGUAGES
AFRICAN LANGUAGES (600-619)

602A,B,C. Beginning Hausa—Successful completion of 602C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Leben)

604A,B,C. Advanced Hausa.
4 units, Aut, Win, Spr (Leben)

606A,B,C. Beginning Swahili—Successful completion of 606C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Rubanza)

4 units, Aut, Win, Spr (Rubanza)

608A,B,C. Advanced Swahili.
4 units, Aut, Win, Spr (Rubanza)

610A,B,C. Beginning Kikuyu.
3 units, Aut, Win, Spr (Staff)

613C. Intermediate Afrikaans.
3 units, Aut (Staff)

614A,B,C. Beginning Igbo.
3 units, Aut, Win, Spr (Staff)

618A,B,C. Beginning Zulu.
3 units, Aut, Win, Spr (Staff)

Other African languages may be offered on request. In the past several years, these courses have included:

608A,B,C. Beginning Amharic.
610A,B,C. Beginning Yoruba.
611A,B,C. Intermediate Shilok.
616A,B,C. Setswana.
618A,B,C. Beginning Bambara.

SPECIAL LANGUAGE PROGRAM (620-679)

The Special Language Program offers a number of foreign languages not otherwise taught at Stanford. Courses planned for 1988-89, given sufficient enrollment, are:

620A,B,C. Beginning Arabic — Successful completion of 620C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Barhoum)

621A,B,C. Intermediate Arabic.
4 units, Aut, Win, Spr (Barhoum)

622A,B,C. Advanced Arabic.
4 units, Aut, Win, Spr (Barhoum)

633A,B,C. Intermediate Tibetan.
3 units, Aut, Win, Spr (Zhang)

634A,B,C. Beginning Serbo-Croatian—Successful completion of 634C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Staff)

635A,B,C. Intermediate Serbo-Croatian.
4 units, Aut, Win, Spr (Staff)

643C. Intermediate Norwegian.
3 units, Aut (Gould)

646A,B,C. Beginning Quechua.
3 units, Aut, Win, Spr (Staff)

3 units, Aut, Win, Spr (Singh)

654A,B,C. Beginning Bengali.
3 units, Aut, Win, Spr (Staff)

656A,B. Beginning Indonesian.
3 units, Win, Spr (Staff)

658C. Beginning Punjabi.
3 units, Aut (Dhillon)

664A,B,C. Beginning Czech.
3 units, Aut, Win, Spr (Henzl)

3 units, Aut, Win, Spr (Henzl)
666A,B,C. Beginning Polish—Successful completion of 666C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Kolaczkowska)

4 units, Aut, Win, Spr (Miodunka)

670A,B,C. Modern Greek—Successful completion of 670C may fulfill the foreign language requirement.
4 units, Aut, Win, Spr (Prionas)
given 1989-90

671A,B,C. Intermediate Greek.
4 units, Aut, Win, Spr (Prionas)

676A,B- Beginning Mandarin.
3 units, Win, Spr (Staff)

678A,B,C. Beginning Sign (ASL).
3 units, Aut, Win, Spr (Haas)

3 units, Aut, Win, Spr (Haas)

All beginning level 3 unit courses are offered on a Pass/No Credit basis only. "Beginning and Intermediate" each refer to an academic year's sequence of language study; the suffixes A, B, and C refer to 1st, 2nd, and 3rd quarter of language instruction that year.

These and other languages will be offered only on request. Requests must be made by the end of Autumn Quarter registration period at the Special Language Program, Bldg. 380 room 381A. The course offerings for the entire year are decided immediately following Autumn Quarter registration, and additional new courses cannot usually be given. If a sufficient number of requests are received and suitable arrangements for instruction can be made, a 3 units per quarter course will be set up. Intermediate and advanced level courses are also available on request, for 3 units, with a grading option. For further information, consult Coordinator, Special Language Program, Linguistics, Bldg. 380 room 381E.

Languages offered on the basis of student requests during the last few years have included:

632A,B,C. Beginning Armenian (Computer-Assisted).

638A,B,C. Beginning Nepali.

646A,B,C. Beginning Quechua.

648A,B,C. Beginning Marathi.

650A,B,C. Beginning Navaho.

654A,B,C. Beginning Tagalog.

658A,B,C. Beginning Korean.

660A,B,C. Beginning Taiwanese.

666A,B,C. Beginning Cantonese.

690. Spoken Usage—Structured practice in spoken English with emphasis on current use in a variety of daily situations. Review and practice of grammatical patterns as needed.
3 units, Aut, Win (Staff) by arrangement

691A. Discussion—Participation in seminar-style discussions as discussant and leader. Emphasis on fluency and intelligibility; feedback from instructor on language and effectiveness.
3 units, Aut, Win, Spr (Staff) by arrangement

691B. Making Oral Presentations in English—Preparation and delivery of numerous oral presentations, followed by short discussions. Emphasis on appropriate language and style in university settings. Video and other feedback from instructor.
3 units, Aut, Win, Spr (Staff) by arrangement

692. Speaking and Teaching in English—For non-native speakers who must teach in English. Focus is on developing clarity, intelligibility, and effectiveness through weekly presentations simulating actual teaching assistant responsibilities. Methods of feedback include videotaping and self and staff evaluations.
1 unit, Aut, Win (McChesney, Marincovic) by arrangement

693. Aural Comprehension—Practice in listening to lectures, and discussions with evaluation of comprehension. Strategies for improving understanding and retention. Prerequisite: Consent of instructor.
3 units, Aut, Win (Staff) by arrangement
694. Interpreting English—For advanced graduate students. Analysis of complex spoken and written language in academic and professional contexts, including recognition of underlying meaning, nuance, and inference. Practice in expressing ideas appropriately within those contexts. Prerequisite: Consent of instructor.  
3 units, Win, Spr (Staff) by arrangement

695. Special Topics in English—Topics such as pronunciation, reading comprehension, professional correspondence, or intercultural communication determined each quarter according to enrollment.  
3 units, Aut, Win, Spr (Staff) by arrangement

696. English Composition—For undergraduate foreign students or recent immigrants whose first language is not English. Organization and production of papers reflecting vocabulary, structure, and style appropriate for academic English. Emphasis on the writing process, from prewriting strategies through multiple drafts. Review of selected points of grammar and practice writing in-class examinations. Prerequisite: Consent of instructor.  
3 units, Aut (Hubbard) by arrangement

698A. Writing Academic English—Prepares graduate students for writing academic papers; emphasis on fluency, documentation, and appropriateness for specific tasks. May be repeated for credit. Prerequisite: Consent of instructor.  
3 units, Aut, Win, Spr (Staff) by arrangement

698B. Advanced Graduate Writing—For graduate students experienced in English writing and currently required to write for courses and research. Class meetings and frequent individual conferences. Prerequisite: Consent of instructor.  
3 units, Aut, Win, Spr (Staff) by arrangement

699. Tutorial in Academic Writing—For students actively engaged in writing dissertations, whose problems with English are clearly the result of non-native use of the language, and who demonstrate potential for rapid improvement with individualized instruction. Focus is on student’s work in progress. Emphasis on self-correction and achievement of independent control. Recommendation of major adviser and consent of instructor required.  
1 unit, Aut, Win, Spr (Staff) by arrangement

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. However, 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 language. The following list of courses has been prepared to assist students in selecting courses which feature foreign works in English translation. Please consult departmental listings for further information.

ASIAN LANGUAGES

CHINESE

132. Chinese Fiction and Drama in Translation.
133. Modern Chinese Literature in Translation.

JAPANESE

given 1989-90
given 1989-90
given 1989-90

CLASSICS

11. Age of Heroes.

FRENCH AND ITALIAN

FRENCH

105. The Writings of Albert Camus.
114B. The Modern French Novel.
190. Great French Plays.
268. The Literature of Decolonization.
272. From Existentialism to Structuralism and Post-Structuralism.
284D. Literature and Philosophy: Complexity and Self-Reference in the Humanities and Social Sciences.
296. Western Views of the Non-West through the Literature of Travel.

267. Brazilian Literature I.

MATHMATICAL AND COMPUTATIONAL SCIENCE

Committee in Charge: Bradley Efron, Chairman (Statistics); Paul W. Berg (Mathematics), Richard W. Cottle (Operations Research), Robert W. Floyd (Computer Science), John G. Herriot (Computer Science), Joseph B. Keller (Mathematics), Robert Osserman (Mathematics), David O. Siegmund (Statistics), Mary V. Sunseri (Mathematics)

Ex-officio Members: Takeshi Amemiya (Economics), Thomas M. Cover (Electrical Engineering and Statistics), John T. Gill III (Electrical Engineering), J. Michael Harrison (Graduate School of Business), David R. Rogosa (Education)

This interdepartmental, interschool undergraduate program is designed as a major for students interested in the mathematical and computational 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 and computational 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.
The requirement for the bachelor's degree, beyond the University's basic requirement, is an approved course program of 75 to 79 units, distributed as follows:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics (33-34 units)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Math 41, 42, 43. Calculus and Analytic Geometry or Math 19, 20, 21, 43</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Math 44. Calculus</td>
<td>3</td>
<td></td>
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<tr>
<td>Math 103. Matrix Theory and Its Applications or Math 113. Linear Algebra and Matrix Theory</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math 104. Continuation of Math 103 or Math 114. Continuation of Math 113</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math 109. Modern Algebra and its Applications or Math 120. Modern Algebra</td>
<td>3</td>
<td></td>
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<tr>
<td>Math 130. Ordinary Differential Equations</td>
<td>3</td>
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<tr>
<td>2. One of the following:</td>
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<tr>
<td>Math 115. Fundamental Concepts of Analysis</td>
<td>3</td>
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<tr>
<td>Math 160A. First Order Logic</td>
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<tr>
<td>Computer Science (CS) 137. Fundamentals of Numerical Computation</td>
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<tr>
<td><strong>Computer Science (13-15 units)</strong></td>
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<tr>
<td>1. CS 106X. Programming Methodology and Abstractions (CS 106A and B may be substituted)</td>
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</tr>
<tr>
<td>2. CS 106C. Theoretical Foundations for Computer Science</td>
<td>5</td>
<td></td>
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<td>or</td>
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<tr>
<td>CS 109A and B. Introduction to Computer Science (credit earned for CS 109B may be applied to the electives requirement)</td>
<td>5 each</td>
<td></td>
</tr>
<tr>
<td>3. One of the following:</td>
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<tr>
<td>CS 107. Programming Paradigms</td>
<td>3</td>
<td></td>
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<tr>
<td>CS 110. Introduction to Computer Systems and Assembly Language</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CS 137. Fundamentals of Numerical Computation</td>
<td>4</td>
<td></td>
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<tr>
<td>CS 154. Introduction to Automata and Complexity Theory</td>
<td>4</td>
<td></td>
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<td>or</td>
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<tr>
<td>CS 254. Automata, Languages, and Computability</td>
<td>3</td>
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<tr>
<td>CS 160. Discrete Mathematics</td>
<td>4</td>
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<tr>
<td><strong>Operations Research (8-9 units)</strong></td>
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<tr>
<td>OR 153. Introduction to Operations Research II</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>OR 152. Introduction to Operations Research I</td>
<td>4</td>
<td></td>
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<tr>
<td>or</td>
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<tr>
<td>OR 240. Linear Programming</td>
<td>3</td>
<td></td>
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<tr>
<td>OR 250. Deterministic Models in Operations Research</td>
<td>3</td>
<td></td>
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<tr>
<td>OR 251. Stochastic Models in Operations Research</td>
<td>3</td>
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</tbody>
</table>

* This course is best taken before CS 106C and CS 109A.

Statistics (9 units)
**Electives (12 units)**

Four courses in mathematical and computational science, 100-level or above, and at least 3 units each.

At least one must be chosen from the following list:
Math 101. Advanced Calculus | 3 |
Stat. 217. Introduction to Stochastic Processes | 3 |

For Computer Science, suggested electives include those courses not taken under Part 3 of the above listing for Computer Science and the following 3-unit courses:
CS 112. Computer Organization | 3 |
CS 140. Concurrent Programming | 3 |
CS 143A. Compilers | 3 |
CS 157. Logical Basis for Computer Programming | 3 |
CS 161. Discrete Structures and Algorithms | 3 |
CS 211. Logic Design | 3 |
CS 212. Computer Architecture and Organization | 3 |
CS 221. Introduction to Artificial Intelligence | 3 |
CS 225A. Declarative Programming | 3 |
CS 237A. Numerical Analysis | 3 |
CS 240A. Operating Systems | 3 |
CS 243. Advanced Compiling Techniques | 3 |
CS 250. Concrete Mathematics | 3 |

With the advisor's approval, courses other than those offered by the sponsoring departments may be used to fulfill part of the elective requirement. There are courses in economics, electrical engineering, industrial engineering, etc., that might be relevant to a mathematical sciences major, depending on the particular interest of the student.

Majors must file a plan with their advisors for completing their degree requirements at least three quarters before their graduation. All courses used to fulfill major requirements must be taken for a letter grade with the exception of courses offered Pass/No Credit only. A course used to fulfill the requirements of one section of the program may not be applied toward the fulfillment of the requirements of another section. The student must have a letter grade indicator of "C" or better in all course work used to fulfill the major requirement.

**HONORS PROGRAM**

The Honors program 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 and Computational Science, the student must:
1. Maintain, in mathematical sciences courses, an average letter grade indicator equivalent of at least 3.4.
2. Complete at least 15 units in mathematical sciences in addition to the requirements for the 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 and Computational Science Program.

3. Include in the above 15 units at least one of the following: (a) an approved higher-level graduate course, (b) participation in a small group seminar, or (c) at least 3 units of directed reading.

Students interested in doing Honors work should consult with their advisors by the last quarter of the junior year to prepare a program of study for submission to the committee in charge for its approval.

**MATHEMATICS**

Emeriti: (Professors) Harold M. Bacon, Kai Lai Chung, Georg Kreisel, Ralph Phillips, Hans Samelson, Menahem Schiffer, Mary Sunseri

Chairman: Solomon Feferman


Associate Professors: Steven Kerckhoff, Brad Osgood, Brian White

Assistant Professors: Scot Adams, Alejandro Adem, Daniel Bump, Walter Craig, Russell Lyons, Rafe Mazzeo, Alexandre Freire, Karl Luttinger, Tomasz Mrowka, Philip Scowcroft, Michael Ward, Rugang Ye

Visiting Professors: Paul Halmos, Atle Selberg

Acting Assistant Professor: David Eisen

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 B.S. in Mathematical and Computational Science. The department also participates in the new degree program in Scientific Computation and Computational Mathematics.

**ADVANCED PLACEMENT FOR FRESHMEN**

Secondary school students of unusual ability in mathematics often pursue one or more semesters of college-equivalent courses in mathematics while they are still in high school. Under certain circumstances, it is possible for such students to secure both advanced placement and credit toward the bachelor's degree on the basis of these courses. A decision as to placement and credit will be made by the department after consideration of the student's performance on the Advanced Placement Examination in Mathematics (forms AB or BC) of the College Entrance Examination Board. This examination is the only one used for granting credit. 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.

**UNDERGRADUATE PROGRAMS**

**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, 43, 44; or 41, 42, 43, 44). These courses should be started during the first year.

2. Nine courses each carrying at least 3 units credit, numbered 100 or above or 44H, 45H, excluding 103, 104, and 109, distributed as follows: three courses in algebra or number theory, four courses in analysis, and two courses in geometry or topology, or foundations, at least one of which must be in geometry or topology. These will typically be chosen among the following: algebra—113, 114, 120, 152, 154, 155, 157; analysis 44H, 45H, 106, 115, 116, 130, 131, 132, 134A,B, 171, 173 and 175; geometry—any of the courses numbered in the 140's; foundations —160A,B, 161, 162. Notice that the courses 103 (formerly 113S), 104 (formerly 114S) and 109 (formerly 120S) will not satisfy algebra requirements. Graduate courses in the same subject may be substituted for the preceding courses—for example, 206A for 106.

3. Five additional courses, each of at least 3 units, chosen from courses numbered 100 or above.

Mathematics majors must have a letter grade indicator of at least a "C" 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, 114, and 115 or 171 as early as possible. Students intending to go on to graduate work in mathematics are also strongly urged to study at least one foreign language chosen from French, German, and Russian.

4. One of the following options. The choice of (a) or (b) is recommended.
   a) Physics 51, 53, 55, 57 (total, 15 units) or 61, 62, 63 (total, 12 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 departmental Committee on Undergraduate Affairs.

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.

HONORS PROGRAM

The Department of Mathematics program leading to the degree of Bachelor of Science in Mathematics with Honors is intended for students having strong theoretical interests and abilities in mathematics. The goal is to give students a strong background in the three basic areas of pure mathematics—analysis, algebra, and geometry. Through the Honors thesis program, a student will be introduced to current mathematical research. The program provides an excellent background with which to enter a Ph.D. program in Mathematics.

The basic requirement for entry into the Honors program is the completion of Math 45H, or equivalently, Math 44, 101, 113, and 130. Beyond this level, fourteen 3-unit Math courses are required, as well as the successful completion of a senior thesis. Of these 14 courses, the following are required: 106, 114, 120, 134A,B, 171, and 173. In addition to these courses, a student must take two geometry/topology courses (courses numbered in the 140's), one algebra course (courses numbered in the 150's), and one course in probability or set theory (123 or 160A or 162). In addition, at least three other courses numbered above 110 must be taken. Students are urged to include graduate level courses numbered above 200, particularly 205A.

In addition to fulfilling these course requirements, an Honors student must write a senior thesis. Typically at the end of the junior year, a student will choose a thesis advisor from among the Mathematics faculty. The advisor and the student together will map out a concentrated reading program culminating in the writing of the thesis. The thesis project is worth 6 units of credit and will generally take two quarters to complete. The student works under the direction of an advisor during the senior year to write a thesis on a problem or set of problems in an area of study. The thesis may consist of original material or be a synthesis of a variety of work in the current research literature. Beyond these requirements, the Honors major has the same physics/applied math requirements as the regular major (see paragraph 4 above). Below is an example of a typical mathematics curriculum of an Honors Math major:

<table>
<thead>
<tr>
<th>Autumn</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman year:</td>
<td>43H</td>
<td>44H</td>
</tr>
<tr>
<td>Sophomore year:</td>
<td>120</td>
<td>134A</td>
</tr>
<tr>
<td>Junior year:</td>
<td>143</td>
<td>4 elective courses from 206A among the 140's and 150's</td>
</tr>
<tr>
<td>Senior year:</td>
<td>205A</td>
<td>205B</td>
</tr>
</tbody>
</table>

Students with questions about the Honors program should see Professors R. Cohen, B. Osgood, or H. Royden.

BACHELOR OF SCIENCE IN MATHEMATICAL AND COMPUTATIONAL SCIENCE

The Mathematics Department participates with the Departments of Computer Science, Operations Research, and Statistics in a program leading to the degree of Bachelor of Science in Mathematical and Computational Science. See the "Department of Mathematical and Computational Science" section in this bulletin.

GRADUATE PROGRAMS

MASTER OF SCIENCE

The University's basic requirements for the master's degree (residence, etc.) are discussed in the "Degrees" section in this bulletin. The following are additional 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 an average letter grade indicator (LGI) of "B" over all course work taken in Mathematics, and an LGI of "B" in the 200 level courses considered separately.

For the degree of Master of Science in Computer Science, see the "Computer Science" section in this bulletin.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, see 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 or relevant teaching experience and wish to strengthen further their academic preparation. Detailed requirements are outlined under the "School of Education, Master of Arts in Teaching" section 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 additional 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 substantial 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 letter grade indicator of "B" or better in a course to satisfy the Ph.D. requirement.

Experience in teaching is emphasized in the Ph.D. program. Each student is required to obtain nine quarters of such experience. The nature of the teaching assignment for each of those quarters will be determined by the department in consultation with the student. Typical assignments include teaching or assisting in teaching an undergraduate course, or lecturing in an advanced seminar.

For the degree of Doctor of Philosophy in Computer Science, see the "Computer Science" section 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.

COURSES

INTRODUCTORY AND UNDERGRADUATE

The Department of Mathematics offers two sequences of introductory courses in 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) covers the material of 41, 42 in three quarters instead of two.

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 (103 or 113). There are no formal prerequisites for this course, but appropriate mathematical maturity is expected.

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.

4 units, Aut (Staff) MTWThF 8

19. Calculus and Analytic Geometry — A 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) is taught in individual sections and covers the same subjects as the sequence (41, 42) described below. Prerequisites: See 41. (DR:6)

3 units, Aut (Staff) MWF 8, 9, and 10

TTh 1:15-2:30

Win (Staff) MWF 9, 10, and 11
   3 units, Win (Staff) MW 8, 9, 10, and 11
   TTh 1:15-2:30
   Spr (Staff) MW 8, 9, and 10

   4 units, Aut (Staff) MW 9 and 2:15
   Spr (Staff) MW 8, 9, 10, and 11
   TTh 1:15-2:30

41, 42, 43—(Autumn, Winter, Spring Quarters respectively) consists of three large lecture classes per week together with two classes in small sections.

41. Calculus and Analytic Geometry—An introduction to differential and integral calculus. Topics: limits, derivatives of polynomials, algebraic functions and trigonometric functions, curve sketching, mean value theorem, maxima and minima, indefinite and definite integrals, geometric and physical interpretations, and applications. Prerequisite: Algebra and trigonometry. (DR:6)
   5 units, Aut (Osgood) MTWThF 11, 1:15

42. Calculus and Analytic Geometry—Continuation of 41. Logarithms, exponential functions, hyperbolic functions, techniques of integration, analytic geometry: conic sections, polar coordinates, introduction to vectors. Prerequisite: 41 or equivalent. (DR:6)
   5 units, Aut (Osgood) MTWThF 9, 10, 11, and 1:15
   Win (Berg) MTWThF 11 and 1:15

43. Calculus and Analytic Geometry—Continuation of 42. Vector functions, functions of several variables, partial derivatives, gradient, Lagrange multipliers, double and triple integrals. Prerequisite: 42 or consent of department. (DR:6)
   5 units, Aut (Staff)
   MTWThF 10, 11, 1:15 and 2:15
   Win (Staff) MTWThF 9, 10 and 1:15
   Spr (Eisen) MTWThF 11 and 1:15

43H, 44H, 45H. Honors Calculus—Three-quarter sequence, beginning in the Autumn covers the topics of 43, 44, 101, 113 and 130, with additional advanced calculus and ordinary and partial differential equations. The Honors sequence provides a unified treatment of multivariable calculus, linear algebra, and differential equations with a different order of topics and emphasis from standard courses. Students should know one-variable calculus and have an interest in a theoretical approach to the subject. Prospective mathematics majors in the Honors program or other areas of science or engineering who have a strong mathematics background are welcome. It is recommended students complete at least the first two quarters. Prerequisite: A score of 5 on the BC Advanced Placement Exam or consent of the instructor. (DR:6)
   5 units, Aut, Win (Sarnak) MTWTh 2:15-3:15
   Spr (Bump) MTWTh 2:15-3:15

44. Calculus—Continuation of 43. Topics: Infinite sequences and series, line and surface integrals. The basic theorems of vector analysis (Green's, Stokes, and Divergence). Prerequisite: 43 or equivalent.
   3 units, Aut (Staff) MW 10, 1:15
   TTh 11-12:15
   Win (Staff) MW 10 and 1:15
   TTh 11-12:15
   Spr (Staff) MW 10, 11
   TTh 11-12:15

51, 52, 53. The Nature of Technology, Mathematics, and Sciences—(Enroll in VTSS 51, 52, 53.) Integrated three-quarter sequence enhancing one's ability to think quantitatively and to understand the character and interrelationships of technology, mathematics, and science. Treats qualitative questions that confront people intending to comprehend and influence contemporary society. Basic concepts: conservation laws, energy, entropy, equilibrium, feedback, probability, reliability, symmetry, uncertainty. Topics: sources of problems, nature of invention and discovery, experiment vs. theory, societal concerns. No partial credit allowed, whole sequence must be taken. (DR:6, 7, and 8 when entire sequence taken.)
   3 units, Aut, Win, Spr (Adams, Fetter, Osserman) MW 1:15

UNDERGRADUATE AND GRADUATE

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: transformations and the implicit function theorem; change of variables in multiple integrals; vector and tensor analysis; the theorems of Gauss, Green, and Stokes. Prerequisite: 44 or equivalent. Recommended: 103 or 113, or equivalent.
   3 units, Win (Bradlow) MW 1:15

103. Matrix Theory and its Applications—(Formerly 113S.) A treatment of linear algebra and matrices emphasizing computational and algorithmic aspects and the scientific problems in which matrix theory is applied. Solution of linear equations. Linear spaces and matrices. Orthogonal projection and least squares. In-
104. Matrix Theory and its Applications—
(Formerly 114S.) (Continuation of 103.) Determinants, eigenvalues, and eigenvectors. Positive definite matrices, extremum problems, computations with matrices, elements of linear programming and game theory.
3 units, Win (Adem) MWF 10
Spr (Scowcroft) MWF 10

110. Matrix Theory and its Applications—
(Formerly 114S.) (Continuation of 103.) Determinants, eigenvalues, and eigenvectors. Positive definite matrices, extremum problems, computations with matrices, elements of linear programming and game theory.
3 units, Aut (Staff) MWF 10, 11, and 1:15
TTh 11-12:15
Win (Staff) MWF 10, 11, and 1:15
Spr (Staff) MWF 11 and 1:15
TTh 1:15-2:30
Sum (Staff)

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 (Levine) MWF 10
Spr (Berg) MWF 10

109. Modern Algebra and its Applications—
(Formerly 120S.) Same as 120, but emphasis on applications of modern algebra including symmetry groups, crystallographic groups, and error-correcting codes. Prerequisite: 103, 113, or equivalent.
3 units, Aut (Scowcroft) MWF 10

113. Linear Algebra and Matrix Theory—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. Topics: linear equations, vector spaces, linear dependence, bases and coordinate systems; linear transformations and matrices; similarity; eigen vectors and eigenvalues; diagonal and Jordan forms. (DR:6)
3 units, Aut (Royden) MWF 10
Win (Schoen) MWF 10

114. Linear Algebra and Matrix Theory—
(Continuation of 113.) A deeper study of 113 topics plus additional topics from 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 (Royden) MWF 10
Spr (Schoen) MWF 10

115. Fundamental Concepts of Analysis—
Development of real analysis in Euclidean space: sequences and series, limits, continuous functions, derivatives. Basic point set topology. Honors math majors and students who intend to do graduate work in Mathematics take 171. Prerequisite: 44.
3 units, Aut (Kerckhoff, Mann) MWF 11 and 1:15
Win (Ye) MWF 1:15

120. Modern Algebra—Basic structures in algebra: groups, rings, fields, homomorphisms, permutations, graphs, quotient groups, ideals. Prerequisite: 103 or 113.
3 units, Aut (Adem) TTh 9:35-10:50

123. Theory of Probability—Introduction to the theory of probability and its applications. Basic concepts of probability, random variables, and their distribution functions are treated in the modern manner. Also, detailed classical limit theorems for sequences of independent random variables. Prerequisite: 44.
not given 1988-89

124. Introduction to Stochastic Processes—An elementary systematic account of several principal areas in stochastic processes including branching processes, Markov chains, Poisson processes. Applications are discussed relevant to the natural, biological, social, and managerial sciences.
not given 1988-89

126. Mathematical Models in Population Biology—(Same as 226, Biological Sciences 179.) For advanced undergraduates and beginning graduate students in biology and mathematics. Topics: the elements of population genetics and ecology, models of the evolution of behavioral traits (kin, altruism, group selection), theoretical studies of mating patterns in natural populations, problems of optimality of population sex ratio, population, growth model, age structure, and life histories.
3 units, Spr (Karlin, Feldman) 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 (Ward, Siegmund) MWF 9 and 1:15
Win (Freise-Brendel) MWF 10 and 1:15
Spr (Ward, Adams, Ward, Luttinger) MWF 10 and 1:15 TTh 11-12:15
Sum (Staff)

131. Partial Differential Equations I—First order equations, classification of second order equations. Initial-boundary value problems for heat equation, wave equation, and related equations. Separation of variables, eigenvalue problems, Fourier series, existence and
uniqueness questions. Prerequisite: 130 or equivalent.

3 units, Win (Levine, Korevaar) MWF 10 and 2:15
Spr (Ward) MWF 1:15


3 units, Spr (Levine) MWF 10

134A,B. Honors Analysis—A coherent, mathematically sophisticated presentation of basic areas in classical real analysis. Primarily for students planning graduate work in mathematics or physics who would normally enroll in an Honors sequence. Required of Honors math majors, but of use and interest to other majors at ease with rigorous proofs and qualitative discussion. Emphasis on ordinary and partial differential equations. Prerequisites: 45H, or 113 and 130, and 171, or consent of instructor.

3 units, Win, Spr (Osgood) MWF 11

135. Perturbation Methods in Mathematics and Physics—Introduction of the analysis intent on securing quantitative results for problems which lack exact solutions, but are correlated with others that admit complete resolution. Applications to eigen-function/eigenvalue problems in irregularly shaped domains, diffusion/wave problems in nonhomogeneous settings and non-linear differential equations. Prerequisite: 131 or equivalent.

not given 1988-89

141. Higher Geometries—A study of various geometries, including projective, affine, and non-euclidean geometry. Prerequisite: 113.

not given 1988-89


3 units, Aut (Osserman) MWF 11

144. Topics in Geometry.

not given 1988-89

145. Algebraic Geometry—Affine and projective spaces, plane curves, Bezout's theorem, singularities and genus of a plane curve, applications of commutative algebra to geometry. Prerequisite: 157.

3 units, Win (Adams) MWF 1:15

147. Differential Topology—(Replaces 159.) Smooth manifolds, transversality, Sards' theorem, embeddings, degree of a map, Borsuk-Ulam theorem, Hopf degree theorem, Jordan Curve Theorem. Prerequisites: 115 or 171, 173.

not given 1988-89


3 units, Aut (Kerckhoff) MWF 1:15

149. Topics in Topology.

not given 1988-89

150. Introduction to Combinatorial Theory.—(Enroll in Computer Science 264.)

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 (Bump) MWF 10

154. Group Theory—Discrete groups, groups, homomorphisms, permutations, representations, classification of finite abelian groups, Krull-Schmidt theorem, Sylow theorems. Solvable groups, central series, and Nilpotent groups. Prerequisite: 120 or consent of instructor.

3 units, Win (Eisen) MWF 1:15

155. Geometrical Groups—The rotation and unitary groups emphasizing two, three, and four dimensions. Quarternions. The Lorentz group and SL(2,C). Prerequisite: 113.

3 units, Spr (Osserman) MWF 11


not given 1988-89

160A. First-order Logic—(Enroll in Philosophy 160A, Symbolic Systems 160A.) The syntax and semantics of sentential and first-order logic. Introduction to the basic concepts of model theory. Gödel's Completeness Theorem and its consequences: the Löwenheim-Skolem Theorem and the Compactness Theorem. Prerequisite: 159 or consent of instructor.

4 units, Win (Devlin)

160B. Computability and Logic—(Enroll in Philosophy 160B, Symbolic Systems 160B.) A precise definition of "effective procedure" through Turing machines, register machines, and recursive functions. Church's Thesis explained. These develop Gödel's work on the undecidability of arithmetic, culminating in his Incompleteness Theorem. Also, other undecidable problems. Prerequisite: 160A.

4 units, Spr (Devlin)
161. Axiomatic Set Theory—(Enroll in Philosophy 158.) Zermelo-Fraenkel axioms. Operations on sets, relations, and functions. Equivalence and ordering relations. Equipollence of sets and cardinal arithmetic. Topics on ordinal numbers and axiom of choice as time permits. This is computer-based; no lectures. Students progress at their own pace.
4 units, Aut, Win, Spr (Suppes)

162. Set Theory—Non-axiomatic (informal) approach. Operations on sets and Boolean algebra. Relations, orderings, equivalence relations, and functions. Set-theoretical characterization of the basic number systems. Equinumerosity of sets, the axiom of choice and cardinal numbers. Well-ordering relations and ordinal numbers. Transfinite arithmetic. Prerequisite: 44.
3 units, Aut (Scowcroft) MWF 2:15

171. Fundamental Concepts of Analysis—Similar to 115 but altered contents and more theoretical orientation. Properties of Riemann integrals, continuous functions and convergence in metric spaces; compact metric spaces, basic point set topology. Recommended for math majors and required of Honors math majors. Prerequisite: 44H or equivalent.
3 units, Aut (Simon) TTh 11-12:15

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

175. Elementary Functional Analysis—(Formerly 117.) Linear operators on Hilbert space. Spectral theory of compact operators; applications to integral equations. Elements of Banach space theory. Prerequisite: 115 or 171.
3 units, Spr (Katznelson) MWF 11

181. Topics in the History of Mathematics from Antiquity to the 17th Century—(Enroll in History 138D, History of Science 140, Philosophy 140.)
3 units, Win (Knorr)

182A,B. Topics in the History of Mathematics.
182A. From the 17th to the 19th century. The rapid development of the powerful new concepts and methods in analysis and their direct connection with the physical sciences, i.e., mechanics. Illustrations from the work of famous mathematicians from Descartes to Abel.
3 units, not given 1988-89
182B. The 19th to the early 20th century. The 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, not given 1988-89

195. Teaching Practicum—An opportunity for students to assist in an undergraduate course, lead problem sessions, and tutor. Some reading in topics in mathematics education is required.
3 units, Aut, Win, Spr

196. Undergraduate Colloquium—Readings and discussions of topics in mathematics, its history and philosophy. Emphasis on the influence of models on science and western civilization. Topics determined on the basis of interests and backgrounds of class members. Term paper required.
3 units, not given 1988-89

199. Independent Work—An opportunity for undergraduates to pursue a reading program. Topics are limited to those which are not the content of regular course offerings of the department. Credit can fulfill the elective requirement for mathematics majors. Approval of the Undergraduate Affairs Committee must be received to use credit for department's area requirement. Consult academic secretary for help in finding an advisor.

(Staff) by arrangement

PRIMARILY FOR GRADUATE STUDENTS

205A. 3 units, Aut, Spr (P. Cohen, Adams) MWF 10
205B. 3 units, Win (P. Cohen) MWF 10
205C. 3 units, Spr (Ornstein) MWF 10

206A,B,C. Theory of Functions of a Complex Variable—Complex integration. Cauchy's theorem, calculus of residues; power series, infinite products, entire functions, Picard's theorem; Riemann mapping theorem. Prerequisite: 116 or 171 or equivalent.
206A. 3 units, Aut (Katznelson) MWF 11
206B. 3 units, Win (Katznelson) MWF 11
206C. 3 units, Spr (P. Cohen) MWF 11

210A,B,C. Modern Algebra—Groups, rings, and fields; Galois theory, ideal theory, introduction to algebraic geometry; representations
of groups and algebras; multilinear algebra. Prerequisite: 120 or equivalent.

210A. 3 units, Aut (Brumfiel) TTh 11-12:15
210B. 3 units, Win (Brumfiel) TTh 11-12:15
210C. 3 units, Spr (Sarnak) TTh 11-12:15


217A. 3 units, Win (White) MWF 1:15
217B. 3 units, Spr (White) MWF 1:15

220A,B,C. Methods of Mathematical Physics—An exposition of characteristic and Green's function, integral transform, variational, perturbation and distribution theoretic methods for the analysis of differential, difference and integral equations, together with numerous specific illustrative examples. Prerequisite: Some familiarity with differential equations and functions of a complex variable.

220A. 3 units, Aut (Levine) MWF 2:15
220B. 3 units, Win (Ward) MWF 2:15
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.

not given 1988-89

222. Topics in the Calculus of Variations—Global direct methods for multidimensional problems emphasizing geometrical questions, capillarity theory, stability of fluid configurations. Topics chosen according to the interests of the participants. Prerequisite: Foundations of analysis or equivalent. Recommended: Some background in measure theory and classical calculus of variations.

Aut (Finn) by arrangement


Win (Levine) MWF 2:15

224. Integral Equations—Singular types and methods for their solution; alternative integral equation reformulation of boundary value problems, dual equations and affiliated variational principles.

not given 1988-89

226. Mathematical Models in Population Biology—(Same as 126.)

3 units, Spr (Karlin, Feldman)


not given 1988-89

231. Topics in Stochastic Processes—Topics in combinatorial stochastic models are emphasized including random walks on groups, graphs, trees, etc., processes of order statistics, fluctuation theory for partial sums of independent identically distributed random variables. Multidimensional Poisson processes, stochastic population processes, applications to biological structure, population dynamics in space and time, reliability regimes, and to various communication and engineering systems.

3 units, Aut (Karlin) MWF 9


not given 1988-89

234A,B. Probabilistic Methods and Analysis.

3 units, Win, Spr (Katznelson)

233. Stochastic Equations and Waves in Random Media—Differential equations with random coefficients arise in wave propagation in random media vibrations of systems with random imperfections, the theory of amorphous solids, etc. Such equations are developed for various cases, and methods of solution presented. Prerequisite: Some knowledge of differential equations and the elements of probability theory.

not given 1988-89

235A,B,C. Selected Topics in Ergodic Theory—Topics from the Kolmogorov-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, Aut, Win, Spr (Ornstein)

236A,B. Mathematical Population Genetics—Classical evolutionary models of one and multigene traits subject to natural selection, migration, and mutation forces. The effects of nonran-
dom mating. Modeling of various stochastic mechanisms of recombination processes affecting gene frequency distributions. Applications to models on behavioral genetics, effects of population and demographic structure density and frequency dependence, multi-factorial inheritance phenomenon. Mathematical techniques include stability analysis of equilibria for certain nonlinear transformation, algebraic concepts of Kronecker and Sehur products, group symmetries and invariants, aspects of real and probabilistic analysis.

not given 1988-89


not given 1988-89

242. Difference Equations—A theoretical account of linear functional equations which have a difference or recursive character; applications to special (Gamma) functions and to physically motivated problems. Comparison with analogous aspects of differential equations.

not given 1988-89

244A,B. Riemann Surfaces—Compact Riemann surfaces: topological classification, Hurwitz formula, Riemann-Roch formula, uniformization theorem, Abel’s theorem, Jacobian varieties. Also, some elements of harmonic analysis are developed with applications. Methods generally applicable to algebraic curves are highlighted.

not given 1988-89


not given 1988-89


248A. 3 units, Aut (P. Cohen) TTh 11-12:15
248B. 3 units, Win (P. Cohen) TTh 11-12:15


not given 1988-89

254A,B. Ordinary Differential Equations—The qualitative theory of ordinary differential equations, analytic and geometric methods. Topics from the stability and perturbation theory of dynamical systems; Hamiltonian systems; applications to the theory of oscillations and celestial mechanics.

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

256A,B.C. Partial Differential Equations—Local solvability; regularity of weak solutions; Sobolev sparse methods and the $L^1$ theory of elliptic equations; potential theoretic methods and Schauder theory; nonlinear elliptic equations; apriori estimates and nonlinear functional analysis; the minimal surface equation and its properties; elliptic systems; variational problems. Topics from the theory of hyperbolic and parabolic equations.

256A. 3 units, Aut, Win (Simon) TTh 9:15-10:30
256C. 3 units, Spr (Schoen) TTh 11:15-12:30


261A. 3 units, Aut (Hdmos) MW 1-2:15
261B. 3 units, Win (Halmos) MW 1-2:15


263A. 3 units, Aut (Bump) TTh 11-12:15
263B. 3 units, Win (Bump) TTh 11-12:15

267. Harmonic Analysis—Topics from the “$L^1$ theory” of harmonic analysis — the singular
integral theory of Calderon and Zygmund and its extensions, interpolation of operators, multiplier transformations, and smoothness properties of functions; sets of uniqueness for trigonometric series, spectral syntheses, thin sets, the spectral theory of convolution operators, and applications. Prerequisite: Knowledge of the elements of Fourier analysis.

3 units, Win, Spr (Lyons) by arrangement

270. Perturbation and Asymptotic Methods with Applications—An exposition of perturbation and asymptotic methods. Topics: regular perturbation theory, singular perturbation theory, initial and boundary layers, the method of multiple scales, ray theory, two-time methods. Applications: problems from fluid and solid mechanics, wave propagation, etc. Prerequisite: Some familiarity with ordinary and partial differential equations.

3 units, Win, Spr (Lyons) by arrangement

274. Wave Propagation—(Same as Mechanical Engineering 236B.) Concepts presented: waves, wavefronts, rays, phase functions, amplitude functions, ray equations, ekialon equations, transport equations, reflection coefficients, transmission coefficients, edge diffraction coefficients, surface diffraction coefficients, asymptotic expansions. Applications are made to electromagnetic, acoustic, elastic, and other types of waves.

not given 1988-89


not given 1988-89

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.

not given 1988-89

281A,B.C. Introduction to Algebraic and Differential Topology—Fundamental group, covering spaces, embeddings and immersions of manifolds, transversality, homotopy theory, homology and cohomology of complexes, differential forms, fiber and vector bundles and their characteristic classes.

3 units, Aut, Win, Spr (Milgram) by arrangement

283. Topics in Algebraic Topology—Topics from loop spaces and classifying spaces, cohomology operations, homotopy theory, differential topology.

3 units, Aut (Mann) MF 2:15-3:30

284. Topics in Geometric Topology.

3 units, Win, Spr (Fried, Kerckhoff) by arrangement

286A,B. Topics in Differential Geometry—Prepresents some parts of differential geometry which will lead students to do research in the field. Possible topics: 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. Topics depend to some extent on the interest of the students. Prerequisite: 217B.

3 units, Aut, Win (Schoen) by arrangement

287A,B. Topics in Algebra and Number Theory—The classical theory of algebraic numbers including local p-adic theory, class numbers, Dirichlet unit theorem and decomposition of prime ideals. If time permits, an introduction to class field theory and a discussion of quadratic forms, especially the Minkowski-Siegel theorem.

not given 1988-89


3 units, Aut (Royden) by arrangement


not given 1988-89

systems. Gödel's incompleteness theorems. Recursively unsolvable problems in mathematics and logic. Introduction to recursive ordinals and hierarchies. Prerequisites: 160A, B and 161, or equivalent.

291A. 3 units, Aut (Feferman) TTh 1:15-2:30
291B. 3 units, Win (Scowcroft) TTh 1:15-2:30

292A, B. Set Theory—(Same as Philosophy 392A, B.) First quarter: the basics of Zermelo Fraenkel set theory. Topics: cardinal and ordinal numbers, the cumulative hierarchy, and Axiom of Choice, and the universe of constructible sets. Second quarter: models of set theory, including admissible sets, and models constructed by forcing. Prerequisite: 160A, B and 161, or equivalent.

3 92A, B. Proof Theory—Gentzen's natural deduction and/or sequential calculi for first order predicate logic. Normalization, respectively cut-elimination procedures. Extensions to infinitary calculi; ordinal complexity of proof trees. Subsystems of analysis and their reduction to constructive theories. Prerequisite: 160A, B and 161, or equivalent.

293A, B. Topics in Logic—Varies each year. Examples: complexity of decision procedures, abstract model theory and generalized quantifiers; recursion in higher types, generalized recursion theory; large cardinals, infinite games; constructive functional interpretations, foundations of constructive and semi-constructive mathematics. Prerequisites: Appropriate background from one of 290A, B, through 293A, B or equivalent.

3 units, Spr (Feferman) TTh 1:15-2:30

350. Directed Reading. any quarter (Staff) by arrangement

351. Seminar Participation—Participation in a student-organized graduate seminar under the general supervision of a faculty member. any quarter (Staff) by arrangement

360. Advanced Reading and Research. any quarter (Staff) by arrangement

361. Seminar Participation—Participation in a faculty-led seminar which has no specific course number. any quarter (Staff) by arrangement

380. Seminar in Applied Mathematics. by arrangement

381. Seminar in Analysis. by arrangement

383. Seminar in Function Theory. by arrangement

MEDIEVAL STUDIES

Committee in Charge: George Brown (Chairman), Theodore M. Andersson, Hester Gelber, Gavin Langmuir, William Mahrt, Mary Wack

Affiliated Faculty: Theodore M. Andersson (German Studies), George H. Brown (English), Brigitte Cazelles (French and Italian), John Freccero (French and Italian), Gavin I. Langmuir (History), Suzanne Lewis (Art), Sabine G. MacCormack (Classics and History), William Mahrt (Music), Jeffrey Schnapp (French and Italian), W. Wesley Trimpi (English), Mary Wack (English)

The Medieval Studies Program is administered through Humanities Special Programs. There is no formal undergraduate degree program; instead, the option exists for interested students to propose individually designed majors in Medieval Studies. Such 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 “Program for Individually Designed Majors” section in this bulletin. 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 Undergraduate Advising Center. The major would normally be declared by the beginning of the student’s third year. The major combines interdisciplinary breadth with a disciplinary focus. The interdisciplinary emphasis is provided by the introduc-
tory course, Introduction to Medieval Culture and Society, by upper-level colloquia conducted by two professors from different disciplines, and by the requirement that students take courses in three different areas. Depth is ensured by the requirement that students take at least four courses in one area. A faculty advisor will help each student choose courses that integrate the requirements of breadth and depth. To that end the following guidelines are provided.

Each student should take a minimum of 10 courses dealing directly with the Middle Ages and distributed as follows:

1. The introductory course, Medieval Studies 65, "Medieval Culture".
2. Two upper level interdisciplinary courses in Medieval Studies.
3. Four courses in one of the following categories:
   a. Literature
      1) English
      2) German and Scandinavian
      3) French
      4) Spanish
      5) Italian
      6) Slavic
      7) Latin
   b. History
   c. Art History, Drama, Music
   d. Philosophy, Religious Studies, Humanities. (Certain Humanities courses may fulfill requirements within other categories.)
4. Two courses in a second category chosen from the above list.
5. One course in a third category chosen from the above list.

In addition to these 10 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. Introduction to Medieval Culture and Society—(Same as English 65.) An introduction to the development of medieval culture through religious, philosophical, literary, artistic, social, and political sources with emphasis on interrelationships among them. Lectures by faculty from various departments. (DR:2) 5 units, Spr (Brown, Staff)

300. Graduate Colloquium—The problems of research and methodology in the various disciplines of medieval studies. Bi-weekly discussions are led by specialists in history, literature, art history, and music, exploring the character of each discipline's medieval scholarship, common concern, and intellectual integration. 3 units, Spr (Wack)

**RELATED AREAS**

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. See the *Time Schedule* each quarter for changes in listings.

**ANTHROPOLOGY**


**ART**


**CLASSICS**

103. History of the Roman Empire.

107. Art, Religion, and Society in Late Antiquity, 284-717 A.D.

**ENGLISH**


164C. Medieval Literature of Heroism and Romance.

171A. Chaucer's *Canterbury Tales*.

171B. Chaucer's *Troilus* and the *Dream Poems*.

181C. From Epic to Romance: Courtly Love and the Heroic Ideal.

205. Old English.

209. Introduction to Paleography and Codicology.

211. Readings in Middle English.

270A. *Beowulf*.

351. Seminar: Representing Self and World in Ricardian Poetry.

360B. History of Literary Theory—Medieval/Renaissance.

367. Seminar: Theology and the Reading of Medieval Literature.

**FRENCH**

130. French Literature I: Middle Ages and Renaissance.

210. Old French.

314. Vengeance in Chrétien de Troyes.
GERMAN STUDIES
208A. Introduction to Middle High German.
208B. Advanced Middle High German.

HISTORY
7S. Introductory Seminar: Joan of Arc.
108. The Christianization of Western Europe, 500-1350.
208. Undergraduate Colloquium: The Church-State Problem in the Middle Ages.

ITALIAN
227. Italian Literature I: The Middle Ages and the Renaissance.
233/333. Dante’s Divine Comedy.
345. Petrarch and Petrarchism.

MUSIC
100. Music History: Medieval and Renaissance.

PHILOSOPHY
13SB. Introduction to Cosmology: Middle Ages to Newton.

RELIGIOUS STUDIES
23. Judaism.
135. Introduction to Jewish Mysticism.
273. Aquinas’ Ethics.

SPANISH AND PORTUGUESE

MODERN THOUGHT AND LITERATURE

Committee in Charge: Beverly Allen (French and Italian), Jay Fliegelman (English), Regenia Gagnier (English), Van Harvey (Religious Studies), Marjorie Perloff (English), Mary Pratt (Spanish and Portuguese), Paul A. Robinson (History), Renato Rosaldo (Anthropology), Lucio Ruotolo (English), Jeffrey Schnapp (French and Italian), James Sheehan (History), Peter Stansky (History), Hans Weiler (German Studies)

The Program in Modern Thought and Literature admits students for the Ph.D. and, in conjunction with the Humanities Honors Program, it makes available an interdisciplinary concentration in Modern Thought and Literature for undergraduates.

UNDERGRADUATE PROGRAM
HONORS PROGRAM

The undergraduate program is designed for students with a strong commitment to the interdisciplinary study of modern literature (since the 17th-century), intellectual history, and critical theory. Students planning to concentrate in Modern Thought and Literature must apply for admission to Humanities Honors program and for graduation with Honors in Humanities.

Modern Thought and Literature as a major is one of the options within the Humanities Honors program major. Students in the program do not need to complete an additional major in another department, but in order to satisfy the fourth requirement listed below, they will normally have the equivalent of a major in a single national literature. It is in the student’s interest to complete the requirements of a departmental major in order to be able to graduate, should the Honors essay not be completed in acceptable form. The requirements for the program include:

1. Completion of the Western Culture requirement (15 units, freshman year) with a letter grade indicator (LGI) of at least “B” and an “A-” or better in at least one quarter of the sequence.
2. Humanities 90 (5 units).
3. Two seminars drawn from the series Humanities 191-197, of which one must be Humanities 197.
4. Six courses in a national literature, read in the original language, and covering a wide range of periods and genres.
5. Three courses, to be chosen in consultation with the advisor, covering major movements in intellectual history since the en-
lightenment. The scope of these courses must be comparable to that of German Studies 241, 242, 243, or History 136, 136A, 136B.

6. One course in the history of modern science or technology.
7. One course in modern art or music.
8. One course addressing modernization from a historical or social scientific perspective.
9. Completion of at least two years of college-level study of a modern foreign language or demonstration of equivalent proficiency.
10. Honors essay on a literary topic treated in an interdisciplinary manner (2 units, Spring Quarter, junior year; 5 units, Autumn Quarter; 5 units, Winter Quarter, senior year). An LGI of at least "B" is required on the essay for graduation with Honors in Humanities.

GRADUATE PROGRAMS

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, and 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.

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 specific 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 the modern literature of one language, normally English. Another national literature taught at Stanford may be substituted. 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 readings in various areas of modern thought and culture, and individual creative work.
4. Qualifying Procedures:
   a) 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) 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 additional works in modern thought or drawn from the student’s special field of interest.

5. Teaching is an essential part of the program. All candidates are required to do four quarters of supervised teaching at half-time. During the first year, a candidate is expected to act as a reader for two courses or a section leader for one course, in the second year to teach two quarters of Freshman English, and in the third or fourth years to assist a faculty member as a section leader in a larger course.

As preparation for teaching, students are required to take English 396, a 2-unit course introducing students to the obligations and opportunities of graduate study, and 397A, a 5-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 oral 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 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.

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 in this bulletin.

COURSES

See departmental listings for course descriptions and for (DR) notations. Courses are open to qualified students from any department.

157N. Contemporary Black Playwrights—(Enroll in Drama 157N.)
4 units, Win (Kennedy)

159. Women and Difference: Marginality, Art, and Politics—(Enroll in English 160.
5 units, Aut (Rich, Cliff)

160. Women in Dance—(Enroll in Dance 160.)
3 units, Win (Ross)

161. Dance and Live Art in the 20th Century—(Enroll in Dance 161, Drama 127.)
3 units, Spr (Ross)

161A. Afro-American Writing, 1945-1970—(Enroll in English 161A.)
5 units, Win (Drake)

165. Dance Heritage: History and Styles—(Enroll in Dance 165.)
3 units, Aut, Win, Spr (Ross)

165Z. Living in the Past: The American Experience in Europe—(Enroll in English 165Z; Tours campus.)
5 units, Aut (Evans)

187C. The Avant Garde of the Early 20th Century—(Enroll in English 182C.)
5 units, Win (Perloff)

212. Psychiatry and Literature—(Same as Comparative Literature 212, Psychiatry 212.)
2-3 units, Aut (Van Natta)
220. Literary Translation—(Enroll in Slavic Languages 220.)
   4 units, Win (Brown)

221. History of Film—(Enroll in Communication 141/241.)
   4 units (Brietrose) not given 1988-89

222. Introduction to 19th-Century Spanish Literature—(Enroll in Spanish 219.)
   3-5 units, Aut (Predmore)

223. Introduction to 20th-Century Spanish Literature—(Enroll in Spanish 220.)
   3-5 units, Win (Predmore)

228. Italian Literature II: From Mannerism through the Modern—(Enroll in Italian 228.)
   4 units, Win (Allen)

233. Dante’s Divine Comedy—(Enroll in Italian 233.)
   4 units, Win (Freccero)

239. Racine—(Enroll in French 239/339.)
   4 units, Win (Girard)

241. Deutsche Geistesgeschichte I—(Enroll in German Studies 241.)
   3-5 units, Aut (Trabant)

242. Deutsche Geistesgeschichte II—(Enroll in German 242.)
   3-5 units, Win (Wellbery)

243. Deutsche Geistesgeschichte III—(Enroll in German 243.)
   3-5 units, Spr (Wilke)

245A. Survey of Russian Literature in English Translation I: The Age of Experiment—(Enroll in Slavic Languages 145/245.)
   4 units, Aut (Fleishman)

245B. Survey of Russian Literature in English Translation II: The Novel and Beyond—(Enroll in Slavic Languages 146/246.)
   4 units, Win (Wachtel)

245C. Survey of Russian Literature in English Translation after 1917: Invention of Tradition—(Enroll in Slavic Languages 147/247.)
   4 units, Spr (Freidin)

248. The Caribbean-Americas: An Introduction to Their Literature, Thought, and Cultural Worlds—(Enroll in Spanish 248.)
   3-5 units, Aut (Gonzdles)

250. Theory of Literature and Culture in Latin America—(Enroll in Spanish 252.)
   3-5 units, Win (Ruffinelli)

252. Major Dramatic Texts III: Early Realistic to the Present—(Enroll in Drama 252.)
   4 units, Spr (Graver)

255. Italian Renaissance: 14th Century to 17th Century—(Enroll in Italian 250.)
   4 units, Win (Harrison)

258. Contemporary Latin American Short Story—(Enroll in Spanish 258.)
   3-5 units, Spr (Ruffinelli)

259. Short Novel as Genre in Latin America—(Enroll in Spanish 259.)
   3-5 units, Spr (Corral)

   5 units, Win (Pratt)

261. History of Theater: 19th and 20th Century—(Enroll in Drama 261.)
   4 units, Win (Eddelman)

261A. Ritual Content in Works of West Indian Writers—(Enroll in English 261A.)
   5 units, Win (Ismond)

262. Seminar: Thought and Action—(Enroll in Political Science 262.)
   5 units, Aut (Drekmeier)

263A. Seminar in Feminist Studies—(Enroll in English 263A, Feminist Studies 103/203.)
   5 units, Aut (Rich)

264. Seminar: Social Theory and Political Thought—(Enroll in Political Science 264.)
   5 units, Spr (Drekmeier)

264B. Nineteenth-Century Narrative—(Enroll in English 264B, Comparative Literature 264B.)
   5 units, Aut (Parker)

265. Knowing the Holocaust: Psychoanalytical and Literary Perception—(Enroll in English 265.)
   5 units, Spr (Auerholm)

266. Surrealism—(Enroll in French 266/366.)
   4 units, Spr (Newman-Gordon)

268. Perspectives in Dance—(Enroll in Dance 268.)
   3 units, Aut (Cashion, Ross)

269. The Literature of Decolonization—(Enroll in French 268.)
   4 units, Win (Giraud)

271. Brazil in Film and Fiction—(Enroll in Portuguese 271.)
   3-5 units, Spr (Patai)

272. From Existential to Structuralism and Post-Structuralism—(Enroll in French 272.)
   4 units, Win (Girard)

284A. Joyce, Proust, Mann—(Enroll in German Studies 284A/384A.)
   3-5 units, Aut (Gillespie)

284C. Literature and Philosophy: The Problem of Time—(Enroll in French 284C.)
   2 units, Spr (Serres)
284D. Literature and Philosophy: Complexity and Self Reference in the Humanities and the Social Sciences—(Enroll in French 284D.)
3-4 units, Spr (Dupuy)

4 units, Aut (Girard)

286. William Carlos Williams—(Enroll in English 286.)
5 units, Spr (Sorrentino)

286A. Literature and Politics: The Left and the Right—(Enroll in French 286A.)
2 units, Aut (Serres)

286B. Literature and Politics: Individualism and Social Justice—(Enroll in French 286B.)
3-4 units, Win (Dupuy)

288. Dickens and His Society—(Enroll in English 288.)
5 units, Aut (Pope)

290. History of Anthropological Theory: The 19th Century—(Enroll in Anthropology 290.)
5 units, Aut (Wolf)

291. Generative Devices in Imaginative Writing—(Enroll in English 291.)
5 units, Win (Sorrentino)

294A. Feminist Attitudes in French—(Enroll in French 294A.)
4 units, Win (Newman-Gordon)

3-5 units, Spr (Patai)

303A. Colloquium: Swift, Pope, and Satiric Tradition—(Enroll in English 303A.)
5 units, Aut (Carnochan)

303B. Colloquium: Sexuality and Terror—Gothic and Fantastic Literature of the 18th Century—(Enroll in English 303B.)
5 units, Aut (Castle)

303C. The Enlightenment in France and England—(Enroll in English 303C.)
5 units, Spr (Watt)

304. Colloquium: The Romantic Age—The Generation of Wordsworth and Austen—(Enroll in English 304.)
5 units, Win (Dekker)

305. Colloquium: Literature and Institutions—(Enroll in Comparative Literature 305, English 305.)
5 units, Win (Lindenberger)

306. Colloquium: Modern American Popular Culture and Fiction—(Enroll in English 306.)
5 units, Win (Solomon)

307A. Colloquium: Postmodern Fiction—American and European—(Enroll in English 307A.)
5 units, Win (Sorrentino)

307C. Colloquium: Methods and Materials for the Study of Modern Literature—(Enroll in English 307C.)
5 units, Spr (McPherson)

310. Discourse and Ideology—(Enroll in Spanish 310.)
4-5 units, Spr (Pratt)

320B. Seminar: American Renaissance—(Enroll in English 320B.)
5 units, Win (Halliburton)

331D,E,F. Graduate Core Colloquium on Modern Europe—(Enroll in History 331D,E,F.)
15 units, Aut, Win, Spr (Sheehan, Jankowski)

337. Dante's Divine Comedy: Paradiso—(Enroll in Italian 337.)
4 units, Spr (Jacoff)

341A. Graduate Colloquium: Topics in Culture and Society of Early Modern England—(Enroll in History 341A.)
5 units, Aut (Seaver)

345. Petrarch and Petrarchism—(Enroll in Italian 345.)
4 units, Aut (Freccero)

349A. Graduate Colloquium: Africa Since 1945—(Enroll in History 349A.)
5 units, Spr (Jackson)

351C. Seminar: Brecht in Africa—(Enroll in Drama 351C.)
5 units, Spr (Richards)

354A. Seminar: 20th-Century Visual Aesthetics—(Enroll in Drama 354A.)
5 units, Aut (Eddelman)

354B. Seminar: Contemporary Drama—(Enroll in Drama 354B.)
5 units, Aut (Graver)

354C. Semiotics of Drama—(Enroll in Drama 354C.)
5 units, Win (Esslin)

3-5 units, Spr (Alegria)

360. Seminar on the Italian Baroque—(Enroll in Italian 360.)
4 units, Win (Springer)

360A. Research Seminar: Latin American Women Writers of the 19th Century—(Enroll in Spanish 360A.)
5 units, Win (Pratt)
361. Seminar: The Modern Tradition—(Enroll in English 361.) Conceptualizations of modernity, modernism, and modernization in terms of cultural criticism and social theory. Topics: diachronic designations with reference to tradition and post-modernism; the institutional status of culture; modern identity and the confrontation with alterity.
  5 units, Aut (Gagnier) MW

363. Interdisciplinary Graduate Seminar: Chicano Culture—(Enroll in English 363.)
  5 units, Spr (Islas, Ybarra-Frausto)

365. The Latin American Novel: Julio Cortázar—(Enroll in Spanish 365.)
  3-5 units, Win (Ruffinelli)

365A. Colloquium: Sexuality in American History—(Enroll in History 365A.)
  5 units, Spr (Freedman)

365C. Seminar: American Literature and Culture and Antebellum Poems—(Enroll in English 365C.)
  5 units, Spr (Fliegelman)

368. Manzoni: The Fiction of History—(Enroll in Italian 368.)
  4 units, Spr (Allen)

369. Seminar: The Structuralist Paradigm and Its Transformation—(Enroll in Comparative Literature 369, English 369, German Studies 346.)
  5 units, Aut (Wellbery)

372. Italo Calvino: Neo-realism to Metafiction—(Enroll in Italian 372.)
  4 units, Spr (Harrison, Jacoff)

373. Seminar: Women’s Family and Sexual History—(Enroll in History 473.)
  5 units, Spr (Freedman)

382. 20th-Century Italian Poetry—(Enroll in Italian 382.)
  4 units, Spr (Allen)

385D. Seminar: Henry James and the Romance Tradition—(Enroll in English 385D.)
  5 units, Aut (Dekker)

385E. Seminar: Pound and the Problems of Modernism—(Enroll in English 385E.)
  5 units, Aut (Perloff)

388A. Seminar: E. M. Forster—(Enroll in English 388A.)
  5 units, Spr (Stone)

393. Renaissance Rhetoric, Textual Instances—(Enroll in Comparative Literature 393, English 380D.)
  5 units, Aut (Parker)

  5 units, Win (Parker)

395. Ad Hoc Graduate Seminars—Graduate students (at least three or 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. Letter grade or Pass/No Credit basis.
  any quarter, by arrangement

396. Introduction to Graduate Study—(Enroll in English 396.)
  2 units, Aut (Fifer, Halliburton)

397A. Rhetoric and Teaching Composition—(Enroll in English 397A.)
  5 units, Aut (Fifer)

397B. Teachers Workshop I—(Enroll in English 397B.)
  5 units, Win (Fifer)

397C. Teachers Workshop II—(Enroll in English 397C.)
  5 units, Spr (Fifer)

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 OFFERINGS

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.
Chairman: Karol Berger
Professors: John Chowning, Albert Cohen (on leave Spring), George Houle, William H. Ramsey (on leave Autumn), Leland C. Smith
Associate Professors: Karol Berger (on leave 1988-89), William P. Mahrt
Assistant Professors: Thomas Bauman, Kimberly Marshall
Professor (Research): Max V. Matthews
Professors (Performance): Arthur P. Barnes (Director of Bands), Andor Toth* (Director of Orchestras and Opera, on leave Autumn)
Assistant Professor (Performance): George Earth
Senior Lecturers: Judith Bettina (Voice), Margaret Fabrizio (Early Keyboard), Gennady Kleyman (Violin, Viola), Naomi Sparrow (Piano), Gregory A. Wait (Voice), Bernard Zaslav* (Viola)
Lecturers: Robert Bates, William Bell (Jazz), Frances Blaisdell (Flute), David Burkhart (Trumpet), Christopher Chafe (Computer Music), Marjorie Chauvel (Harp), Anthony J. Citone (Percussion), Floyd O. Cooley (Tuba), Gregory Dufford (Clarinet), Charles A. Ferguson (Guitar), Josephine A. Gandolfi (Piano), Ted Gioia (Jazz), Stephen Harrison* (Violancello), Alexandra W. Hawley (Flute), William Klingelhofer (French Horn, on leave 1988-89), Zoya Leybin* (Violin), Anthony P. Martin (Baroque Violin), James Matheson (Oboe), Herbert Myers (Early Winds), James O. Nadel (Jazz), Karen Nagy (Music Librarian), Rufus Olivier (Bassoon) Julius O. Smith (Computer Music), Harold Stein (Saxophone, on leave, Autumn), Lawrence Ragent (French Horn), David Rakowski (Theory), Stephen Tramontozzi (Contrabass), Michael B. West (Glee Club), J. Elwood Williams (Trombone), Timothy Zerlang (Piano)
Visiting Professor Emeritus: John R. Pierce
*Member of Stanford String Quartet (Ensemble in Residence)

The department's aims are to promote the 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.

The department is housed in Braun Music Center, Dinkelspiel Auditorium, and the Knoll, including two theaters for concert and operatic productions, two small chamber halls, and a variety of early stringed and wind instruments, students may use rare instruments from the Harry R. Lange Historical Collection.

The music 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 a large time-sharing digital computer on which work is being done in sound synthesis, acoustical analysis, composition, digital recording, and music manuscript. 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.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

The undergraduate major in music is built around a series of foundation courses in theory, musicianship, and music history, in addition to performance and proficiency requirements outlined below. Prospective majors are urged to consult one of the major advisors in the department as early as possible in order to plan a program which allows sufficient time for major course work, practice, and University requirements outside the major. Early planning is especially important for students contemplating overseas study at any time during their undergraduate years, and for those with particular musical talents and interests.

1. All students are required to include the following foundation courses in their program:
   a) 21, 22 (Elements of Music), 23 (Functional Harmony), 24 (Elementary Tonal Counterpoint).
   b) 100, 101, 102, 103, 104 (Music History).
   c) 121, 122A, B, or C (Advanced Harmonic Materials).

2. Additionally, all music majors must fulfill the following two performance requirements:
   a) Individual studies in performance: six quarters.
   b) Ensemble: six quarters of work in one or more of the department's organizations or chamber groups. Note: 161C (Sports Activity Band) and 167 (Glee Club) will not satisfy this requirement.
3. All majors are required to demonstrate a minimum proficiency in piano by sight-reading works at the level of Clementi sonatinas and by playing two prepared pieces comparable in difficulty to Bartok's Mikrokosmos, Book IV. This requirement should be fulfilled as early as possible and not later than the beginning of the junior year.

4. Students must also demonstrate an ability to hear music accurately and to perform it at sight. These skills will be tested 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.

The following sample schedule shows how a student may include substantial work on a major in music while also fulfilling the University Distribution Requirements during the freshman and sophomore years. The schedule also includes foreign language study, which is strongly recommended for all music majors and especially for those expecting to continue into graduate work in any area of music.

RECOMMENDED SCHEDULE FOR COMPLETING THE MUSIC MAJOR PROGRAM

FIRST YEAR

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<th>Courses</th>
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<th>W</th>
<th>Sp</th>
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<tbody>
<tr>
<td>Freshman English</td>
<td>3</td>
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<tr>
<td>Music 21-23*</td>
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<td>4</td>
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<tr>
<td>Individual Instruction and/or</td>
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<td>Ensemble</td>
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<tr>
<td>Western Culture</td>
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<tr>
<td>Choice of Foreign Language,</td>
<td>3-5</td>
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<td>Distribution requirement,</td>
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<tr>
<td>or Freshman Seminar</td>
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SECOND YEAR

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<th>Courses</th>
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<tbody>
<tr>
<td>Music 24</td>
<td>4</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Music 100-102 and 121</td>
<td>4</td>
<td>4</td>
<td>8</td>
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<tr>
<td>Individual Instruction and/or</td>
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<tr>
<td>Ensemble</td>
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<tr>
<td>Distribution Requirement</td>
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<tr>
<td>Elective (or Music 23 if not</td>
<td>3-5</td>
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THIRD YEAR

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<th>Courses</th>
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<tbody>
<tr>
<td>Music 103-4 and 122A, B or C</td>
<td>8</td>
<td>4</td>
<td>—</td>
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<tr>
<td>Elective</td>
<td>(4)</td>
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</table>

* The 21-23 sequence may begin in the Winter rather than Autumn Quarter. If so, 23 must be taken in Autumn Quarter of the second year.

CONCENTRATIONS

Students wishing to pursue graduate study should complete a more intensive course of study than is provided by the basic requirements for the major. They are advised to begin the basic courses for the major as early as possible, to identify a concentration, and to complete the work for the concentration in the course of their senior year. Areas of concentrations are performance, composition, or history. The specific coursework in each area is detailed in a brochure available from the department and includes advanced work in the area, some work in a foreign language, an additional year of ensembles, and a senior project appropriate to the area. Approval of the advisor and an appropriate faculty member in the area is required for declaration of a concentration.

HONORS PROGRAM

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 shown by a letter grade indicator 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 Quarter of the junior year.

GRADUATE PROGRAMS

The following statements apply to all the graduate degrees described below, unless otherwise indicated.

Admission—Applicants for admission to graduate study should arrange to take the Graduate Record Examination, including the advanced music sections, and a departmental entrance test in theory and musicianship. In addition, an applicant will be asked to submit evidence of accomplishment, a composition, research paper, or performance in the proposed field of concentration.

Departmental Examinations—(1) A placement examination will test the student in the areas of theory (counterpoint, harmony, and analysis) and history of Western music, and (2) a proficiency examination in sight-singing and piano sight-reading will be given at the beginning of study in the department.

None of Stanford's required undergraduate courses may be credited toward an advanced degree. Only work that receives a letter grade indicator of "A," "B" or "plus" in music courses taken as a graduate student will be recognized.
as fulfilling the advanced degree requirements. Students may have to devote more than the minimum time in residence if their preparation for graduate study is inadequate.

MASTER OF ARTS

Residence—A minimum of three quarters of full-time study in residence is required.

Foreign Language Requirement—Reading knowledge of German, French, or Italian must be demonstrated at the beginning of graduate study.

Study Program—Students may concentrate in composition, history, or performance (including conducting). To be recommended for the A.M. degree, a candidate must complete a program of 36 units of graduate course work. 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 practice involved.

The following are required courses:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Music Bibliography</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Three quarters of work in the student's area of concentration</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Three quarters of ensemble performance</td>
<td>3</td>
</tr>
<tr>
<td>299</td>
<td>Master of Arts Project</td>
<td>4</td>
</tr>
<tr>
<td>223</td>
<td>Composition or</td>
<td>4</td>
</tr>
<tr>
<td>240</td>
<td>Music History: Philosophy and Methods</td>
<td>4</td>
</tr>
</tbody>
</table>

DOCTORAL PROGRAMS

Residence—The candidate must complete a minimum of three years of full-time work, some of which is planned individually for each concentration. Doctoral candidates working in absentia on Ph.D. dissertations or D.M.A. final projects that require consultation with faculty members must continue enrollment in the University under Terminal Graduate Registration (TGR).

Foreign Language Requirements—At the beginning of graduate study, all D.M.A. students, and Ph.D. students in the program on Computer-Based Theory and Acoustics are required to demonstrate a reading knowledge of German, French, or Italian, and the ability to translate from one of these languages into idiomatic English. Ph.D. candidates in Musicology are required to demonstrate proficiency in reading and translating German. All doctoral candidates are required to demonstrate a similar competence in a second language chosen from the three above before the beginning of their second year of doctoral study.

Qualifying Examination—An examination for admittance to candidacy will be given in the sixth quarter of full-time residence. Written sections of the test will examine the students' knowledge of history and repertory and an oral examination will test the student's ability to respond verbally to a wide range of questions in the field.

Teaching—All students in the Ph.D. or D.M.A. degree programs, regardless of their sources of financial support, are required to do three quarters of supervised teaching at half time and one at quarter time.

Basic Requirements—Doctoral programs in the Music Department do not require the A.M. degree as a prerequisite, but students entering with only a bachelor's degree are required to take the following courses:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Music Bibliography</td>
<td>4</td>
</tr>
<tr>
<td>240</td>
<td>Music History: Philosophy and Methods</td>
<td>4</td>
</tr>
</tbody>
</table>

All doctoral candidates are required to take:

310A, B, C. Music Analysis: Modal, Tonal, and Post-Tonal 12

DOCTOR OF MUSICAL ARTS

The Doctor of Musical Arts degree may be pursued in two concentrations, composition or performance practice (including conducting). Each concentration will be given breadth through collateral studies in other branches of music and in relevant studies outside music as seems desirable. A minimum of 72 units of credit is required for the degree.

Examinations—A written examination in the candidate's special area of concentration will be given no later than the third quarter after passing the qualifying examination. A public lecture-demonstration will be given during the last quarter of residence. It should be about one hour in length, treating some aspect of the candidate's final project or composition.

Performance Practice—Candidates will make an extensive study of historical styles of performance, technique, and repertory. In addition to formal course work and such independent study as may be done, the program in performance practice will include a number of performances supported by research papers. This requirement totals 16 units of academic credit and may be satisfied by one of the following course arrangements, to be selected in consultation with an academic advisor:

Four term projects, each of 4 units, investigating and performing compositions in different styles of music, or music from different historical eras.

Three term projects, each for 4 units, and a full recital for 4 units.

Two projects of greater scope, each for 6 units, and one term project, for 4 units.

Two projects of greater scope, each for 6 units, and a full recital for 4 units.
The Final Project in performance practice will be chosen from among different possibilities open to the candidate which include (a) preparing a performing score of a work, with commentary; (b) writing an extended critical or historical essay on a problem of performance practice; and (c) translating and commenting on a notable treatise on performance practice.

Composition—Candidates will be expected to produce a number of works demonstrating their ability to compose in a variety of forms, and for the common media, vocal, instrumental, and electronic music. Insofar as possible, the works submitted will be presented in public performance prepared by the composer.

The Final Project in composition will be an extended work for instruments, voices, electronic media, or a combination of these.

REQUIRED COURSES

Performance Practice:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>267.</td>
<td>Introduction to Performance Practices</td>
<td>4</td>
</tr>
</tbody>
</table>

Two of the courses in the 269 series:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>269A</td>
<td>Performance Practice of Medieval Music</td>
<td>4</td>
</tr>
<tr>
<td>269B</td>
<td>Performance Practice of Renaissance Music</td>
<td>4</td>
</tr>
<tr>
<td>269C</td>
<td>Performance Practice in Baroque Music</td>
<td>4</td>
</tr>
<tr>
<td>269D</td>
<td>Performance Practice of Classic Music</td>
<td>4</td>
</tr>
<tr>
<td>269E</td>
<td>Performance Practice of 19th-Century Music</td>
<td>4</td>
</tr>
<tr>
<td>369.</td>
<td>D.M.A. Performance Projects or</td>
<td>16</td>
</tr>
<tr>
<td>330.</td>
<td>D.M.A. Conducting Projects</td>
<td>16</td>
</tr>
</tbody>
</table>

399. D.M.A. Final Project | 8 |

Additional courses will be required for performance practice candidates, to be determined in consultation with the advisor, from among the following:


221. History of Music Theory | 8 |
224, 225. Solfege and Score Reading | 8 |
230, 231. Orchestral and Choral Conducting | 4 |
268. Thorough-bass Realization | 1 |
300. History of Notation | 12 |

Composition:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>323.</td>
<td>D.M.A. Projects in Composition</td>
<td>16</td>
</tr>
<tr>
<td>399.</td>
<td>D.M.A. Final Project</td>
<td>8</td>
</tr>
</tbody>
</table>

DOCTOR OF PHILOSOPHY

General University regulations regarding this degree are discussed in the "Degrees" section of this bulletin. The Ph.D. in Music can be pursued in two concentrations: Musicology, and Computer-Based Music Theory and Acoustics.

Examinations—(1) An examination testing the candidate's knowledge of music and research in the area of special concentration will be given in the Autumn Quarter after passing the qualifying examination. This will include an oral defense of the dissertation proposal. (2) The University oral examination, to be taken once the dissertation is substantially underway, will be an oral presentation and defense of dissertation research methods and results.

REQUIRED COURSES

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>221.</td>
<td>History of Music Theory</td>
<td>8</td>
</tr>
<tr>
<td>312.</td>
<td>Aesthetics and Criticism of Music</td>
<td>8</td>
</tr>
<tr>
<td>341.</td>
<td>Ph.D. Dissertation</td>
<td>12</td>
</tr>
</tbody>
</table>

MUSICOLOGY

267. or one course in the 269 series | 4 |
300. History of Notation | 12 |
310. Research Seminars in Musicology | 16 |

COMPUTER-BASED MUSIC THEORY AND ACOUSTICS

220A, B, C. Signal Processing | 12 |
320A, B, C. Signal Processing | 9 |
420A, B, C. Reserach Seminar or equivalent work in another Stanford department (e.g. Psychology, Computer Science, or Electrical Engineering), to be decided in consultation with the advisor according to the area of concentration. | 9 |

COURSES

GENERAL

1. Introduction to Music—Techniques of active and skillful listening to music, from awareness of the elements of music through musical forms, styles, and esthetics. (DR:2)
3 units, Win (Houle)

2A. The Symphony—A survey of symphonic literature from 1750 to the present, emphasizing developing skills in critical listening. Ability to read music not required. (DR:2)
3 units (Staff)

2B. The Concerto.
3 units (Barnes)

2C. Opera.
3 units (Mahrt)

3C. Medieval Music.
3 units (Mahrt)

4A. The Music of J. S. Bach—Developing awareness and skill in listening to the music of Bach: structure, style, instruments, and esthetics. Music for the church and chamber: dance music, concerti, cantatas, sonatas, preludes and fugues, and Passions. (DR:2)
3 units (Houle)

4B. The Music of Mozart.
3 units (Bauman)

4C. The Music of Beethoven—The composer's music and personality through selected masterworks. Ability to read music is not required. (DR:2)
3 units (Staff)
4D. The Operas of Mozart—(DR:2)
3 units (Berger)

4E. The Music of Debussy and Ravel.
3 units (Staff)

5A. Music in America—The development of popular folk and art music in America from the pilgrims to the present. (DR:2)
3 units, Aut (Cohen)

5C. Music and Culture at the Court of Louis XIV.
3 units (Marshall)

5D. French Musical Culture from Leonin to Boulez.
3 units (Marshall)

4 units, Spr (Staff)

18. Jazz History.
3 units, Win (Gioia)

19. Introduction to Music Theory—The fundamentals of music notation, basic sight reading, sight singing, ear training, keyboard harmony, and melodic, rhythmic, harmonic dictation. Skill oriented, using piano and voice as basic tools to develop listening and reading skills. For non-music majors and music majors who are unable to pass the proficiency test for entry to 21.
3 units, Win (Barnes)

20A. Jazz Theory.
3 units, Aut (Nadel)

20B. Advanced Jazz Theory.
3 units, Spr (Nadel)

FOUNDATION FOR A.B. MAJOR

21-24. Elements of Music—The elements of melody, harmony, counterpoint, and rhythm studied through analysis, composition, and exercises in practical musicianship. Emphasis is four-part writing and species counterpoint. Analysis and compositional projects in historical styles are part of this series. Three class meetings and two laboratory sessions per week.

21. Elements of Music I—Students intending to continue with 22-24 who do not have piano proficiency should begin 12 (class piano) concurrently. Prerequisite: Ability to pass proficiency examination in basic musical skills given on first day of class. (DR:2)
4 units, Aut (Rakowski, Staff)

Win (Barnes)

22. Elements of Music II—Prerequisite: 21; pass minimum proficiency test in piano, or one quarter prior and concurrent enrollment with 12; or consent of instructor.
4 units, Win, Spr (Barnes)

23. Elements of Music III—Prerequisite: 22; pass minimum proficiency test in piano, or two quarters prior and concurrent enrollment in 12; or consent of instructor.
4 units, Aut, Spr (Barnes)

24. Elements of Music IV—Prerequisite: 23; pass minimum proficiency test in piano, or three quarters prior and concurrent enrollment in 12; or consent of instructor.
4 units, Win (Rakowski)

100. Music History: Medieval and Renaissance—Prerequisites: 21, 22.
4 units, Aut (Houle)

101. Music History: Baroque—A survey of Western music in the 17th and early 18th centuries, including music of Monteverdi, Schutz, Lully, Buxtehude, Couperin, J. S. Bach, Rameau, and their contemporaries. Prerequisites: 21, 22, 100.
4 units, Win (Cohen)

102. Music History: Classical—Prerequisite: 24.
4 units, Spr (Ratner)

103. Music History: Romantic—Prerequisite: 102.
4 units, Aut (Bauman)

104. Music History and Theory: Modern—Prerequisite: 103.
4 units, Win (Smith)

121. Analysis of Tonal Music—Intensive analysis of complete movements or entire shorter works of the 18th and 19th centuries, using a variety of theoretical approaches. Prerequisite: 24.
4 units, Spr (Ratner)

122A. 18th Century Counterpoint—Analysis and composition of two- and three-part inventions and three- and four-voice fugues. Use of keyboard, ear training, and sight singing underlies all written work. Prerequisite: 24.
4 units (Staff)
alternate years, given 1989-90

4 units, Aut (Rakowski)

122C. Introduction to 20th-Century Composition—Projects in free composition based, at first, on 20th century models analyzed in class. Final projects are performed in an informal setting. Prerequisite: 24 or permission of instructor.
3 units, Spr (Rakowski)

COMPOSITION AND THEORY

120. Introduction to Music Synthesis and Programming Using MIDI Based Systems—Com-
position projects demonstrate participant’s own software for voicing and controlling MIDI synthesis. Extensive individual lab time required during week days. Prerequisite: Consent of instructor.

4 units, Win (Chafe)

123. Composition—Individual projects in creative work. May be repeated for credit. Prerequisite: Consent of instructor.

3 units, Aut, Win, Spr (Smith)

127. Orchestration—Prerequisite: 23.

3 units, Aut (Barnes)


220A. Fundamentals of Computer-Generated Sound—Introduction to computersound generation, composition, acoustics, and computer programming. Prerequisite: Experience in musical composition or consent of instructor.

4 units, Aut (Chowning)

220B. Compositional Algorithms, Psychoacoustics, and Spatial Processing—Use of high-level programming language as a compositional aid in creating musical structures. Studies in the physical correlates to auditory perception, 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)

220C. Research—Research projects in composition, psychoacoustics, or signal processing. Prerequisite: 220B.

4 units, Aut, Win, Spr (Chowning, Smith)

220D. Music Typography on the Computer.

4 units (Smith)

223. Seminar in Composition—May be repeated for credit.

4 units, Aut, Win, Spr (Smith)

224,225. Solfege and Score Reading.

224. 4 units (Barnes)

225. 4 units (Barnes)

HISTORY AND LITERATURE

Unless otherwise stated, prerequisite for any course in this section is 103.

50. Readings in Music and Music Theory—(Enroll in German Studies 52E.) For students with a knowledge of German (one year or equivalent) who want to acquire German reading proficiency in music.

3-4 units, Aut (Staff)

140. Studies in Medieval and Renaissance Music—Prerequisite: 100.

140E. The Music of Guillaume Dufay.

4 units (Mahrt)


4 units (Staff)

141C. The Music of Handel—Musical style and technique in cantatas and operas, concertos, sonatas, and the oratorios and dramatic masques. Performance of opera seria and dramatic works, and Handel’s music style is considered.

4 units (Houle)


142A. String Quartets of Beethoven.

4 units, Win (Ratner)

142F. The Operas of Mozart.

4 units (Ratner)

142G. The Music of Mozart.

4 units (Berger)


143A. The Operas of Verdi—The development of Verdi’s style through detailed examination of selected operas. Prerequisite: 23.

4 units (Bauman)

143B. The Music of Brahms.

4 units (Mahrt)

144. Studies in Modern Music—Prerequisite: 104.

144A. Twelve-Tone and Serial Music.

4 units (Smith)

144B. Innovations in Contemporary Music.

4 units (Smith)

144C. The Music of Mozart.

4 units (Barnes)

144D. Music Since 1945.

4 units (Berger)

150A. History of Musical Instruments.

4 units (Myers)

150C. History of Musical Esthetics—Esthetic theories from antiquity (Plato, Aristotle, Plutinus) through Augustine, Aquinas, Boethius, the Renaissance humanists, Descartes, the Enlightenment, to romanticism. Music style and criticism in response or relation to aesthetic theory.

4 units (Houle)

153. Organ Literature.

153A. Organ Music (Cabezón to Bach).

4 units, Win (Marshall)

153B. Organ Music (Bach to Ligeti).

4 units (Marshall)


4 units, Spr (Chafe, Staff)


155A. Keyboard Literature (J. S. Bach to Chopin.)

4 units (Barth)
155B. Keyboard Literature (Chopin to Present).
4 units, Spr (Barth)

198. Senior Honors Project.
4 units (Staff)

199. Independent Study—For advanced undergraduates who wish to do work outside the regular curriculum. Before registering a student must present a specific project and enlist a faculty sponsor. Credit up to 4 units per quarter.

251. Choral Repertory (1500-1750).
4 units (Staff)

252. Choral Repertory (1750 to Present).
4 units (Ramsey)

PERFORMANCE

GROUP INSTRUCTION

12. Introductory Piano—Preference to music majors. A special fee of $60 per quarter is charged for enrollment for non-music majors.
1 unit, Aut, Win, Spr (Zerlang)

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 (Cirone)

72,73,74,75,76,77. Small Group Instruction—A special fee of $60 per quarter is charged for enrollment in any of these groups.
1 unit, Aut, Win, Spr (Zerlang)

72A. Piano Class—For intermediate students.
(Gandolfi, Zerlang)

72B. Organ Class—For beginning organ students who have keyboard skills.
(Marshall)

73. Voice Class.
(Wait)

74A. Stringed Instruments Classes.
(Harrison, Kleyman)

74D. Harp Class.
(Chauvel)

75A. Wind Instruments Classes.
(Hawley, Staff)

75B. Renaissance Wind Instruments Class.
(Myers)

76. Brass Instruments Classes.
(Staff)

77. Percussion Class.
(Cirone)

INDIVIDUAL INSTRUCTION

172, 173, 174, 175, 176, 177, 272, 273, 274, 275, 276, 277. Individual Vocal and Instrumental Instructions—A special fee of $120 per quarter for majors and $240 for non-majors is charged for enrollment in these courses. Students wishing to enroll 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, Barth, Gandolfi, Sparrow)
172B/272B. Organ.
(Marshall)
172C/272C. Harpsichord.
(Fabrizio)
172E/272E. Early Piano.
(Barth, Fabrizio)

(Bettina, Wait)

174/274. Stringed Instruments.
174A/274A. Violin.
(Kleyman, Leybin, Toth)
174B/274B. Viola.
(Kleyman, Zaslav)
174C/274C. Violoncello.
(Harrison)
174D/274D. Contrabass.
(Tramontozzi)
174E/274E. Viola da Gamba.
(Staff)
174F/274F. Classical Guitar.
(Ferguson)
174G/274G. Harp.
(Chauvel)
174H/274H. Baroque Violin.
(Martin)

175/275. Woodwind Instruments.
175A/275A. Flute.
(Blaisdell, Hawley)
175B/275B. Oboe.
(Matheson)
175C/275C. Clarinet.
(Dufford)
175D/275D. Bassoon.
(Oliger)
175E/275E. Renaissance Wind Instruments.
(Myers)
175F/275F. Saxophone.
(Stein)

176A/276A. French Horn.
(Ragent)
176B/276B. Trumpet.
(Burkhart)
176C/276C. Trombone.
(Williams)
176D/276D. Tuba.
(Cooley)
177/277. Percussion.
(Cirone)

PERFORMANCE PRACTICES

130. Orchestral Conducting—Prerequisite: 127.
130A. 3 units (Toth)
130B. 3 units (Toth)
alternate years, given 1989-90

131. Choral Conducting.
131A. 3 unit, Win (Ramsey)
131B. 3 units, Spr (Ramsey)

180. Diction for Singers.
180A. Italian.
  1 unit, Spr (Staff)
180D. English.
  1 unit, Win (Staff)

181. Performance of Vocal Literature.
  1 unit, Aut, Win, Spr (Bettina)

183. Performance of String Literature.
183A. 1 unit, Win (Zaslav)
183B. 1 unit, Spr (Zaslav)

230. Advanced Orchestral Conducting.
  4 units, Win (Toth)

231. Advanced Choral Conducting.
  4 units, Win, Spr (Toth)

267. Introduction to Performance Practice—
  4 units, Aut (Houle)

268. Thorough-Bass Realization.
  1 unit, Aut, Win, Spr (Fabrizio)

269. Studies in Performance Practices—Performance techniques, theoretical principles, aesthetics, and musical resources of various historical periods. Lectures, seminar reports, individual research, and performance. Prerequisite: 267.
269A. Medieval.
  4 units (Mahrt)
269B. Renaissance.
  4 units (Mahrt)
269C. Baroque.
  4 units, Spr (Houle).
269D. Classic.
  4 units, Win (Barnes)
269E. Romantic
  4 units (Barnes)

ENSEMBLE

All courses listed in this section may be repeated for credit, with a maximum of 24 units allowed toward graduation. Membership in these organizations is not limited to students who register in the courses for credit and is open to 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 (Cirone)

158. Contemporary Performance Ensemble.
  1 unit, Aut, Win, Spr (Rakowski) 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—A chamber orchestra performing on instruments closely approximating those of the 17th and 18th centuries, and employing articulations and bowings from historical sources.
  1 unit, Aut, Win, Spr (Houle)

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 (Staff)
  by arrangement

161C. Sports Activity Bands.
  1 unit, Aut (Barnes) MWF 4:15-5:30
  Win, Spr (Barnes) by arrangement

162. University Chorus.
  1 unit, Aut (Wait)
  Win, Spr (Ramsey)
  M 7:30-9:45 p.m. and W 4-5:30

163. University Choir—Official choir of Memorial Church, which furnishes music for Sunday services and special occasions in the Church calendar.
  2 units, any quarter (Ramsey, Wait)
  T 4:15-5:30, Th 7-8:30 p.m., and Su 10-12

165. Stanford Chorale—Small vocal ensemble specializing in performance music of all periods for the chamber chorus.
  1 unit, Aut (Wait) MWF 12
  Win, Spr (Ramsey) MWF 12

166. Chamber Orchestra—Open to advanced players who have had orchestral experience.
  1 unit, Aut, Win, Spr (Toth) TThF 12-1:50

  1 unit, Aut, Win, Spr (West)
  T 7:15-8:45 p.m. and Th 4:15-5:45

168A. University Symphonic Band.
  1 unit, Aut, Win, Spr (Barnes) MWF 12

170. Piano Accompanying.
170A. Piano Accompanying.
  1-2 units, Aut, Win, Spr (Staff)
170B. The Literature and Practice of Accompanying.
1 unit, Aut, Win, Spr (Baller, Barth, Sparrow)

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 (Harrison, Staff)

271. Performance Special—For students who take part in performances organized in 269 while not enrolled in that class.
1 unit, Aut, Win, Spr (Staff)

GRADUATE RESEARCH AND SPECIAL STUDIES

200. Music Bibliography—Use of bibliographical materials in music research; introduction to methods of research.
4 units, Aut (Nagy)

221. History of Music Theory—The principal theories, theorists, and treatises of Western music, from ancient times to the present.

221A. Ancient Through Renaissance.
4 units (Cohen)

221B. Baroque Through Modern.
4 units (Cohen)
alternate years, given 1989-90

240. Music History: Philosophy and Methods
An introduction to the study of music history through intensive reading and discussion of representative primary and secondary works, and the study of selected sources.
4 units, Win (Bates)

241. Seminar in Analysis for Performance.
4 units (Houle, Mahrt)

299. Master of Arts Project.
4 units, any quarter (Staff)

300. History of Notation.
300A. 4 units, Aut (Mahrt)
300B. 4 units, Win (Mahrt)
300C. 4 units, Spr (Mahrt)

301A. Modeal Analysis.
4 units, Aut (Mahrt)

301B. Tonal Analysis.
4 units, Spr (Smith)

301C. Post-Tonal Analysis.
4 units, Win (Rakowski)

302. Research in Musicology.
Aut, Win, Spr (Staff) by arrangement

310. Research Seminar in Musicology.
4 units, Win, Spr (Houle, Bauman)

312. Aesthetics and Criticism of Music—Intensive reading of selected major primary texts.
8 units (Berger)
alternate years, given 1989-90


320A. The Discrete Fourier Transform (DFT)—Fundamentals of Spectrum analysis for discrete-time signals. Topics: sampled signals, complex variables, geometric projection, orthogonality, the DFT, and Fourier theorems relating to time-shift, convolution, correlation, aliasing, signal power, symmetries, and bandlimited interpolation. Prerequisites: High-school algebra and trigonometry.
3 units, Aut (J. Smith)

320B. Applications of the Fast Fourier Transform (FFT)—Spectrum analysis and digital filtering using the FFT. Topics: convolution, z transforms, transfer function analysis, frequency response, FFT windowing, and use of the FFT to implement nonrecursive filters by means of the overlap-add or filter-bank summation techniques. Prerequisite: 320A or equivalent.
3 units, Win (J. Smith)

320C. Recursive Digital Filtering—Analysis, design, and implementation of recursive digital filters. Concepts: difference equations, impulse response, transfer function, frequency response, poles and zeros, stability, phase and group delay, partial fraction expansion, Schur algorithm, physical simulation, and structural/numerical issues. The optional laboratory consists of projects using existing signal processing facilities at CCRMA, and/or signal processing projects related to the research program of the student (final report required). Prerequisite: 320B or equivalent.
3 units, Spr (J. Smith) plus lab by arrangement

321. Readings in Music Theory.
3 units, any quarter (Staff) by arrangement

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.
4 units, Aut, Win, Spr (Staff)

399. D.M.A. Final Project.
any quarter (Staff) by arrangement

alternate years, given 1989-90

420A. Acoustical Signal Processing—Classical acoustics translated into a digital signal processing framework. Topics: mass-spring oscillation, the mass-spring chain, the wave equation for the ideal flexible string and acoustic tubes, traveling waves, wave impedance, scattering theory, signal energy and momentum, digital filter counterparts, all-pass techniques, and efficient physical modeling using delay lines, scattering junctions, and low-order digital filters. Prerequisites: 320C or equivalent, and calculus.

2 units, Aut (J. Smith) plus lab by arrangement

420B. Nonlinear Modeling—Computational models for woodwinds and strings. Physically meaningful synthesis algorithms are built by coupling a "negative-resistance device" (woodwind reed or bow-string interaction) to a linear filter (which models a woodwind bore or vibrating string). The models are designed to capture only the "audible physics" of a musical instrument with a computationally simple algorithm.

2 units, Win (J. Smith) plus lab by arrangement

420C. Linear Modeling—Techniques for system identification and linear prediction. Computational methods are described for designing digital filters which automatically adjust free parameters to match physical measurements of linear resonating components of musical instruments. A special case is linear predictive modeling of speech.

2 units, Spr (J. Smith) plus lab by arrangement

OVERSEAS STUDIES PROGRAM

Stanford Program in Berlin
Director: Karen Kramer
Assistant Director: Hannelore Noack
Faculty: William Eddelman, Eike Gebhardt, Manfred Görtemaker, Hanns-Dieter Jacobsen, Frederick Klinger, Gero Lenhardt, Franz Neckenig, Jürgen Schutte, Peter Schulze, Alexander Shuller, David Stevensen, Frieder Otto Wolf
Stanford Program in Florence
Director: Giuseppe Mammarella
Assistant Director: Carla Lekai
Language Program Coordinator: Joan M. McConnell
Faculty: Stephan Bartolini, Patrizio Bianchi, Judy Brown, Roberto D’Alimonte, Paola Gori, Patrizia Guarneri, Michael Jameson, Julia Rowe, Jeffrey Schnapp, Giovanni Scichilone, Maria Todorow, Carlo Trigilia

Stanford Program in Kraków
Director: Andrzej Kapiszewski
Faculty: Kazimierz Baran, Andrzej Bryk, Emil Orzechowski, Krzysztof Palecki, Jacek Wasilewski, Andrzej Wojtyna

Stanford Program in Oxford
Director: Geoffrey Tyack
Associate Director: Pamela Murray
Faculty: Rosemarie Allen, John Durpe, John Durant, Kate Flint, Regina Gagnier, Charles Grant, Martin Holmes, Ruth Mateer, J. B. McLaughlin, Gerald Meier, Syed Rizvi, Katherine Worth

Stanford Program in Paris
Director: Marc Bertrand
Program Administrator: Estelle Halevi

Stanford Program in Salamanca
Director: Isabel Criado

Stanford Program in Tours
Director: Paul LeMaol
Assistant Director: Claude Doubinsky
Assistant Director: Anne Durand
Faculty: Marc Bertrand, Jean Noel Billard, Gerald Chiax, Olivier Dufresne, Martin Evans, André Gorgues, Nancy Green, Michelle Jomaron, Guy LeBoucher, Françoise Perdoux, Laura Volkerding

Overseas Studies believes academic study abroad should be a normal part of every student’s educational options, and we offer study centers in Berlin, Florence, Krakow, Oxford, and Tours, with a variety of courses from art to zoology. Courses meeting Distribution Requirements in Areas 2 and 5 are usually offered at each of these centers each quarter. Science, engineering, and technology courses are available at Berlin and Oxford, and an internship program is offered in Berlin. Within the
next two years, new programs will open in Kyoto, Japan, in Latin America, and in Israel. The Berlin, Florence, and Tours programs require two quarters of the appropriate language; instruction is largely in English. The Oxford and Krakow programs require no foreign language. Students may enroll for one, two, or three quarters. All courses are taught by local and Stanford faculty to Stanford standards.

Special programs are offered at Paris and Salamanca for students fluent in French or Spanish; students attend some classes in the local universities. Other opportunities through consortium programs exist in Rome and Sao Paulo.

Students stay registered at Stanford and pay the usual tuition, and room and board fees. Regular financial aid rules apply and aid is often increased to cover the cost of transportation and other expenses of living abroad. Students have a variety of housing options, depending upon the center; some students live in the Stanford Center, others with families, and others with local students in apartments or in local university dormitories. A full-time staff is available at the Stanford home campus to assist students in planning all aspects of their program abroad. Courses offered abroad carry regular University credit. Those that also receive credit toward a departmental major are indicated. The information below, while accurate at the time of printing, is subject to change.

For more information on all aspects of the program, come to the Overseas Studies office, 126 Sweet Hall, or phone (415) 723-3555.

COURSES

BERLIN

1. East and West: Complementary Ideologies—(Also listed as International Relations, Cluster B.) A general introduction to the problems of the “taken-for-granted” background assumptions of a society. Focus is on the oppositional ideological “interface” between East and West in Berlin; the divergent conceptions of the individual and society, an area in which differences are most radical and consequences for relations between German cultures East and West most palpable. Such perceptions (on military doctrine, human rights, and world politics) have concrete political ramifications for the respective sense of identity and for the relations between the complementary sides.

4 units, Aut (Gebhardt)

2. Sexual Cultures: German and American—To the casual observer, the attitudes toward sex, gender, and behavior in Germany and the U.S. differ significantly. Sexuality is only in limited respects a biological given. It is also the product of social history in a specific cultural context. The question of national specificity in the sexual cultures of Germany and the U.S. is addressed in the context of broader historical traditions.

5 units, Aut (Schuller)

4. West German Literature between the Ruins and the Student Movement, 1945-68—The relationship between the suppression of Germany’s fascist past and the various schools of post-war German literature.

4 units, Win (Schutte)

6. Comparative Studies of Culture: West Germany and the U.S.—The American and West German societies have a capitalist economy with almost the same level of technological development and a democratic state with extended public welfare institutions. Both countries represent variations of the common Western theme of modern individualism with differences in specific elements of both cultures. Comparisons of formal education, religious organizations, soap operas, work, sports, etc. demonstrate the social composition of the “U.S. citizen” and the “German citizen.”

4 units, Win (Lenhardt)

50. Introductory Science of Materials—(Enroll in Engineering 50.) (DR:8)

3 units, Aut (Stevenson)

101A. German Theater—(Same as Drama 101A.) Weekly trips to the theater, a tour of back-stage facilities, attendance at a rehearsal, and discussions with actors, directors, or other theater professionals. The syllabus is based on the productions attended in any given quarter. The texts of the plays (50% available in English translation) are supplemented by theoretical writings of the respective playwrights and background reading in theater history and theory.

4 units, Aut (Kramer)

117V. Industrial Revolution and its Impact on Art, Architecture, and Theory—(Same as Art 173Y, VTSS 117V.) The interlinking of architecture and painting with technological and scientific development. In a period of industrial revolution, the dominance of positivist thinking and empirical methods tends to prompt in the cultural and artistic realm a response of euphoric acceptance or emphatic rejection. Art work as a social, cultural, and spiritual “symbol” is a response to scientific and technological development of a given period, yet claims timeless validity. Topics: frictions between Idealism and Realism, photography and painting, Historicism and Functionalism, Expressionism and Dada, Futurism and New Sobriety, Functionalism and Nazi Classicism. The extent technolog-
ical and scientific development motivates, aesthetic redefinition. (DR:2)

5 units, Aut (Neckenig)

120X. New Ways of Seeing — (Same as Art 120X.) Art objects in the Berlin cityscape, museums, and galleries as historical symbols. The cultural and ideological movements of the various epochs through an analysis of form and content, ground plan and facade, artistic details, aesthetic effects, and symbolic meanings. (DR:2)

4 units, Win (Neckenig)

123X. German Art in the Weimar Republic and the Nazi Reich — (Same as Art 123X.) An analysis of the active role that German art, 1919-1933, played in the general development of European art. The artistic preconditions, the different schools of art between 1919 and 1933, and the change from the progressive movement of Weimar to the return to national cultural roots and the break with the international scene in the Nazi period. (DR:2)

4 units, Spr (Neckenig)

129B. Psychoanalysis and Social Theory in Modern Europe — (Same as German 129B.) The influence of psychoanalysis on the theory of society and culture and the use of psychoanalytic theory by the Frankfurt School. The historical background of these phenomena within the social and cultural history of "Central Europe." Emphasis on combining texts with the development of historical understanding. Authors include: Adorno, Freud, Horkheimer, Marcuse, and Fromm.

5 units, Spr (Neckenig)

129E. Modernism and Metropolis: Turn of the Century Culture in Berlin — (Same as German Studies 129E.) 19th-century Berlin was the center of European Modernism and cultural crisis in the industrial age. Growing social tensions in the wake of technological development, fear, and fascination of the metropolis were the backdrop for the development of avant-garde cultures: literary and artistic Naturalism and early Expressionism, working class culture, the anti-urban women's movement, and Jewish culture. Literary texts on historical materials, films, the cityscape, and museums. (DR:2)

4 units, Spr (Wolf)

129F. Political Culture and Social Change in Modern Germany — (Same as German Studies 129F.) Germany's political system beyond the approaches of political institutions and institutionalized procedures or through the fragment-ed avenues of policy-making. Changes in the ability and preparedness of political institutions, essential for the survival of German democracy come from external and domestic factors and from the relationship between political culture and political institutions. The internal dynamics of debate with the various parties and between parties and new social movements.

5 units, Spr (Schulze)

141X. The German Federal Republic in the International System — (Same as Political Science 141X.) The emergence of West Germany's foreign policy since the early 1950s. Emphasis is on changing international and domestic conditions (political and economic) which have influenced the Federal Republic in its international environment, especially those which have an impact on German-American relations and the role of the Federal Republic in the East-West conflict. (DR:5)

4-5 units, Spr (Gortemaker)

151X. East and West: Complementary Ideologies — (Same as Political Science 151X; also listed for International Relations Cluster B.)

4 units, Aut (Gebhardt)

179B. Split Images: German Film Culture, East and West — (Same as German Studies 179B.) The emergence in the postwar period of two new German film and television cultures. Screenings of films and TV broadcasts from East and West develop critical tools of film literacy and understanding of the political and aesthetic representations of the respective cultures. Also, shifting strategies for cross-cultural reception — TV as a window to the West. During the Berlin Film Festival, students have exposure to contemporary trends in the cinema. (DR:2)

5 units, Win (Kramer)
227V. Introduction to German History: Politics and Culture from the Middle Ages to the Unification of Germany, 900-1870—(Same as History 227V.) Berlin and Prussia in an “exemplarisch,” selective way. The transformation of social forms and their cultural expressions in the context of political development. History as an interdisciplinary project, drawing on artistic, literary, and theoretical documents and artifacts. (DR:5)
4 units, Win (Neckenig)

4 units, Aut (Neckenig)

258D. Theater and Politics: West and East Germany, Poland and Czechoslovakia—(Same as Drama 258D.) Seminar on the ways theater becomes a means of expressing political attitudes, criticisms, and commentaries within the four countries. Plays are studied with respect to: reactions to Nazism and Communism, the development of democracy, and suppression and conflict in the 1970s to the present. Includes trips to the Berlin theater. (DR:2)
4 units, Spr (Eddelman)

GERMAN LANGUAGE PROGRAM

60. Special Intensive German—Grammar, composition, reading, and conversation. Designed for interns to increase their language proficiency as quickly as possible, help them become integrated into Berlin, and profit from its many cultural opportunities. Required of all interns who have had fewer than two quarters of German.
10 units, Aut (Staff)

70. Intensive German—Grammar, composition, and conversation. Designed to increase students’ fluency in German language as rapidly as possible and to help them take advantage of the many opportunities in Berlin.
6 units, Aut, Win, Spr (Staff)

80. Intermediate German—For students who wish to improve their knowledge of the German language and begin reading texts in history, literature, politics, and economics.
4 units, Aut, Win, Spr (Staff)

88. Intermediate Conversation.
2 units, Aut, Win, Spr (Staff)

90. Advanced German—For advanced students who wish to expand their knowledge of the German language and become more familiar with the finer points of German grammar and style.
4 units, Win, Spr (Staff)

93. Contemporary Berlin: Public Media — A conversation course using radio, television, advertisements, etc. as a basis for the discussion of current events. Vocabulary is expanded in the fields of politics, economics, sports, and the arts.
2 units, Win, Spr (Staff)

FLORENCE

10. Magna Grecia—Greek art as an aspect of the cultural development of the Greek-speaking peoples emphasizing historical Greece with its overseas extensions, especially in the West. Extant written sources from Greek literature are used to compare ancient with modern views on Greek art.
4 units, Aut (Scichilone)

11. Contemporary Art and the Italian Pictorial Tradition—Seminar on ways that Modern and Post-Modern art have recast pictorial issues first formulated in pre-Renaissance and Renaissance Italy and the ways that artists today might look to these earlier achievements to support and enrich their own efforts. Some studio assignments.
3 units, Aut (Rowe)

12. Politics and Management of Cultural Heritage in the Modern World—Explores the way Florence copes with pressures to preserve the past while responding to the needs of residents and the ways in which the preservation of the past are politicized and managed. Case studies such as the expatriation of the Parthenon marbles to England.
3-4 units, Win (Scichilone)

13. The Left in Europe—Analyzes social and political changes in European communist and socialist parties and movements and their relation to the political center and to the international balance of power.
4-5 units, Win (Bartolini)

109. Greek Civilization in Italy—(Same as Classics 109, History 109.) Lecture/discussion includes readings of the first extant Greek poem found on Ischia, the wanderings of Odysseus, the philosophers Pythagoras, Xenophanes, Empedocles and Parmenides, Thucydides’ description of Athens’ disastrous Sicilian expedition, Plato’s Seventh Epistle describing his efforts to train a philosopher-king in Sicily, and the accounts of historical events (the largest slave revolt of antiquity.) (DR:2)
4-5 units, Spr (Jameson)

109V. The Age of the Renaissance—(Same as History 109V.) The artistic and intellectual breakthroughs of the age in relation to the economic, social, and political institutions of Renaissance Italy. (DR:5)
5 units, Aut (Brown)
111. The Political Economy of Small Firms in Italy—The importance of small firm development in Italy is established by government policy, but sociological, political, and cultural factors determine who takes advantage of the opportunity. Their benefits and disadvantages.  
4 units, Spr (Trigilia)

111A. Tuscan Art from Giotto to Leonardo—(Same as Art 111A.) A chronological analysis of the stylistic development of Tuscan art from the 13th to 15th centuries, including study of Giotto, Donatello, Botticelli, and Leonardo. (DR:2)  
4 units, Aut, Spr (Todorow)

111B. The High Renaissance and Mannerism in Florence, Rome, and Venice—(Same as Art 111B.) The stylistic trends, iconography, and social history of Italian art, concentrating on Michelangelo and Raphaello, but including Bronzino, Vasari, Titian, Tintoretto, and Caravaggio. Emphasis on classical influences on the artists studied. (DR:2)  
4 units, Win (Todorow)

121X. U.S. and Western Europe after WWII—(Same as Political Science 121X, History 135V; also listed as International Relations Cluster A.) Economic, political, military, and cultural relations between the U.S. and NATO countries, especially U.S. policy toward Europe as it relates to East-West issues and European unification. (DR:5)  
2-3 units, Spr (Bianchi)

125X. Contemporary European Politics—(Same as Political Science 125X.) Introduction to Western European politics combining a thematic approach with a country-based analysis, with the material grouped by topic to allow for comparison. The country-based analysis is used selectively for a grasp of particular aspects related to single political systems. Also, the political, socio-economic, cultural conditions explaining the rise of democratic regimes in Western Europe and their different pattern of development, constitutional models, parties and party systems, electoral trends and electoral systems, and the development of the "welfare" state. The European Economic Community and its future. (DR:5)  
4 units, Spr (D'Alimonte)

126X. Italian Political System: Part I—(Same as Political Science 126X.) In-depth analysis of Italian political institutions, actors and processes. Emphasis on the pervasive role of the political parties in Italy, and on the connection between the stability of the political system and its performance. Prospects for change with reference to the evolution of the Italian Communist Party. Taught in English and open to all students. (DR:5)  
4 units, Aut (D'Alimonte)

127X. II Sistema Politico Italiano: Part II—(Same as Political Science 127X.) The Italian political system as it has emerged and developed from the end of WW II to the present. General trends of political and economic development and contrasts to a rapidly expanding economy and a political system retaining the traditional features of rural society. Institutional mechanisms of the state and on parties and interest groups. Also, prospects for regime change emphasizing the impact of economic crisis and the communist party in shaping future development. Taught in Italian at the University of Florence.  
4 units, Win (D'Alimonte)

159X. The Political Economy of Industrial Change: Italy and Europe in a Global System—(Same as Economics 159X.) The analysis of structural change and new tendencies of industrial systems. The role played by federal and local authorities in promoting the restructuring of industrial organizations. The differences in industrial organization and public policy between the U.S. and Europe. Emphasis on the Italian experience, mainly in small firm organization and policy.  
2-3 units, Spr (Bianchi)

189. Colloquium: Settlement and Economy of Tuscany Before the Modern Era—(Same as Classics/History 189.) Tuscany has been the home of a series of diverse societies, from Stone Age hunter-gatherers to the sophisticated cities of Etruscans, Romans, and Medieval and Renaissance Italians. This relationship is explored through the history of human societies in this particular environment, before the modern era. Field trips throughout Tuscan to towns, archaeological excavations and museums under the guidance of local experts.  
3-4 units, Spr (Jameson)

190L. Seeing and Measuring Human Differences—(Same as History of Science 190L.) A historical perspective on human biology including physiognomy and phrenology. The origins of racial and sexual stereotypes, and the historical treatment of madness and criminality. (DR:4)  
4 units, Spr (Guarnieri)

216V. The Structure of the City—(Same as History 216V, Urban Studies 142.) An analysis of the major monuments and institutions (civic, religious, legal, cultural, social) which represent phases in the growth and expansion of Florence as an urban center in terms of the language of symbolic forms. Topics: the evolu-
dition of civic and religious iconography; civic architecture and princely power in the Renaissance; the piazza and centro storico and their changing social and cultural function; the history of the museum as a cultural institution; the Florence of the living and of the dead (from the urban to the suburban cemetery); the birth of Firenze Capitale; and the impact of tourism on the city's urban fabric. (DR:5)

5 units, Aut (Brown)

233F. The Literature of the City: Dante's *Commedia*—(Same as Italian 233F.) A study of Dante's theory of the city via the *Divine Comedy* and excerpts from his political treatise, *On Monarchy*. Emphasis on the links between Dante's Florence and contemporary Florence, on the political crises of the 13th and 14th century in Italy, and on the intersection between issues of politics, poetics, and language in Dante's poem. All texts read in dual-language editions. Discussion section is in Italian for students wishing to perfect their linguistic skills. (DR:2)

4 units, Aut (Schnapp)

242F. Contemporary Art in the Italian Pictorial Tradition—Seminar on ways that Modern and Post-Modern art have recast pictorial issues that were first formulated in pre-Renaissance and Renaissance Italy, and the ways that artists today might look to these earlier achievements to support and enrich their own efforts. Expect studio assignments.

3 units, Aut, Spr (Rowe)

257. Discourse of the City—(Same as Italian 257.) Italian and Florentine political theory from the Middle Ages to the late 19th century studied against the background of Greek theories of the *polis* (Aristotle, Plato) and Roman and Christian theories of *civitas* and *imperium* (Cicero, Augustine). Authors: Virgil, Dante, Petrarch, Guicciardini, Machiavelli, Vico and Mazzini. Topics: rhetoric and power, utopias and dystopias, the country and the city, urban typologies, city and empire, the historical development of the Italian city in relation to Italian political theory. Discussion section is in Italian for students wishing to perfect their linguistic skills. (DR:5)

4 units, Win (Schnapp)

474F. Graduate Seminar on Antonio Gramsci—(Same as Italian 474F.) Readings from Gramsci's *Prison Notebooks* emphasizing Gramsci as a theorist of culture and politics. Topics: Gramsci's concept of hegemony, Gramsci on the "organic" and "traditional" intellectual, Gramsci as reader (of Dante, Machiavelli, Pirandello), Gramsci and the Risorgimento. Supplementary readings may include texts by Croce, Foucault, Althusser, Jameson, and others. Qualified undergraduates may be admitted to this seminar, upon approval of the instructor.

5 units, Aut (Schnapp)

490F. Proseminar: Allegory, History, Theory, Practice—(Same as Italian 490F.) Surveys a number of major crises in the history of allegorical interpretation in relation to changes in ancient and modern institution, and examines a variety of theoretical constructions of allegory. Topics: Philo Judeus's *Life of Moses*, heretical allegories of Scripture (Joachism), psychoanalysis and allegory (dream interpretation), Jameson's Marxist reaction to four-fold exegesis in *The Political Unconscious*. Qualified undergraduates may be admitted to this seminar upon approval of the instructor.

5 units, Aut (Schnapp)

ITALIAN LANGUAGE PROGRAM

3F. First-Year Italian, Third Quarter—(Enroll in Italian 3F.)

5 units, Aut, Win, Spr (Staff)

51F. Second-Year Italian—(Enroll in Italian 51F.)

3-4 units, Aut, Win, Spr (Staff)

52F. Second-Year Italian—(Enroll in Italian 52F.)

3-4 units, Aut, Win, Spr (Staff)

198F. Italian Language Specials—(Enroll in Italian 198F.)

1-5 units, Aut, Win, Spr (Staff)

KRAKOW

3. Tolerance and Anti-Semitism: Jews in Poland—An analysis of Polish-Jewish relations through the centuries emphasizing the years of the Holocaust and Polish-Jewish relations after the war in communist Poland, and current trends toward mutual understanding between the two groups. Students visit the concentration camp at Auschwitz.

5 units, Spr (Staff)

7. Polish language Classes—Polish language classes are taught at introductory and continuing levels. Beginning Polish is also available at Stanford. Course information may be obtained from the Special Program in Linguistics or the Overseas Studies Office. There is no Polish language prerequisite for participating in the program. Familiarity with the language will enrich the quality of involvement with Polish society.

3 units, Spr (Miodunka)

8. Eastern Europe Politics and East/West Relations.

4 units, Spr (Bryk)
9. East Meets West—Stanford and Polish students meet in this forum for discussion of issues of mutual concern.
2 units, Spr (Palecki)

10. Polish Film—Survey of Polish films emphasizing understanding the relationship between culture and politics.
2 units, Spr (Orzechowski)

120V. History of Eastern Europe—(Same as History 120V; also listed as International Relations Cluster A.) A comparative history of the countries of Eastern Europe from the Middle Ages to the end of WWII. The Medieval and Renaissance sections emphasize the ways in which Eastern Europe differed substantially from the West: the rise of a new serfdom east of the Elbe in the 15th and 16th centuries, the relatively liberal patterns of the Polish-Lithuanian Commonwealth with its habeas corpus for gentry, etc. The Enlightenment, liberalism, and nationalism in Poland during the 19th century. The interwar period of the 20th century and the drift of East European states (except for Czechoslovakia) from parliamentary democracies to authoritarian governments. A detailed diplomatic history of 1939-1945 emphasizing the Tehran-1943 and Yalta-1945 Conferences.
4 units, Spr (Baran)

123X. Efficiency of Capitalist and Socialist Economies and the Polish Crisis—(Same as Economics 123X.)
4 units, Spr (Wojtyna)

190D. Between Art and Politics: Special Topics in Polish Literature and Theater—(Same as Drama 190D.) Poland in literature, and the arts; the reproduction of a distinct national culture in the face of the loss of political identity. The intelligentsia as a national conscience, manufacturing a national consciousness or mythology which will bind Poland within Europe and assert its cultural autonomy. The continuing theses of this intellectual effort, including the tensions between isolation and cosmopolitanism, realism and idealism, and the controversy over whether there exists a special role of literature and the arts in the survival of Poland's politically powerless civil society. Historical and contemporary texts in translation, current artistic endeavors in Krakow. (DR:2)
3 units, Spr (Orzechowski)

OXFORD

1. Britain, Yesterday and Today—Required of all students. Lectures by the Oxford academic community on modern history, literature, politics, English law, the Irish problem, South Africa, and the Common Market. Week-end trip to South Wales to sites of national and historic interest, including a coal mine, country houses, the Welsh Folk Museum. Pass/No Credit.
1 unit, Aut (Tyack)

10. Seminar in Development Economics.
5 units, Aut (Meier)

11. Britain in the Age of Industrialization, 1760-1914—The development of Great Britain during the period of its most profound change, the industrialization of the economy and the concomitant modernization of the state.
4-5 units, Aut (Tyack)

12. Contemporary British Fiction Seminar—Lectures/seminar on a representative selection of novels and attitudes toward culture and society in modern Britain.
4 units, Win (Jones)

81. Values, Ethics, and Law—(Same as Philosophy 81.) An analysis of values and standards of conduct in the light of traditional ethics; the widening dimensions of human self-interpretation in light of modern scientific, political, and legal developments; the problems of planning for the future. Conceptual and historical approach presupposes no particular familiarity with technical philosophy.
5 units, Win (McLaughlin)

118Z. Seminar in 19th-Century Literature, Art, and Society—(Enroll in English 118Z.) The inter-relationships which took place during the Victorian period in the fields of art, literature, and society. Themes: the city, religious belief and doubt, and women. The problem of writing about visual forms. Issues of social concern, and the solutions put forward to cope with problems raised by industrial and urban life.
5 units, Aut (Flint)

131X. The Political Economy of the European Economic Community—(Same as Political Science 131X.) The Common Market's structure, development, and relations between the EEC and external trading and economic units—COMECON, developing countries, the Mediterranean basin, and the Atlantic triangle. The internal market forces at work, the operation of the customs union, the tensions caused by enlargement of the EEC and remaining trade barriers, and problems of creating common policies, in agriculture, fisheries, and the monetary system. Britain's position in the EEC, with its differing views on the budget and on agricultural policy. (DR:5)
5 units, Win (Allen)

138X. British Foreign Policy and International Relations, 1935-1985—(Same as Political Science 138X.) Britain's changing international position, from the dominant colonialist superpower of the 1930s to the decline of the post-
WW II era. Economic and diplomatic aspects, specific controversies such as Britain’s role in WW II, Yalta and its legacy, Suez, and unilateral disarmament. (DR:5)

4-5 units, Aut (Holmes)

144V. The British Empire and the Commonwealth—(Same as History 144V, Political Science 132X; also listed as International Relations Cluster A.) British imperialism in the 20th century and its legacy today. Topics: the Commonwealth as an element in international affairs, immigration from the Commonwealth, trade with and aid to the Third World. (DR:5)

4 units, Spr (Rizvi)

152A. Darwinism and Social Ideology in the 19th-Century—(Same as Philosophy 152A, History of Science 1521, English 119Z.) The significance of Darwin’s ideas to 19th-century thought in two dimensions; the extent to which the theory of evolution succeeded in undermining traditional religious doctrines and the Christian view of nature and the ways that Darwinian ideas affected and interacted with views of human society. Attention given to ideas about class and race. (DR:3)

5 units, Spr (Dupré)

152J. Modern Drama I—(Same as Drama 152J.) Ibsen’s impact upon the modern theater and his changing role from social agitator to theater poet; Maeterlinck and symbolist theater; Strindberg, naturalism and expressionism; Oscar Wilde; Chekhov; Shaw. For each playwright, lectures incorporate incorporate videos and slides of works as performed in the English theater and for the BBC and a workshop requiring close work on one or two scenes from a major work. Major plays: Ibsen’s Brand and Rosmersholm, Maeterlinck’s Death of Tintagiles, Strindberg’s Miss Julie and The Ghost Sonata, Chekhov’s Three Sisters and The Cherry Orchard, and Shaw’s Man and Superman, Misalliance, and Heartbreak House.

4 units, Win (Worth)

152K. Modern Drama II—(Same as Drama 152K.)

5 units, Win (Worth)

163Z. Gender and Class in 19th-Century Fiction—(Same as English 163Z.) Related to 173, but explores those issues as represented in fiction. (DR:2)

3 units, Spr (Gagnier)

165X. International Economics—(Same as Economics 165X.) The theory of international trade (models from Ricardo to Heckscher-Ohlin), trade policy in the West since the 1930’s, and trade barriers. Currency units and exchange rates, using the Nundell-Fleming model; balance of payments problems, forward exchange rates, the IMF, and problems of international policy coordination. Recommended: Economics 1 or 51.

5 units, Spr (Grant)

173. Britain in the 19th Century: In Pursuit of Bread, Knowledge, and Freedom—(Same as Philosophy 173, English 264Z.) Ideology and social conditions in 19th-century Britain emphasizing issues of class and gender. Autobiographical readings, and social and political theorists. (DR:3)

5 units, Spr (Gagnier, Dupré)

176X. History of English Architecture—(Same as Art 176X.) A chronology of the development of English architecture from the early Middle Ages to the 20th century, using Oxford and places within easy reach. Analysis is stylistic and functional, and buildings are related to their historical background. Topics: the rich variety of materials used; the influence of foreign ideas on English architecture; the rise of the professional architect during the 17th century; and the emergence of new types of building with changing historical circumstances during the 18th and 19th centuries. A study of grand buildings like the Oxford Colleges, and ordinary homes of the people. (DR:2)

4-5 units, Win (Tyack)

254Z. Contemporary British Theater—(Same as English 254Z, Drama 158E.) The 'classics' of modern drama and contemporary plays, the works of the most interesting theater directors; techniques playwrights use to make one free of the 'world' of theater, the illusion, and the means to illusion. Also, the ideologies in plays, the interaction between private life and public issues. Theater visits where appropriate. (DR:2)

4 units, Spr (Mateer)

SUMMER FOCUS
PROGRAM 1989

BRITISH MEDIA AND MODERN BRITISH SOCIETY

During the Summer Quarter of 1989 Overseas Studies will offer an eight-week Summer Focus program on British Media and Modern British Society under the direction of Professors Marion Lewenstein and Kris Samuelson. For more information, please contact the Overseas Studies Office.

101T. Topics in 17th-Century French Literature Survey—(Same as French 101T.) The works and authors that made the most significant contributions to Western literary culture in the 17th-century Age of Classicism. The main features of Renaissance Humanism as they relate to intellectual developments in the 17th century, lectures on the pessimistic vision of the
French moralists (Pascal, La Rochefoucauld, La Bruyere, Madame de Lafayette) and of the plays of Corneille, Racine, and Moliere. (DR:2)

4 units, Spr (Doubinsky)

102T. Topics in 19th-Century French Literature—(Same as French 102T.) The evolution of the 19th-century French novels by Stendhal, Balzac, Flaubert, and Zola studied for their intrinsic literary qualities. Together, they trace the progression of realism in French fiction. (DR:2)

4 units, Aut (Doubinsky)

103T. Topics in 20th-Century French Literature—(Same as French 103T.) Some of the masterworks of the 20th-century French novel. The historical and cultural context are complemented by discussions of the main themes of the excerpts, and by detailed analysis of significant texts. (DR:2)

4 units, Win (Doubinsky)

111X. La politique francaise contemporaine—(Same as Political Science 111X.) Two major aspects of the French political system, political institutions under the Fifth Republic, and agents of political action (political parties and pressure groups). Comparisons with the American political system. (DR:5)

5 units, Spr (Gorgues)

115X. History of Art: The Renaissance in Italy and France—Periods, monuments, and masterpieces of French art. The architecture and interior decoration of castles, churches, and cities on French painting and sculpture, and the chief artistic techniques used over the centuries. Field trips to cities and museums. (DR:5)

4 units, Spr (DuFresne)

119X. Introduction to French Art: Romanesque to Renaissance—(Same as Art 119X.) French art from the 11th to the 16th centuries. Historical and analytical treatment of major works and artists through lectures and slides complemented with field trips to museums, castles, churches, and archeological sites. Periods are Pre-Romanesque, Romanesque, Gothic, and Late Gothic. (DR:5)

4 units, Aut (DuFresne)

120X. French Foreign Policy—(Same as Political Science 120X; also listed as International Relations Cluster A.) The main themes of French foreign policy since WW II: the French rejection of bipolar hegemony, the quest for an autonomous European community, and the preservation of special relationships with the Third World. (DR:5)

5 units, Aut, Spr (Billard)

121X. Painting and Society in France—The artist's position in relation to French society and the French state since the 17th century. Emphasis on the history of painting. (DR:5)

4 units, Win (DuFresne)

127X. France and Europe and the Economic Crisis—(Same as Economics 127X; also listed for the International Relations major.) An approach to contemporary economic problems via the economies of France and Europe. The causes of the present economic crisis, stressing external factors such as increasing interdependence within the EEC and the defective functioning of the international monetary system. Theoretical solutions and concrete policy options. (DR:5)

5 units, Win (Leboucher)

128X. Les Problemes contemporains de la croissance economique—(Same as Economics 128X; also listed for the International Relations major.) The concept of economic growth, its definition and measurement, short and long range consequences, relationship to inflation, and its specific expression on the French economy. (DR:5)

5 units, Aut (Leboucher)

130V. Survey of French History: 1715 to the Present—(Same as History 130V.) Chronological and thematic survey of French history since Louis XIV. Political, social, and economic developments, with emphasis on the emergence of republicanism in France, and its subsequent evolution. (DR:5)

5 units, Aut (Green)

140X. France and the Third World—(Same as Political Science 140X; also listed as International Relations Cluster A.) France's interactions with the Third World from the standpoint of two main geopolitical perspectives: Africa and the Middle East. France's legacy of colonialism and the economic, military, and technical issues that it raised. France's relations with Maghreb (Tunisia, Algeria, Morocco) and Black Africa. DeGaulle's policies, French policies, and cooperation agreements through the present destabilizing activities of Cuba and Libya. France's role in the Middle East. Topics: the Arab-Israeli conflict, the war in Lebanon, France's commitment to Iraq, the Iraq-Iran War, and France's strategy in the Persian Gulf. (DR:5)

5 units, Win (Billard)

157Z. Living in the Past: The American Experience in Europe—(Same as English 157Z.) Analyzes the way in which American writers from Mark Twain to James Baldwin have treated their own European experiences in their fictional writings about Europe. Is the influence of the past perceived as a positive or a negative
force? Has the preoccupation of American writers with Europe's past distracted them from its present? To what extent have changes in the social, political and economic situation in the U.S. affected the way in which Europe has been perceived and represented? How have American commentators on the European scene characterized themselves and their native culture? (DR.2)

4-5 units, Aut (Evans)

171X. Photography and Society—(Same as Art 171X.) A photographic investigation of local culture and the French national identity through the use of illustrated lectures, field trips and critiques. Students complete Art 70 or the equivalent, expose and develop their negatives at Tours, and complete their portfolios when they return to Stanford. Students with minimal knowledge of developing and printing techniques may work at a beginning level in black and white or commercially processed color transparencies and receive a letter grade. Students with no photographic skills or cameras may write a paper for P/NC. Recommended: Art 70.

3 units, Win (Volkerding)

173X. Field Work in Photography—The Loire Valley surrounding Tours is investigated for its landscape, architecture, cultural, and historical sites. Field trips are organized for photographing and for viewing original material in museums, galleries, and archives including 19th-century photographs in the Bibliothèque Nationale and contemporary work at the Centre National de Photographie and current exhibitions. Recommended: Art 70.

3 units, Win (Volkerding)

181T. Modern French Poetry: From Baudelaire to Surrealism—Poets that have been major voices in the French poetry of the last 100 years and have left a profound imprint on the poetry and esthetics of Western culture. All used the medium of poetry to pursue a spiritual adventure, to seek the absolute, or by divergent roads (Romanticism, Symbolism, Surrealism) to explore the mystery of the human condition. A guide towards a just appreciation of the linguistic, imaginative, and musical texture of the poems. Selected poems from Mallarme, Verlaine, Rimbaud, Valery, and Eluard. Taught in French. Credit for French major granted only if student's work (written and oral) is done in French.

4 units, Win (Perdoux)

OVERSEAS STUDIES 533

280I. Individu et société dans le roman contemporain—(Same as French 280I.) Analyzes novels published in the last 10 years for insights into social problems of contemporary French society: women's liberation in Simone de Beauvoir's Les Belles Images; working class life in the late 50's in Christiane Rochefort's Les Petits enfants du siècle; and working conditions, tensions, and race relations in a huge automobile plant in Claire Etcherelli's Elise ou la vraie vie.

4 units, Spr (Bertrand)

LANGUAGE PROGRAM

Intensive French—Grammar, conversation, and composition, emphasizing rapid acquisition of verbal skills necessary to use the French language in daily life.

70. Elementary Intensive French.
   6 units, Aut, Win, Spr (Blot, Jomaron, Perdoux)

   6 units, Aut, Win, Spr (Blot, Jomaron, Perdoux)

90. Advanced Intensive French.
   6 units, Aut, Win, Spr (Blot, Jomaron, Perdoux)

123. French Language Continuation — Advanced language class dealing with more sophisticated grammatical analysis, composition and explication of texts.

4 units, Win, Spr (Jomaron, Perdoux)

TOURS

8. Forms and Theories of Visual Communication—Film in relation to other visual communication techniques, mainly television and computer-based media and the new theoretical perspectives opened by recent communication technologies.

4 units, Spr (Mottet)

9. Modern French Poetry: From Baudelaire to Surrealism—Examines the most important French poets of the last 100 years. The ways that romantics, symbolists, and surrealists explore the mystery of the human condition through poetry.

4 units, Win (Perdoux)

11. L'Amérique: America in the French Imagination—What America has meant to the people of France, from the Renaissance to the present day. Imaginative constructs and historical realities analyze the perception of the beholder and the countenance of the beheld. To
what extent have French perceptions of America been shaped by the changing political relationship between the two countries? How have internal social, economic, and political conditions in France affected the way in which French writers have represented America? What aspects of American culture have been of most enduring interest to French commentators and why? (DR:2)

4-5 units, Aut (Evans)

12. Seminar: The French Revolution—Introduces students to the French revolution while France is celebrating the bicentennial and explores the various accounts given by historians of different classes and political allegiances.

3-5 units, Win (Green)

13. Introduction to the Political Economy of Food: French Policy in the European Community and the World—(Also listed as International Relations, Cluster C.) Food and farm policies in the U.S., the European Community and Africa. Food and farm strategies in the world, whether in terms of famine and malnutrition in Third World countries or in terms of overproduction and overconsumption in industrial countries, specifically with North-South relations. The international dimension of food markets through an economic and socio-cultural approach. The economic approach: the dynamics of international agricultural products markets; the stakes involved in food and agricultural relations between Europe and developing countries in Africa, the Caribbean and the Pacific; the agricultural policies of the U.S. and the European Community’s common agricultural policy with reference to the conflicts among member countries and to their new orientations. The socio-cultural approach: the strategic dimension of food and farm issues, first in the field of food production, through case studies of rural or urban development projects in Africa, second with respect to the cultural dimension of the consumers’ food habits in France, Europe, and Africa.

4 units, Spr (Desjeux, Carfantan)
Philosophy is an excellent major for those planning a career in law, medicine, or business. Philosophy provides analytical skills and a breadth of perspective helpful to those called upon to make decisions about their own conduct and the welfare of others. Philosophy majors who have carefully planned their undergraduate program have an excellent record of admission to professional and graduate schools. There are undergraduate advisors especially for philosophy majors planning careers in law, medicine, and business.

The Special Program in the History and Philosophy of Science enables students to combine interests in science, history, and philosophy. Students interested in this program should see the special advisor.

The Joint Major in Philosophy and Religious Studies combines courses from both departments into a coherent theoretical pattern.

The Tanner Memorial Library of Philosophy 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 elect student representatives to department meetings.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

There are two ways of majoring in philosophy; the "General Program" and the "Special Program in the History and Philosophy of Science." A student completing either of these receives a degree in Philosophy. There is also a major program offered jointly with the Religious Studies Department. To declare a major, a student must consult with the Director of Undergraduate Study. The student will be assigned an advisor with whom he or 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 (under 100) and 80, for a total of 10 units.
   b) The core: 24 additional units as follows:
      1) Logic: 57, or 159, or 160A
      2) Philosophy of Science: 60, or one from 162-169, or 188
      3) Ethics: 79, or 170, or 171
      4) Metaphysics and Epistemology: one from 180-188
   5) History: two of 100-103
   c) One undergraduate philosophy seminar from the 194 series.
   d) Electives: 18 additional units, all of which must be numbered 10 or above, and at least 13 of which must be numbered above 99 for a total of 55 units.

2. Units for Tutorial or Directed Reading (Philosophy 196, 197) may not be counted in the 55 unit requirement. No more than 10 units completed with grades of "Pass" may be counted in the 55 unit requirement.

3. Transfer units must be approved by the Director of Undergraduate Studies, in writing, 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 program is one of the parents of the new Symbolic Systems Program, an independent, degree-granting program described elsewhere in this bulletin. No new majors are being accepted into the old program.

SPECIAL PROGRAM IN HISTORY AND PHILOSOPHY OF SCIENCE

History and Philosophy of Science is a major offered under the Philosophy Department, to which undergraduates can apply. Each participating student will be assigned an advisor who will approve the course of study. 61 units are required. The student will be assigned an advisor with whom he or she should work out a coherent plan for the major. The department strongly urges that students have proficiency in at least one foreign language.

1. General requirements:
   a) Three science courses in a coherent field (e.g., physics, chemistry, biology) (12 units)
   b) One history course, e.g., modern European history, modern American history (3 units)

2. The following core courses must be completed with a letter grade indicator (LGI) of "B-" or better by the end of the junior year.
   a) Philosophy 57 or 159
   b) Philosophy 80
   c) Philosophy 60

3. Two history of philosophy courses.

4. Three history of science courses.

5. Three philosophy of science courses.
Choice of courses must be approved in writing by the program advisor.

6. At least six courses in the major must be completed at Stanford with an LGI of "B" (not including "B-") or better. Units for Tutorial or Directed Reading (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.

7. Transfer units must be approved in writing 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.

HONORS PROGRAM

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 letter grade indicator, 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 years. This should include an undergraduate philosophy seminar either in the Spring Quarter of the junior year or in the Autumn Quarter of the senior year. It should also include at least 5 units of Senior Tutorial (196) during the Autumn and/or Winter Quarters of the senior year. 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 2 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 as to whether students receive Honors.

The Honors Tutorials represent units in addition to the 55-unit requirement.

The Philosophy Department cooperates with the Honors component of the "Humanities Special Program" as described in that section of this bulletin.

JOINT MAJOR IN PHILOSOPHY AND RELIGIOUS STUDIES

The joint major in Philosophy and Religious Studies consists of 60 units of course work with approximately one third in the philosophy core, one third in the religious studies core, and one third in either the general major or the special concentration.

No courses in either the philosophy or religious studies core can be taken pass/no credit. At least three courses in each must be completed with a letter grade indicator of "B" (not including "B-") or better.

In general, transfer units cannot be used to satisfy the core requirements. Transfer units must be discussed with the director of undergraduate studies in the appropriate department at the time of declaring the major.

CORE REQUIREMENTS

1. Philosophy courses
   a) Philosophy 80
   b) 16 units over the following areas:
      2) Ethics and value theory: Philosophy 170 or 171.
      3) Epistemology, metaphysics, and philosophy of language: Philosophy 180, 184, 186, 187.
      4) History of philosophy: Philosophy 100 or 102.

2. Religious Studies courses:
   20 units, including at least two courses in diverse religious traditions (e.g., an Eastern and a Western, or a literate and a preliterate tradition) and including at least one seminar.

3. General major courses:
   An additional five courses (approximately 20 units) divided between the two departments. No more than 5 of these units may come from courses numbered under 99 in either department. Each student must also take at least one undergraduate seminar in religious studies and one undergraduate seminar in philosophy.

4. Special Concentration:
   With the aid of an advisor, students will pursue a specialized form of inquiry in which the combined departments have strength, e.g., American philosophy and religious thought, philosophical and religious theories
of human nature and action, philosophy of religion. Courses for this concentration must be approved in writing by the advisor.

5. Directed Reading and Pass/No Credit Units:
   a) Units of directed reading for fulfilling requirements of the joint major will be allowed only with special permission.
   b) No more than 10 units of work with a grade of "Pass" will count toward the joint major.

HONORS PROGRAM
Students pursuing a joint major in Philosophy and Religious Studies may also apply for Honors by the following procedure for Honors in either of the departments.

COTERMINAL DEGREE
It is possible to earn the A.B. and A.M. in Philosophy at the same time, normally at the end of a fifth undergraduate year. The standards for admission to this "coterminal" Master of Arts degree, and for completion of the program, are the same as those for A.M. applicants who will already have the bachelor's degree when matriculating except that students applying for the co-terminal program are not required to take the Graduate Record Exam. (A student whose A.B. will not be in Philosophy may require an extra year.)

GRADUATE PROGRAMS
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 advisors as early as possible.

Applications to graduate programs in the Department of Philosophy are obtained from and returned to Graduate Admissions, Stanford University. Applicants are required to take, in their senior year or later, the Graduate Record Examination.

MASTER OF ARTS
Two sorts of programs lead 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.

Admissions—All prospective master's students, including those currently enrolled in other Stanford programs, must apply for admission to the program. The application deadline is April 15 of the academic year preceding entry into the program. No fellowships are available for master's students. Entering students must meet with the director of the master's program and their advisors and have their proposed programs approved in writing. The master's program should not be considered a stepping-stone to the doctoral program; these two programs are separate and distinct.

Unit requirements—Each program requires a minimum of 36 units in philosophy though students in a special program may be allowed or required to replace up to 9 units of philosophy by 9 units in the field of specialization. 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. Up to 6 units of directed reading in philosophy may be allowed. There is no dissertation requirement. A special program may require knowledge of a foreign language. At least 36 units must be completed with a letter grade indicator of "B-" or better at Stanford. 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.

GENERAL PROGRAM
The General Program requires a minimum of 36 units in philosophy courses numbered above 99. Courses taken to satisfy the "undergraduate core" requirements may not be counted as part of these 36 units. The requirement has three parts:

1. Undergraduate core—Students must have when they enter, or complete early in their program, the following core undergraduate courses. (Students entering from other institutions should establish equivalent requirements with the master's advisor upon arrival or earlier):
   a) Logic 57, 159, or 160A.
   b) Philosophy of science: 60 or one of 162-169.
   c) Ethics: 170 or 171.
   d) Metaphysics and epistemology: one of 180-187.
   e) History: Two of 100-103.
2. **Graduate core**—Students must take at least one course numbered over 105 from three of the following five areas (courses used to satisfy the undergraduate core cannot also be counted toward satisfaction of the graduate core):
   a) Logic and Semantics.
   b) Philosophy of science and history of science.
   c) Ethics, value theory, and political philosophy.
   d) Metaphysics, epistemology, and philosophy of language.
   e) History.

Each master’s candidate will take at least two courses numbered above 200. One of these may be a graduate core seminar (264, 270, 280, 281), but no student will be admitted to a core seminar before completing undergraduate requirements in the area of the seminar and securing the approval of the instructor.

3. **Specialization**—Students must take at least three courses numbered over 105 in one of the five areas.

**SPECIAL PROGRAM IN THE HISTORY AND/OR PHILOSOPHY OF SCIENCE**

Only students with substantial preparation in philosophy or in the history of science in one of the natural or social sciences will be admitted. Entering students whose primary preparation has been in science may be required to satisfy all or part of the undergraduate core requirement as described in the General Program. Students whose preparation has not been in science may be required to take additional science courses.

**COURSE REQUIREMENTS**

1. At least four courses in the Philosophy Department in the history or philosophy of science. At least two of these must be graduate level courses, or graduate sections of undergraduate courses, and at least one of the four must be in the philosophy of science and one the history of science.

2. In most cases, one upper division or graduate course outside the Philosophy Department in the natural or social sciences or in history.

3. Remaining courses are to be chosen in consultation with an advisor, and must be approved by the advisor.

**SPECIAL PROGRAM IN THE PHILOSOPHY OF LANGUAGE**

Only students with substantial preparation in philosophy or linguistics will be admitted. Entering students whose primary preparation has been in linguistics may be required to satisfy all or part of the undergraduate core requirement as described in the General Program. Students whose preparation is primarily in philosophy may be required to take additional courses in linguistics.

**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 requirements detailed here are departmental requirements. There are six basic areas (Philosophy of Science, Ethics, Metaphysics, Epistemology, Philosophy of Language, Logic, and History) in which students should have proficiency in order to obtain a Ph.D. Demonstrating proficiency will take the form of course work, intensive seminars, and general examinations as detailed below.

Students must have completed this work by the end of their second year and all courses must be passed with a letter grade indicator of “B-” or better (no pass/no credit) to be advanced to candidacy.

At the end of the first year, the department will review the progress of each first year student to determine whether the student may continue in the program.

Any student in a philosophy Ph.D. program may apply for the A.M. when all University and departmental requirements have been met.

**PROFICIENCY REQUIREMENTS**

1. Course requirements, to be completed during the first two years:
   a) Six of the seven items listed below:
      1) Four quarter “core” graduate courses and seminars, in philosophy of language (281); philosophy of mind, metaphysics, and epistemology (280); value theory (270); and philosophy of science (264). These are given every other year. Enrollment requires the student to be a Ph.D. student in philosophy, or have special permission of the instructor.
      2) Three history units, each consisting of a substantial paper in the history of phi...
losophy. The six out of seven require-
mment must include at least one history
unit in ancient philosophy, one in
modern. These units may not be filled
with work done for any of the core
courses used to fill the six out of seven
rule.

b) First-order logic (Philosophy 160A) or the
equivalent.
c) Breadth Requirement: A course in East-
ern or Continental philosophy, or some
other course establishing breadth.

2. Teaching Assistance: Six quarters of teaching
assistance at 25% time, usually during the
second and third years.

3. Dissertation Work and Defense: The third
and fourth (and sometimes fifth) years are
devoted to dissertation work.

a) Dissertation Proposal—By Spring Quar-
ter of their third year, students select a
dissertation topic, a reading committee,
and some possible thesis relative to that
topic. The topic and thesis should be
sketched in a proposal of three to five
pages, plus an annotated bibliography
indicating familiarity with the relevant
literature. These should be approved by
the reading committee before the meet-
ing about graduate student progress late
in the Spring Quarter.

b) Departmental Oral—During Autumn
Quarter of the fourth year, students take
an oral examination, called the “Depar-
tmental Oral,” based on at least 30 pages
of written work, in addition to the pro-
posal. The aim of this exam will be to help
the student arrive at an acceptable plan
for the dissertation and to make sure that
the student, thesis, topic, and advisor
make a reasonable fit. In cases where
such an exam is deemed inappropriate by
the reading committee, the student may
be exempted from this exam by filing a
petition with the Director of Graduate
Studies, signed by the student and the
members of the reading committee.

c) University Oral Exam—Once a draft of
the dissertation has been essentially com-
pleted, there is a second exam, called the
“University Oral Exam.” A portion of this
exam will consist of a student presenta-
tion based on the dissertation, and will be
open to the public. A closed question
period will follow. If a student has such a
draft by Autumn Quarter of the fourth
year, she/he can request that the Univer-
sity oral count as the department oral.

SPECIAL GRADUATE PROGRAMS

The department recognizes that some stu-
dents may need to spend a large amount of time
preparing themselves in some other discipline
related to their philosophical goals or in ad-
vanced preparation in some area within philos-
ophy. In such circumstances, the department is
willing to grant an exemption to some of the
Ph.D. program requirements. Such an exemp-
tion is not automatic; a program must be worked
out with an advisor and submitted to the depart-
ment some time in the student’s first year. This
proposal must be in writing and must include:
1. The areas to be exempted (see below).
2. A program of additional courses and semi-
nars in the special area (usually at least 12
units).
3. A justification of the program that considers
both intellectual coherence and the stu-
dent’s goals.

The department believes there is plenty of
room for normal specialization within the pro-
gram as it stands, and that all students will be
specializing to some extent. Thus, the intent is
not to exempt courses on a one-to-one basis, but
only to grant exemptions when a student plans
an extensive and intensive study of some rele-
vant area.

Special-program students may be exempted
from two of the following:
1) One additional item from the seven items
listed in (1a).
2) Philosophy 160A (but then they must take
Philosophy 57 or 159).
3) The breadth requirement.

Students with special interests in philosophy
of science, requiring detailed knowledge of sci-
ence and perhaps history of science, can design
an individual program of study in close consulta-
tion with an advisory committee from the fac-
ulty. Such students will be expected to satisfy
proficiency requirements (2) and (3) above.

Ph.D. MINOR

Students wishing to obtain a Ph.D. minor in
Philosophy must follow these procedures:
1. Consult with the Director of Graduate Stud-
ies to establish eligibility, and select a suit-
able advisor.
2. Design a program of study with the advisor,
and give a signed copy of the program to the
departmental secretary.
This program must include:
a) 30 units of courses in the Philosophy De-
partment with a letter grade indicator of
“B-” or better. No more than 3 units of
directed reading may be counted in the
30-unit requirement.
b) At least one course or seminar numbered
over 99 must be taken in each of these five
areas:
1) Logic
2) Philosophy of Science and History of Science
3) Ethics, Value Theory, and Political Philosophy
4) Metaphysics, Epistemology, and Philosophy of Language
5) History
c) Two additional courses numbered over 199 must be taken in one of these (b) five areas.
3. 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.
4. Paperwork for the minor must be submitted to the departmental office before the student begins the program.

INTERDEPARTMENTAL PROGRAMS

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 “Humanities Special Programs” section in this bulletin.

GRADUATE PROGRAM IN COGNITIVE SCIENCES

Philosophy is participating along with the Departments of Computer Science, Linguistics, and Psychology in an interdisciplinary program in Cognitive Science. The program is intended to provide students with an interdisciplinary education as well as a deeper concentration in philosophy. Doctoral students are eligible to participate in the Cognitive Science program. Students who complete the requirements within Philosophy and the Cognitive Science requirements will receive a special designation in Cognitive Science along with the Ph.D. in Philosophy. To receive this field designation, students must complete 30 units of approved courses, 18 of which must be taken in two disciplines outside of philosophy. The list of approved courses can be obtained from the Cognitive Science program located in the Psychology Department.

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 Graduate and Professional School Financial Aid Service (GAPSFAS) application.

The Department of Philosophy does not offer separate teaching assistantships as part of its support program. Each Ph.D. student is considered a member of the Philosophy Fellows program. All Fellows, whatever their sources of financial support, are required to do six 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.

COURSES

See the quarterly Time Schedule for revised listings.

INTRODUCTORY

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 5A, B, C form a Western Culture sequence, sponsored by the Department of Philosophy as part of the Western Culture Program. Note: Any one of 5A, B, C may count as the introductory philosophy course requirement for the major.

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.

5A. Ideas in Western Culture: The Birth of Western Philosophy—Traces the origin of philosophizing in antiquity and relates classical problems to current issues of human concern. Reading selections from Greek literature and prose, Greek philosophic writings, and from the Hebrew and Christian traditions. Recommended for entering students. (DR:1; three-quarter sequence)

5B. Ideas in Western Culture: Faith, Reason, and Evil—Great works of literature, philosophy, and art from the Age of St. Augustine to the Age of Descartes in historical context. Authors include St. Augustine,
St. Thomas Aquinas, Avicenna, Dante, Shakespeare, More, Machiavelli and Descartes. The seminal sides of western culture are also examined, such as slavery and anti-semitism. (DR:1; three-quarter sequence)

5C. Ideas in Western Culture: Ideas of Human Liberation—Conceptions of the problems and possibilities of human life in the light of the breakdown of traditions in religion, science, literature, and society in the 19th and 20th centuries. Readings from Voltaire, J. S. Mill, Oscar Wilde, William James, T. S. Eliot, J. P. Sartre, and others. (DR:1; three-quarter sequence)

5 units, Spr (Galison, Follesdal)

MWF 10 plus 2 hour section

10. Cod, Self, and World: Introduction to Philosophy—Some of the basic problems, concepts, and methods of Western philosophy. The nature and existence of God, minds, and things are approached through contemporary and classical philosophical texts. (DR:3)

5 units, Spr (Dretske) MWF 11 plus section

20. Introduction to Moral Theory—Classic questions in moral philosophy through the works of Plato, Aristotle, Kant, and Mill. Topics: What kind of person is it best to be? Which character traits are virtues and which are vices? What makes an action right or wrong? Is being moral contrary to self-interest? What role do desires and feelings play in the life of a morally good person. (DR:3)

5 units, Win (Cohon) MWF 11 plus section

30. Introduction to Political Philosophy—The concepts of equality, justice, tolerance, liberty, utility, and rights, through some major works in political philosophy, each of which presents a distinct and systematic conception of human nature and social and economic conditions of a just association. Readings: Hobbs, Locke, Mill, Marx, Rawls, and Nozick. (DR:3)

5 units, Win (Dupre) MWF

42. Philosophy of Religion—(Enroll in Religious Studies 42.)

4 or 5 units, given 1989-90

46. Introduction to Chinese Thought—(Same as 104, Asian Languages 46, Religious Studies 55.) Religious and philosophical thought of early China, especially the “Classical” period, 550 B.C.-200 B.C. Development of Chinese thought as an extended dialogue among thinkers who provided uncommon and often contradictory answers to a common set of problems. Limited enrollment. (DR:3*)

4 units, Aut (Ivanhoe) MWF 10

plus section by arrangement

57/157. Introduction to Logic.

57. Section 1. Computer-based: no lectures. Axioms and rules of inference for sentential and first-order predicate logic. Elementary applications to a variety of domains. Individual choice of topics for a grade beyond pass. Students progress at their own pace. First class is organizational meeting only, held at 12:45 on first class day of quarter. (DR:6)

5 units, Aut, Win, Spr (Suppes)

57/157. Section 2. Lecture. Study of propositional and predicate logic, emphasizing translating English sentences into logical symbols and constructing derivations of valid arguments. (DR:6)

5 units, Aut, Win, Spr (Hall)

MTWThF 2:15

60. The Growth of Scientific Knowledge—(Same as History of Science 60.) Introduction to the philosophy of science, especially the nature of scientific theory change, and the idea of scientific progress. Readings from prominent 20th-century philosophers (Hempel, Kuhn, Lakatos, and others). Case studies of actual historical/philosophical debates. A writing focus course. (DR:3)

5 units, Win (Dupre) MWF 11

62. History of Biological Thought—(Same as History of Science 62, History 116A, VTSS 127.) A survey from ancient times to the present treating the growth and changing nature of biological thought in historical context as represented through classic controversies; teleological versus mechanistic explanations, vitalism, reductionism, the units and levels of biological organization, the origins of life, development, inheritance, and evolution.

4 units, Aut (Lenoir) MWF 11

75. Computers and Ethics—(Enroll in Symbolic Systems 100.) A philosophical analysis of ethical issues in the use of computers. An introduction to ethical theories and concepts, and application to moral questions concerning the use of computers. Should programs be owned? Do computers violate our right to privacy? Does one have a responsibility for computer errors that result in harm to others? Can an intelligent machine have moral responsibility? Should computers control nuclear weapons?

3 units, Spr (Nissenbaum) TTh 3:15

76. Ethics and Public Policy—A critical examination of assumptions underlying the use of cost/benefit analysis in the evaluation of public policy options. How can costs and benefits of different kinds, to different individuals, and across time be compared? What role should the distribution of costs and benefits play? How
does cost/benefit analysis fit into the large political picture? Are there alternatives to cost/benefit analysis? Readings from recent philosophic, economic, and public policy literature and case studies from various policy areas, depending on student interest.

4 units, Spr (Dresser) MWF 10

77. Ethics in International Relations—The possibility of and theoretical basis for an international morality: Are there moral norms governing relations between states? If so, what are they and what are their philosophical foundations? Focuses on specific moral issues in contemporary international affairs: nuclear warfare and deterrence, world hunger and economic justice, and environmental pollution. Readings from classical and contemporary sources.

4 units, Aut (Satz) MWF 10

78. Medical Ethics—(Same as Human Biology 173.) Philosophical analysis of moral dilemmas in health care, from the perspective of the health care professional and the concerned layman (patient, family member, or observer). Traditional insights about rights, compassion, respect for persons, and other moral matters illuminate such issues as euthanasia, informing vs. lying to seriously ill patients, treatment of deformed newborns, and the just allocation of scarce lifesaving therapies.

4 units, Aut (Cohon) MWF 11

80. Mind, Matter, and Meaning—Intensive and rigorous survey of some central and perennial topics of philosophy: free will and determinism: the mind-body problem and basic issues in the philosophy and language.

5 units, Aut (Zalta) MWF 1:15
Spr (Perry) TTh 11-12:15

HISTORY OF PHILOSOPHY

100-106 are survey courses covering 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. Students planning a philosophy major should take as many as possible during the sophomore year.

100. Greek Philosophy—(Same as Classics 65.) The philosophies of Plato and Aristotle, with some pre-Socratic background. (DR:3)

4 units, Win (Roberts) MWF 11

101. Medieval and Renaissance Religious Philosophy—(Same as Religious Studies 167.) Medieval and Renaissance philosophy focusing on the puzzles which arise when God and world are viewed as creator and created. Medieval and Renaissance debates over time and eternity, necessity and contingency, free will and determinism, knowledge of God. Readings: Augustine, Anselm, Aquinas, Scotus, Ockham, Erasmus, and Luther.

not given 1988-89

102. Modern Philosophy, Descartes to Kant—The origins and early development of modern philosophical thought. Descartes, Leibniz, Locke, Hume, and Kant. Emphasis on metaphysical issues. Prerequisite: One course in philosophy. (DR:3)

4 units, Win (Zalta) MWF 1:15

103. 19th-Century Philosophy—Ideas and conceptions that shaped 19th-century philosophy. Fichte, Hegel, Marx, Kierkegaard, Nietzsche.

4 units, Spr (Forster) MWF 9

104. Introduction to Chinese Thought—(Same as Philosophy 46.) For philosophy majors.

110/210. Pre-Socratic Philosophy—(Graduate students register for 210.) Intensive study of the thought of Heraclitus and Parmenides, with stress on metaphysical doctrines.

4 units, not given 1988-89

111/211. Plato—(Graduate students register for 211.) A survey of Plato's metaphysics and epistemology.

4 units, Spr (Roberts) MWF 11

111A/211A. Plato's Epistemology—(Graduate students register for 211A.)

4 units, not given 1988-89


4 units, not given 1988-89

112A/212A. Aristotle's Metaphysics—(Graduate students register for 212A.) An examination of the concepts of substance, essence, and potentiality.

4 units, Win (Moravcsik) TTh 2:15-3:30

113. Plato's Cosmology—(Same as History of Science 113, Classics/Greek 155.) The system of world order and creation that Plato elaborates in his dialogue, Timaeus. Issues: Is the world unique? Is it finite or infinite? Was it created, or is it eternal? Does the order of the world result from natural necessity or intelligent design?

4-5 units, Spr (Knorr) TTh 10
plus section Th 2:30

119. Spinoza and Leibniz—A comparative study of the two philosophies, with attention to their theories of knowledge and of explanation. Texts are Spinoza's Ethics and a collection of readings from Leibniz's principal works.

4 units, Spr (Hampshire) TTh 11-12:15
128. Austrian Philosophy from Bolzano to Wittgenstein—(Graduate students register for 228.) Survey of the philosophical systems of Bolzano, Brentano, Meinong, and the early Wittgenstein.
4 units, Win (Morscher) MW 1:15-3:05

129/229. Kant’s Critique of Pure Reason—(Graduate students register for 229.) An in-depth study of Kant’s greatest work together with selected secondary literature.
4 units, Win (Forster) TTh 11-12:15

131/231. Kant’s Critique of Practical Reason—(Graduate students register for 231.) A historical and systematic study of Kant’s ethics and philosophy of religion, with attention to Kant’s second Critique.
4 units, given 1989-90

134. Phenomenology and Its Background—The development of phenomenology and its contemporary philosophical significance. An analysis of the writings of Husserl and others.
4 units, Spr (Follesdal) MW 11-12:15

HISTORY OF SCIENCE

138A. Ancient Period—(DR:3; also satisfies Area 6 when taken in sequence with 138B.)
4 units, Aut (Knorr) MWF 2:15

138B. Middle Ages to Newton—(DR:3; also satisfies Area 6 when taken in sequence with 138A.)
4 units, Win (Knorr) MWF 2:15

138C. Newton to Einstein—(DR:3; also satisfies Area 6 when taken in sequence with 138A.)
4 units, Spr (Magnus) MWF 2:15

140. Topics in the History of Mathematics: From Antiquity to the 17th Century—(Same as History 138D, History of Science 138A,B,C; History 138A,B,C.) Origins and development of concepts and techniques in their social and philosophical context. Emphasis on ancient Greek geometry, its adoption of the idea of proof and interaction with early philosophy, its application in optics and mechanics, its significance and limitations.
3 units, Win (Knorr) TTh 2:30

145. Scientific Revolution—(Same as History 139, History of Science 145, VTSS 125.) Social, intellectual, and institutional background of the 17th century period that established modern science. Theories of matter and motion, Descartes, Galileo, and Newton. Historical controversies: Yates thesis on hermeticism and magic; Merton on Protestantism and science; Hessen on the economic basis of scientific change. Readings from era texts and modern historical studies. (DR:3)
5 units, Aut (Galison) TTh 11-12:15

152. The Darwinian Revolution—(Same as History of Science 152, History 133, Human Biology 152, VTSS 130.) The conceptual developments leading to the establishment of the major unifying paradigm of biological science, the theory of evolution by natural selection.
4 units, Win (Lenoir) MWF 9

152B. Darwinism and Social Ideology in the 19th Century—(Same as English 119Z, History of Science 152A; Oxford campus.) Darwin’s ideas and influence in terms of scientific knowledge (vis-a-vis religious belief) and power (vis-a-vis class, race, and gender.) (DR:3)
5 units, Spr (Dupre, Gagnier)

155. Sociology of Scientific Knowledge—(Same as Anthropology 158, History of Science 155, History 133B, Sociology 140, VTSS 138.) Some of the classical problems in the sociology of knowledge. Recent work in the social construction of scientific knowledge. Emphasis on recent studies in the historical sociology of experimental science and laboratory practice.
4 units, Spr (Lenoir) MWF 11

LOGIC AND PHILOSOPHY OF SCIENCE

156. Popper, Kuhn, and Lakatos—Three controversial figures in recent philosophy of science. Popper: scientific methods as openness to refutation and rational criticism. Kuhn: science develops discontinuously via scientific revolutions. Lakatos: scientific research programs have a "hard core" which adherents try to protect by making changes in the "protective belt." Interactions and criticisms.
4 units, Win (Phillips) Th 7-10 p.m.

157. Introduction to Logic—(Same as 57.) For graduate students.

158. Axiomatic Set Theory—Zermelo-Fraenkel axioms. Operations on sets, relations, and functions. Equivalence and ordering relations. Equipollence of sets and cardinal arithmetic. Topics on ordinal numbers and axiom of choice as time permits. This is computer-based; no lectures. Students progress at their own pace. The first meeting is organizational only, at 2:15 the first day of class of the quarter.
4 units, Aut, Win, Spr (Suppes)

159. Basic Concepts in Mathematical Logic—An informal introduction to the basic concepts
and techniques used in mathematical logic: sets, functions, structures, formalization, proof, mathematical induction, enumerability, and effectiveness. (DR:6)

4 units, Aut (Barwise) MWF 9

plus section

160A. First-order Logic—(Same as Symbolic Systems 160A.) The syntax and semantics of sentential and first-order logic. Introduction to the basic concepts of model theory. Gödel’s Completeness Theorem and its consequences (the Löenheim-Skolem Theorem and the Compactness Theorem) discussed and applied. Prerequisite: 159 or consent of instructor.

4 units, Win (Devlin) MWF 9 plus section

160B. Computability and Logic—A precise definition of “effective procedure” through Turing machines, register machines, and recursive functions. Church’s Thesis explained. These are used to develop Gödel’s work on the undecidability of arithmetic, culminating on his Incompleteness Theorem. Also other undecidable problems. Prerequisite: 160A.

4 units, Spr (Devlin) MWF 9 plus section

162. Foundations of Measurement—Fundamental theories of measurement from a formal standpoint. Their empirical adequacy. Basic representation theorems for extensive, conjoint, and difference measurements. Organizational meeting 3:15 on the first class day. not given 1988-89

164. Topics in Philosophy of Science — Analysis of structure and methods of empirical science. Examples from physics, psychology, and sociology. Intended for undergraduate and graduate students and for philosophy majors interested in conceptual problems in the natural and behavioral sciences. 4 units, not given 1988-89

165. Philosophy of Physics—An introduction to issues relating to Bell’s Theorem and the implications of this result for epistemological views about science and nature. The thought experiment of Einstein, Podolsky, and Rosen and attempts to resolve the paradox by means of hidden variable theories. Any physical concepts necessary for understanding the philosophical issues will be introduced.

4 units, Win (Cartwright) MWF 2:15

166. Introduction to Philosophy of Social Science—(Same as Education 211.) Focuses on the differences writers have noted between the natural and social sciences, and topics in the social sciences: explaining human action, the functional explanation of social phenomena, holistic versus reductionist orientations. Exam-

167. Philosophy of Biology—Philosophical issues in biology. The structure of evolutionary theory, and the epistemological and political debates surrounding sociobiology.

4 units, Aut (Dupré) TTh 11-12:15

168. History and Philosophy of 20th-Century Physics—(Same as History 139A, History of Science 168, VTSS 126.) The philosophical questions raised by historical developments in 20th-century physics. Late 19th-century reductionist world-views leading to special and general relativity. Einstein’s response. How did early workers in quantum mechanics attack the wave-particle duality? The problem of scientific realism in quantum mechanics. Nuclear fission, the bomb, and the growth of large-scale experimental high-energy physics. What is meant by “unified” field theories in contemporary physics? Readings: Scientific, historical, and philosophical texts. (DR:3)

5 units, Win (Galison) TTh 11-12:15

169. Modal Logic—Basic results in modal logic, concentrating on possible worlds semantics and its recent applications to computer science, artificial intelligence, and linguistics. Prerequisite: 160A or consent of instructor.

4 units, Spr (Barwise) TTh 11-12:15

ETHICS, AESTHETICS, AND SOCIAL AND POLITICAL PHILOSOPHY

170. Ethical Theories—The ethical theories of Hume and Kant and of some issues in 20th-century moral theory that have roots in their work: emotivism, moral subjectivism, and the role of reason in morality. Prerequisite: 2 courses in philosophy.

4 units, Spr (Cohon) TTh 11-12:15

171. Political Philosophy—In depth topics in political philosophy, especially the ability of contemporary liberal political thought to respond to its critics’ attacks on its psychological and methodological foundations. Also, Marxist, communitarian, conservative, and anarchist critics.

4 units, Spr (Satz) MWF 2:15

172. Is and Ought: From A Logical Point of View—(Graduate students register for 272.) Analysis of the is-ought question, its relevance for moral philosophy and other fields. Presentation and discussion of results achieved during the last 15 years. Prerequisite: 2 courses in philosophy or graduate standing.

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

173. Britain in the 19th Century: In Pursuit of Bread, Knowledge and Freedom—(Same as
In English 264Z; Oxford campus) Ideology and social conditions, emphasizing class, gender, and race. The relevance of Victorian social and political theory (e.g., Adam Smith, J. S. Mill, Malthus, Engels, Ruskin) to the concrete conditions revealed in Victorian autobiographies.

5 units, Spr (Dupré, Gagnier)

174. Morality of Peace and War—(Same as Religious Studies 164.) Moral, political, and religious issues surrounding conflict and conflict-resolution, especially in a nuclear age. General nature of peace and war, their theory and practice, just war tradition, and pacifism.

5 units, Aut (Jackson) MWF 1:15

177/277. Feminism and Political Theory—(Graduate students register for 277.) What various types of political theory (liberal, Marxist, socialist) say about the position and role of women and feminist criticisms of those theories. Also, concrete political/ethical problems of concern to feminists: affirmative action, pornography, abortion.

4 units, not given 1988-89

EPISTEMOLOGY, METAPHYSICS, AND PHILOSOPHY OF LANGUAGE

Philosophy 80 or permission of the instructor is a prerequisite for the 180 series.

180. Philosophy of Language—The basic issues in the relationship between language, mind, and world through the work of Frege, Russell, Tarski, Carnap, Quine, and Wittgenstein. Prerequisites: 80 and some background in logic. (DR:4)

4 units, Spr (Zalta) MWF 10

183/283. Meaning and Experience—(Graduate students register for 283.) The interrelationships between meaning and experience emphasizing how our judgments concerning meaning may be based on empirical evidence. Philosophers: W. V. Quine and Donald Davidson. Lectures presuppose some acquaintance with the philosophy of language.

4 units, not given 1988-89

184. Theory of Knowledge—Some central problems of epistemology, including the analysis of knowledge and memory, the nature of perception, and an evaluation of skepticism.

4 units, Win (Dretske) MWF 2:15

186. Philosophy of Mind—The mind-body problem, including behaviorism, functionalism, and other forms of materialism; intentionality and the nature of mental representation.

4 units, Spr (Dretske) MWF 1:15

188. Science and Knowledge—The nature of causation and the role of causal explanation in scientific and non-scientific contexts. Traditional approaches to causation (Kant and Hume) and current philosophical accounts. The changing role of causation in science and the extent to which this has or has not influenced philosophical thought.

4 units, given 1989-90

189. Intensional Semantics—(Graduate students register for 289.) Survey of the development of semantics for so-called intensional languages. Basic works by Tarski, Carnap, Kanger, Kripke, Kaplan, Hintikka, and Montague. Also, recent work in the area, if time permits.

3 units, given 1989-90

194. Undergraduate Seminars in Philosophy—A series of advanced undergraduate seminars. Enrollment limited to 16 in each seminar. Preference is given to undergraduate majors. For those in the Philosophy Honors program, these seminars serve as a preparation for writing an Honors thesis.

194A. Metaphysical Realism and the Philosophy of Language—If you called the tail of a horse a leg, how many legs would a horse have? Curiously, this question has come to preoccupy some of the best philosophical minds of our day. Why? Readings from the usual collection of deep thinkers.

4 units, Aut (Tawil) Th 2:15-5:05

194B. Philosophy of Mathematics—Episodes in the history of calculus emphasizing the problem of its foundations. Indivisibles, infinitesimals, fluxions, and other ghosts. Readings: Archimedes, Leibniz, Newton, Berkeley, Robinson, and other primary and secondary sources. No previous knowledge of the calculus is presupposed.

4 units, Aut (Mancosu) T 2:15-5:05

194C. Ancient Skepticism—A survey of skeptical views in the Classical and Hellenistic periods, emphasizing the epistemological debate between the Academic Skeptics and the Stoics. Also, the relation of the skeptical attitude to practical beliefs arising from Sextus Empiricus' Outlines of Pyrrhonism.

4 units, Win (Ward) W 2:15-5:05

194D. Philosophy of Mind and Body.

4 units, Win (Hampshire) Th 2:15-5:05

194E. The Politics of Biology—Examines areas where biology has played a significant role in political culture. The relationship between evolution and religion, and the eugenics movement. Topics are in historical context, but shed light on certain philosophical issues.

4 units, Win (Magnus) T 2:15-5:05

194F. Robots and Natural Languages—The philosophical and computational problems encountered in the design of robots that understand natural language. Topics: percep-
tion and natural-language processing, in-
structability, types of verbal interactions, lex-
ical meaning and context, language and learn-
ing.
4 units, Spr (Suppes, Crangle) T 3:15-6:05
194G. Topic to be arranged.
4 units, Spr (Vailati) Th 2:15-5:05
196. Tutorial—Senior year.
3 units, any quarter (Staff)
197. Individual Work for Undergraduates.
5 units, any quarter (Staff) by arrangement
PRIMARILY FOR GRADUATE STUDENTS
211A. Plato's Epistemology—(Same as 111A.)
For graduate students.
3 units, Aut (Moravcsik, Code)
Th 3:15-5:05
212A. Aristotle's Metaphysics—(Same as
112A. For graduate students.
228. Austrian Philosophy from Bolzano to
Wittgenstein—(Same as 128.) For graduate
students.
231. Kant's Critique of Practical Reason—
(Same as 131.)
not given 1988-89
237A,B,C. Methods in History and Philos-
ophy—(Same as History of Science 237A,B,C.)
Contemporary issues in the history of science.
Guest lecturers from history, history of science,
philosophy, physics, biology, and medicine ad-
dress what they see as the important topics in
the history of science. Each student pursues an
individual research topic in consultation with
the instructor.
3 units, Aut, Win, Spr (Galison, Cartwright)
Th 4:15-6:05
239. Teaching Methods in Philosophy.
1-3 units, any quarter (Zalta)
by arrangement
240. Individual Work for Graduates.
any quarter (Staff) by arrangement
242A,B,C. Seminar in the Philosophy of Sci-
ence.
242A. Topic: Representation Theory.
not given 1988-89
3 units, Win (Suppes) M 3:15-5:05
255. Interdisciplinary Workshop in Equity and
Social Choice Theory—(Same as Political
Science 267, Economics 387.) Recent work on
social choice theory and related literatures in
economics, philosophy, and political science, as
it concerns the equitable allocation of resources
and respect for individual rights.
3-5 units, Win (Suppes, Hammond, Ferejohn)
264. Philosophy of Science—Core seminar in
philosophy of science for first and second year
students in the Philosophy Ph.D. program.
4 units, Aut (Suppes) MW 3:15-5:05
270. Moral Philosophy—Core seminar in
moral philosophy for first and second year stu-
dents in the Philosophy Ph.D. program.
given 1989-90
271. Graduate Seminar in Political Philos-
ophy—Justice, impartiality, and individual in-
terests. Possible authors: Brian Barry, Jon
Elster, Michael Sandel, and Bernard Williams.
3 units, Aut (Hampshire) T 3:15-5:05
273. Graduate Seminar on Ethics of Char-
acter and Communitarianism.
3 units, Spr (Moravcsik) T 1:15-3:05
274. Graduate Seminar in Moral Philosophy
—The rationality of moral conduct. Specifically:
are there, necessarily, reasons for each person
to behave as morality requires? Investigation of
practical rationality, and the nature of moral
motivation and reasons to be moral. Readings
mostly from contemporary writers: Darwall,
Foot, Gauthier, McDowell, T. Nagel, B.
Williams.
3 units, Spr (Cohon) Th 3:15-5:05
275. Varieties of Justice—(Same as Religious
Studies 275.) Theological, philosophical, polit-
ic, economic views of justice, stressing char-
ity, liberty, rights, duties, equality, and wealth.
Relation of systems of political economy to the
just society.
5 units, Win (Jackson) TTh 4:15-6:05
276. Marx and Recent Marxism—Marx's criti-
cism of morality, his concept of ideology, and
his theory of history. Also, recent contributions
by "analytical Marxists."
3 units, Win (Satz) M 3:15-5:05
277. Feminism and Political Theory—(Same
as 177.) For graduate students.
280. Metaphysics and Epistemology—Core
seminar in metaphysics and epistemology for
first and second year students in the Philosophy
Ph.D. program.
not given 1988-89
281. Philosophy of Language—Core seminar in
philosophy of language for first and second year
students in the Philosophy Ph.D. pro-
gram.
4 units, Spr (Follesdal) MW 3:15-5:05
283. Meaning and Experience—(Same as 183.)
For graduate students.
not given 1988-89
284. Complexity and Self-Reference in the Humanities and Social Sciences—(Same as French 284C.)
3-4 units, Spr (Dupuy)

285. Semantics and the Logic of Natural Language—(Same as Linguistics 231.) Treats a substantial fragment of English: presentation and justification of a detailed syntactic analysis—justification of a semantic analysis within situation semantics, presentation of detailed rules assigning to the expressions in the fragment, development of the logic of the fragment under the given semantic analysis, presenting rules of inference. Prerequisite: Consent of instructor.
4 units, Aut (Peters)

289. Intensional Semantics—(Same as 189.) not given 1988-89

304. Philosophical and Educational Thought of John Dewey—(Same as Education 304.) A careful analysis of important works of John Dewey, The School and Society, The Quest for Certainty, and Experience in Education. Attention to Democracy and Education, related essays, and critiques.
4 units, Spr (Noddings, Phillips) MW 1:15-3:05

311. Graduate Seminar on Plato's Republic.
3 units, Spr (Roberts) Th 1:15-3:05

312. Graduate Seminar in Aristotle's Ethics.
not given 1988-89

326. Nonmonotonic Reasoning—(Same as Computer Science 323.) Formalisms for representing nonmonotonic reasoning and their applications to AI. Nonmonotonic aspects of commonsense knowledge and reasoning. Default logic, autoepistemic logic and circumscription. Computational nonmonotonic reasoning. Applications of nonmonotonic formalisms to inheritance systems, to logic programming and to reasoning about action using the situation calculus. Prerequisite: A basic knowledge of logic.
3 units, Win (McCarthy) TTh 2:45-4

345. Graduate Seminar in the Philosophy of Mind—The role of intentionality in the explanation of behavior; the causal efficacy of mental states vs. the explanatory relevance of mental properties.
3 units, Win (Dretske) W 3:15-5:05

346. Seminar in the Philosophy of Action.
3 units, Spr (Bratman) T 3:15-5:05

370. Graduate Seminar: Justice and Morality.
3 units, Win (Hampshire) T 3:15-5:05

380. Graduate Seminar in Metaphysics.
3 units, Aut (Perry) T 3:15-5:05

385. Propositions, Statements, and States of Affairs—Survey and comparison of different theories of propositions, statements, and states of affairs in modern philosophy. Also contemporary views like the possible-world approach to propositions.
3 units, Win (Morscher) T 3:15-5:05

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

3 units, Aut, Win (Feferman, Scowcroft) TTh 1:15-2:30

392A,B. Set Theory—(Same as Math 292A,B.) First quarter: the basics of Zermelo Fraenkel set theory. Topics: cardinal and ordinal numbers, the cumulative hierarchy, the Axiom of Choice, and the universe of constructible sets. Second quarter: models of set theory, including admissible sets, and models constructed by forcing. Prerequisites: 160A, 160B, 161 or equivalent.
3 units, Aut, Win (Devlin) MW 2:15-3:30

393A,B. Proof Theory—(Enroll in Mathematics 293A,B.) Gentzen's natural deduction and/or sequential calculi for first order predicate logic. Normalization, cut-elimination procedures. Extensions to infinitary calculi; ordinal complexity of proof trees. Subsystems of analysis and their reduction to constructive theories. Prerequisite: 160A,B, and 161, or equivalent.
not given 1988-89

394. Topics in Logic—(Enroll in Mathematics 294.) Topics vary each year. Examples: complexity of decision problems, abstract model theory and generalized quantifiers; recursion in higher types, generalized recursion theory; large cardinals, infinite games; constructive functional interpretations, foundations of constructive and semi-constructive mathematics. Prerequisites: Appropriate background from one of 390A,B through 393A,B, or equivalent. May be repeated for credit.
3 units, Spr (Feferman) TTh 1:15-2:30

3 units, Aut (Etchemendy) T 3:15-5:05
397. Selected Topics in Applied Logic—Topics: Anselm's and Gödel's proofs for the existence of God, existence as a predicate; traditional and modern solutions for the liar paradox; analysis of "practical and performative contradictions"; moral dilemma and conflicts; paradoxes of deontic logic.

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

450. Thesis, any quarter (Staff) by arrangement

PHYSICS

Emeriti: (Professors) William M. Fairbank, Robert Hofstadter, Paul H. Kirkpatrick, David M. Ritson, J. Dirk Walecka
Chairman: Alexander L. Fetter
Director of Graduate Study: Robert V. Wagoner
Director of Undergraduate Study: Mason R. Yearian


Associate Professors: Blas Cabrera, Savas G. Dimopoulos, Robert B. Laughlin

Assistant Professors: Bryan Lynn, C. Jeff Martoff (on leave Autumn, Winter, Spring), Zein-Eddine Meziani, Peter F. Michelson, Ann E. Nelson

Professor (Research): John A. Lipa

Acting Assistant Professors: Elizabeth Cohen, Karsten Danzmann, Sebastian E. Kuhn, Jack L. Ritchie

Consulting Professor: Bernard Couillaud, Theodor W. Hänsch, Melvin Schwartz

By Courtesy: Peter Galison

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 Graaff accelerator. A 120 MeV superconducting electron linear accelerator is currently available to provide free electron laser radiation. Separated from this group is the Stanford Linear Accelerator Center (SLAC), a high-energy physics laboratory which has as its principal tools a two-mile-long 50-GeV electron accelerator and a 6-GeV electron-positron storage ring. A 30 GeV electron-positron storage ring (PEP) and the Synchrotron Radiation Laboratory are also located at SLAC. A new high energy facility, the Stanford Linear Collider (SLC), has been completed and will provide electron-positron collisions at about 100 GeV in the center of mass.

Professor Mason Yearian is the Director of the High Energy Physics Laboratory; Professors Cabrera, Lipa, Michelson, 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 in the "Applied Physics" and "Stanford Linear Accelerator Center" sections of this bulletin.

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. Students who wish to specialize in astronomy, astrophysics, or space science should also consult the "Astronomy Course Program" section in this bulletin.

Undergraduates are also offered laboratory work at several levels. All three introductory series 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 and atomic collision physics, intermediate energy physics, high energy physics, coherent optical radiation, and condensed matter physics. Opportunities for research are also available with the faculty at SLAC in the areas of theoretical and experimental particle physics and accelerator design and with the faculty in Applied Physics in the areas of astrophysics, theoretical and experimental condensed matter physics, materials research, quantum electronics, photon science, and novel imaging technology.

The number of graduate students admitted to the Physics Department is strictly limited. Students should complete application by January 1
for the following Autumn Quarter. Graduate students may normally enter the department only at the beginning of Autumn Quarter.

UNDERGRADUATE PROGRAMS

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 61, 62, 63, 64A, 64B, 105, 106, 107, 110, 111, 120, 121, 122, 130, 131, 132, 170, 171, 181, 200, 201 and Mathematics 41, 42, 43, 44, 130, 131, and any additional Math course numbered 100 or higher. Physics 51, 53, 54, 55, 56, and 57 can replace the Physics 60 series requirements. Students who have taken Physics 55 or its equivalent may substitute Physics 167, 172 or 204 for 181. Mathematics 43H, 44H, and 45H may be substituted for Mathematics 43, 44, and 130. The department advises the study of some Chemistry e.g., 31, 33, and 35; some Computer Science, e.g., 106; and also the study of a modern language. The requirements of Physics 55, 56, and 57 may be waived upon approval of the Physics Undergraduate Study Committee. Mathematics and physics courses offered to satisfy the Physics Department's major requirements cannot be taken on a Pass/No Credit basis.

Students can follow either of the two course sequences. Sequence I (based on Physics 61, 62, and 63) is deemed preferable for students who have had physics and some calculus in high school. In this sequence, Mathematics 41 is not required. Sequence II (based on Physics 51, 53, 55, and 57) is mainly for students who have a lesser background in science and mathematics. Students contemplating a major in physics are urged to consult with the instructor of Physics 61 at the earliest possible date to see which sequence would be the most suitable for them. Students who decide to enter the physics program after the freshman year would normally be advised to take the Physics 61, 62, 63 sequence, provided they had previously taken Mathematics 41 and 42.

Sample programs in physics and mathematics under the two sequences are shown below. Students should consult their advisors about the course distribution requirements in other areas. The sequence of courses during the first two years is relatively inflexible, but considerable freedom exists during the upper-class years. Students are urged to work out, in consultation with their advisors, a program which will best fulfill their individual aims. The Undergraduate Office of the Physics Department has more detailed information on how to obtain a bachelor's degree in physics. This should be carefully studied by prospective majors, especially if they intend to make use of Stanford's programs abroad. Under some circumstances the department will permit, by petition, flexibility in the requirements so that the student may fit a period abroad into the program.

SEQUENCE I

FIRST YEAR

<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 61, 62, 63, Advanced</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Physics 64A, 64B, Advanced Freshman Physics Laboratory</td>
<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>Math. 42, 43, 44, Analytic Geometry, Calculus</td>
<td>5</td>
<td>5</td>
<td>3</td>
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</tr>
</tbody>
</table>

SECOND 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 110, 111, Intermediate Mechanics</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 105, 106, 107, Intermediate Physics Laboratory Seminars</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Physics 120, 121, 122, Intermediate Electricity and Magnetism</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math. 130, 131, 132, Ordinary Differential, Equations, Partial Differential Equations I and II</td>
<td>3</td>
<td>3</td>
<td>(3)†</td>
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</tbody>
</table>

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. Quantum Mechanics</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
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<tr>
<td>Physics 181, Optics</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 167. Essential General Relativity</td>
<td>(3)†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 170, 171, 172. Thermodynamics, Kinematic Theory and Introduction to Statistical Mechanics, Physics of Solids</td>
<td>3</td>
<td>3</td>
<td>(3)†</td>
<td></td>
</tr>
<tr>
<td>Physics 210, 211, 212, Advanced Mechanics (Particle, Continuum, Statistical, Nonlinear, &amp; Relativity)</td>
<td>(3)</td>
<td>3</td>
<td>3†</td>
<td></td>
</tr>
<tr>
<td>Math. 103, 104, 106, or 103. Linear Algebra and Matrix Theory, Complex Variables or Modern Algebra</td>
<td>(3)</td>
<td>3</td>
<td>3†</td>
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</tbody>
</table>

FOURTH 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 200, 201, Advanced Physics Laboratory</td>
<td>3</td>
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</tr>
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### SEQUENCE I

<table>
<thead>
<tr>
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<th>Subject</th>
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<tbody>
<tr>
<td>Physics 220, 221. Classical Electrodynamics</td>
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<td>(3)</td>
<td>(3)†</td>
<td></td>
</tr>
<tr>
<td>Physics 205. Honors Program</td>
<td></td>
<td>(3)</td>
<td>(3)</td>
<td>(3)†</td>
</tr>
<tr>
<td>Physics 204. Senior Seminar in Theoretical Physics</td>
<td></td>
<td></td>
<td></td>
<td>3†</td>
</tr>
</tbody>
</table>

### SEQUENCE II

#### FIRST YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
<th>A</th>
<th>W</th>
<th>Sp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 51, 53. Mechanics, Electricity, Magnetism</td>
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<td>4</td>
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</tr>
<tr>
<td>Physics 54. Electricity, Magnetism, Laboratory</td>
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</tr>
<tr>
<td>Math. 41, 42, 43. Analytic Geometry and Calculus</td>
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</table>

#### SECOND YEAR*

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Subject</th>
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<th>W</th>
<th>Sp</th>
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</thead>
<tbody>
<tr>
<td>Physics 55, 57. Light and Heat, Modern Physics</td>
<td></td>
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</tr>
<tr>
<td>Physics 56. Light and Heat Laboratory</td>
<td></td>
<td>1</td>
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<td></td>
</tr>
<tr>
<td>Physics 110, 111. Intermediate Mechanics</td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math. 44, any additional Math course numbered 100 or higher.</td>
<td></td>
<td>3</td>
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</tr>
<tr>
<td>Math. 130, 131, 132. Ordinary Differential Equations, Partial Differential Equations</td>
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<td>3</td>
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<td>(3)†</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 105, 106, 107. Intermediate Physics Laboratory Seminars</td>
<td></td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Physics 120, 121, 122. Intermediate Electricity and Magnetism</td>
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<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Physics 130, 131, 132. Quantum Mechanics</td>
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<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Math. 103, 104, 106 or 109. Linear Algebra, Matrix Theory, Complex Variables, or Modern Algebra</td>
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<td>3</td>
<td>(3)†</td>
<td></td>
</tr>
</tbody>
</table>

#### FOURTH 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 170, 171, 172. Thermodynamics, Kinetic Theory and Introduction to Statistical Mechanics, Physics of Solids</td>
<td></td>
<td>3</td>
<td>3</td>
<td>(3)**</td>
</tr>
<tr>
<td>Physics 167. Essential General Relativity</td>
<td></td>
<td>(3)**</td>
<td></td>
<td></td>
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<tr>
<td>Physics 181. Optics</td>
<td></td>
<td>(3)**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 200, 201. Advanced Physics Laboratory</td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Physics 210, 211. Advanced Mechanics, (Relativity, Statistical)</td>
<td></td>
<td>(3)</td>
<td>3†</td>
<td></td>
</tr>
</tbody>
</table>

*Additional elective units must be added to bring the total number of units to 180 as required by the University. Students should consult their advisors about the course distribution requirements in areas outside of the sciences.

† Not required for degree in physics.

** Students who have taken Physics 55 or its equivalent may elect to take any one of these four courses (see text).

### HONORS PROGRAM

The Department of Physics offers a program leading to the degree of Bachelor of Science in Physics with Honors:

1. Students should find a physics project, either theoretical or experimental.
2. The student shall submit his or her proposal to the Honors Subcommittee, which will decide on its suitability as an Honors project.
3. Course credit for the project will be assigned by the advisor within the framework of Physics 205.
4. A written report of the work at its completion will be required for Honors.
5. 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.
6. 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.
7. The work done in the Honors program may not be used as a substitute for regularly required courses.

### GRADUATE PROGRAMS

#### 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 (includes registration requirement of at least three quarters at full tuition or its equivalent). Among the departmental requirements are an average letter grade indicator of at least "B" in courses 130, 131, 132, 170, 171, 172, 200, 201, 210, 211, 212, 220, 221, 230, 231, 232, or their equivalent. Up to 6 of these units of requirements may be waived on petition if a thesis is submitted.
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:

Minimum requirements for the Ph.D. degree in Physics consist of completing all courses on list (A) and at least one quarter from each of two subject areas chosen from list (B). The requirements in list (A) may be fulfilled by passing the course at Stanford or passing an equivalent course elsewhere.


All Ph.D. candidates must also take the following mathematics courses or have taken their equivalent previously: 106, 113, 114, 130, 131, 132. An average letter grade indicator of at least "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 during the week preceding the start of the Autumn Quarter. The examination should be taken at the end of the Summer Quarter after the first year graduate courses have been taken. After completion of the thesis each student 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.

Three quarters of teaching are a requirement for obtaining the Ph.D. in Physics. This regulation applies to students who entered Stanford in the Autumn Quarter of 1981 and thereafter.

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" section in this bulletin.

Ph.D. MINOR

Minors in Physics must take either Physics 210, 211, and one other course above 100, or Physics 130, 131, and 132, or 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.

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.

TEACHING CREDENTIALS

For information concerning the requirements for teaching credentials, consult the "School of Education" section in 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, 64A, 64B, 105, 110, 111, 120, 121, and Mathematics 130, 131. Detailed requirements for the degree are outlined in the "School of Education" section in this bulletin.

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, 22, 23, 24, 25, 26) 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 some physics majors. The Advanced Freshman Series (61, 62, 63, 64A, 64B) is for the well-prepared student and is the preferred introductory series for physics majors.
The Twenty and Fifty Series are similar in content and objectives. Both consist of 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 is that topics are discussed more thoroughly and treated with greater mathematical rigor in the Fifty Series.

Courses beyond 64 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), research, special or current topics (4). The second digit indicates the general subject matter: laboratory (0), general courses (1), (2), (3), nuclear physics (4), elementary particle physics (5), astrophysics, cosmology, gravitation (6), condensed matter physics (7), optics and atomic physics (8), miscellaneous courses (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.

11. Symmetries of Nature—Familiarizes humanities and social science students with concepts of atomic and subatomic physics; how physicists have used symmetry principles to discover the laws of nature on a subatomic scale, and how symmetries determine the behavior of atoms, nuclei, and elementary particles. (DR:7)

3 units, not given 1988-89


3 units, Aut (Cohen) T 9-10:50 discussions and field trips by arrangement

15. Cosmic Horizons—Familiarizes the non-science student with modern cosmology. The physical laws that govern the universe; its evolution traced from the initial primeval fireball; the formation of galaxies, stars, and planets; and the development of life. Exotic astronomical objects, quasars, pulsars, and black holes. Some algebra is used. (DR:7)

3 units, Spr (Bloom) TTh 2:15-3:30 discussion by arrangement


3 units each quarter, Aut, Win, Spr (Adams, Fetter, Osserman)

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 introduced through the historical background, emphasizing present knowledge and current problems. Likely topics: classical mechanics, relativity, and quantum mechanics. (DR:7)

3 units, Aut (Schwettman) TTh 11-12:15 plus one hour discussion by arrangement

21. Mechanics and Heat—Introduction to Newtonian mechanics, fluid mechanics, theory of heat. Intended for biology, social science, pre-medical students. Prerequisites: Working knowledge of elementary algebra and trigonometry. Calculus is used as a language and developed as needed. (DR:7)

3 units, Aut (Meyerhof) MWF 10 or 11

Sum (Gillespie) MTWThF 10-12 plus one hour discussion by arrangement

22. Mechanics and Heat Laboratory—Concurrent or prior registration in 21 is required. Mandatory Pass/No Credit grading.

1 unit, Aut (Meyerhof) by arrangement

Sum (Gillespie) TW or Th 2:15-5:05

23. Electricity and Optics—Electric charges and currents, magnetism, induced currents; wave motion, interference, diffraction, geometrical optics. Prerequisite: 21. (DR:7)

3 units, Win (Schwettman) MWF 10 or 11

Sum (Gillespie) MTWThF 10-12 plus one hour discussion by arrangement

24. Electricity and Optics Laboratory—Concurrent or prior registration in 23 is required. Mandatory Pass/No Credit grading.

1 unit, Win (Schwettman) by arrangement

Sum (Gillespie) TW or Th 2:15-5:05

25. Modern Physics—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. (DR:7)
3 units, Spr (Dimopoulos) MWF 10 or 11
plus one hour discussion by arrangement

26. Modern Physics Laboratory—Concurrent or prior registration in 25 is required. Mandatory P/NC grading.
1 unit, Spr (Dimopoulos) by arrangement

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 20 or 41 and continuation in Mathematics 42, or consent of instructor. (DR:7)
4 units, Win, (Cabrera) lec MWF 9 or 11; discussions by arrangement

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 21 or 42, or consent of instructor. (DR:7)
4 units, Spr (Michelson) lec MWF 9 or 10
discussions by arrangement

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 23 or 43, or consent of instructor. (DR:7)
4 units, Aut (Yearian) TTh 11-12:15

57. Modern Physics—Relativity, experimental basis of quantum theory, Schrödinger equation, atomic structure, nuclear structure, high energy physics, elementary particles. Prerequisite: 55. (DR:7)
3 units, Win (Yearian) TTh 11-12:15

58. Modern Physics Laboratory—Concurrent or prior registration in 57 is required. Mandatory P/NC grading.
1 unit, Win (Yearian) by arrangement

61,62,63. Advanced Freshman Physics—Fundamental structure of classical physics including Newtonian mechanics, special relativity and electricity and magnetism; selected topics in heat and light in Spring Quarter. Lectures and small discussion sections. Recommended for students contemplating a major in Physics and other students interested in a more rigorous treatment of physics. Prerequisites: High school physics and familiarity with calculus (differentiation and integration in one variable); prior or concurrent registration in Math 42. Physics 61, 62, and 63 are all (DR:7)
61. 4 units, Aut (Yearian) TTh 9-10:50
62. 4 units, Win (Chu) TTh 9-10:50
63. 4 units, Spr (Chu) TTh 9-10:50

64A, B. Advanced Freshman Physics Laboratories—Experimental work in mechanics, electricity and magnetism, and optics. Prerequisite: 61.
64A. 1 unit, Spr (Cabreria) by arrangement
64B. 1 unit, Spr (Cabreria) by arrangement

105,106,107. Intermediate Physics Laboratory Seminars — A year-long series of mini-courses in important experimental techniques between two weeks and eight weeks, depending on the subject matter. Must be taken in sequence. Topics: electronics, detectors and radioactive sources, optics and lasers, statistics and data handling, microwaves, low temperatures and computer interfacing. 105, 106, and 107 are required for all Physics majors. Each schedules a one hour weekly lecture, usually Friday noon. Prerequisites: 54 and 56, or 64A and 64B; concurrent registration in the 120 series.
105. Laboratory Seminar I: Electronics—(DR:8)
3 units, Aut (Lankford) by arrangement
106. Laboratory Seminar II.
2 units, Win (Osheroff) by arrangement
107. Laboratory Seminar III.
2 units, Spr (Danzmann) by arrangement

110,111. Intermediate Mechanics—Mechanics of systems of particles and rigid bodies. Coordinate transformation and vectors; Newtonian mechanics; linear and nonlinear oscillations; Hamilton’s principle, Lagrangian and Hamiltonian dynamics; central forces, planetary motion; collisions; non-inertial reference systems; rigid body dynamics; coupled oscillations; and introductory fluid mechanics. Prerequisites: 51 and Mathematics 130.
110. 3 units, Win (Nelson) MWF 9
111. 3 units, Spr (Nelson) MWF 9

120,121,122. Intermediate Electricity and Magnetism—Vector analysis, electrostatic fields, including multipole expansion; dielectrics. Special relativity and transformation between electric and magnetic fields. Maxwell’s equations. Static magnetic fields, magnetic ma-
Electromagnetic radiation, plane wave problems (free space, conductors and dielectric materials, boundaries). Dipole and quadrupole radiation. Waveguides and cavities. Prerequisites: 53 and prior or concurrent registration in 110; concurrent or prior registration in Mathematics 130 and 131 with Physics 120 and 121, respectively. Recommended: Concurrent or prior registration in Mathematics 101.

120. 3 units, Aut (Kuhn) MWF 11
121. 3 units, Win (Dunham) MWF 11
122. 3 units, Spr (Dunham) MWF 11

130, 131, 132. Quantum Mechanics — The origins of quantum mechanics, wave mechanics and the Schrödinger equation, Heisenberg's matrix formulation of quantum mechanics, solutions to one dimensional systems, separation of variables and the solution to three dimensional systems, the central field problem and angular momentum eigenstates, spin and the coupling of angular momentum, Fermi and Bose statistics, perturbation theory and other approximation techniques. Scattering theory: partial wave expansion, Born approximation, Green's functions. Reference to problems in atomic and nuclear physics explaining the basic phenomenology of these disciplines. Invariance principles and conservation laws in the context of quantum theory. Prerequisites: 57 or equivalent and 110, 111; concurrent or prior registration in 120, 121, 122, and Mathematics 130, 131.

130. 3 units, Aut (Meziani) TTh 1:15-2:30
131. 3 units, Win (Meziani) TTh 1:15-2:30
132. 3 units, Spr (Meziani) TTh 1:15-2:30

145 Physics of Nuclear Weapons — Physics and technical issues of radioactivity, nuclear chain reactions, weapons effects; also nuclear proliferation, arms control, advanced weapons development, and weapon deployment and use in warfare. Enables students to understand and critically evaluate technical issues in national security policy and the political process of arms control. Prerequisites: 21 or 51, concurrent enrollment in 25 or 53 or consent of instructor. (Course offered occasionally.) (DR:8)

3 units, Spr, not given 1988-89

167. Essential General Relativity — Mathematical development emphasizes the component tensor calculus rather than the abstract differentiable manifold approach. Cosmological solutions are obtained and discussed. Prerequisites: 110, 120, Math 131.

3 units, Win (Michelson) MWF 11

170, 171. Therodynamics, 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 (Danzmann) MWF 9
171. 3 units, Win (Kapitulnik) MWF 9

172. Physics of Solids — Introduction to the principal types of solids emphasizing thermal, electrical, and magnetic properties. Elementary treatment of phonons in solids, electrons in metals, energy bands. Applications to semiconductors, rectification, superconductors, paramagnetism, and ferromagnetism, magnetic resonance. Prerequisite: 171.

3 units, Spr (Kapitulnik) MWF 9

181. Intermediate Optics — (Formerly 161.) electromagnetic waves, superposition, interference, Fraunhofer and Fresnel diffraction, crystal optics, matrix optics, laser beams and resonators, guided waves, quantum aspects of light. Prerequisite: 122.

3 units, Aut (Little) MWF 11

190. Independent Study — Experimental or theoretical physics under supervision of a faculty member. Prerequisites: Superior work as an undergraduate physics major; approval of the instructor and of the Undergraduate Study Committee of the Department of Physics.

any quarter (Staff) by arrangement

198. History and Philosophy of 20th Century Physics — (Formerly 168; enroll in History of Science 168, Philosophy 168, History 139A, VSSS 126.)

5 units, Win (Galison)
204. Senior Seminar in Theoretical Physics—
Topics of recent interest in theoretical physics: string theory, supersymmetry, inflationary cosmology, chaos, and others. Work in the seminar may provide a basis for an Honors project in theoretical physics. Prerequisite: 132 or permission of the instructor.

3 units, Aut (Quinn) by arrangement

205. Honors Program—Experimental or theoretical Honors project and thesis in physics under supervision of a faculty member. Prerequisites: Superior work in physics as an undergraduate major and approval of the Honors committee. It is strongly urged that the student who elects to do an Honors thesis begin the planning of the project no later than the middle of the student’s junior year.

1-3 units, Aut, Win, Spr (Yearian) Sum (Staff)

207, 208. Electronic Techniques for Physics—
(Enroll in Applied Physics 207, 208.) Prerequisite: Background at the level of Horowitz and Hill.

207. given 1989-90

208. given 1989-90

210. Advanced Particle and Continuum Mechanics—Lagrangian and Hamiltonian dynamics of particles (review) and continuia, useful methods of mathematical physics. Fluid mechanics; foundations, kinematics, and dynamics. Incompressible, adiabatic flows; boundary layers, laminar and turbulent flows, instabilities, surface waves and solitons. Compressible flows; transition to supersonic flow, shock waves. Prerequisites: 111 and 122.

3 units, Aut (Wagoner) TTh 9:30-10:50


3 units, Win (Wagoner) TTh 9:30-10:50

212. Nonlinear Mechanics and Relativity—Simple nonlinear mathematical models; phase-plane analysis, attractors, transition to chaos. Tensor analysis; special relativity (review), the energy-momentum tensor, and curvature. Einstein’s equations; weak fields, tests of general relativity, spherically-symmetric solutions. Prerequisites: 210 and 211.

3 units, Spr (Wagoner) TTh 9:30-10:50

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 formulation, Noether’s theorem and conservation laws. Radiation: dipole and quadrupole radiation, electromagnetic scattering and diffraction, the optical theorem, Liénard-Wiechert 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 (Lynn) MW 1-2:15

221. 3 units, Win (Lynn) MW 1:15-2:30


223. 3 units, Aut (Laughlin) MWF 11


230. 3 units, Aut (Laughlin) MWF 11

231. 3 units, Win (Laughlin) MWF 11

232. 3 units, Spr (Laughlin) MWF 11

242. Introduction to Nuclear Physics—(Formerly 240.) 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.

3 units, Aut (Hanna) not given 1989-90

252. Introduction to High-Energy Physics—
The elementary-particle phenomena. Leptons

3 units, Spr (Dorfan)


271. 3 units, Aut (Harrison)

272. 3 units, Win (Harrison)


3 units, Spr (Dorfan)

274. Electronic Structure—(Enroll in Applied Physics 274.)

3 units (Harrison) given 1989-90

290. Research Activities at Stanford—(Formerly 260.) 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, Aut (Meyerhof) TTh 12:15-1:05

293. Literature of Physics—(Formerly 290.) Intensive study of literature of any special topic. Preparation, presentation of reports on 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

294. Teaching of Physics—(Formerly 299.) Techniques of teaching physics by means of lectures and laboratories. All teaching assistants in Physics are required to register for this course.

0-3 units, Aut (Jacobs)

315. Computational Physics—(Enroll in Applied Physics 315.)

3 units (Doniach)


3 units, Aut (Chu) MWF 2:15


3 units, Win (Danzmann) MWF 2:15

322. Bound States and High Precision Tests of QED and Electroweak Unification—Relativistic effects, configuration mixing, multiple-photon transitions, parity nonconservation in atoms, atomic electric dipole moments, high-Z (overcritical) atoms, cavity quantum electrodynamics, quantum theory of measurement, Bell's theorem and photon polarization correlation experiments, Bethe-Salpeter equation. Lamb shift, hyperfine splitting, positronium and muonium structure and decay, precision tests of quantum electrodynamics, electroweak effects in atoms. Prerequisites: 320, 321.

3 units (Brodsky)

alternate years, given 1989-90

324, 325. Physics of Particle Accelerators—(Formerly 354, 355; enroll in Applied Physics 324, 325.)

324. 3 units, Aut (Miller)

325. 3 units, Win (Miller)

integral methods, quantization of Yang-Mills fields, asymptotic freedom. Quantum Chromodynamics. Prerequisites: 211, 221, 232.

330. 3 units, Aut (Nelson) MW 11-12:30
331. 3 units, Win (Susskind) MW 11-12:30
332. 3 units, Spr (Susskind) MW 11-12:30

351, 352. Elementary Particle Physics—Phenomena of elementary particle interactions, and their theoretical interpretation. Winter—Introduction to the Standard Model: features of high-energy interactions of hadrons; deeply inelastic lepton-hadron scattering; structure functions; the parton model; QCD, gluons and scaling violations; jets and quark fragmentation in pp and e+e− annihilation to hadrons; radiative corrections in QED and QCD; running coupling constants; experimental measurements of the strong coupling; Monte Carlo techniques. Spring—Hadron spectroscopy in the static quark model; properties of heavy quarks and quarkonium systems. Weak interactions: muon, pion, and beta decay; weak mixing angles; The K_L–K_S system on CP violation; charged and neutral current neutrino scattering; the standard model of electroweak interactions; determinations of sin^2 θ_W; properties of W and Z bosons; gauge symmetries and the Higgs mechanism; properties of Higgs particles. Introduction to topics beyond the standard model: Grand unification, proton decay, supersymmetry. Prerequisite: 330.

351. 3 units, Win (Toki) MWF 9-10
352. 3 units, Spr (Swartz) MWF 9-10


3 units, Win (Dimopoulos) TTh 11-12:30

365. Extragalactic Astrophysics and Cosmology—(Enroll in Applied Physics 365.)

3 units, Win (Petrosian)


3 units, Aut (Doniach) TTh 1:15-2:30


3 units (Fetter) alternate years, given 1989-90

383. Introduction to Atomic Processes — (Enroll in Applied Physics 383.)

3 units, Aut (Harris) MWF 2:15 alternate years, not given 1989-90

450, 451, 452. Theoretical Physics of Particles and Fields—(Formerly 357, 358, 359.) Advanced topics in theoretical high-energy physics. Topics change quarterly and each year to survey the elements of formalism needed for theoretical research. Topics for Winter—Supersymmetry and supergravity. Spring—Solitons. Prerequisite: 332.

450. 3 units, not given 1988-89
451. 3 units, Win (Peskin) TTh 1-2:30
452. 3 units, Spr (Lynn) TTh 1-2:30

453. Special Topics in Elementary Particle Physics—(Formerly 336.)

3 units, not given 1988-89

473A. Dynamics of Computation — (Enroll in Applied Physics 473A.)

1 unit, Spr (Huberman)

490. Research Orientation—(Formerly 389.) Familiarizes students with the activities of one or more research groups, within the department or outside. Registration limited to one quarter per research group with an overall limitation of two quarters. Prerequisite: Consent of the student’s advisor.

any quarter (Staff) by arrangement

491. Research—(Formerly 390.) All work is in experimental or theoretical problems in research, as distinguished from independent study of non-research character listed as 190 and 293. Open only to graduate physics major students, with consent of instructor. If taken under supervision of a faculty member outside the department, Physics Graduate Study Committee approval is required.

any quarter (Staff) by arrangement
UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

A total of 60 units is required for the degree of Bachelor of Arts in Political Science. These include:

1) Completion of 45 units of political science.
2) Completion of at least one advanced course in three different areas chosen from the following: public administration, comparative politics, international relations, political theory, public policy, and American politics.
3) Completion of at least one seminar, which may also fulfill one of the areas listed above.
4) Completion of 15 additional units, which may be in political science (including an Honors thesis) or in another department which relates in a direct way to the student's interest in political science.

Directed Reading, although numbered above 100, may not be used toward fulfillment of the distribution requirement.

No more than 20 units of political science transfer work, and no more than 10 units of directed reading may be counted toward the total of 45 units of political science.

Courses used to fulfill the major requirements must be taken for standard letter grades, although units in excess of the required 60 may be taken on a pass/no credit basis.

PUBLIC POLICY EMPHASIS

The student who wishes to receive the A.B. degree with a focus on public policy may choose the "public policy concentration" within the political science major. This program will introduce the student to political and economic institutions and processes, analytical techniques, and to substantive courses in public policy. For further information, the student should consult with the Chair of Undergraduate Studies in Political Science.

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 year in Political Science 10.

HONORS THESIS PROGRAM

The Honors thesis program offers qualified students an opportunity to conduct independent research, and to write a thesis of superior quality summarizing the results of their research. The program provides for close contact between students and their advisors, so that students can receive intensive guidance and assistance throughout their research and writing. The aim is to help students go through the process of research, analysis, drafting, rethinking, and redrafting which is essential to excellence in writing.

Because the Honors thesis program involves close student-faculty contact, the basic requirement for admission to the program is that students secure the agreement of a regular faculty member to be their thesis advisor. Students should be aware that no faculty member can effectively supervise more than a few Honors theses each year. Application to the program should therefore be made as early as possible, and certainly well before the beginning of the quarter in which the student wishes to enter the program. Application forms can be obtained from the department office, should be countersigned by both the student and his or her thesis advisor, and then approved by the Director of Undergraduate Studies, who supervises the program. Normally, the thesis advisor will be a faculty member with whom the student has...
already worked. Normally, too, students enroll in the program in their senior year, and have at least a letter grade indicator (LGI) of 3.3 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: (1) 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). (2) 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 maximum of 15 units).

Successful completion of the Honors thesis program, and graduation with Honors in political science, requires (1) completion of all requirements for the major and (2) successful completion of a thesis of Honors quality (LGI) of "B" or better). 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 PROGRAMS**

**Admission**—Prospective graduate students should write to the Graduate Admissions Office for application materials. All applicants are required to submit a sample of their writing and to take the General 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). The TSE is also mandatory. For details concerning these tests, see "Guide to Graduate Admission." The application deadline is January 1. 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 Autumn Quarter of the first year in the professional school within the University.

Terminal A.M. students, and doctoral candidates who wish to apply, will be awarded the A.M. 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 10 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 letter grade indicator of "B" or better must be attained in each course. Directed reading courses do not apply to the A.M. degree.

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 coterminal bachelor's and master's degree program.

**MASTER OF ARTS IN TEACHING**

The degree of Master of Arts in Teaching is offered jointly by this department and the School of Education. The degree is intended for candidates who have a teaching credential or relevant teaching experience and wish to further strengthen their academic preparation. The program consists of a minimum of 25 units in political science courses and 12 units in the School of Education. A student's program must be approved by the Director of Graduate Studies before the courses are taken. Detailed requirements for the course are outlined in the "School of Education" section in this bulletin.

**DOCTOR OF PHILOSOPHY**

The University's basic requirements for the Ph.D. degree are discussed in the "Degrees" section in this bulletin.

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 department requirements. A student will be recommended to the University Committee on Graduate Studies to receive the degree of Doctor of Philosophy in Political Science
when the following program of study has been completed:

1. The candidate for the Ph.D. degree will offer three of the following fields of political science: American politics, comparative politics, international relations, political theory, and public organizations. Upon petition a special field, e.g., public law, urban politics or methodology, may be offered as a third field. Students will concentrate on two of these fields by fulfilling, depending on the field, combinations of the following: written qualifying examinations, research papers, research design, course work. The requirement for the third field may be satisfied either by taking a written examination in that field or by offering a minimum of 10 units with a letter grade indicator of "B" or better in the third field from among the formal graduate level courses in the five divisions of the department. The third field cannot be satisfied by courses taken as a requirement for a first or second field. A third field in theory requires two courses in addition to the 5 units necessary to fulfill the program requirement. A third field in methodology requires two courses in addition to the two core courses offered by the department.

2. The Ph.D. candidate is required to demonstrate competence in a language and/or 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 some cases, it may be necessary for the student to show competence in both a language and relevant research skills.

3. 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.

4. All candidates must complete 5 units of statistical methods or its equivalent. Previous instruction can be counted towards this requirement only if approved by the Director of Graduate Studies.

5. By the end of 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/or research papers, and, where possible, dissertation ideas or plans. This statement will be discussed with, and must be approved by, the student’s advisor. In the September following completion of their first year, students will be reviewed at a regular meeting of the department faculty. 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.

6. When both the student and advisor feel that the student is ready, he or she will take one or two comprehensive examinations or complete one or two research papers, depending on the fields chosen. Comprehensive examinations are offered at the discretion of the faculty. If scheduled, they 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 and papers by the end of their second year.

7. During a student’s sixth quarter, and upon completion of three out of four of the field requirements in his/her two major fields, he or she will file an Application for Admission to Candidacy for the Ph.D. which details program 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.

8. 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.

9. A candidate for the Ph.D. in Political Science may be asked to serve as a teaching assistant (TA) in the department for three quarters. Two quarters must be served. The student normally will begin serving as a TA after the sixth quarter and will complete service as a TA by the end of the ninth quarter.

10. 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.

11. 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.

12. The candidate shall complete a dissertation satisfactory to the Dissertation Reading Committee and the University Committee on Graduate Studies.

Ph.D. MINOR

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 a letter grade indicator 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.

COURSES

During 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.

The department uses the following course numbering system:

1-99 Introductory Courses
100-199 Advanced Courses and Undergraduate Seminars (at the instructor’s discretion, graduate students may enroll and be given graduate credit when additional work is assigned and appropriate department Graduate Credit Authorization form is completed)
200-299 Graduate-Undergraduate Seminars (principally for graduate students; at the instructor’s discretion, undergraduates may be admitted)
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.

INTRODUCTORY

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. (DR:5)
   5 units, Aut, Win (Marshall)

9. Introduction to Public Opinion—An introductory survey of public opinion. How well informed the average American is about politics; how consistent are opinions about political issues likely to be; how do they conclude what they are in favor of; and how tolerant (politically and racially) they tend to be.
   5 units, Aut (Sniderman)

10. American National Government—Critical thinking about American politics and government by comparing class and pluralist explanations of the national system. (DR:5)
    5 units, Win (Manley)

    5 units, Spr (Halpern)

22. The World Outside the West in the Age of European Imperialism—(Same as Anthropology 22, History 22.) Confrontation and accommodation as non-European societies respond to Western Europeans, and to Western institutions and ideas, from the early 19th century to the present. Changes in production and trade, in social and political structures, and in religious and ethical values in Mexico, China, and Nigeria. Recommended: Anthropology/History 21. (DR:5*; also satisfies Area 3 when taken in sequence with Anthropology 21, History 21.)
    5 units, Win (Abernethy, Staff, Van Slyke) given 1989-90

25. Colonialism and Nationalism in the Third World—A comparative historical analysis of European exploration, conquest, and colonial rule in Latin America, the Caribbean, Africa, and Asia. Factors affecting the timing, character, and effectiveness of nationalist movements in the Third World. Impact of colonialism on post-colonial political and economic systems. (DR:5*)
    5 units, Aut (Abernethy)

35. International Politics — A variety of approaches to the study of world politics including realism, Marxism, and bureaucratic politics. WWI, the nuclear arms race, and international
economic relations, and the normative and policy implications of different theories. Enrollment limited to 450. (DR:5)

5 units, Aut (Krasner)

50. The Idea of Freedom in Western Political Thought—An introductory survey of political thought since Machiavelli and the Reformation emphasizing the major conceptions of freedom and the conditions of the development of political and social freedom.

5 units, Win (Drekmeier)

60. The American Dream—The idea and reality of the American dream in light of two general theories that claim to explain America: pluralism and class analysis. Emphasis on equality, democratic theory, class and class conflict, and the historical development of American capitalism.

5 units, Spr (Manley)

ADVANCED UNDERGRADUATE

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. Sign-up sheets for undergraduate seminars are posted in the department office at class list sign-up time. Undergraduates interested in taking seminars should also consider the graduate-undergraduate seminars, numbered 200-299, listed in the next section.

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.

Public administration courses numbered 206-210 are graduate-undergraduate seminars and are open equally to undergraduates and graduates. There are prerequisites for some of these courses. Check the course descriptions.

101. Political Analysis—(Same as Business 338.) An introduction to some ideas used in the analysis of political processes: rational actors, information, power, political rules, symbols.

5 units, Win (Bendor)

101P. Politics and Public Policy—(Same as Public Policy 101.) An overview of the domestic policy-making process. Prerequisite: 10.

5 units, Spr (Brady)


5 units, Aut (March)

108. Organizational Leadership—(Same as Sociology 165, Business 379.) The problems of leadership in complex organizations, universities, schools, hospitals, business firms, armies, and public bureaucracies. Attention to the role of major executives.

5 units (March) given 1989-90

109. Directed Reading/Research in Public Administration—Advanced individual study in public administration.

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.

111. Politics and the State in Germany—The formation of two states in post-WW II Germany. Analysis of the role of the state in the Federal Republic of Germany and the German Democratic Republic. Emphasis on problems of representation; policy conflict (energy, education, environment); legitimacy and governability. (DR:5)

5 units (Weiler) given 1989-90

112D. Readings in Political Science and International Relations in German—(Same as German Studies 52D.) For students with a knowledge of German (one year or equivalent) who want to acquire reading proficiency in various disciplines. Reading materials include excerpts from scholarly works and professional journals. Students may introduce material they need to read for their course work or research. Open to undergraduate and graduate students.

3-4 units, Aut (Rindisbacher)

113A. Politics and Development in Latin America—Survey of the major political systems (normally Brazil, Mexico, Cuba, and Argentina) in Latin America, the patterns of economic and social development associated with them, and their historical and international contexts. (DR:5)

5 units, Spr (Packenham)

114. Theoretical Approaches to Japanese Politics—An introduction to Japan's political system emphasizing the relationship between politics and the economy. (DR:5*)

5 units, Win (Okimoto)
114K. The Political Economy of Development
—Introduction to major theories of political development emphasizing the interplay between economic and political processes, and national and international factors from Latin America, and also Africa and Asia. Cases include Brazil, China, Cuba, El Salvador, India, Taiwan, Nigeria, and Venezuela (DR:5)
5 units, Win (Karl)

115. Politics in The People's Republic of China—Introduction to politics in China: the historical background of the communist revolution; post-1949 political development; and selected topics—Institutions, ideology, policymaking process, and state-society relations. (DR:5*)
5 units, Aut (Halpern)

116A. European Politics and Society (I)—First of a two-quarter series introducing the diversity and complexity of European politics from the 16th century to WWI: Italian city-states and Cantonal Switzerland to Republican France, the German Reich, and British constitutional monarchy. Emphasis on the interrelated processes of capitalist development, nation-building, state formation, and democratization. The state: how this form of political organization emerged in Western Europe and how the system of unequal competing states conditioned economic, social and political outcomes up to catastrophic collapse in WWI. Substantial reading required. Useful for those taking Stanford Overseas courses in Europe.
5 units (Schmitter) alternate years, given 1989-90

116B. European Politics and Society (II)—Continuation of 116A. The "rebuilding" of bourgeois Europe and the rise of Fascism and National-Socialism following WWI, and national reconstruction and regional integration in the aftermath of WW II. Emphasis on the rise of the modern welfare state and its consequences. Substantial reading required. Useful for those taking Stanford Overseas courses in Europe. Recommended: 116A.
5 units (Schmitter) alternate years, given 1989-90

117R. The Role of the Military in Politics—The interaction between military and political leaders in western-industrial, communist, and developing states. The questions of military professionalism, the role of the military in political processes, and the problem of the allocation of resources to defense. Diverse cases including the U.S., the U.S.S.R., and countries of the developing world.
5 unit, Aut (Rice)

118B. Politics of Race and Class in Southern Africa—The political history of the region’s 10 countries, emphasizing relations among racial and ethnic groups. Diplomatic, economic, and military interactions among these states, and the impact of movements, corporations, and international organizations based outside the region. Attention to domestic politics and foreign policy of South Africa. (DR:5*)
5 units, Spr (Abernethy)

119. Socialism in Latin America—Socialist experiences in Latin America. The interrelationships between political, economic, and cultural change. Emphasis to the historical and international contexts relevant in each case. (DR:5)
5 units (Fagen) given 1989-90

119A. The Soviet Union: Politics and Society Since 1917—Major trends and events: political leadership, political process, social change and stratification, legitimacy and dissent, major conceptual frameworks used to explain the Soviet experience; alternative approaches and conflicting points of view. (DR:5)
5 units (Dallin) given 1989-90

120. Seminar: Legitimacy, Consensus, and Conflict in European Democracies—The performance and normative basis of the political process in Western democracies and of institutions, parliaments, parties, bureaucracies, and unions, have become the subject of public criticism and critical scholarship. Using the Fifth Republic of France and the Federal Republic of Germany, the sources and symptoms of this phenomenon. Recommended: Reading knowledge of French or German.
5 units (Weller) given 1989-90

120P. Seminar: European Political Economy and Public Policy—Political economy and public policy of contemporary Western Europe. Content depends on student interests. Possible topics: the emergence of the welfare state and its present crisis, the process and prospects of regional integration, the successes and failures of incomes and industrial policies, the impact of new technologies and international competition.
5 units, Aut (Schmitter)

120Z. Seminar: The Israeli Society—Development and Crisis—Historical development of the Zionist movement as a reaction to assimilation and anti-Semitism; the conflicting aims of the Zionist enterprise; the structure of the Zionist movement and organizations; basic history of the State of Israel; crisis and achievements; the next 40 years.
5 units, Win (Segre)
122G. Seminar: Problems in Contemporary European Politics—How the European countries responded to dramatic political and economic changes in the past 20 years; the decline of the Keynesian welfare state, the rise of neo-liberalism. Recent developments in Britain, France, and Sweden.
5 units, Spr (Garrett)

124. Seminar: Latin American Dependency—Basic concepts and theoretical frameworks, single country case studies, and research and political strategies regarding dependency and development in Latin America. (DR:5)
5 units, Win (Packenham)

126. Seminar: Politics in Eastern Europe—The eight East European political systems in terms of their historical development, their policy-making processes, and their system maintenance and adaptation. Eastern Europe as a region in world politics.
5 units, Aut (Triska)

126F. Seminar: Politics and the Novel—An examination of "realist" 20th-century works of fiction that deal with key political issues of our time. American and European novels are read with a view to understanding the conditions which produced them and their impact. Open only to juniors and seniors. Preference given to Political Science and International Relations majors.
5 units, Win (Fagen)

126K. Seminar: The United States and Central America—The crisis of development in Central America and the challenge it poses for U.S. policy towards Latin America. Emphasis on the historic roots of the crisis and the emergence of specific policy dilemmas in the issue areas of democratization, national security, and human rights.
5 units, Win (Karl)

129. Directed Reading/Research in Comparative Politics—Advanced individual study in comparative politics.
any quarter (Staff) by arrangement

INTERNATIONAL RELATIONS

Students interested in international relations are encouraged to take Political Science 35, International Politics. While not a formal prerequisite for many of the courses listed below, 35 provides a desirable background for more advanced work.

The courses in international relations offered by the Political Science Department can 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 in this bulletin, which lists international relations courses in other departments.

130. Introduction to International Law—Theories, development, present state, and propensities of international law as a policy process in various critical arenas of international interaction.
5 units (Triska) given 1989-90

132D. Political and Ethical Aspects 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 posed in the allocation, monitoring, and evaluation of development assistance. Also, international disaster relief operations.
5 units, Spr (Abernethy)

133. Peace Studies—(Same as History 154, Political Science 133, Psychology 142, Sociology 108, VTSS 143.) Interdisciplinary examination of the current international situation, beginning with historical examples and turning to underlying processes (psychological, social, political, and economic). The assumptions of current doctrines concerning war and peace are related to what is known about humans and their institutions. The nature of peace as a process is related to issues of justice. Alternative approaches towards peace are critically analyzed.
3 units, Spr (Dornbusch, Bernstein, Drekmeier, Moses, Ross) TTh 2:15-4:05

5 units, Spr (Sagan)

135C. Introduction to International Political Economy—The interrelationships between states and the international economy: problems of cooperation and coordination in the international economy—international regimes, East-West relations, the North-South conflict; the impact of the international economy on
national political economies—the politics of economic decline in Western countries, dependent development in the LDCs.

5 units, Win (Garrett)

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. (DR:5)

5 units, Win (Dallin)

138A. Arms Control and Disarmament—International security relations since 1945: the impact of nuclear weapons; the arms competition and efforts at arms control, and disarmament. The political, technological, and conceptual bases of national security and arms control policies. Negotiations on the limitations of military forces: including SALT, START, INF, and space based weapons, etc. Taught by an interdisciplinary faculty.

5 units, Win (Holloway)

138B. Seminar: Arms Control.

5 units, Spr (Staff)

139. Seminar: Chinese Foreign Policy—Chinese foreign policy and its sources: historical, ideological, strategic, political, economic, and the decision making process. Relations with the two superpowers and the Third World. Crisis behavior. Prerequisite: 115 or equivalent, or permission of the instructor.

5 units (Halpern) given 1989-90

139A. Japanese Foreign Policy—The postwar evolution of Japanese foreign policy in terms of historical background, external environment, and domestic institutions. (DR:5*)

5 units, Aut (Okimoto)

140A,B,C. Ethics of Development in a Global Environment (EDGE)—(Same as Anthropology 133A,B,C; Engineering 297A,B,C.) A series of speakers on current development issues emphasizing problems of poorer nations. Autumn Quarter: basic world resources (energy, food, housing, population, and environment) and the political development and dependencies of developing regions. Winter Quarter: the international institutions and their roles—international banking, international businesses, U.S. and foreign universities, East-West political policies, and organizations of developing countries. Spring Quarter: the roles of individuals in national and international institutions dealing with the problems of developing countries. The speakers represent a range of political, professional, and national backgrounds and present candid and differing points of view. Gives students working in developing countries or in institutions dealing with developing countries a better knowledge of the challenges and issues with which they must deal. One unit credit for attendance of the speaker series; 3 units additional credit for optional workshops treating selected issues in more depth. (Sequential registration not required.)

1-4 units, Aut, Win, Spr (Fagen, Lusignan, McWhorter, Siegel) lectures W 7:30-9:30 p.m. workshops by arrangement

140Z. Seminar: The Arab-Israeli Conflict—The basic elements of the conflict; the decolonization of the Arab world and the rise of Arabism and Moslem fundamentalism; the clash of Arab-Jewish "Zionisms" attempts at solutions; obstacles to peace.

5 units, Win (Segre)

143H. Seminar: Security Studies—The evolution of strategic thought in the pre-nuclear and nuclear eras. Topics: the causes of war, civil-military relations, the impact of technological and social change on military strategy, and nuclear weapons and arms control. Research paper required.

5 units (Sagan) given 1989-90


5 units (Sagan) given 1989-90

149. Directed Reading/Research in International Relations—Advanced individual study in international relations.

any quarter (Staff) by arrangement

150. Ancient and Classical Political Thought—From the beginnings of political speculation in preliterate societies to the Stoics; Greek thinkers are emphasized.

5 units, Win (Drekmeier)

154. Social and Political Theory from Hegel to Freud—The major contributions to understanding conflict, order, development, and value in individuals, societies, and states. Writers and traditions include Marx, French conservatism, the utilitarians, Weber, and the sociological perspective, and existentialism.

5 units (Drekmeier) given 1989-90

are human beings in terms of political and social arrangements? Is it possible to eliminate private property and the ensuring competition and greed, as Marx suggests? Are people the victims of their own sexual and biological drives which are incompatible with the needs of society, as Freud suggests? Have we lost sight of the need for permanence and turned everything into consumer objects as Arendt argues? Can we create a world we can live in without being alienated? Will it take a revolution or are there less drastic solutions?

5 units, Win (Ring)

**POLITICAL THEORY**

**156. Liberalism**—The history, theory, and ramifications of the “liberal” political position. The origins of modern thinking about the self and its relation to authority, particularly mechanistic and natural rights theories. Contrasts the several schools of English liberalism, the relation of state and society in these arguments, and contrasts Anglo-American philosophies with continental liberalism. Modern interpretations of the classic sources and the implications of liberalism for our own day.

5 units (Drekmeier) given 1989-90

**161S. Seminar: Democratic Theory**—The major questions in modern democratic theory, including obedience to authority, alienation, participatory democracy, and political tolerance.

5 units, Win (Sniderman)

**162M. Research Seminar: The American Dream**—The American dream in American history. Weekly meetings to discuss readings and individual research projects on the American dream. Open to juniors and seniors. Prerequisites: 10 or 60 or permission of instructor.

5 units, Spr (Manley)

**164J. Seminar: Political Theory and Feminism**—(Same as Feminist Studies 124.) How traditional political theory has dealt with “the woman question,” and how contemporary feminist theory has dealt with traditional theories about women. The parameters of the first are set by liberal, dialectical, and psychoanalytic theory; of the second, by liberal, socialist, and radical feminism. Readings include traditional political theory and contemporary American feminist theory.

5 units, Win (Ring)

**169. Directed Reading/Research in Political Theory**—Advanced individual study in political theory.

any quarter (Staff) by arrangement

**AMERICAN POLITICS**

**180. Civil Rights and Civil Liberties in the United States**—Law and politics, how each affects the other, how both impact our notions of freedom, equality, privacy, and due process. The great controversies of our society: race and sex discrimination, affirmative action, freedom of speech, freedom of the press, abortion, school prayer, capital punishment, and the right to die. The laws, lawyers, and judges who fashion our constitutional doctrines as they render decisions on the fundamental moral and social issues which shape our values and politics. (DR:5)

5 units, Spr (Steyer)

**180D. The President and Congress**—The structure and the environment of the U.S. Presidency and Congress. Lectures and readings focus on the environmental context, the internal organization, and the interactions among and between the two institutions. The way in which these institutions shape American public policy; context, internal organization, and institutional interaction feature relevant historical developments. The elections part of the context section analyzes over time changes in ballot forms, nominating procedures, and electoral behavior. Prerequisite: 1.

5 units, Win (Brady)

**182F. Introduction to American Law**—(Same as American Studies 179, Law 106.) American law for undergraduates dealing with the structure of the American legal system including the courts: American legal culture; the legal profession and its social role; the scope and reach of the legal system; the background and impact of legal regulations; the relationship between the American legal system and American society in general.

5 units, Aut (Friedman) MTWTh 9

**182L. Law in Radically Different Cultures**—(Same as Anthropology 157, Law 316.) Using American law as a benchmark, examines comparable issues in the law of the Peoples Republic of China (Eastern law), Republic of Egypt (religious law), and Botswana (traditional law) to identify the historical, philosophical, social, and cultural factors which contribute to the development of different attitudes and practices regarding law. Topics: the passing on of status and property rights—especially at death, the handling of antisocial 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. Covers Winter and Spring Quarters starting January 23. Students must register for both quarters.

2 units, Win plus 3 units, Spr (Barton, Staff) MTTh 3:15-4:05
186K. American Education and Public Policy  
—(Same as Education 105, History 158B.)  
Treats policy issues in education. Who influences schooling and how? How have American schools responded to human diversity? What consequences does schooling have? What are the prospects for reform in public education? Lectures and small group discussions.  
3 units, Aut (Kirst, Tyack) MW 2:15 and by arrangement

189. Voting in the American Electoral System  
—Focus is on the citizen; object is to make voting behavior comprehensible. What lies behind electoral participation, the turnout decision, the candidate choice, the voting decision? The effect of the legal context on behavior, the social background of the voter, partisanship, issue concerns, media effects, campaign and candidate effects. Voting behavior in primary and general elections, both Presidential and Congressional elections.  
5 units, Aut (Brody)

190W. Seminar: National Public Policymaking—(Given at Stanford in Washington, D.C.)  
Analyzes national public policymaking institutions and processes.  
5 units, Aut, Spr (Danelski) TW 7-9 p.m.

191. Seminar: The President, the Press, the Public and Politics—(Same as Communication 163.) The interactions between the American President, the media, and the public in contemporary American politics. Standard and new conceptions of the sources of Presidential power in policy making. Whether the evidence justifies the new conceptions of the role of President in the politics of policy making.  
5 units, Win (Brody)

192. Seminar: Political Psychology—An introduction to the principal topics in political psychology: consistency theory, preference estimation, personality, and categorization.  
5 units, Aut (Sniderman)

193. Seminar: Civil Rights and the Constitution—Substance, procedure, and political consequences of civil rights law in the U.S. The historical development of law and policy in school desegregation, employment discrimination, gender-based discrimination, abortion and privacy rights, and criminal defense rights. The procedural law involved in litigating civil rights cases develops skills in the analysis of case law and social policy. For juniors and seniors.  
5 units, Win (Steyer)

195. Seminar: Political and Economic Power in the United States—The various theories about the distribution of political and economic power in contemporary America. Topics: pluralism, elitism, Marxism, and the role of national political institutions in affecting the distribution of economic values. Prerequisites: 10 or equivalent, and junior standing.  
5 units (Manley) given 1989-90

198. Directed Reading/Research in American Politics—Advanced individual study in politics. Prerequisite: 10 or equivalent.  
any quarter (Staff) by arrangement

199. Senior Honors Thesis.  
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 on class list sign-up days. These sheets should be checked for indications of class size and other specific enrollment information.

GENERAL

201A,B,C. Seminar: Economy of Political Institutions—(Same as Business 680, 681, 682.) A three course sequence in political economics. Introduces research on the strategic analysis of political behavior and institutions. Topics drawn from collective choice theory, spatial models of electoral competition, the positive theory of legislative behavior, and bureaucratic behavior. Analytical techniques include methods of game theory, microeconomics, and information economics.  
201A. 5 units, Win (Ferejohn, Baron)  
201B. 5 units, Spr (Ferejohn, Baron)  
201C. 5 units, Aut (Krehbiel)

203A. Political Data Analysis—An introduction to fundamentals of research design, measurement, and parametric and non-parametric statistics. Lectures, discussions of examples in political science literature, and computer assisted analyses of political data sets.  
5 units, Win (Moe)

203B. Comparative Political Inquiry—Methodologies for comparative inquiry: single and comparative case methods, univariate descriptive statistics, multivariate analytic techniques. Focus is on problems in the application of these methods to substantive issues in political science.  
5 units, Spr (Garrett)

PUBLIC ADMINISTRATION

206. Politics and Organization—Provides an analytical foundation for understanding organized activity as it reflects the organization of
political life. Coverage of theories is eclectic and interdisciplinary. Emphasis on political institutions and formal organizations generally, and the norms, expectations, and routines characteristic of informal political structure.

5 units, Win (Moe)

206M. Bureaucratic Politics—Survey and critical evaluation of the literature on bureaucratic politics. Topics: public bureaucracies as organizations; public bureaucracies and the political environment; and formal models of bureaucratic behavior.

5 units, Win (Moe) given 1989-90

207M. International Perspectives on Organizations—(Same as Sociology 265, Business 475.) Perspectives and research on organizations by foreign scholars and in non-American contexts. Emphasis on identifying a few key concepts from the foreign literature and contrasting the points of view, research results, and experiences with those based on research in the U.S. 1988-89 focus is on perspectives drawn from Denmark, Finland, Norway, and Sweden. Prerequisites: Business 270, Sociology 160, or Industrial Engineering 100.

5 units, Aut (March) TTh 8-9:50

209. Directed Reading in Public Administration.

any quarter (Staff) by arrangement

COMPARATIVE POLITICS

212. Comparative Interest Politics—The theoretical foundations for the comparative analysis of interest associations in advanced capitalist/industrialist societies. Emphasis on pluralist and corporatist arrangements and the contract between North American and Western European experiences. Enrollment limited to 15-25.

5 units, Aut (Schmitter)

215A,B. Japanese Political Economy—The role of state and private enterprise in Japan’s capitalist economy. Cultural and social foundations, institutions, policies, performance, and international consideration. The international economy, political and economic institutions, policies and practices, and performance. 215B is a research seminar for which 215A is a prerequisite.

5 units, Aut, Win (Okimoto)

219W. Power Elite Recruitment in East European Communist Countries—The recruitment processes of the power elite data from Poland, Yugoslavia, Hungary, and the U.S.S.R. are analyzed. Includes: general rules of selection of elite members on regional and national levels; social determinants of attaining elite positions; career patterns. Some comparisons to Western political systems.

5 units, Win (Wasilewski)

225. Seminar: The Political Economy of Reform in Socialist Countries—The nature of the Stalinist and post-Stalinist political-economic systems in the U.S.S.R., Eastern Europe, and China. Focuses on selected reform efforts in these countries, analyzing the interaction of political, economic, and social factors in producing the reform efforts and conditioning their success or failure.

5 units, Spr (Halpern)

226C. Colloquium: Major Problems in Soviet Politics and Society—(Same as History 319A.)

5 units, Win (Schmitter)

227P. Seminar: Democratization—East and West—Comparison of political changes possibly leading to more democratic institutions in Eastern and Southern Europe, with reference to Latin America and perhaps Asia: differences in previous regimes and economic systems; in levels of development and international context; in modes of demise and efforts at reform; in eventual institutions and practices. Open to advanced undergraduates and graduate students.

5 units, Win (Schmitter)

228T. European Sociological Theories of Law.

5 units, Spr (Teubner)

229. Directed Reading in Comparative Politics.

any quarter (Staff) by arrangement

INTERNATIONAL RELATIONS


5 units, Win (Holloway)

241. International Political Economy—Major theoretical approaches emphasizing structural/mercantilism, liberalism, and Marxism applied to a variety of historical and contemporary issues. Includes lectures and class presentations on readings.

5 units, Spr (Krasner)

243. Seminar: International Relations Theory—The causes of conflict and cooperation in international politics. Contemporary theories and approaches and the work of earlier writers (Thucydides, Hobbes, Clausewitz). Issues: the causes of war and peace, the conditions furthering political and economic cooperation among
nations, and the role of ethics in international relations.

5 units, Aut (Sagan)

244R. The Politics of Alliances—Role of political-military alliances in the international system. Theories of alliance formation and behavior and issues of alliance utility. The role of alliances in the propagation of conflict. Cases from the 19th and 20th centuries, including NATO and the Warsaw Pact. Prerequisite: 35 or permission of the instructor.

5 units, Win (Rice)

249. Directed Reading in International Relations.

any quarter (Staff) by arrangement

POLITICAL THEORY

Graduate students interested in Political Theory offerings should also see courses numbered 150-169.

250. Classics of Modern Political Theory—Intended (not exclusively) for graduate students wishing a basic knowledge of the works of Machiavelli, Hobbes, Locke, Rousseau, and Marx. Lectures/discussions on conceptions of power, and legitimation and models of society.

5 units (Drekmeier) given 1989-90

254. Essentials of Political Theory—Methods, concepts, and concerns of political theory: problems of valuation and interpretation; recent contributions to the philosophy of political analysis.

5 units (Drekmeier) given 1989-90

259D. Individualism and Social Justice—Anglo-American Liberalism from the viewpoint of contemporary French political philosophy. Readings of Smith, the Utilitarians, Rawls, Nozick and Hayek.

3-4 units, Win (Dupuy)

262. Seminar: Thought and Action—The relation between knowing and doing, and making and doing; the ranges from the ideological presuppositions of psychological theories, the nature of revolutionary consciousness, the various types of knowing and types of ideology, and the responsibilities of science and the role of knowledge as a factor of production.

5 units, Aut (Drekmeier)

264. Seminar: Social Theory and Modern Political Thought—The contributions of Max Weber, Emile Durkheim, and Sigmund Freud to the understanding of political behavior, institutions and values.

5 units, Spr (Drekmeier)

267. Interdisciplinary Workshop in Equity and Social Choice Theory—(Same as Philosophy 255, Economics 387.) Recent work on social choice theory and related literatures in economics, philosophy, and political science concerns the equitable allocation of resources and respect for individual rights. Students receive up to 3 units of credit for participating, including presenting their own work or a survey paper.

1-3 units, Win (Hammond, Ferejohn, Suppes)

269. Directed Reading in Political Theory.

any quarter (Staff) by arrangement

AMERICAN POLITICS

289. Seminar: Congress—A survey of institutions and practices of the House and Senate in the post-war period. Topics: the internal institutional structures of Congress—the rules, the committee, leadership, and party systems, the seniority system, and the structure of congressional careers; the relation of Congress to other political structures—Congressional elections, interest groups, the President, the media, the bureaucracy, and the courts.

5 units, Win (Ferejohn)

292A. Seminar: American Political Institutions—Theories of American politics, interest groups, political parties, Federalism.

5 units, Aut (Ferejohn)

292B. Introduction to Political Behavior—Analysis of public opinion, ideology, political tolerance and political values, racism, and voting.

5 units, Win (Brody, Sniderman)

292C. Seminar: American Political Institutions—An overview of the state of American political institutions with attention to bureaucracy, the Presidency, and Congress.

5 units, Spr (Moe)

296M. Seminar: The Institutional Presidency—The growth and development of the institutional presidency and its integral connection to other basic components of the American political system—Congress, the bureaucracy, the courts, parties, interest groups, the public, and the media.

5 units, Spr (Moe)

298. Directed Reading in American Politics.

any quarter (Staff) by arrangement

GRADUATE SEMINARS

Seminars numbered 300 and above are limited to graduate students. Instructors should be consulted before enrolling.

300. Thesis.

any quarter (Staff) by arrangement

306. Seminar: Advanced Organization Theory—(Same as Business 676, Sociology 365.) Topics
in organization theory for advanced students. Prerequisite: Consent of instructor.
4 units, Win (March)

311. Seminar: Comparative Political Analysis—A seminar for political science Ph.D. candidates. Required for all persons offering comparative politics as a first or second field. Qualified Ph.D. candidates in other departments and A.M. candidates in political science may be admitted with permission of the instructors. Limited to 12 students.
5 units, Win (March)

313F. Seminar: Development and the International System—Focus is on late-developing peripheral nations and problems of accumulation, distribution, state and class forces, and the international system as it affects development. Participants select a country and a problem and examine them in detail. Prerequisites: Consent of instructor and enrollment or acceptance in a Ph.D. program.
5 units, Fagen (1989-90)

316. Seminar: Latin American Politics—Interweaves specific country studies with a number of key themes in Latin American politics: the state, populism, political parties, labor, the military, authoritarianism, and democratization. Emphasizes the relationship between political regimes and economic performance. Cases include: Peru, Venezuela, Brazil, Central America, and Chile.
5 units, Spr (Karl)

323. Seminar: Theories of Development—A literature-review seminar for graduate students in the social sciences and area studies. Analysis of major theoretical approaches and empirical studies regarding political, economic, and social development in national units.
5 units, Win (Packenham)

324. Seminar: Dependence, Interdependence, and Autonomy in National Units—A research-oriented workshop for graduate students in the social sciences and area studies. Theoretical perspectives, empirical studies, and research strategies regarding dependence, interdependence, autonomy, and autarchy in national units.
5 units, Spr (Packenham)

325. Seminar: Capitalists and Workers—Studies comparatively the efforts of capitalists and workers in North America and Western Europe to organize collectively and influence public policy. Emphasis on the structure and role of business associations and trade unions with data from nine nation research projects (Austria, Canada, West Germany, Italy, The Netherlands, Spain, Sweden, Switzerland and the United Kingdom). Also, the U.S. and France. Prerequisite: 212 or permission of the instructor.
5 units, Win (Schmitter)

328. Knowledge and Legitimation: The Politics of Educational Research—(Same as Education 307X.) Within the theoretical framework of legitimation theory, the notion of "compensatory legitimation" for the analysis of the national and international politics of educational research. Case studies on the work of agencies for research support, cooperation, and dissemination. Research seminar for doctoral students; consent of instructor required.
5 units, Win (1989-90)

332. Research on Decision Making and Strategic Interaction in International Relations.
5 units, Win (Sagan) by arrangement

336. Seminar: Research on Soviet Foreign and Defense Policy—An analysis of the major approaches that have been employed in the study of Soviet foreign and defense policy. The relationship between Soviet studies and international relations theory. The special problems of working with Soviet sources. Students have the opportunity to develop research designs and/or to write research papers in areas of interest to themselves.
5 units, Spr (Holloway)

380A,B,C. Workshop on Political Economy.
5 units, Aut, Win, Spr (Ferejohn)

OVERSEAS STUDIES

The following courses are approved for the Political Science major and taught overseas at the campus indicated. Students are encouraged to discuss with their major advisors which courses would best meet individual educational needs. Course descriptions can be found in the "Overseas Studies" section of this bulletin, or in the Overseas Studies Program office, 126 Sweet Hall.

111X. Contemporary French Politics: A Comparative Approach—Tours. (DR:5)
5 units, Spr (Gorgues)

113X. Ethnicity and Public Policy in Germany—Berlin.
4 units, Aut (Lenhardt)

115X. Contemporary European Politics—Florence. (DR:5)
4 units, Win (Mammarella)

120X. French Foreign Policy—Tours. (DR:5)
5 units, Aut, Spr (Billard)

121X. The U.S. and Western Europe after World War II—Florence. (DR:5)
4 units, Win (Mammarella)

125X. Contemporary European Politics—Florence. (DR:5)
4 units, Spr (D'Alimonte)
For the convenience of students interested in population studies, offerings at Stanford are listed below.

## COURSES

### ANTHROPOLOGY

5 units, Spr (Klint)

164. Ecological Anthropology—(Same as Human Biology 134.) 
3 or 5 units, Aut (Durham) alternate years, not given 1989-90

168. Medical Anthropology. 
5 units, Aut (Barnett)

250. Nutritional Problems of Developing Nations—(Same as Food Research 250, Human Biology 110.) 
5 units, Win (Martorell)

260. Topics in Urban Anthropology. 
5 units (Yanagisako) alternate years, given 1989-90

275. Demographic Anthropology. 
5 units (Skinner) alternate years, given 1989-90

### BIOLOGICAL SCIENCES

175H. Problems in Marine Biology. 
15 units, Spr (Gilly, Baxter, Denny, Thompson)

178. Biology of Natural Populations. 
4 units, Spr (Mooney) by arrangement alternate years, not given 1989-90

183. Colloquium on Population Studies—(Same as Food Research 188/288, Human Biology 60.) 
1 unit, Win (Feldman, John) W 4:10-5:30

190. Population Biology of Butterflies—Must be registered in Winter Quarter to get credit for field work in Spring. 
2-5 units, Win, Spr (Ehrlich) by arrangement

283. Theoretical Population Genetics. 
3 units, Aut (Feldman) TTh 9-10:30 alternate years, not given 1989-90

3 units (Roughgarden) alternate years, given 1989-90

286H. Marine Ecology. 
6 units, Sum (Roughgarden) alternate years, not given 1989-90

1-3 units, Aut, Win, Spr (Ehrlich) by arrangement

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**INSTITUTE FOR POPULATION AND RESOURCE STUDIES**

Faculty: Marcus W. Feldman, Director (Biological Sciences), W. Brian Arthur (Food Research), Kingsley Davis (Hoover Institution), Carl Djerassi (Chemistry), William Durham (Anthropology), Paul R. Ehrlich (Biology), A. Meredith John (Food Research)

Although Stanford University at present does not have a formal degree program in Population Studies, it does have scholars of international reputation in such specialties as population biology, population genetics, epidemiology, demographic methods, demographic history, economic demography, and in the sociology and anthropology of population.

The Institute for Population and Resource Studies is an interdisciplinary group supporting and fostering population studies at Stanford. It serves three major functions: (1) encouraging graduate work in population studies through fellowship grants and supervision; (2) instituting courses and seminars in population studies; (3) bringing visiting faculty to Stanford to strengthen existing course offerings. The Institute also organizes an Interdisciplinary Colloquium in Population Studies to introduce upper division and graduate students to a wide variety of issues in population-related specialties.
1-3 units, Aut, Win Spr (Ehrlich, Feldman, Mooney, Roughgarden, Thomas, Vitousek, Watt) by arrangement

1-3 units, Aut, Win, Spr (Feldman) by arrangement

1-3 units, Aut, Win, Spr (Roughgarden) by arrangement

ECONOMICS

119. Development and Population Interactions in the Third World—(Same as Food Research 121.)  
5 units, alternate years, given 1989-90

133. Population Perspectives in the Third World—(Same as Food Research 136/236, Human Biology 136.)  
5 units, given 1989-90

249. Economic Demography—(Same as Food Research 287.)  
5 units, alternate years, given 1989-90

ENGINEERING

297A,B,C. The Ethics of Development in a Global Environment (EDGE)—(Same as Anthropology 133A,B,C; Political Science 140A,B,C.)  
1 or 4 units, Aut, Win, Spr (Fagen, Lucignan, McWhorter, Siegel)

FOOD RESEARCH INSTITUTE

5 units (Yotopoulos) alternate years, given 1989-90

137/237. Human Populations: Birth, Death, and Disease—(Same as Human Biology 137.)  
5 units (John) alternate years, given 1989-90

138/238. Introduction to Epidemiology—(Same as Human Biology 106.)  
5 units, Win (John) MW 1:15-3:05

286. Demographic Methods—(Same as Sociology 284.)  
5 units, Win (John) W 9-10:50

287. Economic Demography.  
5 units (Arthur) alternate years, given 1989-90

386. Seminar: Demography.  
3 units, Spr (John) by arrangement

GENETICS

205. Human Population Genetics and Genetic Epidemiology.  
3 units (Cavalli-Sforza) alternate years, given 1989-90

HEALTH RESEARCH AND POLICY

270. International Health.  
2-4 units, Spr (Basch)

HUMAN BIOLOGY

120. Human Nutrition—(Same as Food Research 119.)  
4 units, Aut (Martorell, Bray) MWF 10

148. Environmental Policy.  
3 units, Spr (Ehrlich, Anne)

150A. Biosocial Aspects of Birth Control—(Same as Chemistry 137A.)  
6 units (Djerassi) not given 1988-89

MATHEMATICS

226. Mathematical Models in Population Studies—(Same as 226, Biology 179.)  
3 units, Spr (Feldman, Karlin) TTh 11-12:15

PSYCHOLOGY

Emeriti: (Professors) Edith M. Dowley, Ernest R. Hilgard, Douglas H. Lawrence, Eleanor E. Maccoby, Robert R. Sears

Chairman: Herbert H. Clark


Assistant Professors: Laura L. Carstensen, Anne Fernald, Susan K. Nolen-Hoeksema, Michael Pavel, George A. Quattrone (on leave Autumn), Daniel A. Weinberger (on leave Winter)

Associate Professor (Teaching): Barbara Tversky


Department Affiliates: Stuart Card, Douglas Daher, Vincent D'Andrea, Sam Edwards, William Hazle, Ronald Hudson, Ronald Kap-
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. Bing nursery school, located on campus at 850 Escondido Road, provides a laboratory for child observation, for training in nursery school teaching, and for research. The building was constructed with funding from the National Science Foundation and a special grant from Mrs. Anna Bing Arnold and Dr. Peter Bing.

The department provides: (1) courses designed for the general student; (2) a major program leading to the degree of Bachelor of Arts which includes Honors, and a specialization in one of five content area tracks; 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.

UNDERGRADUATE PROGRAMS

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 and 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, 120, 146, 147, 163, 164

Group B: 111, 115, 121, 133, 136

These two lists of courses, it should be noted, may change from year to year, and students are encouraged to check with the Academic Assistant for additional information.

No more than 10 units of independent study (104, 184, 188, 257, and 257A) may be counted toward the 45 units. Independent study courses (104, 184, and 188) 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 Requirement—Many students will wish to complete a “stronger” program rather than merely fulfill the minimal requirements listed above. This may be done in any or all of the ways listed below:

1. Within the general major, the student may elect to take advanced undergraduate or graduate courses in the department and in supporting disciplines, such as anthropology, biology, statistics, and computer science. The student may also take advantage of the widespread opportunities for directed research, working closely with individual faculty and graduate students.

2. The student may apply to the senior Honors program, which is described below.

3. The student may elect to pursue one of five specialization tracks. These tracks are: General Psychology, Health and Development, Computational Neurosciences, Decision Sciences, and Cognitive Sciences.

The training that would be obtained from the pursuit of any of these options would be very valuable not only for students who are considering graduate work in psychology, but also for those thinking of professional careers outside of psychology.

SENIOR HONORS PROGRAM

The senior Honors program is designed for those exceptionally able students who wish to pursue a year of intensive supervised independent research. Admission to the program is made at the end of student’s junior year on the basis of: (1) excellent academic performance, (2) previous research experience, and (3) recommendations by faculty and/or graduate students. An information meeting about the program is held in Winter Quarter. Students interested in the program should involve themselves in research as early as possible and acquire a broad general background in psychology as well as a deep background in their chosen area. The program is particularly appropriate for students planning
to go to graduate school in psychology, and in other social sciences, as well as computer science, law, medicine, and business. Funds for research, though not necessary, are available on a competitive basis in the form of Firestone Grants (applied for early in Spring Quarter of the junior year) and Small Grants (applied for early in Autumn Quarter of the senior year). Information is available at the Undergraduate Research Opportunities office in Sweet Hall.

During the Autumn Quarter of their senior year, students participate in a weekly seminar concerned with general methods and issues in psychological research. At the same time, students plan their research under the supervision of an appropriate faculty member. Research proposals are presented orally at the seminar for discussion. A written copy of the proposal is turned in at the end of the Autumn Quarter. During Winter and Spring Quarters, students are primarily involved in completing the research and writing the dissertation. Students present their completed projects at a convention at the end of Spring Quarter, attended by other students, faculty, and graduate students.

SPECIALIZATION TRACKS

Students in the major program, including those in the Honors program, may elect to specialize in one of five tracks, namely, General Psychology, Health and Development, Computational Neurosciences, Decision Sciences, and Cognitive Sciences. This specialization consists of a coherent sequence of courses leading to advanced undergraduate or even graduate level courses in an area. Typically, the sequence would include 2-4 required courses and 4-6 recommended courses in psychology, along with 4-7 courses in related disciplines. (These courses would count toward satisfying the major requirements stated above.) In the ideal case, the student who specializes would acquire an understanding of a range of psychological processes, as well as an appreciation of the significance of these processes in the chosen area of application. In this way, specialization could facilitate the student’s preparation for a professional career in, for example, medicine, business, or counseling, or for graduate work in psychology and a more academic career.

Two or three faculty members serve as academic advisors for each track. Students who wish to specialize are encouraged to consult with an appropriate advisor, immediately after declaring the major, in order to discuss their individually tailored program within each track. Information about the advisors and about the required and recommended courses for each track is available from the Academic Assistant in the department.

GRADUATE PROGRAMS

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 (general and advanced psychology) on the Graduate Record Examination as part of the application. This examination may be taken at most universities and colleges.

MASTER OF ARTS

The Department of Psychology offers a Master of Arts program to students who are concurrently enrolled in another doctoral or professional program at Stanford. Students can be admitted to the masters program by submitting an application to the Psychology Department’s Graduate Education Committee. Applicants will be admitted based on their undergraduate transcripts, letters of recommendation, graduate record exams, and the agreement of a member of the psychology faculty to serve as an advisor.

Candidates for the A.M. degree must take Psychology 252 and five courses from the departmental core group defined in the Ph.D. program requirements. Students must complete 36 units in psychology at Stanford. Serving as a Teaching Assistant for Psychology 1 or 60 (by registering for 257A—Practicum in Teaching) may be substituted for one 3-unit course. Beyond the coursework, masters students must complete a thesis under the supervision of their psychology faculty advisor.

DOCTOR OF PHILOSOPHY

In addition to fulfilling the residence requirement for the degree, the following requirements are stipulated:

First-Year Course Requirement—During the first year of graduate study, the student is required to take 207 (Pro-seminar for First-Year Graduate Students), 252 (Analysis of Data), and 253 (Statistical Theories, Models, and Methodology). 205 (Cognition) must be taken during the first or second year. 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
206. Behavioral Neuroscience
208. Physiological Psychology
will receive additional feedback on CADA at the time of the oral examination itself. At this same time, the student would select two faculty members to read the paper and give feedback. These should be two faculty members most likely to serve on the dissertation reading committee. If the student should radically change the research topics, the procedure will not have to be repeated for the second dissertation topic. 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 a written report of his or her first-year research activities.

Second-Year Course Requirement—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 S and at least two from Group H. 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.

Third-Year Major Area Paper—During the first week of the Autumn 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 major 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 oral committees. 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.

Minor Requirements—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.

Dissertation Reading Committee—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.

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.

Dissertation Requirements—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.

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 1.

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.

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 ASSISTANTS

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 Autumn Quarter 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.

Ph.D. MINOR

Candidates for the degree of Doctor of Philosophy in other departments may elect a minor in psychology. To obtain a minor the student must complete 30 units in psychology. Up to 15 units of this coursework may be satisfied by psychology classes at other accredited institutions. At least 15 units towards the requirement must be taken in the Stanford Psychology Department. Of the 15 units at Stanford, at least two courses must be from graduate-level courses numbered 200 or above. These two graduate-level courses may be cross-listed courses.

APPLIED COGNITIVE PSYCHOLOGY PROGRAM

The department is establishing a graduate program in applied cognitive psychology, in which the theory and methods of cognitive psychology are applied to practical, real-world problem domains. The domains of interest to
psychology are those in which human cognitive activity is paramount—such as medical diagnosis, technical instruction, and training. They include also domains traditionally covered in "human factors" and "engineering psychology", man-machine systems and human-computer interactions. The current course offerings include Survey of Applied Psychology, Applying Cognitive Psychology to Computer Systems and Advanced Seminars in Applied Psychology. The department has established affiliations with research psychologists at the nearby Xerox Palo Alto Research Center. These scholars participate in teaching and student supervision, and provide on-site experience in applied psychology research during the summer and during the academic year. A second research setting and resource is the nearby NASA/AMES aero-space laboratories. Some research psychologists at AMES are affiliated with the department and offer relevant courses for graduate students. The department seeks to expand its contacts with local and national companies, to expand its program of course offerings, and to arrange for research internships for graduate students in these applied research settings.

COGNITIVE SCIENCE PROGRAM

Psychology is participating, along with the Departments of Computer Science, Linguistics, and Philosophy, in an interdisciplinary program of cognitive science. The program is intended to provide students with an interdisciplinary education as well as a deeper concentration in psychology. Doctoral students are eligible to participate in the Cognitive Science program. Students who complete the requirements within psychology and the cognitive science requirements will receive a special designation in cognitive science along with the Ph.D. in Psychology. To receive this field designation, students must complete 30 units of approved courses, 18 of which must be taken in two disciplines outside of psychology.

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.

COURSES

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, 1989.

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. Topics: cognition and cognitive development, personality development, motivation, emotional adjustment and psychopathology, social behavior, learning, perception, and the physiological basis of behavior. (DR:4)

4 units, Aut (Carstensen, Zimbardo)
TTh 1:15-2:30
Win (Quattrone MW 2:15-3:30
Spr (Pennebaker) MWF 11

1A. General Psychology Discussion Section—Optional supplement to Psychology 1. Small discussion groups led by graduate teaching assistants. Prerequisite: Concurrent enrollment in 1.
1 unit, Aut, Win, Spr (Staff)
by arrangement

60. Statistical Methods—The elements of statistical description (measures of average variation, correlation, etc.). Develops an understanding of statistical inference. Emphasis on those statistical methods of principal relevance to psychology and related social sciences. Students who receive credit for 60 will not be given credit for Statistics 60. (DR:6)
5 units, Aut (Pavel) MTWThF 9
Win (Stork) MTWThF 9
Spr (Horowitz) MTWThF 9

102. Perception—A review of the basic processes of vision and hearing. Topics: basic anatomy of the eye and ear, speech perception, color vision, depth perception, and more. (DR:4)
3 units, Aut (Palmer) MWF 10

103A. Visual Sensing by Humans and Computers—(Graduate students register for 203A.) Topics in basic visual science including the physiology of human vision, basic human visual performance, and computational algorithms that characterize physiology and performance. Prerequisites: 102 or equivalent, calculus. (DR:7)
3 units, given 1989-90

103B. Visual Sensing by Humans and Computers—(Graduate students register for 203B.) Topics in the application of visual science to the design of images (television, computer terminals, avionics displays) for viewing, and the design of sensor systems for analyzing the con-
tent of image data (assembly line part inspection, object recognition). Prerequisites: 102 or equivalent, calculus.

3 units (Wandell) given 1989-90

104. Special Laboratory Projects—Independent study. Offered for pass/no credit. Can be repeated for credit. Prerequisites: 1 and 60, and consent of instructor.

1-6 units, any quarter (Staff) by arrangement

106. Introduction to Cognitive Psychology—A survey and analysis of the major topics in cognitive psychology, including perception, memory, and thought. Emphasis on contemporary research and theory. Prerequisites: 1 and 60. (DR:4)

4 units, Win (B. Teversky) MW 11-12:30

107. Introduction to the Nervous System: Cell Signaling and Behavior—(Same as Biological Sciences 153.) A survey of neural interactions underlying behavior. Prerequisites: 1 or equivalent, and elementary biology.

4 units, Aut (Wine) TTh 1:15-2:30
alternate years, not given 1989-90

108. Basic 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.

4 units, Win (Pribram) MWF 10

109. The Neuropsychology of Perception, Attention, and Memory—(Graduate students register for 209.) An analysis of the structure of our sensations and memories as determined by physiological encoding mechanisms. Examination of neuronal machines which produce our perception of color, brightness, movement, shape, and the selective attention and deposition-into-memory of those events. Prerequisite: 1 or equivalent.

4 units, Spr (Ganz) TTh 11-12:30

110. Health Psychology—Health psychology deals with many of the classic problems of the mind-body relationship. How psychological events or stressors affect physiological response. Current psychological theories and explanations related to stress and illness (e.g., learning, family, dynamics, symptom perception). Eating disorders, Type A and heart disease, and psychotherapy. Prerequisite: 1.

3 units, Win (Pennebaker) MW 10-11:30

111. Developmental Psychology—Psychological development from birth to adulthood, emphasizing the infancy, early childhood, and middle childhood years. The nature of change during childhood and theories of development. Supervised experience with children at Bing School, Stanford's child development laboratory school, is available if taken for 5 units. Prerequisite: 1 or equivalent. (DR:4)

3 or 5 units, Aut (Flavell) MWF 11

114. Introduction to the Nervous System: Ion Transport and Intracellular Messengers—Ion channels, carriers, and ion pumps, and their regulation by intracellular messengers in a variety of cell types. Prerequisite: Consent of instructor. Recommended: Introductory Biology or Human Biology, or Psychology 107.

3 units, Spr (Wine) by arrangement

115. Social Development—Socialization and the development of social behaviors. A review of research concerning conscience and conduct, altruism and aggression, cooperation and competition, achievement and self-control. (DR:4)

3-4 units, Win (Lepper) TTh 10-11:30

116. The Psychology of Women—(Same as Feminist Studies 126.) Research and theory on the socialization and psychological development of women. Consideration given to the biological, cultural, and social factors that influence gender-specific behavior. (DR:4)

3 units, Aut (Carstensen) TTh 10-11:30

117. Observation of Children—Seminar on learning about children through guided observations weekly at Bing School, Stanford's Child Development Laboratory School. Physical, emotional, social, cognitive, and language development studied. Recommended: 111.

3-5 units, Win, Spr (Staff) T 4-5:30 and by arrangement

118. Developmental Practicum—Supervised experience with young children at Bing School, Stanford's Child Development Laboratory School. 4 units involves seven hours per week in Bing classrooms throughout the quarter; 5 units involves 10½ hours per week. Weekly seminar on developmental issues in the teaching-learning environment at Bing School. May be repeated for credit up to 15 units. Prerequisite: 111 or 117, or consent of instructor.

4-5 units, Aut, Win, Spr (Staff) Th 4-5:30 and by arrangement

120. Cognitive Development—Topics and issues on cognitive development, developmental changes in memory, conceptual organization, logical reasoning, and communication skills. Prerequisite: 1.

3 units, Spr (Markman) MWF 10

121. Social Psychology—Interpersonal behavior. A survey of relevant research concerning attitudes, groups, person perception, and selected topics in social psychology. Prerequisite: 1 or equivalent.

3 units, Spr (Quattrone) MW 2:15-3:30
122. Children's Literature: A Psychological Perspective—The ways of looking at children's literature (ages 2-12) as mirrors for the conscious and unconscious, as reflectors of what children value, and as indicators of where our society is headed. Writers and illustrators: Maurice Sendak, A. A. Milne, Russell Hoban, and E. B. White, etc. Fairy tales are discussed from several viewpoints including the psychoanalytic represented by Bruno Bettelheim. Prerequisite: 1 or 117.
3 units, Win (B. Shepard) TTh 1:15-2:30

125. Psychology and Law—Legal, psychological, and popular views of morality, responsibility, equity, intention, insanity, evidence, crime and punishment; the police; psychological processes in jury deliberation; homicide and aggression; treatment of accused persons.
3-4 units, Spr (Rosenhan) TTh 2:15-3:30

127. Afro-American Psychology—An introduction to ethnic psychology, specifically, the psychological dimensions of the Black experience in America. Lectures and readings. Black psychology from its evolution as a concentration area in the social sciences to present concerns that impact Black Americans' mental health. Students are encouraged to expand upon the methodological constructs employed in the study of Black Americans.
3 units, Spr (Hudson) MWF 10

128. Research Methods and Experimental Design—An examination of experimental research methods and principles in psychology. Structured research exercises and the design of an individual research project are required. Prerequisite: Consent of the instructor.
5 units, Spr (Lepper) TTh 1:15-3:05

130. Infancy—Development in the first two years of life. Topics: prenatal development and childbirth, perceptual development, cognitive development in infancy, parent-infant interaction, infant social cognition, the development of emotion, and preverbal communication.
4 units, Aut (Fernald) TTh 11-12:30

132. Laboratory Course in Developmental Psychology—For students interested in acquiring research skills. Focus is on conceptual and methodological issues related to research on early development: training in experimental design, laboratory, and observational procedures, and the collection, analysis, and interpretation of data. Students conduct a series of supervised experiments, with infants and preschoolers, at the Center for Infant Studies in the Department of Psychology and at the Bing School. Limited enrollment. Prerequisites: 111 or 120 or 130, and consent of instructors.
5 units, Win (Fernald, Flavell, Markman)
MWF 11-12:30 plus weekly 2-hour lab

132A. Laboratory Section for Psychology 132—One two-hour period per week. Prerequisite: Concurrent enrollment in 132.
1 unit, Aut (Fernald, Flavell, Markman)
W 9-11 or Th 9-11 or 10-12 or F 1-3

133. Psychological Disorders of Childhood—Develops an integrative understanding of various disorders ranging from autism to delinquency. The interplay of biological, psychological, familial, and social determinants is emphasized. Films and case material supplement summaries of current research. Recommended: Some background in child development and/or abnormal psychology.
3-4 units (Weinberger) given 1989-90

134. The Affective Disorders—(Graduate students register for 234.) Current evidence on the experience of depression and mania in adults and children, including gender differences, socioeconomic class differences, and culture differences in depression. The genetic, biochemical, psychodynamic, cognitive and behavioral theories of affective disorders, and the treatments prescribed by these theories. Prerequisite: 136.
3 units, Win (Nolen-Hoeksema) TTh 1:15-2:30

135. Abnormal Psychology—The characteristics, possible causes, and best treatments for many types of psychological disturbance. Emphasis is on how one builds and tests theories of psychological disturbances. Prerequisites: 1 or equivalent.
4 units, Aut (Nolen-Hoeksema) WF 1:15-2:30

136. Abnormal Psychology Discussion Section—Optional supplement to 136. Small discussion groups are led by graduate teaching assistants. Prerequisite: Concurrent enrollment in 136.
1 unit, Aut (Nolen-Hoeksema) by arrangement

137. The Interpersonal Basis of Abnormal Behavior—The role of interpersonal problems and processes in producing different forms of psychopathology, ranging from neurotic reactions to schizophrenia. Combines clinical (case study) approach with conventional empirical approaches to clarify the origin, nature, and treatment of emotional disorders. Prerequisite: 136.
3 units (Horowitz) given 1989-90

138. Carl Jung and Analytical Psychology—An introduction to C. G. Jung, focusing on the person of Jung, his seminal philosophical perspectives and their impact upon modern thought and life. The formation of analytical psychology with regards to Jung's past relationship with Freud and later emergence as a prominent 20th-century thinker.
4 units, Aut (Daher) TTh 1:15-3:05
142. Peace Studies—(Same as History 154, Political Science 133, Psychology 142, Sociology 108, VTSS 143.) Interdisciplinary examination of the current international situation, beginning with historical examples and turning to underlying processes (psychological, social, political, and economic). The assumptions of current doctrines concerning war and peace are related to what is known about humans and their institutions. The nature of peace as a process is related to issues of justice. Alternative approaches towards peace are critically analyzed.

3 units, Spr (Bernstein, Dornbusch, Drekmeyer, Moses, North, Ross) Th 2:15-4:05

146. Language and Thought—(Same as Linguistics 145.) The psychology of language, including production and understanding of utterances; from speech sounds to speaker's meaning; children's acquisition of the first language; and psychological bases for language systems. Language functions in natural contexts and their relation to the processes by which language is produced, understood, and acquired. Prerequisite: 1 or Linguistics 1. (DR:4)

4 units, Aut (H. Clark) MWF 1:15

147. Animal Behavior: Neurobiological Aspects—(Same as Biological Sciences 164.) Ethological studies of behavior with an emphasis on understanding the physiological substrates of simple behavior. Prerequisite: 1 or equivalent, and elementary biology.

4 units (Wine) alternate years, given 1989-90

152. Statistical Analysis of Data—(Graduate students register for 252; same as Education 250A.) Analysis of variance and covariance; correlation and regression; analysis of categorical data. Proficiency with statistical computer packages. Prerequisites: Statistics 160, consent of instructor.

4 units, Win (Rogosa) MWF 11-12:30

153. Statistical Theory, Models, and Methodology—(Graduate students register for 253.) Elementary probability theory and the theory underlying statistical techniques. Applications of these ideas and methods in psychology and the social sciences. Topics: 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.

3 units, Spr (Thomas) MWF 9

155. Human Abilities—(Same as Education 255.) Introductory survey of psychological theory and research on human cognitive abilities; their nature, development, and measurement; and their importance in society. Relation of education and intellectual abilities; examples relating to other social institutions. Cognitive analysis of verbal reasoning and spatial abilities. Individual differences in abilities in relation to motivation, personality, gender, and ethnic differences. Prerequisites: 1 and Statistics 60 or Psychology 60, or equivalent.

3 units, Win (Snow) MW 1:15-2:30

156. Decision and Judgment—(Graduate students register for 256.) Theory and experiments about decision making and judgment under uncertainty. Focuses on the contrast between the rational theory of judgment and choice, and the psychological principles that produce judgment biases and cognitive illusions. Prerequisite: Elementary concepts of probability or statistics.

3 units, Win (A. Tversky) MW 1:15-2:30


3 units, Win (Rumelhart) MWF 9

163. Mathematical Models of Psychological Processes—(See 215.)

164. Mathematical Representation of Structures in Psychological Data—(See 218.)

165. Graduate Seminar: Selected Topics in Cognition—(See 219.)

167A. Peer Counseling: Bridge Community—Instruction in peer counseling. Topics: verbal and non-verbal attending and communication skills, the use of open and closed questions, working with feelings, and summarization and integration. Instruction through lectures, individual training, group exercises and discussion, role-play, and videotaped practice. Students develop and apply the above skills in a variety of contexts. Enroll for credit in only one quarter.

2 units, Aut, Win, Spr (D'Andrea, Staff) M 3:15-5:05

167B. Peer Counseling: Chicano Community—Instruction in basic counseling. Topics: verbal and non-verbal attending and communication skills, the use of open and closed questions, working with feelings, and summarization and integration. Also, counseling issues that are or may be salient when working with Chicanos, including the significance and process of Spanish-English code switching in communication,
the role of ethnic identity in self-understanding, the relationship of culture to personal development, and the experience of Chicano students in university settings. Instruction includes lectures, individual training, group exercises and discussion, role play, and videotape practice.

2 units, Aut, Spr (Martinez) M 2:15-5

167C. Peer Counseling: The Black Community—Instruction in peer counseling with Blacks. Topics: the concept of culture, Black cultural attributes and their effect on Blacks’ reactions to accepting counseling, verbal and non-verbal attending, the use of open and closed questions, working with feelings, summarization, and integration. Geared toward counseling with Blacks; methods of instruction include reading assignments, lectures, guest speakers, group discussion, role play, and videotaped practice. Students develop and apply skills in the Black community on campus or in other settings that the student may choose.

2 units, Aut (Edwards, Reed-Hoskins)
M 3-5, W 4-5

167D. Peer Counseling: Contraceptive Advising—Trains staffers for the student-run Contraceptive Information Center at Cowell. Instructors and guest speakers provide a thorough training in contraceptive issues. Topics: reproductive anatomy and physiology; the effectiveness, mechanism of action, and usage of available birth control methods; all aspects of abortion; and counseling techniques. Also, sexually transmissible diseases, future methods of contraception, and sexuality. Preference is given to students who make a commitment to staff at the Contraceptive Information Center in subsequent quarters, but all interested students are encouraged to enroll as space permits.

3 units, Aut, Win, Spr (Cowell Staff)
T 7-10 p.m.

167E. Peer Counseling Techniques: Substance Abuse—The medical, psychological, and social issues involved with alcohol and drug abuse, and dependence. Students are trained to identify, assess, intervene upon, and refer alcohol and drug problems. Prerequisite: 167A, B, or C. Limited enrollment.

3 units, Aut (Matano, Hazle) M 2:15-4

170. Identity and Role: A Practicum—(Same as Drama 124.) Topics and concepts at the interface of psychology and drama: emotion, self, madness, situated identity, status transactions, power, and time perspectives. The exploration is academic and experiential, with readings, lectures, demonstrations, class exercises, and dramatic presentations. A team project on one of the major topics is presented to the class as a videotaped performance. Preference given to Psychology and Drama majors. Prerequisite: Consent of instructors.

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

175. Applications of Social Psychology—The application of social psychological theory and research to a variety of issues and problems, including: 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, problems of conflict resolution and negotiation, applications of social psychology in legal, medical, educational, and business settings. Prerequisites: 1 and 60, or permission of instructor.

4 units, Win (Ross) TTh 1:30

176. The Person and the Situation—(See 276.)

177. Undergraduate Seminar: Social Psychology of Physical Deviance and Disability—(Same as Human Biology 177.) The issues faced by the disabled and the physically deviant. Focus is on interaction problems (short term and long term). Emphasis on the data needed to formulate policy changes. Enrollment limited by application process.

3 units, Aut (Hastorf) W 1:15-3:30

180. Undergraduate Seminar: Selected Topics in Psychology—(Refer to quarterly Time Schedule for seminar listings.)

180A. Undergraduate Seminar: New Directions in Innovative Problem Solving—New approaches involving high technology tools for creative thinking and innovative problem solving. Topics: knowledge as information versus knowledge as design; learning how to learn; thinking skills and styles; the cognitive and social psychology of creativity; heuristics for designing human-computer interfaces; software tools for generating, organizing, and communicating novel solutions; interactive learning and problem-solving via telecommunications. Prerequisite: 1.

2 units, Aut (Milojkovic) M 7-10 p.m.

180B. Knowing the Holocaust: Psychoanalytic and Literary Perspectives—(Same as English 265.) The psychosocial legacy of the Holocaust as illuminated by the immediate impact on victims and its long term consequences. Analysis of interviews and psychotherapeutic work with survivors and the writings of survivors such as Primo Levi, Eli Wiesel, Jean Amery, and Paul Celan integrate psychoanalytic formulations (e.g., Freud, Kohut, Winnicott) with the writings of humanists (e.g., Des Pres, Felstiner, Hallie, Langer). The resulting perspective helps understand other major traumatic experiences (e.g., Vietman, Hiroshima, rape).

4 units, Spr (Auerhahn) T 3:15-6

182. Senior Honors Seminar—Limited to students in the senior Honors program. Autumn Quarter: students participate in a weekly semi-
nar concerned with methods and approaches to psychological research and initiate an independent research project under the supervision of an appropriate faculty member. Winter and Spring Quarters: complete the research and writing the thesis. Students present their completed projects at a convention near the end of Spring Quarter.

4 units, Aut, Win, Spr (B. Tversky)
T 3:15-5:05

184A,B,C. Paraprofessional Internship Program—Primarily for students interested in counseling, clinical, educational, and community psychology through field experience. Variety of opportunities for working with emotionally and behaviorally disturbed children: with adolescents in high school peer-counseling programs or through Juvenile Probation; with adults at the V.A. Hospitals, mental health clinics, or centers for the elderly. On-site training and supervision provided. No previous experience required, but internships demand a generous commitment of time and energy (8-12 hours per week) for two consecutive quarters. Weekly seminar explores diversity of clinical opportunities and covers specific therapeutic techniques.

3-5 units, Aut, Win, Spr (Carlsmith)
T 1:15-3:05 and by arrangement

185A,B,C. Experience-based Study on the Meaning of Being Handicapped—A comprehensive look at a number of handicaps; the life experience of the individual affected and his or her family. Also, the roles of the doctor, the therapist, the special education teacher, the counselor, and other professionals involved in the life of the handicapped person. Weekly seminars; students also teach swimming and/or other skills to children and adults with different handicaps (mental, physical, emotional, learning, etc.) for at least 3 hours each week, keep an ongoing journal, and participate in a final group or individual action project.

3 units, Aut, Win, Spr (Carlsmith)
Th 7:30-9:30 p.m. and by arrangement

187. Computational Models of Cognition—Computational models of information processing covering relevant current research in Artificial Intelligence (AI) and Cognitive Psychology. Computer simulations test psychological theories. Applications of psychological research to building AI systems. Topics: knowledge representation, machine learning, natural language understanding, and parallel processing models. Students give presentations in class on weekly readings and submit, as a final paper, a proposal for a research project. Enrollment by permission of instructors and limited to 15. Prerequisites: Advanced undergraduate standing and either 106, Computer Science 223, or equivalent experience.

2-3 units (Pavel)
alternate years, given 1989-90

188. Reading and Special Work—Independent study. Offered for Pass/No Credit. Can be repeated for credit. Prerequisite: Consent of instructor.

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

189. Behavioral Endocrinology—(Same as Human Biology 189.) The behavioral and environmental influences on endocrine regulation, in particular, hormones which are related to responses to stress. The basic endocrinology and neuroendocrine regulation of stress-related hormones. Emphasis on the interaction on psychological variables and the activity of the pituitary-adrenal system. Also, the concepts of stress and coping from a theoretical perspective. Prerequisites: Human Biology Core, consent of the instructor.

3 units, Win (Levine) TTh 4:15-5:05
alternate years, not given 1989-90

190A. Early Experience—(Same as Human Biology 143.) Experimental literature related to the effects of pre- and postnatal environmental factors on development and adult function. Animal and human research and behavioral and physiological function. Prerequisite: Consent of instructor.

3 units (Levine)
alternate years, given 1989-90

191. Undergraduate Seminar: Behavior Change—An analysis of social cognitive approaches to personal and social change. Ethical and value issues in behavior change. Prerequisite: Consent of instructor.

3 units, Win (Bandura) M 2:15-4

192. Undergraduate Seminar: Aggression—Analysis of the causes and modification of individual and collective aggression. Major issues in aggression: the social labeling of injurious conduct, social determinants of aggression, effects of the mass media, institutionally sanctioned violence, terrorism, psychological mechanisms of moral disengagement, and legal sanctions and nuclear deterrence doctrines. Prerequisite: Consent of instructor.

3 units, Spr (Bandura) M 2:15-4

194. Undergraduate Seminar: Development of Children's Knowledge About the Mind—Prerequisite: Consent of instructor.

3 units, Spr (Flavell)
alternate years, given 1989-90

195. Undergraduate Seminar: Cognition and Control—Prerequisite: Consent of instructor.

3 units, Spr (Rosenhan) Th 2:15-4:45
196. Undergraduate Seminar: The Study of Lives—The theories and methods relevant to understanding life histories. The work of Erik Erikson and other psychobiographers. Longitudinal studies. Prerequisite: Consent of instructor.

3 units, Spr (Hastorf) W 1:15-3:30

197. Undergraduate Seminar: Selective Attention and Consciousness—Analysis of current theory and research of: pre-attentive processing, focal attention, parallel vs. sequential processing, bottle-neck models, zoom-lens models, unconscious perception, feature-integration models, neurobiological approaches, and more. Prerequisites: 1 and consent of instructor.

3 units, Win (Ganz) TTh 10-11:30

198. Undergraduate Topical Seminar on the Psychology of Women—(Same as Feminist Studies 186; graduate students register for 238.) In depth coverage of a specified topic related to psychology and women. See Time Schedule for topic.

3 units, Win (Carstensen) T 2:15-4:30

199. The Psychology of Mind Control—Analysis of psychological phenomena in which central aspects of individual functioning undergo dramatic reorganization: attitude and value change, religious conversion, "brainwashing", and sudden personality change. Focus is on techniques (hypnosis, "love-bombing, "sensory deprivation), agents of persuasion (charismatic leaders, supersalesmen, therapists, gurus), contexts (total environments, "normal appearances") and vulnerabilities of target populations. A practical goal is to design effective resistance strategies.

3-4 units (Zimbardo) not given 1988-89

PRIMARILY FOR GRADUATE STUDENTS

Undergraduate students may be admitted only by consent of instructor.

203A. Visual Sensing by Humans and Computers—(See 103A.)

203B. Visual Sensing by Humans and Computers—(See 103B.)

205. Cognition—A survey of topics in cognition: perception, attention, memory, representations, language, reasoning, judgment, skills, and problem solving. Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Aut (Staff) MW 10:30-12

206. Behavioral Neuroscience—The biological substrates of behavior emphasizing topics currently being investigated by resident and visiting neuroscientists at Stanford. Example topics: neuroanatomical and neurophysiological aspects of vision, audition, motor control and learning and memory, and hormonal and neurochemical aspects of stress and motivation.

3 units, Spr (Wandell, Wine) TTh 1:15-2:45 alternate years, not given 1989-90

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 (Clark) TTh 10:30-12

208. Cognitive Neuropsychology — Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Win (Pribram) MW 1:15-3:05

209. Perception—(See 109.)

210. Human Memory and Learning—A survey of major topics in human memory emphasizing information-processing approaches to short-term memory, the organization and long-term memory, forgetting, retrieval processes, prose memory, imagery, emotional memory, autobiographical memory, and skills. Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Win (Bower) TTh 2:30-3:45

211. Developmental Psychology—Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Win (Fernald, Flavell, Markman) TTh 3:45-5:15

212. Social Psychology—Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Aut (Lepper, Ross) TTh 1:15-3:05

213. Personality—A survey of: methodologies appropriate for personality research; relations among major theoretical perspectives; parental, peer, and genetic influences; mediating cognitive and emotional processes; and applications to clinical, community, and health psychology.

3-4 units, Spr (Weinberger) WF 1:15-3:05

214. Psycholinguistics—(Same as Linguistics 246.) Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Spr (H. Clark) MW 1:15-2:30

215. Mathematical Models of Psychological Processes—A survey of uses of mathematical models in psychology emphasizing measurement theory, perception, and learning. Prerequisite: Graduate standing in psychology or consent of instructor.

3 units, Spr (H. Clark) MW 1:15-2:30

216. Abnormal Psychology—Selected literature in abnormal psychology approached from a

3 units, Spr (Pennebaker) Th 10-12:30

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, Aut (Shepard) TTh 3:15-4:45

219. Graduate Seminar on Selected Topics in Cognition—(Undergraduates register for 165.) Prerequisite: Consent of instructor.

3 units, Spr (B. Tversky) Th 12:15-2:05 alternate years, not given 1989-90

220. Ion Transport—Ion channels, carriers, and ion pumps, and their regulation by intracellular messengers in a variety of cell types. Laboratory demonstrations, and brief hands-on introduction to some techniques (e.g., patch clamping).

3 units, Spr (Wine) by arrangement


4 units, Spr (Thoresen) MW 9-10:50

222. The Affective Disorders—(See 134.)

223. Seminar in Cross-Cultural Counseling—(Same as Education 233.) How the New World experience has affected the adaptive strategies, acculturation patterns, family structure, and support systems of Afro Americans, American Indians, Asian Americans, and Hispanic Americans. Intensive analysis of the theory and practice of cross-cultural counseling, the cultural appropriateness of present mental health service delivery approaches, alternatives to individual counseling interviews, and the process of culturally adapting counseling interventions. Major emphasis on cross-cultural competence with diverse ethnic minority groups. Mixed lecture-discussion format, with alternating Wednesdays from 1:15-3:05 set aside for simulations and discussions.

3 units, Spr (LaFromboise) M 1:15-3:05 alternate years, given 1989-90

224. Survey of Research Topics in Artificial Intelligence—(Same as Computer Science 520.) A survey of current research in AI. Topics vary each year. Current research topics: machine learning and discovery, speech or image or language understanding, automatic programming, formal reasoning, nonmonotonic logic, game playing, intelligent computer assisted instruction, knowledge representation and expert systems. Involves distinguished outside lecturers who are specialists in these research topics. Prerequisite: Computer Science 223 or equivalent.

1 unit, Spr (Staff) T 11-12:15

225. Psychology and Law Proseminar—(Same as Law 345.) Current Stanford research on psycholegal issues. Designed to acquaint faculty and students in the Psychology/Law program with each other's current research and with contemporary issues in the field. Prerequisite: Graduate standing in psychology or law, or consent of the instructor.

3 units, Aut (Rosenhan) Th 2:15-4:45 alternate years, not given 1989-90

226. Career and Personal Counseling in Culturally Diverse Settings—(Same as Education 134.) The design and implementation of career counseling interventions based on cross-cultural perceptions and definitions of career competence, career development theories, and appropriate counselor behavior. Case studies of bicultural role conflict in work settings are analyzed for their counseling implications.

3 units (Krumholz, La Fromboise) alternate years, given 1989-90
238. Topical Seminar on the Psychology of Women—(See 198.)

239. Advanced Cognitive Development—
Current theory and research in cognitive development. Topics: Piagetian and other theoretical approaches; developmental aspects of perception, attention, memory, comprehension, communication, and social cognition. Prerequisite: 211 or consent of instructor.
3 units (Flavell)
alternate years, given 1989-90

240. Language Acquisition I—(Same as Linguistics 240.) Survey of present knowledge of processes of language acquisition from a linguistic point of view, and recent and past literature.
4 units, Aut (E. Clark) MW 2:15-3:30

241. Language Acquisition II: Acquisition of Syntax—(Same as Linguistics 241.) Examines proposals about and evidence of syntactic rules.
4 units, Win (E. Clark) by arrangement

242. Conceptual Organization and Development—Theories and research in conceptual organization and development critically evaluated. Topics: the acquisition of categories and category terms informed by the general problem of induction, by philosophical and psychological analyses of the nature of human categories (natural kind terms, family resemblances), by recent arguments how the acquisition of category terms is guided by constraints children place on possible word meanings, and by more traditional theories of cognitive development.
3 units, Aut (Markman) by arrangement
alternate years, not given 1989-90

243. General Developmental Seminar — Prerequisite: Consent of the instructors.
1-2 units, Win (Fernald, Flavell, Markman) by arrangement

244. The Psychology of Aging—Critical examination of theory and research in gerontology. Normal and abnormal changes that occur in biological, cognitive, and psychological aging. Emphasis on environmental factors that influence the aging process. Prerequisite: Graduate standing in psychology or consent of instructor.
3 units (Carstensen) not given 1988-89

248. Introduction to Test Theory—(Same as Education 252.) Concepts of reliability and validity; derivation and use of test scales and norms; mathematical models and procedures for test validation, scoring, and interpretation. Prerequisite: Statistics 60 or Psychology 60 or equivalent.
3-4 units, Win (Haertel) MW 3:15-5:05

249. Problems in Measurement—(Same as Education 353.) Models, methods, and applications of factor analysis. Models for factor anal-

yis; estimation procedures; factor rotation; factor scores; using factor analysis in research; confirmatory factor analysis, methods for dichotomous variables. Prerequisites: 152 and 248, or Education 250B and 252, or equivalent.
3 units, Aut (Haertel) MW 3:15-4:30

250. Applications of Counseling Theories —
(Same as Education 234.) Techniques for helping individual clients learn successful procedures for coping with shyness, depression, anxiety, obesity, and aggression.
3 units, Aut (J. Krumboltz) M 3:15-5:05
and by arrangement
alternate years, not given 1989-90

252. Statistical Analysis of Data—(Same as Education 250A.) Analysis of variance and covariance; correlation and regression; analysis of categorical data. Proficiency with statistical computer packages.
4 units, Win (Rogosa) MWF 11-12:30

253. Statistical Theory, Models, and Methodology—Elementary probability theory and the theory underlying the more popular statistical techniques. Applications of these ideas and methods in psychology and the social sciences. Topics: 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.
3 units, Spr (Thomas) MWF 9

254. Principles of Personality Change —
Analysis of the determinants and mechanisms of human motivation and psychological disfunctions. Social cognitive approaches to personal and social change. Prerequisite: Graduate standing.
3 units, Aut (Bandura) M 2:15-4

255. Graduate Seminar: Selected Topics in Personality and Abnormal Psychology—Prerequisite: Consent of instructor.
3 units, Aut (Horowitz) by arrangement

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
258. Graduate Seminar: Problems of Construal in Social Perception and Conflict Resolution—For students who are already or planning to become involved in research on social construal and the role that it plays in a wide variety of phenomena, most notably the origin and escalation of conflict.

3 units, Win (Ross) by arrangement


3 units, Spr (Rumelhart) W 10-1

261. Psychology of Problem Solving and Reasoning—(Same as Education 295X.) Introduction to results and methods of research on cognitive processes of solving problems and reasoning. Focus is on accomplishments and limitations of research conducted since 1970.

3 units, Spr (Greeno) MW 3:15-4:40

264. Selected Topics in Human Learning—Recent empirical and theoretical analyses of verbal learning, learning from text, learning of concepts, and intellectual skills. Emphasis on information processing theories of memory and retrieval. Readings from recent research journals with topics determined partly by students interests. Discussion format. Prerequisites: 210 or consent of instructor.

3 units, Spr (Bower) Th 3:15-5

265. Parallel Distributed Processing: Explorations in the Microstructure of Cognition—Advanced graduate seminar on the emergence of intelligence from the interaction of a large number of neuron-like elements. Focuses on current work in the application of brain-style computational models to psychological phenomena and to applications in artificial intelligence.

3 units, Aut (Rumelhart) W 12-3

267. Perceptual Research that Combines Psychophysics and Cognition—An analysis of perception that combines the approaches of psychophysics and cognitive psychology. Pursues a few specific topics in depth. Likely topics: attention, the constancies, and perceptual representation.

3 units, Win (Palmer) W 9-12

269. Graduate Seminar in Personality Research—Can be repeated for credit. Prerequisite: Graduate standing in psychology.

1-2 units, Aut, Win, Spr (Nolen-Hoeksema, Weinberger) T 12-1:30

272. Special Topics in Psycholinguistics—May be repeated for credit. Prerequisite: Consent of instructor.

3 units, Win (H. Clark) by arrangement

274. Selected Topics in Judgment and Choice—Seminar addresses some central issues in the analysis of decision and judgment: the determinants of confidence, the assessment of well-being, the basis of wishful thinking and the resolution of intrapersonal conflict. Prerequisite: Graduate standing in psychology or permission of instructor.

1-3 units, Aut (Toersky) M 4-5:30

275. Graduate Research—Research of intermediate nature; undertaken with members of departmental faculty. Prerequisite: Consent of instructor.

(Staff) by arrangement

276. The Person and the Situation—(Undergraduates register for 176.) Seminar explores the situationist tradition in social psychology and relates it to the search for consistent, stable individual differences in the field of personality and to the applied problem of changing beliefs, behavior, and social institutions. Prerequisite: At least 1 prior course in social psychology or personality, or consent of instructor.

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

278. Graduate Seminar: Internal Representation—Can be repeated for credit. Prerequisite: Consent of instructor.

1-3 units, Win (Shepard) W 1:15-3:15

280. Doctoral Research—For dissertation. Prerequisite: Consent of instructor.

(Staff) by arrangement

282. Research Seminar on the Representation of Similarity Relations—Reviews and contrasts various conceptions of similarity; notably the dimensional geometric model and the feature-matching model. Implications to psychological theory and to the representation of proximity data.

1-3 units (A. Toersky)

283. Interdisciplinary Workshop in Decision, Conflict and Risk—(Same as Business 694, Economics 396, Law 325, Operations Research 366.) Addresses problems of decision making, risk analysis, conflict resolution and negotiation from normative and descriptive perspectives.

1-2 units, Win, sometimes Spr (Arrow, Mnookin, Ross, A. Toersky, Wilson) T 4-5:30

286. Applying Cognitive Psychology to Computer Systems—Issues in applying psychology to various domains emphasizing computer-user interaction, and on using models of human abilities and limitations in solving real problems. Methodology: model building and testing. The computer related topics: the model-based approach to design computer-user interfaces, software psychology, and knowledge representation. Prerequisite: Consent of the instructor.

1-3 units Win (Pavel) by arrangement alternate years, not given 1989-90
289. Advanced Seminar in Perception, Cognition, and Human Performance—Research-oriented in-depth analyses of selected current topics on problems related to computer systems, artificial intelligence, and human information processing. Special topics to be announced in Time Schedule. Prerequisite: Consent of the instructor.

1-3 units, Spr (Pavel) by arrangement

308. Research Seminar in Neuropsychology—Can be repeated for credit. Prerequisite: Consent of instructor.

1-3 units, Aut, Win, Spr (Pribram) F 1:15-3:05

351. Issues in Child Custody — (Same as Law 244.) How information from psychology and other behavioral sciences can be utilized in the development of legal policies affecting children, primarily child custody decisions. Applies existing knowledge about child development to the resolution of policy issues in each of these areas and designs research projects that provide new data relevant to policy makers. Seminar limited to 20 graduate and Law students. Admission by consent of instructors.

3 units, Aut (Wald) W 4-6

355. Jury Decision-Making—Seminar examining the psychological processes regulating jury decision-making. The cognitive aspects of a presentation (the amount of information that can be retained and processed), story, and construal processes. The social psychological aspects of group decision making. Preparation for trial, including trial simulations, voir dire, and juror selection. Limited to Law and graduate students who have permission of instructor.

3 units, Aut (Rosenhan) T 3:20-5:20

**PUBLIC POLICY PROGRAM**

Director: Roger Noll
Associate Director: John Ferejohn
Affiliated Faculty: Wolfgang Bielefeld (Public Policy), David Brady (Political Science), Timothy Bresnahan (Economics), Marcus Feldman (Biology), Victor Fuchs (Economics), Carl Gotsch (Food Research), Michael Kirst (Education), Robert McGinn (Values, Technology, Science, and Society), Catherine Milton (Public Policy), Terry Moe (Political Science), Lincoln Moses (Statistics), Leonard Ortolano (Civil Engineering), A. Mitchell Polinsky (Law), David Rogosa (Education), Nathan Rosenberg (Economics), W. Richard Scott (Sociology), Bernard Siegel (Anthropology), Timothy Stanton (Public Policy), James Sweeney (Engineering Economic Systems), Nancy Tuma (Sociology)

Government plays an important, ubiquitous role in contemporary society. Moreover, the growing complexity of public policies, the political processes that give rise to them, and the organizations that implement them have created a need in government, business, and the nonprofit sector for people who understand how government operates. The Public Policy Program gives students the foundational skills and institutional knowledge for understanding the policy process. It provides an interdisciplinary course of study in the design, management, and evaluation of public sector programs and institutions. The major in Public Policy is useful as preparation for employment after graduation as an analyst in government agencies or business, as a foundation for postgraduate professional schools in business, law, and public policy, and as preparation for graduate study in the social sciences, especially economics, political science, and sociology.

**UNDERGRADUATE PROGRAM**  
**BACHELOR OF ARTS**

The core courses in the Public Policy Program develop the skills that are necessary for understanding the political constraints faced by policy makers, assessing the performance of alternative approaches to policy implementation, evaluating the effectiveness of policies, and appreciating the sharp conflicts in fundamental human values that often animate the policy debate. After completing the core, students apply these skills by focusing their studies in one of several areas of concentration. The areas of concentration may deal with a specific field of public policy, with types of public institutions, or with deeper development of the tools of policy analysis. The fields of concentration are:

1. Resources and Environment
2. Health Care
3. Population
4. Education
5. Social Policy: Poverty, Discrimination, Crime
6. Science and Technology Policy
7. International Relations and Trade
8. Developing Areas
9. The Law and Legal Systems
10. Government Regulation of Business
11. Urban and Regional Policy
12. Advanced Methods of Policy Analysis
13. Design of Public Institutions

Completion of the program in Public Policy requires 78 units of coursework:

1. 35 units of prerequisite courses: Political Science 10; Statistics 60 and 61; Economics...
1. 51 or 51Q, and 52; and Sociology 160 or Industrial Engineering 100. In addition, students are encouraged to take at least one year of coursework in calculus and linear algebra.

2. The 25-unit sequence of 5-unit core courses, which students should plan to complete by the end of their junior year (see below for descriptions).

3. During the senior year, majors must complete 15 units of coursework in a problem-focused area. The 15 units of post-core coursework must be approved by an advisor, who will be appointed when the student selects an area of concentration. This usually is done midway through the junior year, and must be done no later than the beginning of the Autumn Quarter in the senior year.

4. Seniors are also required to participate in the Senior Seminar (Public Policy 200) or write an Honors thesis (Public Policy 199). Internships and coursework related to internships are also available. A maximum of 10 units may be taken on a Pass/No Credit basis in fulfillment of the major requirements.

5. To be nominated for A.B. degrees, students must complete an application available at Building 60, room 61D. For additional information drop by or phone (415) 723-4551.

COURSES

101. Politics and Public Policy—(Same as Political Science 101P.) The domestic policy-making process, emphasizing how elected officials, bureaucrats, and interest groups shape governmental policies in various areas including tax policy, environmental policy, and social-welfare policy, given their goals and available tactics. How public policies are formulated and implemented. The results of this process using equity and efficiency criteria. Prerequisite: Political Science 10.

5 units, Spr (Brady)

102. Organizations and Public Policy—(Same as Sociology 166.) The concepts and methods for analyzing the influence of organizations on the setting and implementation of public policy. The varying conceptions of organizations, as corporate actors and as social contexts. The several roles of organizations in relation to public policy, including organizations as decision makers and problem solvers, as change agents, and as clients. Prerequisite: Industrial Engineering 100 or Sociology 160.

5 units, Win (Scott)

103. Philosophical and Ethical Issues in Public Policy—(Enroll in VTSS 11, Philosophy 30.) VTSS 110 is oriented towards ethical issues in public policy, and focuses primarily on science and technology policy. Beyond sensitization to underlying philosophical issues, VTSS 110 develops the capacity for critical analysis of complex, value-laden policy disputes. Topics: the nature of ethics and morality; the natures of and rationales for liberty, justice, and human rights; and the analysis of case studies illustrating the use (and abuse) of these concepts in recent and current policy disputes. Philosophy 30, Spring Quarter, examines the relationship between the individual and the state. Topics: social and economic justice, political freedom, individual rights, political obligation, and civil disobedience.

5 units, Win (McGinn)

Spr (Satz)

plus two-hour section by arrangement

104. Economics and Public Policy—(Same as Economics 150.) The reasons for, the varieties of, and the consequences of government policies in economic affairs. The means of policy formulation and the means and effects of policies by focusing on specific case materials in market regulation policies (antitrust and commission regulation), tax and income redistribution policies, and macroeconomic stabilization policies. Prerequisites: Economics 1, 51, and 52.

5 units, Win (Noll)

105. Quantitative Methods and Their Application to Public Policy—(Same as Statistics 209.) Applications of statistical methods, rather than methodology per se. 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 or equivalent, and Statistics 61.

5 units, Spr (Moses)

190. Washington D.C.: Issues and Players—For undergraduates who will be interning in a government agency the Summer Quarter following the course. Emphasis on internships in the federal government in Washington, D.C. to provide a background on how public policy decisions are made in Washington, and to help the students develop skills that assist them to become effective interns.

2 units, Win (Milton)

181. Policy Making for California State Government—An overview of the major institutions, actors, and policymaking processes for California state government. For students who plan to work in Sacramento. Focus is on the recent history and current status of legislative policymaking, electoral campaigns, and coali-
tion building between the executive and legislative branches.

1 unit, Spr (Kirst)

182. Preparation for Internship Learning: Policy Making at the Local and Regional Level—Provides students with knowledge and skills necessary for effective learning through internships in organizations engaged in public policy formulation, analysis, or implementation in the San Francisco Bay Area. Focus is on: understanding the structure and interrelationships of public sector institutions and programs; instruction and practice in data gathering skills necessary for effective internship-based learning; opportunity to interact with and learn from local policymakers and community leaders. Students may obtain assistance in obtaining internships through the Public Service Center, Owen House. Prerequisite: Permission of instructor.

4 units, Win (Stanton)

198. Directed Readings in Public Policy.
1-5 units (Staff) by arrangement

1-5 units (Staff) by arrangement

200A,B,C. Senior Seminar—Designed to give Public Policy students the opportunity to make oral presentations and to write a seminar-length paper on a topic in public policy. Topic and the methods of analysis used in the paper are determined by the student in consultation with the instructor. Also a limited number of lectures and seminars in which the question of how to conduct "good" research in public policy is discussed. Prerequisite: Completion of the core courses in Public Policy or permission of the instructor.

200A. 1 unit, Aut (Bielefeld)
200B. 1 unit, Win (Bielefeld)
200C. 1 unit, Spr (Bielefeld)

Acting Assistant Professors: Anne C. Klein, Alan Sponberg
Visiting Associate Professors: Marcia Falk, Daniel C. Matt
Visiting Assistant Professor: Mark S. Cladis

The purpose of Religious Studies is to understand and interpret the history, literature, thought, and social structures of various religious traditions and cultures. The department offers courses at several levels. See "Courses" below.

UNDERGRADUATE PROGRAMS

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 9 to 15 units in introductory courses (1-89), at least two of which must be in diverse religious traditions (e.g., Eastern and Western, pre-literate and literate); at least 40 units in courses numbered above 100, including no fewer than three seminars.

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 director.

MAJOR IN RELIGIOUS STUDIES AND PHILOSOPHY

The Departments of Religious Studies and Philosophy jointly nominate for the A.B. students who have completed a major in the two disciplines. Please see a description of this joint major under the "Philosophy" section in this bulletin, or in the guidelines, which are available from the undergraduate director of either department.

GRADUATE PROGRAMS

MASTER OF ARTS

University regulations pertaining to the Master of Arts are listed in the "Degrees" section in this bulletin. The following requirements are in addition to the University’s basic requirements for the A.M. Complete informa-
Each student completes at least 48 units of graduate work at Stanford beyond the Bachelor of Arts degree, including the two required graduate seminars (302 and 304). Residence may be completed by four quarters of full-time work or the equivalent, but must go through Winter Quarter of the second year.

The student's plan of courses is subject to approval by the graduate director. No field of specialization is expected, but students may focus their work in particular areas. Advanced and graduate courses in other departments may be taken. No thesis is required; a thesis, if elected, may count for as many as 9 units.

Each student demonstrates reading knowledge of at least one foreign language before enrolling for the second required graduate seminar.

DOCTOR OF PHILOSOPHY

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 the equivalent, in graduate work beyond the Bachelor of Arts degree, and a minimum of 90 units of graduate work in addition to the dissertation, of which the last 60 units must be taken at Stanford.

Field of Study — The Ph.D. signifies special knowledge of a field of study and potential mastery of an area of specialization within it. The faculty of the department has established certain fields of study in which its strengths and those of other departments in the University cohere. They are: East Asian religions, Judaic Studies, Western religions, and modern Western religious thought. Students who wish to specialize in other fields must obtain early approval by the faculty.

Stages of Advancement — There are four stages through which the student advances to the degree: (1) in the first year the student acquires a general knowledge of the chosen field of study; (2) in the second year the student deepens and refines acquaintance with the field of study in preparation for the candidacy decision; (3) after attaining candidacy, the student concentrates on a more specialized area within the chosen field in preparation for the qualifying examination; (4) the student writes a dissertation and defends it in the University oral examination.

Languages — Each student demonstrates a reading knowledge of two foreign languages, including French or German, before beginning the second full year of graduate work. Each student demonstrates reading knowledge of other ancient or modern languages necessary for the field of study. Area of specialization and dissertation topics may require knowledge of additional languages.

Courses — Each student satisfactorily completes the two graduate seminars (302 and 304) before the candidacy decision. Other courses are taken with the approval of a faculty advisor in consideration of the student's field of study.

Candidacy — At the end of each academic year, the departmental faculty identifies those second-year students whom it recommends for candidacy on the basis of all relevant information, but especially on the student's candidacy dossier, which includes the approved declaration of an area of specialization; faculty course evaluations; and one prescribed essay.

Teaching Internships — At least two teaching internships under the supervision of faculty members are undertaken at a time negotiated with the graduate director. Students receive academic credit for the required internships, which are projects of academic training and not of employment.

Qualifying Examination — In order to qualify for writing a dissertation, the student must successfully pass a comprehensive examination in the student's chosen field and area of specialization.

Dissertation — 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. The University oral examination is a defense of the completed dissertation.

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 "Humanities Special Programs" section in this bulletin.

COURSES

The department offers courses at several levels.
1-89 Introductory (4 or 5 units)
101-189 Topics in Religion (5 units)
197-199 Undergraduate Directed Reading (variable units)
201-289 Seminars for Undergraduates and Graduates (5 undergraduate units or 4 graduate units)
299 Graduate Directed Reading (variable units)
301-399 Graduate Seminars, Research, and Teaching (variable units)

INTRODUCTORY

1C. Comparative Religious Thought.
   4 units (Staff) not given 1988-89

1D. Religions of the East—(Formerly 12.) (DR:3*)
   4 units (Bielefeldt) not given 1988-89

1E. Eastern and Western Conceptions of the Self—(Formerly 40A.)
   4 units (Yearley) not given 1988-89

14. Introduction to Buddhism—Key elements of Buddhist thought, such as meditation and related philosophical perspectives, theories of mind and personality, compassion, and the meaning of death. Limited enrollment. (DR:3)
   4 units, Win (Klein) MWF 1:15
   Spr (Sponberg) MWF 11 plus section by arrangement

18. Zen Buddhism—History, teachings, and practices of Ch' an and Zen Buddhism. Limited enrollment. (DR:3*)
   4 units, Spr (Bielefeldt) MWF 1:15 plus section by arrangement

   4 units, Win (Faure) MW 10

23. Judaism—Historical development of Jewish religious thought and practice, from the Biblical period to the present. Various kinds of texts reflecting that development: scriptural, liturgical, midrashic, legal, historical, and philosophical. (DR:3)
   4 units, Aut (Eisen) MW 11-12:15

24A. Christianity—(DR:3)
   4 units (Gelber) not given 1988-89

27. Islam—(DR:5*)
   4 units (Berman) not given 1988-89

42. Philosophy of Religion—(DR:3)
   4 or 5 units (Gelber) not given 1988-89

52F. Readings in Philosophy and Religious Studies —(Same as German 52F.)
   3-4 units, Spr (Staff) MW 12

55. Introduction to Chinese Thought—(Same as Asian Languages 46, Philosophy 46.) Religious and philosophical thought of early China, especially the “Classical” period, 550-200 B.C. Development of Chinese thought as an extended dialogue among thinkers who provided uncommon and often contradictory answers to a common set of problems. Limited enrollment. (DR:3*)
   4 units, Aut (Ivanhoe) MWF 10
   plus section by arrangement

63. Religion and Contemporary Society—The contribution of religious thinkers and institutions to debate on pressing social issues such as racism, feminism, and economic justice.
   4 units, Aut (Cladis) MW 9

65. Introduction to Christian Ethics—Christian ethics and modern moral issues. Themes in major ethical thinkers. Love, law, sin, freedom, and salvation as understood by Augustine, Aquinas, Luther, Kierkegaard, and Barth. (DR:3)
   5 units, Win (Jackson) MWF 1:15
   plus section by arrangement

TOPICS IN RELIGION

115. Lotus Sutra in East Asian Buddhism—The teachings of the sutra and their interpretation in China and Japan. Limited enrollment.
   5 units, Win (Bielefeldt) MW 10

116. Japanese Buddhism—(DR:3*)
   5 units (Bielefeldt) not given 1988-89

117. Syncretism and Sectarianism in Chinese Buddhism—Focus is on the dialectical relationships between sectarian and syncretic tendencies, conservative and subversive elements, and orthodoxy and heterodoxy in development of Chinese Buddhism. Prerequisite: Consent of instructor.
   5 units, Aut (Faure) MW 11

119. Hindu and Buddhist Meditation.
   5 units (Staff) not given 1988-89

121. The Hebrew Bible—The Hebrew Bible, studied as literature, i.e., as narrative, poetry, essay, oracle, and other forms emphasizing the ways in which the Biblical materials present themselves. (DR:2)
   5 units, Spr (Falk) T 2-5

122. Mystics and Intellectuals in the Middle Ages.
   4 units (Berman) not given 1988-89

   5 units, Spr (Bielefeldt) MW 10

126. Age of the Reformation—(Same as History 110.) (DR:3)
   5 units, Win (Spitz) MTWTh 11
131. Founders in Myth and History.
   4 units (Berman) not given 1988-89

   5 units, Win (Matt) TTh 11-12:15

140. Religious Ethics.
   5 units (Staff) not given 1988-89

141. Renaissance Humanists and Reformers—(Same as History 213.)
   5 units, Aut (Spitz) T 2:15-4:05

142 Early Christianity—(Same as Classics 104.) Literature and art of the Christian movement to 500 B.C., emphasizing community organization and rituals, debates about orthodox and heretical doctrine, and interactions with other religions.
   5 units, Aut (Gregg) MWF 10

145. Protestantism—The development of Protestantism from the Reformation to the present.
   5 units, Win (Harvey) MWF 9

147. Modern Christian Thought.
   5 units (Harvey) not given 1988-89

148. Social Theory and Religion—(Same as Sociology 146.)
   5 units (Eisen) not given 1988-89

149. Theories of Religion—Attempts to explain the origin and persistence of religious behavior and belief in the modern period. Philosophical, sociological, historical, and psychological theories, "classic" and contemporary.
   5 units, Spr (Eisen) MW 8:30-9:50

150. Systems of Buddhist Thought.
   5 units (Bielefeldt) not given 1988-89

153. Jews and Judaism in America—(Same as Sociology 151.) A particular Jewish community and the religious forms it has evolved, using historical, literary, sociological, and theological materials.
   4 units, Spr (Eisen) TTh 11-12:15

158A. Buddhism and the Feminine.
   5 units (Klein) not given 1988-89

161. Modern Jewish Thought.
   5 units (Eisen) not given 1988-89

161A. Jewish Intellectual History: Modern—(Same as History 106B. See 161B.)
   5 units (Funkenstein) not given 1988-89

161B. Jewish Intellectual History: Medieval—(Same as History 106A.)
   5 units (Funkenstein) not given 1988-89

162. Ethics: "Abominations," and "Liberations".
   5 units (Jackson) not given 1988-89

164. Morality of Peace and War—(Same as Philosophy 174.) Moral, political, and religious issues surrounding conflict and conflict-resolution, especially in a nuclear age. General nature of peace and war, their theory and practice, just war tradition, and pacifism. (DR:3)
   5 units, Aut (Jackson) MWF 1:15
   plus section by arrangement

165. Religious Ritual.
   5 units (Eisen) not given 1988-89

167. Medieval and Renaissance Religious Philosophy—(Same as Philosophy 101.)
   4 units (Gelber) not given 1988-89

171. Augustine.
   5 units (Staff) not given 1988-89

174. From Kant to Kierkegaard—(Same as German 174.)
   5 units (Harvey) not given 1988-89

183. The Emergence of Modern Liberal and Communitarian Thought—The historical origins of two prominent schools of contemporary social thought, and current attempts at synthesis. Readings from Hobbes, Locke, Rousseau, Kant, and contemporary thinkers.
   5 units, Spr (Cladis) MWF 11

185. Hermeneutics—(Same as Philosophy 135/235.)
   5 units (Harvey) not given 1988-89

UNDERGRADUATE DIRECTED READING

197. Senior Essay—Prerequisite: Consent of instructor and of the department.
   Aut, Win, Spr (Staff) by arrangement

198. Honors Essay—Prerequisite: Consent of instructor and of the department.
   Aut, Win, Spr (Staff) by arrangement

199. Individual Work—Prerequisite: Consent of instructor and of the department.
   Aut, Win, Spr (Staff) by arrangement

UNDERGRADUATE AND GRADUATE SEMINARS

212. Interpreting Confucian Texts—(Same as Asian Languages 230.) Philosophically interesting passages from a variety of early Confucian texts and how they have been interpreted by
Asian and Western interpreters. Prerequisite: Consent of instructor.
5 units, Win (Ivanhoe) TTh 4:15-6:05

5 units (Staff) not given 1988-89

216. Buddhist Abhidharma: The Psychology of Liberation—The Abhidharma tradition within Buddhism, in light of Western models of psychology and psychoanalytic therapy.
5 units, Win (Sponberg) TTh 2:15-4:05

221. Ch'an/Zen Tradition and Popular Religion—Relationships between Ch'an and Zen tradition(s) and Chinese or Japanese local cults. Forms of symbolic mediation (ritual, meditative techniques, etc.) in both religious traditions, the "unmediated vision" advocated by the "sudden" school of Ch'an. Prerequisite: Consent of instructor.
5 units, Spr (Faure) MW 2:15-4:05

222. Forms of Interpretation.
5 units (Berman) not given 1988-89

225. Jewish History—(Same as History 215S.) Selected texts from different periods, and methods for their interpretation. The text is chosen from another period for 226.
5 units, Win (Funkenstein) T 2:15-4:05

226. Jewish History—(Same as History 216S.)
5 units, Spr (Funkenstein) M 2:15-4:05

229. Religions of Abraham.
5 units (Berman) not given 1988-89

230A. Topics in Ch'an and Zen.
5 units (Bielfeldt) not given 1988-89

5 units, Win (Matt) Th 2:15-4:05

234B. The Virgin Mary and Images of Power.
5 units (Gelber) not given 1988-89

235. Tibetan Wisdom Texts.
5 units (Klein) not given 1988-89

236. Buddhist Meditation Texts: Gender and Models of Personal Change—Texts and topics from the Indo-Tibetan tradition, their intellectual contexts and associated traditions. Analysis in light of current scholarship on gender. Prerequisite: Consent of instructor.
4 units, Spr (Klein) MW 4:15-6:05

236A. Buddhism and the Play of Wisdom.
5 units (Klein) not given 1988-89

237. Halevi and Maimonides.
5 units (Berman) not given 1988-89

241. Asceticism in Pagan and Christian Antiquity—(Same as Classics 184.) Battles of flesh and spirit, as seen in philosophical and medical writings, Roman educational disciplines, and emergent theories and practices of early Christian monasticism.
5 units, Spr (Gregg) TTh 11-12:15

241A. Luther and the Radicals—(Same as History 213A.)
5 units (Spitz) not given 1988-89

245. Comparative Religious Ethics.
5 units (Yearley) not given 1988-89

257. Buddhist Theories of Knowledge.
5 units (Klein) not given 1988-89

5 units (Bielfeldt) not given 1988-89

260. Contemporary Jewish Thinkers—Close reading of Jewish religious thought of the past 10 years in Israel, America, and Europe. Prerequisite: Consent of instructor.
5 units, Aut (Eisen) TTh 2:15-4:05

263. The Book of Job.
5 units (Good) not given 1988-89

266. Medical and Legal Ethics—Ethical problems and assumptions of medicine and law. "Principles and cases" approach to interrelated concerns of the two professions. Topics: euthanasia, informed consent, quality of life vs. medical indications policies, mens rea, confidentiality, and justice within an adversarial system. Prerequisite: Consent of instructor.
5 units, Aut (Jackson) TTh 4:15-6:05

268. Francis of Assisi.
5 units (Gelber) not given 1988-89

273. Aquinas' Ethics—Thomas Aquinas' analysis of virtues emphasizing his general theory of ethics. Prerequisite: Consent of instructor.
5 units, Aut (Yearley) MW 4:15-6:05

274A. Sigmund Freud.
5 units (Yearley) not given 1988-89

274D. Friedrich Nietzsche.
5 units (Harvey) not given 1988-89

275. Varieties of Justice—(Same as Philosophy 275.) Theological, philosophical, political, and economic views of justice, addressing such issues as charity, liberty, rights, duties, equality, and wealth. Relation of systems of political economy to the just society.
5 units, Win (Jackson) TTh 4:15-6:05
277. Religious Existentialists.
5 units (Harvey) not given 1988-89

281. Encounters Between Modern Philosophy and Judaism.
5 units (Eisen) not given 1988-89

284. From Heidegger to Deconstruction.
4 units (Girard) not given 1988-89

284A. From Existentialism to Structuralism and Post-Structuralism—(Same as French 272.) Readings from Heidegger, Sartre, Levi-Strauss, Michel Foucault. Attempts to define a historical continuity behind the apparent discontinuities of post-War French theory. In English.
4 units, Win (Girard)

4 units, Aut (Girard) M 11-12:50

286. Character and the Good Life—Applicability of traditional notions of virtue in China and the West to late 20th-century America. Limited enrollment.
5 units, Win (Yearley) TTh 2:15-4:05

288. Life in Light of Death.
5 units (Sponberg) not given 1988-89

GRADUATE DIRECTED READING

299. Individual Work—Prerequisite: Consent of instructor.
Aut, Win, Spr (Staff) by arrangement

GRADUATE SEMINARS

302A. Problems in the Interpretation of Religion—Required of all graduate students in Religious Studies. Inquiry into historical and conceptual methods in the study of religion; may be repeated for credit. Prerequisite: Consent of instructor.
4 units upon completion of 302B, Aut (Harvey) MW 2:15-4:05

302B. Problems in the Interpretation of Religion—(See 302A.) Prerequisites: Consent of instructor; completion of 302A.
4 units, Win (Harvey) MW 2:15-4:05

304A. Theories and Methods in the Study of Religion—(See 304A.) Prerequisites: Consent of instructor, completion of 304A.
4 units, Win (Staff) given 1989-90

GRADUATE RESEARCH AND TEACHING

304B. Theories and Methods in the Study of Religion—(See 304A.) Prerequisites: Consent of instructor, completion of 304A.
4 units, Win (Staff) given 1989-90

Topics of directed research (numbers ending in 9) vary each year according to student initiatives and faculty research interests.

311. Buddhist Studies Seminar—Topic for 1988-89. Soteriology. May be repeated for credit. Prerequisite: Consent of instructor.
4 units, Aut (Bielefeldt) by arrangement

315. Ch'an Studies: Methodological Issues—Relevance of recent developments in “theory” (hermeneutics, structuralism, post-structuralism, critical theory) for the study of the Ch'an and Zen traditions. Readings from Foucault, Derrida, Ricoeur, Bourdieu, and Ch'an/Zen classics. Prerequisite: Consent of instructor.
4 units, Spr (Faure) TTh 4:15-6:05

319. East Asian Religions.
(Bielefeldt, Faure, Klein, Sponberg, Yearley) by arrangement

(Berman, Good, Gregg) by arrangement

339. Medieval Western Religions.
(Berman, Gelber, Yearley) by arrangement

343. Humanism and the Reformation—(Same as History 319.)
4 units, Aut (Spitz) W 2:15-4:05

349. Modern European Religions.
(Eisen, Harvey, Yearley) by arrangement

359. American Religions.
(Eisen, Harvey) by arrangement

369. Social Aspects of Religion—Prerequisite: Consent of instructor.
(Staff) by arrangement

371. Selected Problems in Philosophy of Religion.
5 units (Gelber) not given 1988-89

378. Analytic Philosophy of Religion.
4 units (Jackson) not given 1988-89

379. Religious Thought—Prerequisite: Consent of instructor.
(Staff) by arrangement

389. Theory of Religion—Prerequisite: Consent of instructor.
(Staff) by arrangement

390. Teaching in Religious Studies—Required supervised internship.
4 units, Aut, Win, Spr (Staff) by arrangement
392. Candidacy Essay—Prerequisite: Consent of graduate director.

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

2-9 units (Staff) by arrangement

CENTER FOR RUSSIAN AND EAST EUROPEAN STUDIES

Committee in Charge: The Steering Committee on Russian and East European Studies.

Chairman: Alexander Dallin (History and Political Science)
Assistant Director: Barbara Voytek (Anthropology)

Professors: Edward J. Brown, Emeritus (Slavic); Alexander Dallin (History and Political Science); Terence L. Emmons (History); Martin Esslin, Emeritus (Drama); Lazar Fleshman (Slavic); Joseph N. Frank (Comparative Literature and Slavic Languages); Alexander L. George (Political Science); John Gurley, Emeritus (Economics); David J. Holloway (Political Science); Alex Inkeles (Sociology and Hoover Institution); Mark Mancall (History); Norman Naimark (History), Henry Rowen (Business), Richard Schupbach (Slavic Languages); Jan F. Triska (Political Science); Joseph Van Campen (Slavic Languages); Wayne S. Vucinich, Emeritus (History)

Associate Professors: Karol Berger (Music), William S. Eddelman (Drama), Gregory Freidin (Slavic), Sabine MacCormack (History), Condoleezza Rice (Political Science)

Assistant Professors: Nina P. Halpern (Political Science), Nancy S. Kollmann (History), John M. Litwack (Economics), Szonja Szelenyi (Sociology), Andrew Wachtel (Slavic Languages)

Affiliated Professors: Donald L. Carpenter (Stanford Electronics Laboratory), Sidney Drell (SLAC), John W. Lewis (Political Science)

Lecturers: G. Robert Hamrdla (German), Barbara Voytek (Anthropology), Wojciech Zalewski (Slavic and Stanford Libraries)

Visiting Professors: Marietta Chudakova (Slavic Languages), Gary Morson (Slavic Languages)

Visiting Associate Professors: Detleff Brandes (History), Mary Gluck (History and Humanities Center), Daniel T. Orlovsky (History)

Visiting Lecturers: Bojka Djukanovic (Slavic Languages), Wladyslaw Miodunka (Linguistics), Jacek Wasilewski (Political Science)

Instructor: Vera M. Henzl (Linguistics)

Affiliated Staff: Dorothy Atkinson (AAASS), Robert Conquest (Hoover Institution), John B. Dunlop (Hoover Institution), Joseph D. Dwyer (Hoover Institution)

The Center for Russian and East European Studies coordinates the University's teaching, research, and extracurricular activities related to the Soviet Union and Eastern Europe, and administers a co-terminal A.B./A.M. and an A.M. program in Russian and East European Studies.

PROGRAMS OF STUDY

The degree program in Russian and East European Studies is directed by a committee of faculty members who are affiliated with the center. The program is offered primarily 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 acquire a competence in Russian and East European Studies in preparation for careers in government, journalism, business, law, or teaching at other than the college or university level.

Each A.M. candidate is assigned an academic advisor who monitors his/her program of courses and course performance.

The basic prerequisite for admission to the program is completion of at least three years' study of the Russian language (or the equivalent). A minimum of four years of the language (Advanced Russian) or the equivalent is to be completed before the awarding of the A.M. degree. With the permission of the master's committee, an East European language may be substituted for Russian (at a similar level) where appropriate for the student's program and objectives.

CO-TERMINAL A.M./A.M.

To qualify for a co-terminal A.M. degree in Russian and East European Studies, a student must, besides completing University requirements for the A.B. degree:

1. Submit a co-terminal application for admission to the program no earlier than the beginning of the eighth quarter, and no later than the end of the 11th quarter of undergraduate study. Students with advanced placement and transfer credit must apply at least four quarters before the expected
master's degree conferral date. Applications may be obtained from the Graduate Programs office.

2. Include in the application a program which outlines, by quarter, the schedule of courses the student plans to complete toward the A.M. degree. The student should seek the advice of his/her proposed advisor in Russian and East European Studies in drafting this schedule. The application also includes: (a) a current Stanford transcript; (b) a one-page statement of purpose; and (c) two letters of recommendation from Stanford professors. Applicants must have at least an average letter grade indicator of "B" (3.0).

3. Complete 15 full-time quarters or the equivalent, or three quarters in full-time residence after completing 180 units; and complete, in addition to the 180 units required for the bachelor's degree, a minimum of 40 units for the master's degree.

The same courses may not be counted to meet both undergraduate and graduate requirements, and no courses taken before the junior year may be used to meet the course requirements for the master's degree. (See “Requirements” below for distribution of units.)

A.M. PROGRAM

A limited number of students are admitted as candidates for a terminal master's degree in Russian and East European Studies. Application materials may be obtained directly from the Graduate Admissions Office, Old Union, Stanford University, Stanford, CA 94305-3052.

To qualify for admission to the program, applicants must have the equivalent of an A.B. or a B.S. degree. They must have completed three years of Russian language study (or the equivalent).

Applicants must also take the Aptitude Test of the Graduate Record Examination and have the results sent to the Office of Graduate Admissions. Applicants whose native language is not English and who have not studied in an English-speaking institution for at least one and a half years must take the Test of English as a Foreign Language (TOEFL). Deadline for submission of applications for admission and financial aid is January 1. Admission is normally granted to begin in the Autumn Quarter only.

Candidates for only an A.M. degree must meet University requirements for a Master of Arts degree as described in the “Advanced Degrees” section of this bulletin. All requirements for the A.M. degree may normally be completed in three academic quarters as a full-time student. The University does not offer a Ph.D. in Russian and East European Studies.

REQUIREMENTS

For students in both the Co-terminal A.B./A.M. and the Terminal A.M. programs, the 40 units toward the master's degree must be distributed as follows:

1. A minimum of five graduate courses in the program field, distributed over at least three different departments. None of the five graduate courses may be directed reading courses. At least one course must require a research project resulting in a substantial paper. The remaining required units may include advanced undergraduate courses in various departments, but all must deal with the Russian/Soviet and East European field. Of the 40-unit minimum, no courses may be below 100 and at least 50 per cent must be at the 200 level or higher. To count toward fulfillment of A.M. requirements, 100-level courses should have additional requirements for graduate students, to be assigned by the instructor.

2. No credit toward the master's degree will be given for the first three years of Russian or East European language instruction. Credit will be allowed for fourth- and fifth-year Russian courses.

3. All students must enroll in the Core Seminar in Russian and East European Studies (see below).

4. All students must obtain a minimum letter grade indicator of "B" in courses counting toward fulfillment of requirements for the master's degree.

5. All students should have taken introductory courses in Modern Russian History, Modern Russian Literature, and Soviet or East European Politics. These courses, if taken at Stanford, 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 coursework 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 master's committee.

For current courses offered within the area of Russian and East European Studies, please consult the quarterly Time Schedule or contact the Center for Russian and East European Studies.
COURSES

200. Directed Individual Study—For students engaged in special interdisciplinary work that cannot be arranged by department.
1-5 units, Aut, Win, Spr (Staff)

by arrangement

250,251,252. Core Seminar in Russian/Soviet and East European Studies—Introduction to methodologies and the status of research within the interdisciplinary area studies program.
I unit, Aut, Win, Spr (Staff)

SLAVIC LANGUAGES AND LITERATURES

Emeriti: (Professors) Edward J. Brown, Jack A. Posin, Lawrence L. Stahlberger; (Assistant Professor) Elisabeth Stenbock-Fermor
Chairman: Richard D. Schupbach
Professors: Joseph A. Van Campen (on leave Spring), Lazar Fleishman, Joseph Frank, Richard D. Schupbach
Associate Professor: Gregory Freidin
Assistant Professor: Andrew Wachtel
Lecturers: Elena Lifschitz, Wojciech Zalewski (Curator, Russian and East European Collection, Stanford Libraries)
Visiting Professors: Marietta Chudakova, Vjacheslav Vsevolodovich Ivanov, Gary Saul Morson

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.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

Candidates for a major in Russian 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—In addition to the basic first- and second-year sequence or its equivalent, candidates should complete a minimum of 35 units selected with the approval of their advisor, to include, in any case, courses numbered 111, 112, 113, and either 195, 196, or 211, 212, and 213. The remaining units are to be selected from among the following: 114, 115, 116, 167, 168, 187, 188.

Students majoring in Russian must earn a letter grade indicator of "C" or better in order to receive credit toward the major.

In addition to the 35 units mentioned above, students majoring in literature or language who are not enrolled in the Honors program in Humanities (see the “Humanities Special Programs” section in this bulletin) are to select with the help of their advisor a minimum of three additional courses (9 units) in support of their major program.

HONORS PROGRAM

Majors with a minimum letter grade indicator (LGI) 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 a reading knowledge of French, German, or a second Slavic language, to be demonstrated by passing an examination.

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 an LGI of “B” or better on a thesis written during this period.

5. Strongly recommended courses in other disciplines: A course sequence in Russian History.

RUSSIAN LANGUAGE REQUIRED

1. Four years of Russian, including Slavic 111-116, 167-168, and 187 or 188.

2. At least two additional courses within the department to be chosen from among the following: 191, 195, 196, 197, 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 an LGI of “B” or better on a thesis or project conducted under the close supervision of a member of the professorial staff.
1. Strongly recommended courses in Russian literature: 145, 146, 147, 187, 188.
2. Recommended courses in other departments: Communications 100; Computer Science 101, 106, or 108A,B,C; History 120; Linguistics 4, 5, 11, 25, 35; Mathematics 3; Philosophy 57, 180.

GRADUATE PROGRAMS

MASTER OF ARTS

Admission—The requirements for admission to the master's degree program in Russian 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 of required course work.

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 or relevant teaching experience who wish to further strengthen their academic preparation. Detailed requirements for the degree are outlined in the "School of Education" section in 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.

DOCTOR OF PHILOSOPHY

Students enrolled in the Ph.D. program in Slavic Languages and Literatures at Stanford
University are expected to fulfill the following requirements:

1. **Minor or Related Field**—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 is one of the following:
   a) A sequence of three courses in one West European literature, to be selected in consultation with the advisor, or
   b) three basic courses in comparative literature to be selected in consultation with the graduate advisor and the Comparative Literature Department, or
   c) 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. Students who wish to enroll in the Graduate Program in the Humanities should apply to it directly.

2. **Admission to 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 departmental chairman. No student is accepted as a candidate until he or she has completed the equivalent of the training represented by the requirements for the Master of Arts degree as described above. Admission to candidacy for the Ph.D. degree will be determined at the end of the fourth quarter of graduate studies. The candidate must by that time (1) have demonstrated a commitment to graduate studies by having successfully completed a minimum of 48 quarter units of credit with a letter grade indicator (LGI) of "B + " or better; (2) In the case of students wishing to specialize in literature, written an acceptable A.M. thesis, to be completed before the end of the 4th quarter, or, in the case of students wishing to specialize in Slavic linguistics, passed a written examination based on course materials and a reading list. Failure to comply with the above two require-

3. **Proficiency Test**—Administered for all entering graduate students, this test is designed to determine whether the student's knowledge of Russian falls below the department's standard. Students who fail this test will be asked to complete the appropriate courses.

4. **Course Requirements**—Before qualifying for the departmental oral and written examinations, a Ph.D candidate is expected to accumulate at least 72 quarter units of credit for courses taken while in graduate school. No less than half of this course work (36 units) has to be done at the Department of Slavic Languages and Literatures, including at least 12 units of credit for seminar-level courses. (All entering graduate students are expected to enroll in Slavic 200.)

5. **Foreign Languages**—A candidate must have a reading knowledge of French and German, to be demonstrated by passing a written examination.

6. **Examinations**—A candidate must 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 an LGI of "B - " or better.)
   b) The history of Russian literature, including its relationship to the development of other Slavic literatures, or Western European literature, or to Russian intellectual history. (Students specializing in Slavic linguistics will be excused from this portion of the examination if they have completed, with an LGI of "B - " or better, Slavic 221, 222, and either Slavic 187 or Slavic 188. They should also have taken Slavic 145, 146, and 147 or show equivalent training.)

Following the departmental examinations, a candidate must pass a University oral examination in the defense of a dissertation proposal covering content relevant to the area of study, rationale for the proposed investigation, and strategy to be employed in the research.
Specialization—Candidates in Slavic Languages and Literatures specialize either in language and linguistics or literature. Candidates may draw up individual programs of study and research in close consultation with the graduate advisor. Requirements will thus vary according to the nature of the specialized program requested.

Continuation—Continuation in the Ph.D. program will be contingent upon the following: for first-year students, a high quality of performance in course work (decided by departmental evaluation); for second-year students in literature, an A.M. thesis; and for linguistics students a written examination based on course materials and a reading list. Both the thesis and the written examination should be completed no later than the end of the first quarter of the second year.

Course Work and Overall Scheduling—
1. Candidates for the Ph.D. degree are allowed as much freedom as possible in the selection of their course work to suit their individual program of study. It should be emphasized, however, that candidates will be held responsible for all the areas covered by the general examinations, regardless of whether they have registered for the department’s offerings in a given field. It should be noted that students may not normally register for individual work in a given area until they have covered the basic course offerings in that area. First-year students will be permitted to register for individual work only under special circumstances and must obtain the written approval of the graduate advisor. Those candidates who are also candidates for the A.M. degree should consult the section dealing with course requirements for that degree in planning their first year’s work. For University residence requirements, see the “Advanced Degrees” section in this bulletin. The A.M. thesis or written examination should be completed by the end of the fourth quarter of graduate study at the latest. The remainder of the second year of graduate study should be devoted to course work designed to prepare the student for the general qualifying examination and to fulfill the requirements for his or her minor, if any. The department general qualifying examinations must be taken by the end of the first quarter of the third year of study; they may be taken during the second year if the student and the advisor feel this is appropriate. During the two quarters following the general qualifying examination the student should be primarily concerned with preparation for the University oral examination. (The latter should take place no later than the end of the third quarter of the third year.) However, students may, if necessary, do limited amounts of course work not directly related to the dissertation proposal. The fourth year should be devoted to the completion of the dissertation.

2. Students possessing the equivalent of the Stanford A.M. will normally be expected to adhere to the schedule for the second, third, and fourth years of work outlined under (1), above.

3. Students in the Ph.D. program will be required to do four quarters of teaching in partial fulfillment of the requirements of the Ph.D. degree.

Non-Slavic Language Requirements — 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, 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.

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.

COURSES
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.

GENERAL
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.
131. Introduction to the Russian Short Story: 19th Century—Selected short stories by Pushkin, Gogol, Dostoevsky, Leskov and others. Short reading assignments (20 to 30 pages) facilitate concentration on the individual author's style. Consideration of the short story as a genre. Offered in English translation for 1 unit, in Russian for 2 units.

1-2 units, Aut (Von Stamwitz) T 5

145/245. Survey of Russian Literature in English Translation I: The Age of Experiment—(Graduate students register for 245.) Part 1 of a three-quarter survey of the Russian prose tradition covers the first 40 years of the 19th century emphasizing the formative period of Russian prose, the lesser known contributions of poets, and Romantic and popular writers. Recognized “classics,” Pushkin’s Eugene Onegin, The Belkin Tales, The Captain’s Daughter; Lermontov’s Hero of Our Time; Gogol’s Petersburg Tales and Dead Souls, are considered in the context of “local” literary and stylistic developments and of contemporary European trends. Open to all students. (DR:2)

4 units, Aut (Fleishman) MWF 10

146/246. Survey of Russian Literature in English Translation II: The Novel and Beyond—(Graduate students register for 246.) Selected novels and short fiction by Turgenev, Dostoevsky, Tolstoy, Chekhov, and Bely. A continuation of 145 but may be taken independently of it. Open to all students. (DR:2)

4 units, Win (Wachtel) MWF 10

147/247. Survey of Russian Literature in English Translation after 1917: Invention of Tradition—(Graduate students register for 247.) Major works of Russian fiction and selected poetry, including the emigre and samizdat writings, in their literary and historical context (Blok, Mayakovsky, Babel, Zoshchenko, Kataev, Scholokhov, Nabokov, Olesha, Pasternak, Grossman, Solzhenitsyn, Siniaevsky, and Brodsky, etc.) Attention to the way poets and novelists have constituted the post-revolutionary “historical experience” of the Russians. A continuation of 145 and 146, but may be taken independently of them. Open to all students. (DR:2)

4 units, Spr (Freidin) MWF 10

151. Fyodor Dostoevsky—Major works in English translation with reference to related developments in Russian and European culture and intellectual history. Open to graduates, seniors, and juniors. Lectures and discussion section. (DR:2)

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

153/253. Leo Tolstoy—An intensive study of War and Peace in its literary and cultural context. Tolstoy’s innovations in narrative form and his theories of history, psychology, and ethics. War and Peace in Tolstoy’s time and its significance in ours. (DR:2)

4 units, Aut (Morson) MWF 11

154. The Russian Drama in the 19th Century—A survey of Russian theatrical texts from Pushkin to Chekhov. The variety of dramatic genres in Russian literature, and the peculiar text/spectator/author relationship typical for dramatic literature in general. All readings in English.

4 units, Spr (Wachtel) by arrangement

UNDERGRADUATE

By special arrangement with the department, courses numbered 100-159 can be taken for graduate credit. The department urges students to take all three quarters of first-year, second-year, and third-year language series in the same academic year.

1. First-Year Russian A—Completion of Russian 1, 2, and 3 fulfills (DR:4); three-quarter sequence. (Optional unit for extra work on pronunciation and grammar, by arrangement.)

5 units, Aut (Schupbach) MTWThF 9 and 1:15

2. First-Year Russian B—Completion of Russian 1, 2, and 3 fulfills (DR:4); three-quarter sequence. Continuation of 1. (Optional unit for extra work on pronunciation and conversation.)

5 units, Win (Schupbach) MTWThF 9 and 1:15

3. First-Year Russian C—Completion of Russian 1, 2, and 3 fulfills (DR:4); three-quarter sequence. Continuation of 2. (Optional unit for extra work on conversation and reading.)

5 units, Spr (Schupbach) MTWThF 9 and 1:15

51. Second-Year Russian—Intensive review and expansion of grammar and vocabulary.

5 units, Aut (Van Campen) MTWThF 12 and 1:15

51A. Second-Year Russian: Conversation—Emphasis is on the development of “oral proficiency”.

2 units, not given 1988-89

52. Second-Year Russian—Continuation of 51 with focus on vocabulary building, syntax.

5 units, Win (Van Campen) MTWThF 12 and 1:15

52A. 2 units, not given 1988-89

53. Second-Year Russian—Continuation of 52.

5 units, Spr (Lifschitz, Staff) MTWThF 12 and 1:15

53A. 2 units, not given 1988-89
111-113. Third-Year Russian—Emphasis on reading, vocabulary building, and textual analysis. Recommended: Take 114-116 in conjunction with this series. Prerequisite: 53 or equivalent (with 114-116 only).
3 units, Aut, Win, Spr (Schupbach, Lifschitz) MWF by arrangement

114-116. Third-Year Russian Conversation and Composition—Coordinated with and to be taken in conjunction with 111-113. Focus on the development of oral skills. Readings from contemporary literature and journalistic sources.
2 units, Aut, Win, Spr (Lifschitz) TTh 1:15

119/204. Advanced Russian for Social Scientists—Develops reliable reading skills for students of the technical language of this area. Underscores systematic differences between this level and spoken Russian and the language of literature. Questions of terminology, the use of participles, and other parts of speech, as well as use of the cases, prepositions, derivational innovations, et al. Extensive practice is provided.
1 unit, Aut (Schupbach) by arrangement

120/205. Advanced Russian for Students of the Physical Sciences, Mathematics, and Engineering—Develops reliable reading skills for students of the technical language of this area, emphasizing the language of mathematics and the physical sciences.
1 unit, Win (Schupbach) by arrangement

ADVANCED AND GRADUATE

167-168. Fourth-Year Russian Seminars I-III—Designed to perfect verbal and written skills while concentrating on major problems in Russian cultural history, as reflected in that country’s literature. Texts approached systematically as “literature” and “documents” in the social and intellectual history of Russia. Open to all majors; the seminars are conducted in Russian.
167. Fourth-Year Russian Seminars I—Closeup of Alexander Pushkin’s major poetical works.
4 units, not given 1988-89
168. Fourth-Year Russian Seminars II—A close reading of Tolstoy’s Anna Karenina, its literary, historical, and political context. Also, relevant contemporary texts in a variety of genres.
4 units, not given 1988-89

177/201. Advanced Russian—Reading, conversation, and composition.
3 units, Aut (Lifschitz) TTh 3:15

3 units, Win (Lifschitz) TTh 3:15

179/203. Advanced Russian—Reading, conversation, and composition.
3 units, Spr (Lifschitz) TTh 3:15

184. Introduction to Slavic Bibliography—Historical and evaluated analysis of Slavic bibliographic and research tools emphasizing Russian and Soviet materials. Application of bibliographic search methodology. Final bibliography project required. Knowledge of Russian and/or another Slavic language is helpful. Open to graduate and undergraduate students.
3 units, Aut (Zalewski) Th 3:15-5:05

186. 18th-Century Russian Literature—18th-century literature in Russia evolved from a barely appreciated didactic tool to a major force for the expression of a wide variety of social and cultural ideals. The aesthetic development of 18th-century literature and the gradual rise of its socio-political function. Emphasis on the aspects of 18th-century Russian literary culture that paved the way for the age of Pushkin.
4 units, Aut (Wachtel) MWF 1:15

187. Russian Poetry of the 19th Century—Major poetic styles of the 19th century as they intersected with the late classicism, romantic movement, the realist, and post-realist traditions. Representative poems by Derzhavin, Zhukovskii, Pushkin, Baratynskii, Lermontov, Tiutchev, Nekrasov, Fet, Soloviev, Nadson. Lectures and discussions in Russian. Open to graduate students.
4 units, Aut (Fleishman) MWF 12-1

188. Russian Poetry of the 20th Century—The main developments in Russian poetry in this century (Symbolism, Acmeism, Futurism, Constructivism) emphasizing analysis of representative lyric poems of major modern poets (from Block and Belyi to Pasternak and Tsvetaeva).
3 units, Win (Fleishman) MWF 9

189. Old Russian Literature—Russian literature, culture, and thought from the earliest times through the 17th century (some readings in the original).
4 units, not given 1988-89

191. Grammatical Categories of Russian—Major grammatical categories of Russian: case, gender, number in the noun and aspect, tense, voice, mood, prefixation and transitivity in the verb are analyzed in detail. Comparisons are drawn between the Russian and English systems.
3 units, not given 1988-89

193. The Orthodox World—Introductory survey of the history, spirituality, and religious culture of the Eastern Christian peoples emphasizing Orthodox theology and spirituality, comparing and contrasting it with that of the Western Church.
3 units, not given 1988-89
3 units, Win (Van Campen) by arrangement

196. Advanced Topics in Russian Grammar II: Morphology and Syntax.
3 units, Spr (Schupbach) by arrangement

197. Advanced Russian Topics in Russian Grammar III.
3 units, given 1989-90

198A/298A. Structural Typology of the Slavic and Balkan Languages—(Enroll in Linguistics 271.)
3 units, Win (Ivanov) by arrangement

198B/298B. The History of Semiotics.
3 units, Win (Ivanov) by arrangement

199. Individual Work—Open to Russian majors or students working on special projects. May be repeated for credit. Prerequisite: Consent of instructor.
1-5 units, any quarter (Staff) by arrangement

200. Proseminar in Russian Literature—Literary scholarship as a profession: languages of literary criticism; rhetoric, poetics, and reception. Students should also register for 194. Required of all entering graduate students and all Honors majors in Russian literature.
4 units, Aut (Freidin) Th 1:15-3:05

211. Introduction to Old Church Slavic.
3 units, not given 1988-89

212. Reading of Old Church Slavic and Old Russian Texts—Prerequisite: 211.
3 units, not given 1988-89

213. History of the Russian Literary Language—The major structural and semantic changes from the 10th to the 19th centuries. Prerequisites: 211, 212.
3 units, not given 1988-89

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/her principal course work a publishable translation of a literary text.
4 units, Win (Brown) by arrangement

221. Studies in Russian Fiction: The Age of Realism—The development of realism over the first two-thirds of the 19th century with attention to problems of structure, and social and philosophical contexts, Russian and European.
4 units, not given 1988-89

222. Early Soviet Prose: Osip Mandelstam, Isak Babel, and Mikhail Zoschenko—These three writers in the literary, social, and historical context of the decade following the 1917 Revolution.
4 units (Freidin) not given 1988-89

223. Russian Literature and the Literary Milieu of the NEP Period: The Problem of Authorship (1921-1928)—A variety of texts (primarily the journal fiction and criticism) which deal with the problem of authorship examined in the contemporary literary and socio-historical context. Emphasis on non-Party authors, Babel, Eikhenbaum, Mandelstam, Olesha, Tynianov, Zamiatin, and Zoshchenko.
4 units, not given 1988-89

224. Readings in the Russian Novel—An intensive study of The Brothers Karamazov and its relation to contemporary European and Russian philosophical, literary, and social contexts. Readings in Russian. Open to graduate and advanced undergraduate students.
4 units, not given 1988-89

225A. Bulgakov—Close analysis of Mikhail Bulgakov’s major prose works.
3 units, Spr (Chudakova) by arrangement

4 units (Freidin) not given 1988-89

227. Boris Pasternak and the Poetry of the Russian Avant Garde—Pasternak’s work examined within a broad cultural context. To identify and analyze characteristic features of the Russian avant-garde poetry.
4 units (Fleishman) not given 1988-89

228. Boris Pasternak’s Safe Conduct (1929-1931)—Close analysis of the text. Theoretical and historical problems of the study in the autobiographical genre.
4-5 units (Fleishman) not given 1988-89

229. Russian Versification—History and theory of Russian versification from the 17th to the 20th century.
4 units (Fleishman) not given 1988-89

230A. Russian Formalism and Structuralism—The Russian Formalists’ contribution to literary criticism and theory; the relationship of Russian Formalism to critical movements in the
230B. Russian Formalism and Structuralism in their Historical Background—Consideration of formalist and structuralist ideas in the context of the 19th and 20th century critical movements.
4 units, not given 1988-89

270. Pushkin—A close reading of Pushkin’s major poems and prosaic works accompanied by a detailed examination of his cultural milieu. Emphasis on the essential changes in the understanding of literary concepts relevant to this period of Russian literature (poetic genres, the opposition between poetry and prose, Romanticism, etc.).
4 units, Win (Fleishman) MWF 11

271. Solzhenitsyn—(Undergraduate students register for 155.) Solzhenitsyn in the novel, short story, drama, and essay forms, and in the genre most characteristic of him: “literary investigation.” No knowledge of Russian is required, but concentrators in Slavic are expected to do a major portion of the reading in Russian.
4 units, not given 1988-89

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

277. Gogol—His fiction, drama, and essays emphasizing problems of structuration and re-fractation of cultural contexts. Open to under-graduates with advanced training in Russian.
4 units, not given 1988-89

278. Tolstoy—Tolstoy’s creative evolution from his early and late short fiction (Childhood, The Sevastopol Tales, and The Kreutzer Sonata, etc.) and non-fiction, Confession, and Anna Karenina, together with the appropriate critical texts. Readings in Russian; open to exempt undergraduates.
4 units, not given 1988-89

279. Dostoevsky—Dostoevsky’s shorter works in the context of European thought and literature.
4 units, not given 1988-89

299. Individual Work—Exclusively for graduate students in Slavic working on theses or engaged in special work. Prerequisite: Written consent of instructor.
1-12 units, any quarter (Brown, Fleishman, Freidin, Frank, Schupbach, Lifschitz, Wachtel, Van Campen) by arrangement

300. Graduate Seminar: Theory of Narrative—Studies of narrative (fictional, historical, sacred) as verbal structure, representation, rhetoric, and social institution. Readings: theoretical writings by Jakobson, Barthes, Bakhtin, Iser, Lukács, and others. Discussions analyze these readings and relate them to selected works of Russian and European literature. A seminar for graduate and advanced undergraduate students. Prerequisite: Consent of instructor.
4-5 units, not given 1988-89

300A. Graduate Seminar: Literature as Institutions—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 instructor.
4 units, not given 1988-89

300B. Graduate Seminar—The theme of utopianism in Russian literature from Dostoevsky through the late 20’s.
4 units, not given 1988-89

300C. Introduction to Archival Research in Russian Literature and History.
3 units, not given 1988-89

300D. Graduate Seminar: The Voices of History—An analysis of the web of interrelationships linking belles-lettres and historical genres in Russian culture of the 1820’s, 30’s, and 40’s. The role that discussions of history had in the formation of a uniquely Russian cultural world view. Problems of genre and literary form in Karamzin, Pushkin, and Gogol.
4 units, Win (Wachtel) by arrangement

375. Dostoevsky and French Literature—(Same as Comparative Literature 375.) Dostoevsky’s relations with French literature as a source of inspiration for his own work and as himself inspiring modern French Writers. Notes from Underground and Crime and Punishment are read with works by Diderot, Balzac, Cide, Camus and Sartre.
5 units, Win (Frank)
SOCIETY

Emeriti: (Professors) St. Clair Drake, Dudley Kirk
Chairman: Joseph Berger (on leave, Autumn)
Assistant Professors: Carol Conell (on leave), David Grusky, Jerald R. Herting, Leonard Hochberg (on leave), Szonja Szelenyi
Courtesy Professors: Bruce Bueno de Mesquita, Jeffery Pfeffer
Courtesy Associate Professors: James Baron (on leave), Arnold Eisen, JoAnne Martin, Francisco Ramirez
Courtesy Assistant Professors: Larry Diamond, Clifford J. Nass, Donald Palmer
Senior Lecturer: Ruth Cronkite
Consulting Associate Professor: Janet Johnston
Visiting Professors: Shmuel Eisenstadt, Guler Fisek, Hamit Fisek

Sociology is concerned with the full spectrum of social behavior (of individuals, small groups, large organizations, communities, institutions, and societies) and provides a strong intellectual background for students considering careers in the professions and in business. Students may pursue degrees in sociology at the bachelor's, master's (coterminal), or doctoral levels.

UNDERGRADUATE PROGRAMS

AREAS OF CONCENTRATION

Each area identifies a specialized arena of inquiry, a set of skills within sociology, and basic preparation for a variety of careers. A brief description of each of these areas follows.

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.

Organizational Behavior — This area encompasses the study of individual behavior within organizations and the behavior of organizations as collective actors and the factors which affect them. 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 in firms and public organizations; voluntary associations and total institutions such as prisons; and 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 include all areas of management and administration: public, business, education; management consulting and analysis; and organizational development.

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, institutional, and comparative perspectives are utilized. Foundation courses introduce students to one or more of these perspectives and to specific institutional areas. Careers related to this area of study include law and governmental service.

COURSE OFFERINGS

Most of the courses offered by the department can be categorized as primarily oriented to one of the three areas of concentration; a few courses are relevant to more than one area. Within each area of concentration, one or more foundation courses are identified which provide a general introduction to the area or some portion of it. Courses, classified by area, are as follows:

1. Social Psychology and Interpersonal Processes
   Foundation Courses: 5, 120, 121

2. Organizational Behavior
   Foundation Course: 160
   Other Courses: 118, 127, 141, 143; 161-169, 260-269

3. Comparative Social and Political Institutions
Foundation Courses: 141, 142, 143, 144, 145

BACHELOR OF ARTS

The department offers two basic programs leading to the A.B. degree in Sociology: the general sociology major and the specialized sociology major. Both programs are designed around a core curriculum, the intent of which is to insure adequate coverage of basic sociological knowledge, but provide enough flexibility to enable students to tailor the degree program to fit individual needs and interests. These programs, and the requirements for each, are described below.

CORE CURRICULUM AND GENERAL SOCIOLOGY MAJOR

All recipients of the A.B. degree in Sociology must complete a minimum of 60 units of course work in the major. Related coursework from other departments may fulfill part of this requirement, but such work must be approved in advance by a departmental advisor and must not exceed 15 units. All degree candidates must fulfill the following core requirements:

1. 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.

2. 180A and 180B, Introduction to Sociological Research, or its equivalent.

3. At least three foundation courses, one each from the three substantive areas of concentration (see areas 2-5 above).

SPECIALIZED SOCIOLOGY MAJOR

The department recognizes that some students may wish to engage in more in-depth study than that provided by the major in general sociology. The specialized sociology major permits students to pursue a more concentrated program of study. To complete the requirements for the A.B. degree in Sociology with a specialization in Comparative Social and Political Institutions, Organizational Behavior, or Social Psychology and Interpersonal Processes the student must take a minimum of 25 units from courses listed under the proposed area of specialization.

HONORS PROGRAM

Each year several energetic students participate in the departmental Honors program, undertaking an intensive, individualized program of study. Each Honors student works closely with one or more faculty members on an independent research project. Most projects are student initiated but can be developed in association with ongoing faculty research.

Admission to the program requires an average letter grade indicator (LGI) of "B" or better. Completion of the Honors thesis does not guarantee an Honors degree. A minimum LGI of "B" or better is required on the thesis for a student to be considered for Honors. If the grade on the thesis is less than a "B", credit for the thesis counts toward the major in sociology.

Honors students may earn up to 15 units credit for work leading to completion of the required Honors thesis, including Honors seminars. Students normally begin work on the project during Spring Quarter of their junior year (by enrolling in Sociology 194 for 2 units) and the remaining units are typically spread over two or three quarters during their senior year. The Honors thesis may be submitted in the form of a scientific paper (similar to the format required for submission to a journal in the field), or that required of a Stanford master's thesis. Students interested in the Honors program should talk with their academic advisor or the director of the undergraduate studies no later than the start of Spring Quarter of the junior year.

COTERMINAL MASTER'S PROGRAM

Stanford undergraduate students who wish additional training in sociology (whatever their undergraduate major), and who have a good academic record (ordinarily, at least a letter grade indicator of "B"), may apply to the coterminal masters program as described in the "Degrees" section of this bulletin. Students may apply by: submitting a brief statement of purpose, names of one or more faculty or researchers with whom they have worked, and an up-to-date transcript to the department secretary. The program requires completion of 45 units of work in sociology at the 100 level or above. Advance approval of the program by an advisor who may, for instance, suggest relevant methodological training, is required.

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

Admission—Although it is desirable to have had undergraduate preparation in sociology,
the department does consider for admission 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 on the General Test of the Graduate Record Examination. The GRE Subject 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 a letter grade indicator of "B" or better. All course work should be at level 100 or above 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 master's 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 department secretary for further information. Students may also apply for the co-terminal master's program as described in the “Degrees” section of this bulletin. Information may be obtained from the department secretary.

**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 or relevant teaching experience 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.

**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.

A candidate for the Ph. D. must: (1) have a master's degree or its equivalent; (2) 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; (3) complete a teaching apprenticeship, working for three quarters as a teaching assistant under the supervision of a faculty member; (4) develop a thorough grounding in sociological theory and research methods (to accomplish this, five graduate courses are required: Sociology 370A, 370B, 381, 382, and 383. In addition, students entering with little background in statistics are required to take an elementary course in the first quarter after entering); (5) 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. For basic University requirements see the “Degrees” section of this bulletin.

**JOINT PROGRAM WITH THE SCHOOL OF LAW**

The faculties of the School of Law 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 School of Law and meet the Sociology Department requirements. Applications for a joint program must be approved by the Research and
Interdisciplinary Studies Committee of the School of Law 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 School of Law 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 School of Law 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 **

Courses numbered 1-199 are open to all students without prerequisites, unless specifically indicated. Courses numbered 200-299 are open to advanced undergraduate and graduate students. Courses numbered 300 and above are normally offered to graduate students only.

** OPEN TO ALL STUDENTS **

** INTRODUCTORY **

1. **Introduction to Sociology**—Basic concepts of sociological analysis. Topics: how social systems and social organization emerge, are maintained, and change; how they differentiate, with consequences for inequality and stratification; and how the individual is related to society. These are studied from the simplest social interactions, through more complex organizations and communities, and to the structures and processes of whole societies and their basic institutions. (DR:5)
5 units, Aut (Staff MWF 10
Win (Meyer) MWF 1:15
Spr (Staff) MWF 1:15
plus one section by arrangement

5. **Status, Friendship, and Social Pressure: An Experiential Approach**—The basic social processes that structure the individual's experience in interpersonal situations. Processes include (1) group pressure on individual choices, (2) social control of deviants, (3) operation of status distinctions (sex and race), (4) formation of friendships and, (5) formation of intimate relationships (love relationships). Through structured exercises and simulation gaming, the student has the opportunity to experience these processes in section meetings. After these laboratory experiences, lectures examine the processes in terms of theoretical ideas, empirical research, and clinical strategy. Enrollment limited. (DR:4 or DR:5)
5 units, Win (Berger) MWF 10 plus one 2-hour section M or T 2:15-4:05

** SOCIAL ISSUES IN CONTEMPORARY SOCIETY **

104. **The Sociology of Gender**—The social definitions of masculinity and femininity, and social inequalities which are based on gender-specific social roles. Topics: inequalities in interpersonal behavior, the family and work organizations, and implications of inequality for illness behavior, family violence, sexual harassment, and rape.
3-5 units (Staff) given 1989-90

105. **Poverty and Public Policy in America**—Why large-scale poverty persists in America and what are the effects of poverty on the individual? Lectures, class discussions, and individual projects explore the facts, myths, and theories.
3-5 units (Staff) given 1989-90

106. **Deviance and Social Control**—Sexual deviance, drug abuse, mental illness, crime in the streets; corporate and governmental abuses. The social foundations of the detections, labeling, and processing of people as "deviants." The institutions and agencies mandated to keep "the public order," how labeled persons are separated from the rest of society physically and symbolically, and the consequences for those individuals and for society.
3-5 units, Spr (Staff) MWF 9

107. **Sociology of Mental Health**—Sociological perspectives on mental illness and the organization of mental health services. Topics: epidemiological, psychosocial, and sociocultural approaches toward mental illness; socio-environmental factors that influence the use of the response to mental health services; patient-program relationships, and the evaluation of mental health services. Types of mental and emotional disorders covered: depressive disorders, alcohol and drug abuse, psychosomatic disorders, and schizophrenia.
5 units, Win (Cronkite) TTh 10:30-12
one section by arrangement

108. **Peace Studies**—(Same as History 154, Political Science 133, Psychology 142, VTSS 143.) Interdisciplinary examination of the current international situation, beginning with historical examples and turning to underlying processes (psychological, social, political, and economic). The assumptions of current doctrines concerning war and peace are related to
what is known about humans and their institutions. The nature of peace as a process is related to issues of justice. Alternative approaches towards peace are critically analyzed.

5 units, Spr (Dornbusch, Bernstein, Drekmeir, Moses, North, Ross)
TTh 2:15-4:05

112. Gender and Education—(Same as Education 170.) Gender as a critical variable in educational institutions and labor markets. An interdisciplinary approach to 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 Institute for Research on Women and Gender Wednesday noon lecture series. The three primary disciplines are economics, history, and sociology, but psychology and law are examined.

4 units (E. Cohen, Strober) given 1989-90

117. Education and the Status of Women: An International Perspective—(Same as Education 197X.) Theories and perspectives from the social sciences relevant to an understanding of the role of education in changing, modifying, or reproducing structures of gender differentiation and hierarchy. Cross-national research on the status of women and its uses to evaluate knowledge claims from varying perspectives.

4 units, Win (Ramirez) MWF 10

118. Groups, Teams, and Organizations—What makes groups productive? What is an effective group member? How does "team spirit" affect individual performance? How do organizations expand and constrain individuals? The course provides experience with group and organizational phenomena through use of simulation games, structured exercises, and case studies. Lectures/reading provide tools for analyzing these experiences based on empirical research and theoretical ideas. Limited to 35 students.

5 units, Spr (B. Cohen) TTh 2:15-4:05

SOCIAL PSYCHOLOGY AND INTERPERSONAL BEHAVIOR

120. Interpersonal Relations—Power, exchange, coalition formation, status, conformity, and deviance. Important traditions of research have developed from basic theories of these processes. Emphasis is on understanding basic theories, and drawing out their implications for change in a broad range of situations, families, work groups, and friendship groups. (DR:4 or DR:5)

5 units, Aut (Johnston) MWF 8
one section by arrangement

121. Introduction to Social Psychology—Understanding the individual's relationship to social groups, from intimate two-person groups to the society at large. Theoretical and experiential perspectives illuminate these relationships. Simulation and observation exercises. Topics: social pressure and conformity, racism, and sexism, self-evaluation, equity and justice, and the social self. Limited to 120 students. Pass/No Credit not offered. (DR:4 or DR:5)

5 units, Win (B. Cohen) MWF 11
one section by arrangement

127. Power in Interpersonal Relations—Concepts of power and influence, sources of power, dynamics of power-dependence relations, authority, and the legitimation of power. Topics: the role of power in face-to-face interactions, the influence of individuals on groups and of groups on individuals; applications to families, task groups, other small groups, and implications for the study of power in larger social units. Laboratory exercises alternate with lectures.

3-5 units, Win (Staff) given 1989-90

COMPARATIVE SOCIOLOGY: SOCIAL INSTITUTIONS AND SOCIAL CHANGE

130. American Society in Film and Literature—Plays, films, and novels are used to analyze some fundamental values, structures, and processes underlying American society. Emphasis is on processes of social control, including causes of conformity and deviance, and stratification, including inequalities in gender, ethnicity, race, and socioeconomic status. Film and literature are used only to study central features of American society. Readings: Ellison, Fitzgerald, James A. Miller, M. Norman, Updike, and Steinbeck. Films: A Thousand Clowns, Officer and a Gentleman, Long Days' Journey Into Night, One Flew Over the Cuckoo's Nest, The Little Foxes, Adam's Rib, Streetcar Named Desire, and Harlan County, USA. Films on Wednesday nights. (DR:5)

3-5 units, Win (Zelditch) TTh 11
W 7-9 p.m., and one section Th 1:15, 2:15, 3:15, or 4:15

132. The Sociology of Israeli Society—(Same as Religious Studies 24.) Society from a sociological perspective. Unifies a historical-conflictual approach with a structural one. The institutionalization of a social system and the influence of structure upon people's life. Issues of the Israeli society: the definition of the collective identity and its cultural and territorial boundaries; some characteristics of Israeli culture; the system of stratification and especially Israel's ethnic problems; the Israeli political
system, its structure and influence on different social areas; the relations between religious and non-religious Jews and the status of religion in the Israeli state; the Israeli army, wars, and the influence of security problems on daily life including emigration. The Arab minority (citizens and non-citizens) and its influence on the Israeli labor market.

5 units, Aut (Ben-Eliezer) MWF 1:15

133. State and Society in Israel—(Same as Religious Studies 26.) The development of the political system in pre-independent Israel and the changes it has undergone in the 40 years since the establishment of the state. Israel's democratic political regime and its power structure. Topics: Israel's party system, political elites, interest groups, social movements, parliamentary politics, and patterns of political participation. Contemporary theories concerning the state as a social system and state-society relations clarify issues dealing with the involvement of the Israeli state in economy, religion, culture, education, and demography. The relations between the state and various groups—minorities and new immigrants; the state's involvement in different internal conflicts, and its relations with other countries.

5 units, Spr (Ben-Eliezer) TTh 1:15

134. Power Elite Recruitment in East European Communist Countries—(Same as Political Science 219W.) Recruitment of the power elite in Eastern Europe. Data from Poland, Yugoslavia, Hungary, and the U.S.S.R. General rules of selection of elite members on regional and national levels; social determinants of attaining elite positions; career patterns. Some comparisons to Western political systems.

5 units, Win (Waslewski)

135. Contemporary Socialist Society—Socialism from the Romantic tradition of William Morris to the scientific theory of Karl Marx and the unique doctrine of Mao Zedong. Contrasted to the realities of "existing socialist societies" by the examination of empirical material on: the problems of centrally managed economies; the extent and dynamics of social inequalities; dissent and opposition under socialism; and recent strategies for economic reform. Alternative views on the nature of these societies and their overall prospect for social transformation.

5 units, Spr (Szelenyi) TTh 3:15-4:45

139. Introduction to Historical Sociology—Conceptions of the field and how it differs from social history and comparative history in its use of social theory. An examination of significant works in: the rise of the market and capitalism out of the context of Western feudalism; revolutions and the formation of new political regimes; the demographic transition and industrialization; and cross-civilizational perspectives and European uniqueness. Emphasizes how to combine the logic of comparative history with the testing of hypotheses derived from social theory.

3-5 units (Hochberg) given 1989-90

140. The Sociology of Scientific Knowledge—(Same as Anthropology 158, Philosophy 155, History of Science 133B, VTSS 138.) Some of the classical problems in the sociology of knowledge as represented in the writings of Marx, Durkheim, and Mannheim. Recent work in the social construction of scientific knowledge. Emphasis on recent studies in the historical sociology of experimental science and laboratory practice. Working with case studies and drawing on anthropological approaches in the works of Mary Douglas, Pierre Bourdieu, and others, a theory of practice and a critique of historically situated practical reasons are explored as the foundation for the sociology of scientific knowledge.

4 units, Spr (Lenoir) MWF 11

141. Politics and Society—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 polities; the internal distribution of power and authority; and the structure of political group formation and individual participation in modern states. Emphasizes modern empirical literature. (DR:5)

5 units, Aut (Meyer) MWF 10

142A. The Family—Family composition, organization, and processes. Historical and recent trends in Western societies are examined and compared with current situations in developing countries. Topics: marriage and divorce, fertility, illegitimacy, value of children, family size, household composition, and sex roles.

5 units, Aut (Herting) TTh 10-11:30

142B. The Family in Transition—A cross-cultural examination of the new kinds of family patterns that have been emerging: single parent families, joint custody families, remarriage and blended families, the computer marriage, and perhaps families headed by homosexual parents. Students produce a paper by examining the available literature and interviewing families exhibiting one of these patterns or by studying their own families.

5 units, Win (G. Pisek) MWF 9

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

144A. Social Inequality and Social Stratification — The processes and institutions by which social rewards and resources are differentially distributed. Functional, conflict, and integrative theories of stratification. Social mobility and status attainment, issues in labor markets, and the salience of race, ethnicity, and gender in the U.S. stratification system. (DR:5)

5 units, Win (Herting) MWF 10

144B. Social Mobility — Classical and contemporary statements on the functions, sources, and consequences of social mobility, the major theories in this area, and some of the recent research on rates and patterns of social mobility in pre-industrial and industrial societies and the implications of social mobility for class structure and formation.

5 units, Spr (Grusky) MWF 1:15

145. Race and Ethnic Relations — Racial and ethnic relations in contemporary perspective. The social behavioral implications of attributions of race and ethnicity in small group interactions, the world of work and the larger society. Topics: race and IQ, interracial dating and marriage, inequalities in employment and income, affirmative action and ethnic political mobilization. (DR:5)

3-5 units, Spr (Staff) MWF 10

plus section by arrangement

147. Politics and Society in the Predominantly English-speaking Countries: Australia, Britain, Canada, United States — Comparative analysis of social and political institutions in the major English-speaking nations, Australia, Britain, Canada, and the U.S. The four, coming out of similar cultural and political traditions, have diverse status patterns, party systems, union organizations, patterns of social mobility, education systems. The way varying social structures and values emerging out of different histories affect national styles and institutions.

5 units (Lipset) given 1989-90

148. Social Theory and Religion—(Same as Religious Studies 148.)

5 units (Eisen) given 1989-90

149. Communication, Technology, and Society — (Same as Communication 169, VTSS 162.) The intellectual tools for analyzing the question: Does technology drive societal change or does society drive technological change? How technology is related to psychological, social, economic, cultural, and political systems. Technologies in the U.S. since 1850 emphasizing informational information processing.

4 units, Spr (Nass)

150. Urban Sociology — Over the last 200 years the scale of the ecological communities in which people are embedded has increased more rapidly than the psychological communities with which people identify themselves and the political communities within which they are governed. Explores all three kinds of communities and the impact on the ability of people to govern themselves, and of the disparity between the scales of the ecological, psychological, and political communities.

3-5 units (Conell) given 1989-90

151. Jews and Judaism in America—(Same as Religious Studies 153.) A particular Jewish community and the religious forms it has evolved, using historical, literary, sociological, and theological materials.

4 units, Spr (Eisen) TTh 11-12:15

152. Social Structure of World Society—(Same as Education 231, VTSS 155.) A sociological analysis of human society on a world-wide basis. Competing models of the emerging world order and its dynamics. 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. Mixed lecture-discussion format. (DR:5)

5 units (Inkeles) given 1989-90

154. Urban Growth and Change—Cities and towns changing: in size, density, composition, and internal organization; causes and consequence. The processes of change in a city as a whole; the processes of change in a sub-area of a city (i.e., in a neighborhood). The consequences of these changes for individuals, families, organized groups and voluntary associations, firms and public institutions.

5 units (Tuma) given 1989-90

157. American Political Development: Social and Geographic Foundations—Seminar, a historical overview of the geographic context of party conflict, voting behavior, institutional development, and public policy formation in the U.S. Various theories (sectionalism, the Annales school, world-system analysis, and socio-geography) demonstrate the usefulness of geographic inquiry in the study of political events and social processes. Students have the opportunity to utilize a geographic information system for analyzing and displaying quantitative data via computer designed maps.

3-5 units (Hochberg) given 1989-90

158. Social Movements and Social Protest— The underside of electoral politics, "the politics of disorder." How do new issues get placed on
political agendas? What determines whether a given grievance leads to collective protest, and what role does formal organization play in the process? What determines whether protest leads to amelioration of the underlying grievances, to proto-revolutionary foment or to incorporation of new interest groups into the polity? What role do the procedures for channeling protest, which are associated with the liberal state, play in preserving that state, and is that role sufficient to justify the charge that the liberal state’s response to protest is essentially repressive?

3-5 units (Conell) given 1989-90

159. The Sociology of Revolution—The study of revolution, its causes, processes, and consequences. Readings organized around the major paradigms in the social sciences. Some of the major cases of revolution and revolutionary movements and the major issues (the significance of ideology, violence, class conflict, political regimes, and geographic structures) which cut across the cases. Emphasis on cases and issues viewed in the context of the theoretical explanations of revolutionary crises.

3-5 units (Hochberg) given 1990-91

FORMAL ORGANIZATIONS


5 units, Aut (Scott) MWF 9

section by arrangement

162. Organizational Cultures—(Same as Business 370.) Organizational cultures include institutional mythology, jargon, rituals, ceremonies, humor. Through these mechanisms, organizational members communicate philosophies of management, values, and expectations. What is a culture? How do the cultures of major corporations or agencies differ? Can charismatic entrepreneurs or leaders create cultures? Does cultural inertia prevent the deliberate management of culture? Student participate in research projects, including a diagnosis of the culture of a public or private sector institution.

4 units, Aut (Martin)

163. Organizational Decision Making—(Same as Political Science 107, Business 371.) Business decision making in complex organizations: universities, schools, hospitals, business firms, and public bureaucracies. Information, power, resources, organizational structure, and the environment. Alternate models of choice and their implications.

5 units, Aut (March) TTh 8-10, plus section by arrangement

165. Organizational Leadership—(Same as Business 379, Political Science 108.) The problems of leadership in complex organizations: universities, schools, hospitals, business firms, armies, and public bureaucracies. Attention to the role of major executives.

5 units (March) given 1989-90

166. Organizations and Public Policy—(Same as Public Policy 102.) The concepts and methods for analyzing the influence of organizations on the setting and implementation of public policy. Varying conceptions of organizations as corporate actors and as social contexts. The several roles of organizations in relation to public policy: organizations as decision makers and problem solvers, as change agents, and as clients. Prerequisite: 160 or Industrial Engineering 100.

5 units, Win (Scott) MWF 9

plus section by arrangement

167. Women and Organizations—(Same as Business 378, Feminist Studies 135/235.) An examination of dilemmas faced by women in contemporary American organizations: complex formal organizations such as corporations, university, and health and welfare institutions, and smaller, less formal professional firms and social and political groups. Focus is on tradition and change in the definition of women’s roles, and on women’s styles of management, leadership, decision-making, and communication. Emphasis on the importance of women’s alliances, the dilemmas and characteristics of separate women’s organizations, and the potential for revising organization theory based on observation of women’s behavior.

5 units, Spr (Krieger) TTh 1-3

SOCIOLOGICAL THEORY

170. Classics of Modern Social Theory—The work of three classical sociological theorists: Karl Marx, Max Weber, and Emile Durkheim. Their contributions to the discipline through their ideas on: the transition from feudalism to capitalism, the problems of modern social organization, and the nature of the emergent social relation. To place these theories in a contemporary perspective, material from Georg Lukacs, Robert K. Merton, and Talcott Parsons. (DR:3)

5 units, Aut (Szelenyi) TTh 1:15-2:45

171. Theory and Method in Contemporary Sociology—How theory is used in contemporary sociology. The purpose: to teach you to analyze, evaluate, develop, and use theory.
Analysis of varied examples of contemporary theoretically-oriented sociology from which are extracted models of theory and its relation to research design. Exercises identify sociological questions, propose theories that might answer these questions, and suggest research that might test the consequences of these theories.

5 units (Staff) given 1989-90

**RESEARCH METHODS**

180A. Introduction to Sociological Research—Provides the consumer of social research with standards by which to evaluate the findings of sociological studies, and to present a critical analysis of basic notions and theories used in sociological analysis. Required of all sociology majors. Associated laboratory, see 180B.

3 units, Aut (B. Cohen) MWF 11

180B. Introduction to Sociological Research: Laboratory—Laboratory exercises consider problems of collecting observations, constructing theory, testing hypotheses and generalizing research results. Required of all sociology majors. Students must enroll concurrently in 180A.

4 units, Aut (B. Cohen) by arrangement

181. Research Design and Data Collection—Instruction and experience in designing social scientific research and in collecting data. Students design a research project on some social scientific issue, collect data to answer questions pertaining to it, and perform analyses of the data collected during the quarter. Enrollment limited to 20. Recommended for Honor and other students doing department research.

5 units, Win (H. Fisek) MWF 1:15

182. Data Analysis—Analyzing social scientific data. The basic statistical techniques used in data analysis. Emphasis on students’ own analysis of social scientific data. Follow-up to 181; an opportunity to analyze data collected in that course in some depth; useful to students who wish instruction in and supervision of analysis of other collected data. Data sets on variety of topics are available for students who do not have access to social scientific data prior to the course. Enrollment limited to 20.

5 units (Herting) given 1989-90

**INDIVIDUALIZED LEARNING EXPERIENCES, PRIMARILY FOR UNDERGRADUATE MAJORS**

190. Undergraduate Individual Study.

1-5 units (Staff) by arrangement

191. Undergraduate Directed Research—An opportunity to work on a project of ones' own choice under the close supervision of a faculty member. Prior arrangement required.

1-5 units (Staff) by arrangement

192. Undergraduate Research Apprenticeship—An opportunity to work in an apprentice-like relationship to a specific faculty member or members in an on-going research project. Prior arrangement required.

1-10 units (Staff) by arrangement

193. Undergraduate Teaching Apprenticeship.

1-5 units (Staff) by arrangement

194. Departmental Seminar for Undergraduate Majors—Introduces sociology as an academic discipline, career opportunities in the field, and current faculty research interests. Required of all sociology majors.

2 units, Aut (Staff) W 12

195. Honors Seminar—Required of all students planning an Honors thesis. Provides an opportunity to write and present portions of thesis (e.g., prospectus and a research proposal) to fellow Honors students who may assist you in beginning your project. Workshop format helps conceptualize, develop, and review thesis as it progresses. Organized to encourage the early development of a thesis, and to enable the student to compete for awards from the Fund for Undergraduate Research.

2 units, Win (Staff) W 12

196. Senior Thesis—An opportunity to work intensively on an Honors thesis project under faculty supervision (see description of Honors program). Must be arranged early in the year of graduation, or before.

3-10 units (Staff) by arrangement

**FOR ADVANCED UNDERGRADUATES AND GRADUATE STUDENTS**

207. Sociology of Mental Health—Same as 107 with special work for graduate students.

5 units, Win (Cronkite) TTh 10:30-12

210. Sociology of Education—(Meets with 310; same as Education 210.) Introduction to sociological approaches to educational phenomena. Topics: 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. Readings and evaluating social science research. Short written assignments and individual feedback.

4-6 units, Win (E. Cohen) MW 3:15-5:05

220. Interpersonal Relations: Lectures and Seminar—Same as 120 plus seminar for graduate students.

5 units, Aut (Johnston) MWF 8 section by arrangement
221. Theories of Social Psychology — The major theoretical perspectives in interpersonal processes and social psychology. The basic principles and assumptions of each perspective; techniques of investigation and methodological issues. Perspectives: symbolic interaction, field theory and exchanges, and problems associated with perspectives, e.g., power and influence, development of the self or attribution. Open to advanced undergraduates.

5 units

222. Social Processes and Pathological Outcomes — Seminar on abnormal family and group processes which result in emotional disturbance and behavioral disorders. The development of disorders in personality (or the self) from a social psychological or sociological point of view, emphasizing searching for the mechanisms by which pathological interpersonal interactions get translated into pathological self processes. Topics: the impact of experiences of neglect, abuse, molestation, violence, marital separation and divorce, war, and natural disasters on children and adults. Prerequisites: 120 or 220, and 121, or consent of instructor.

5 units, Win (H. Fisek) Th 2:15-5:05

229. Status, Expectations, and Rewards — The effect of status characteristics, race and sex, on the individual's interpersonal behavior: how status distinctions are maintained; how status distinctions determine an individual's performance expectations and expectations for rewards; how these performance and reward expectations can be changed. Theoretical and empirical research on status characteristics theory is examined for an understanding of the dynamics that link status, performance and reward expectations, and behavior in interpersonal situations. Prerequisites: 5, 120, or by permission of instructor.

5 units, Win (Johnston) T 7-10 p.m.

230. Seminar: Evaluation Research, Issues and Applications — The paradigms for evaluation research, the role of theory in formulating evaluations, and common issues faced in the design and execution of evaluations studies. Topics: general issues in program evaluation, development of assessment procedures, and examples of ongoing treatment and health services related evaluation projects. For advanced students, co-sponsored by the Department of Psychiatry and Veterans Administration Far West Health Services Research and Development Field Program. Prerequisite: Permission of instructor.

2 units, Win (Moos, Cronkite, Finney) Th 3-4:30

240. Seminar: Social Stratification.

5 units

242B. Interaction Processes in Education: Design and Evaluation — (Same as Education 312B.) Educational applications of sociological/social psychological theory and research to classroom processes, staff relations, teams, and task forces. The principles for design and evaluations of groupwork for students and teamwork for teaching staff. Topics: social processes of influence, role differentiation, and evaluation. Methods of systematic evaluation and observation are included; students receive practical experience in using these methods.

4 units, Aut (E. Cohen) MW 1:15-3:05

245. Origin and Diffusion of Mass Education — (Same as Education 245X.) Introduction to issues regarding the rise, organization, and expansion of mass education throughout the world. Interdisciplinary readings with a comparative/historical and cross-national research focus. Evaluation of functionalist, conflict, incorporation, and other theories of mass education.

4 units, Spr (Ramirez) MWF 10

247. Democracy in Developing Countries — Seminar on the conditions related to the emergence, institutionalization, and consolidation of democratic government, and the factors making for instability and breakdown. The theoretical and empirical literature on the relationship between political democracy and social structure, culture, economic development, constitutional structure and the international environment weighed against the historical experiences with democratic, semi-democratic and authoritarian government of numerous countries in Asia, Africa, Latin America, and the Middle East. Open to advanced undergraduates with background in political sociology, political development or international relations. Major research paper required.

5 units, Spr (Diamond) W 2:15-5:05

249. Social Demography — The causes and consequences of population and demographic change as they relate to social change. These relations with respect to fertility, mortality, family/kinship structure, demographic transitions, social mobility, marriage, and other selected social structures. Historical and present patterns. Theories explaining these changes/patterns and basic demographic techniques for analyzing the relation.

5 units

260. Formal Organizations: Lectures and Seminar — Same lectures as 160 plus seminar session for graduate students.

5 units, Aut (Scott) MWF 9; M 3:15-5:30

262. Organization and Environment — (Same as Business 672.) Inter-organizational relations
and the external control of organizational behavior. Provides experience in analyzing and thinking about organization-environment issues. Topics: 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 merger, co-optation, and joint ventures; the analysis of collective structures of interorganizational behavior, and how such structures emerge; and an analysis of social consequences of interorganizational activity. Completion of a major term paper in which the analytical concepts are applied to the analysis of a small set of organizations.

4 units, Win (Palmer)

263. 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. Relative power of subunits and individuals considered 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: the definition of power and politics, and whether power is a measurable and meaningful concept; the sources and determinants of 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. Enrollment limited: Sociology majors sign the class list in the Sociology Department.

4 units, Win (Pfeffer)

264. Managing the Organization's Workforce—(Same as Business 470.) All organizations face the following decisions: which activities to manage internally, and which to contract out; how to assign tasks to specific positions; how to compensate those positions, and how to balance pressures for equal compensation with pressures to pay for performance; how to select individuals to fill positions; how to structure careers to ensure training and learning, and to motivate and retain excellent employees; how to adapt to pressures for flexibility and change. These are made in a business environment increasingly constrained by litigation and government regulation, and by unions and employee associations. How such decisions are made and how to make them more effectively. Topics: the structure of rewards, the externalization of work, the organization of work in other countries, the legal environment of the employment relationship, unions and their effects, and organizational hiring standards and internal labor market arrangements.

4 units, Win (Pfeffer)

265. International Perspectives on Organizations—(Same as Business 475, Political Science 207M.) Perspectives and research by foreign scholars and in non-American contexts. Emphasis on identifying a few key concepts from the foreign literature and contrasting the points of view, research results, and experiences with those based on research in the U.S. 1988-89 focus is on perspectives drawn from Denmark, Finland, Norway, and Sweden. Prerequisites: Business 270; Sociology 160, or Industrial Engineering 100 or equivalent.

5 units, Win (March) TTh 8-9:50

267. Spatial Systems and Social Processes—(Same as Anthropology 267.) Seminar on the differentiation of social process through spatial systems in agrarian and commercial societies. The contingencies of human interaction in space elucidate central problems of comparative social science history. Topics: peasant marketing, population processes and family demography, internal colonialism, economic development and decline, social movements and revolutions, regime consolidation and disintegration, and the world system.

5 units, Spr (Skinner) TTh 1:15-2:45

282. Seminar: Topics in Comparative and Historical Sociology—The comparative and historical approaches to sociological analysis. Topics vary each year.

5 units (Conell) given 1989-90

284. Demographic Methods—(Same as Food Research 286.) Population theory and data analysis. Static and dynamic models of population composition and growth. Methods for estimating population parameters from flawed data. Prerequisite: Multivariate calculus, or consent of instructor.

5 units, Win (John) MW 9-10:50

285. Seminar: Political and Economic Organization of the World System—Current theory and research on the structure of the world economy and polity as they affect the organization and development of national societies. Dependency theories, current world-economy theories, and world effects on the evolution, dominance, and modern forms of states and regimes.

5 units, Win (Meyer) F 2:15-5:05
286. Seminar on Institutional Analysis—
Reading and research on the nature, origins, and effects of the modern institutional system. Emphasis on the state system.
5 units (Meyer) given 1989-990

287. Seminar: Convergence and Divergence
in Industrial Societies—Whether, and how far, the industrial and the developing societies are converging or diverging in their social and cultural patterns. The theory of convergence evaluated in relation to general theories of social change. Emphasis on family and kinship, education, social stratification and mobility. Other institutional complexes of interest.
5 units (Inkeles) given 1989-90

PRIMARILY FOR
GRADUATE STUDENTS

300A,B,C. Graduate Proseminar—Limited to first-year graduate students in Sociology.
2 units, Aut, Win, Spr (Staff)
by arrangement

301. Mathematics for Methodology.
5 units, Aut (Staff) TTh 11-12:30

306. Sociology of Development and Education—(Same as Education 306D.) The analysis of the relations between educational and societal developments from a comparative perspective. Readings on theoretical perspectives and empirical studies on the structural and cultural sources of educational expansion and differentiation, and on the cultural and structural consequences of educational institutionalization. Research topics: education and nation-building; education, mobility, and equality; education, international organizations, and world culture.
5 units, Spr (Ramirez) MW 3:15-5:05

310. Sociology of Education—(Same as Education 310.) For doctoral and master's students. Meets with 310. Emphasis on conceptualizing and analyzing applied sociological research in education. Short written assignments, individual feedback, and work with actual research data.
4 units, Win (E. Cohen) MW 3:15-5:05

320A,B,C. Seminar: Frontiers in Social Psychology—Recent developments in social/psychological research. Open to all graduate students and advanced undergraduates who have completed at least 15 units in Sociology. Required of trainees in the NIMH program on normal pathological interpersonal processes.
2 units, Aut, Win, Spr (Dornbush, Zelditch) M 12:15-1:30

Selected current issues in sociological social psychology. Topics: effects of family process on status attainment; social structure and group productivity; operation and interrelation of status, affect and control as social processes; and effects of power and legitimacy on responses to inequity. Prerequisites: 120 or 121, or permission of instructor.
5 units, Spr (Staff) MW 2:15-3:45

360A,B,C. Trainees Seminar: Organizations, Mental Health, and Aging—An ongoing seminar examining the impact of organizations on the mental health of their participants, the relations between organizations and the age structure of their participants, and the organization of services for the mentally ill and the aged. Required of NIMH and NIA trainees, but open to others.
2 units, Aut, Win, Spr (Scott, Staff) T 3:15-5:05

361. Seminar: Social Psychology of Organiza-
tions—(Same as Business 671.) The social psychological theories and research relevant to organizational behavior. Past topics: organizational culture, mythology, and the creation of knowledge structures such as script or schema; distributive injustice and its relationship to alienation, sabotage, violence, and theft organizational contexts. Prerequisites: Enrollment in a Ph.D. program and permission of the instructor.
4 units, Win (Martin)

365. Seminar: Advanced Organization The-
ory—(Same as Business 676, Political Science 306.) Topics in organization theory for advanced students. Prerequisite: Permission of the instructor.
4 units, Win (March)

367. Seminar: Organizational Analysis—
(Same as Business 670.) A doctoral level introduction to research on organizations. Emphasis on recent theoretical and methodological advances in various social science disciplines, particularly sociology and social psychology. Prerequisites: Consent of instructor and enrollment in a Ph.D. program.
4 units, Aut (Martin)

370A,B. Basic Problems in Sociological The-
ory—A two-quarter course on the analysis and construction of theories and on the basic strategies of sociological analysis. 370A introduces strategies of sociological analysis selected from among functionalism, historical materialism, human ecology, the theory of action, symbolic interactionism, social phenomenology, decision theory, and behaviorism, illustrated by one or more programs of theoretical research originating the classical literature (e.g., Durkheim,
Marx, Weber, et al) still active in the contemporary literature (e.g., Homans, Merton, Parsons, et al). Also, some elementary methods required to intelligently read and analyze theory. 370B refines these methods and extends them to the construction of new theory. It includes a self-directed computer course in logic. Prerequisite: Consent of the instructor.

3 units, Aut (Zelditch) TTh 3:15-5:05
Win (B. Cohen) MW 2:15-4:05
plus section by arrangement

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 (B. 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 (B. Cohen) by arrangement

381. Sociological Methodology: Design and Analysis—The basic principles of experimental and non-experimental design applied to the various observation plans used in sociological research. Measurement theory. Statistical foundations, including exploratory data analysis and the general linear model. Prerequisite: 160 or equivalent.
4-6 units, Win (Szelenyi) MW 10:30-12;
plus section F 10:30-12

382. Sociological Methodology: Quantitative Outcomes — The methods for systematic analysis of quantitative features of social process. Analysis of static relationships, using structural equation methods and social dynamics. Prerequisite: 381 or equivalent.
4-6 units, Spr (Herting) MWF 10-12

383. Sociological Methodology: Discrete Variables — Rationale for and interpretation of quantitative methods of analyzing discrete variables: tabular analysis, log-linear and logit analysis, probit analysis, and event history analysis. Prerequisite: 381, or equivalent.
4-6 units, Aut (Gzusky) MWF 1:15-3:05

384. Seminar: Measurement in the Social Sciences—Principles and problems of measurement in the social sciences within the context of causal modeling. Methodological approaches, from traditional factor analytic methods to recent developments in the causal modeling of error structures. Emphasis on the utility of multiple indicator approaches to social measurement.
5 units (Herting) given 1989-90

385A, B, C. Frontiers in Quantitative Research and Methods.
3-5 units, Aut, Win, Spr (Staff)
T 2:15-5:05

**SPACE SCIENCE AND ASTROPHYSICS**

**GRADUATE INDIVIDUAL STUDY**

390. Graduate Individual Study.
(Staff) by arrangement

391. Graduate Directed Research.
(Staff) by arrangement

392. Research Apprenticeship.
(Staff) by arrangement

393. Teaching Apprenticeship.
(Staff) by arrangement

(Staff) by arrangement

**CENTER FOR SPACE SCIENCE AND ASTROPHYSICS**

Emeriti: (Professors) William A. Bonner, John V. Breakwell, Oscar Buneman, William M. Fairbank, Laurence A. Manning, Jean Meyers, Alan T. Waterman; (Research Professor) Aldo V. daRosa, John P. Katsufrakis

Director: Robert A. Helliwell
Deputy Director: Peter A. Sturrock
Associate Directors: Peter M. Banks, L. R. Owen Storey, Robert V. Wagoner


Associate Professors: J. Richard Bond, Lambertus Hesselink, Umran S. Inan, Bruce B. Lusignan, Norman H. Sleep

Professors (Research): Donald L. Carpenter, C-W. Francis Everitt, Henry T. Howard, L. R. Owen Storey, J. Gethyn Timothy, G. Leonard Tyler, John F. Vesekey

Consulting Professors: Owen K. Garriott, Emery Reeves

The center is an interdepartmental organization coordinating teaching and research in space science and astrophysics. Its members are drawn from the Departments of Applied Earth Sciences and Geology in the School of Earth Sciences; the Departments of Aeronautics and Astronautics, Electrical Engineering and Mechanical Engineering in the School of Engineering; and the Departments of Applied Physics, Chemistry, and Physics in the School of Humanities and Sciences.
Research now in progress covers a very wide field and is approached in a variety of ways, including experiments flown on rockets, satellites, and space probes; ground-based observations made from the Wilcox Solar Observatory and from national observatories; and theoretical research including computer modeling. Specific topics currently being studied include: technical aspects of space projects such as guidance and control; the application of information sciences to the transfer and analysis of space data; planetary sciences; solar-terrestrial phenomena; solar physics; stellar structure; infrared astronomy; x-ray and extreme ultraviolet astronomy; gamma-ray astronomy; high-energy astrophysics; theoretical astrophysics; gravitation theory and experiments; cosmology; and the study of life in the universe. Many of these projects involve collaboration with scientists at the NASA-Ames Research Center. For administrative purposes, the center comprises a number of smaller units with specialized research activities. It also has a close working relationship with the Center for Aeronautics and Space Information Sciences (Director, Professor Peter M. Banks), which is the primary vehicle within the University for research on information systems in their application to space programs.

Stanford is a member of the Universities Space Research Association, a consortium of universities which operates the Lunar Science Institute in Houston, Texas, and also of the University Corporation for Atmospheric Research, which operates the National Center for Atmospheric Research in Boulder, Colorado. The facilities of the center 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, Applied Physics, and Physics offer opportunities leading to an M.S. or Ph.D. degree for work in space science or astrophysics. The center also offers opportunities to undergraduates who may, for instance, participate in research projects in their junior or senior years, either on a part-time basis during the school year or on a full-time basis during the summer. The Astronomy Course Program operates a small student observatory where students may gain practical experience in astronomical observing. The course list at the end of this entry includes courses of interest to undergraduates as well as courses primarily of interest to graduates. For descriptions of these courses, see their listing under Aeronautics and Astronautics, Applied Physics, Electrical Engineering, Geophysics, Mechanical Engineering, Physics, and also under the Astronomy Course Program.

Further information is available from the Director.

**COURSES**

15A. The Nature of the Universe—(Enroll in Applied Physics 15.)
3 units, Win (Walker)

15B. Cosmic Horizons—(Enroll in Physics 15.)
3 units, Spr (Bloom)

50. Astronomy Laboratory and Observational Astronomy—(Enroll in Applied Physics 50.)
3 units, Aut, Sum (Walker)

100. Introduction to Observational and Laboratory Astronomy—(Enroll in Applied Physics 100.)
4 units, Spr (Walker)

106. Planetary Exploration—(Enroll in Electrical Engineering 106.)
3 units, Spr (Eshleman)

110. Introduction to Stellar and Galactic Astrophysics—(Enroll in Applied Physics 160.)
3 units, Win (Staff)

111. Introduction to Extragalactic Astrophysics and Cosmology—(Enroll in Applied Physics 161.)
3 units, Spr (Petrosian)

129. Life in Space—(Enroll in Aeronautics and Astronautics 129.)
3 units, Win (Billingham, Ballard, Chang, Clearwater, Cohen, Daunton, Foushee, Goldwater, Holton, Lawless, MacElroy, Wydeven)

190A, B, C. Independent Study in Astrophysics and Honors Thesis—(Enroll in Astronomy 169A, B, C.)
1-9 units, Aut, Win, Spr (Staff)

3 units, Spr (Sleep)

212. Introductory Hypersonic Aerophysics—(Enroll in Aeronautics and Astronautics 212.)
3 units, Win (Bershader)

227. Atmospheric and Space Physics—(Enroll in Aeronautics and Astronautics 227.)
3 units, Spr (Spreiter) alternate years, not given 1989-90

235A, B. Space Systems Engineering—(Enroll in Engineering 235A, B.)
3 units, Win, Spr (Lusignan)

249. Introduction to Space, Telecommunications, and Radioscience—(Enroll in Electrical Engineering 249.)
3 units, Aut (Banks) not given 1989-90
279A. Space Mechanics—(Enroll in Aeronautics and Astronautics 279A.)
3 units, Win (Staff)

279B. Advanced Space Mechanics—(Enroll in Aeronautics and Astronautics 279B.)
3 units, Spr (Breakwell)
alternate years, not given 1989-90

279C. Optimal Space Trajectories—(Enroll in Aeronautics and Astronautics 279C.)
3 units (Breakwell)
alternate years, given 1989-90

280. Rocket Propulsion Fundamentals—(Enroll in Aeronautics and Astronautics 280.)
3 units, Win (Chang)

286. Advanced Space Propulsion—(Enroll in Aeronautics and Astronautics 286.)
3 units, Spr (Chang, Altman)

348. Ionospheric and Magnetospheric Processes—(Enroll in Electrical Engineering 348.)
3 units, Spr (Staff) alternate years, not given 1989-90

350. STAR Laboratory Seminar in Radio-science.
1 unit, Aut, Win, Spr (Vesecky)

352. Electromagnetic Waves in the Ionosphere and Magnetosphere.
3 units, Spr (Helliwett)

354. Introduction to Radio Wave Scattering
—(Enroll in Electrical Engineering 354.)
3 units, alternate years, given 1989-90

3 units, Spr (Staff) alternate years, not given 1989-90

3 units (Staff) alternate years, given 1989-90

3 units (Staff) alternate years, given 1989-90

364. Gravitation—(Enroll in Physics 364.)
3 units, Win (Dimopoulos)

364A,B. Basic Plasma Physics I and II—(Enroll in Applied Physics 312, 313.)
3 units, Win, Spr (Sturrock) alternate years, given 1988-89

366. Extragalactic Astrophysics and Cosmology—(Enroll in Applied Physics 365.)
3 units, Win (Petrosian) alternate years, not given 1989-90

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SPANISH AND PORTUGUESE

Emeriti: (Professors) Fernando Alegria, Aurelio M. Espinosa, Jr., Bernard Gicovate, Juan B. Rael, Isabel Magaña Schevill; (Assistant Professor) Grace Knopp

Chairman: Michael P. Predmore


Associate Professors: Wilfrido H. Corral, Mary Louise Pratt, Tomás Ybarra-Frausto

Assistant Professor: Adrienne L. Martin

Research Associate: Lyris Wiedemann

Associate Professor (Teaching): María-Paz Haro

Senior Lecturer: Karin Van den Dool

Visiting Professors: José Luis González (Autumn), Daphne Patai (Spring), Anthony N. Zaharias (Winter)

Director, Undergraduate Language Program: María-Paz Haro

The Department of Spanish and Portuguese accepts candidates for the degree of Bachelor of Arts, Master of Arts in Spanish and Portuguese, and Doctor of Philosophy in Spanish and Portuguese.

Students interested in Iberian and American languages not offered in this department should contact the Special Language Program, Department of Linguistics.

UNDERGRADUATE PROGRAMS

BACHELOR OF ARTS

Recognizing that students have different interests and reasons for pursuing a major in the Department of Spanish and Portuguese, the following major paths have been designed. Each has different objectives and requirements. Students will wish to consider, in conjunction with a faculty advisor, which major path corresponds most closely to their own personal and professional objectives.

Literature Emphasis—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 50 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, Ad-
vanced Grammar and Composition; three courses in Peninsular literature; three 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.

**Literature and Society Emphasis**—The aim of this path is to permit a more flexible approach by allowing students 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 40 units in the department from courses numbered 100 or higher, and 10 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; three courses in Peninsular literature; three courses in Latin American literature.

**Chicano Studies Emphasis**—The aim of this path is to permit more flexibility to students in Chicano Studies, allowing them to take optional courses in, for instance, the Departments of Linguistics, Anthropology, or History. Professor Ybarra-Frausto serves as individual program advisor. Students will also be expected to acquire an adequate knowledge of the roots of Chicano literature. Candidates must complete 40 units in Chicano Studies. In addition, they must take 10 units in Latin American or Peninsular literature from courses numbered 100 or higher in the department.

Requirements: Spanish 140, Introduction to Methods of Literary Analysis; 180, Undergraduate Winter Colloquium; 201 and 202, Advanced Grammar and Composition; three courses in Chicano literature; four courses in Latin American and Peninsular literature.

**Language Emphasis**—This path is intended for students whose primary interest is in the structure and use of the Spanish language. Students must complete a minimum of 50 units from courses in the department numbered 100 or higher.

Requirements: Spanish 140, Introduction to Methods of Literary Analysis; Spanish 180, Undergraduate Winter Colloquium; Spanish 201, 202, Advanced Grammar and Composition; one course in introductory linguistics (in the Linguistics Department); three courses in Spanish linguistics.

Recommended: Spanish 205; two literature courses in one area; Portuguese 109 (Portuguese for Speakers 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 150-151 (Peninsular literature) and 160-161 (Latin American literature) are introductory survey courses. These satisfy the minimum literature requirements for all the paths. It is recommended that majors enroll initially in 150-151 or 160-161. It is also expected that they will go on to take courses at the 200 level. The core courses will be offered each year.

Courses numbered 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.

It is also recommended that majors take Portuguese 109, Portuguese for Speakers of Spanish, so as to acquire a basic reading knowledge of Portuguese. This is not a substitute for First- or Second-Year Portuguese but is intended to build skills for conducting research in the language.

**EXTENDED MAJORS**

Candidates for the A.B. in English and Spanish Literature or English and Portuguese/Brazilian 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 50 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 6 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 Overseas Studies (room 126, Sweet Hall).

The program offers two types of courses: those under departmental listings in overseas Studies and courses taught at the University of Salamanca. Special courses for Stanford students include:
Overseas Studies 101A, Bases sociopoliticas de la evolución cultural española (5 units)
Spanish 101B, Literatura Española Contemporánea (5 units)
Overseas Studies 102A, Historia de España, s.XIX (4 units)
Overseas Studies 102B, Historia de España, s.XX (4 units)
Spanish 201, Advanced Grammar and Composition (3 units)
Spanish 202, Advanced Grammar and Composition (3 units)

These courses are required for all students in the Salamanca program. Three of the courses are offered in the Autumn Quarter and three in the Winter Quarter.

Each Stanford student enrolls in two additional courses at the University of Salamanca from among those offered to Spanish students by the University. The list of these courses is available at the Overseas Studies office. Courses taught at the University of Salamanca include: Spanish Civilization; Spanish Linguistics; History of Spain; Art History, etc.

For information and course list, consult Dr. Haro or the office of Overseas Studies.

SAO PAULO, BRAZIL
Stanford participates in a consortium-based program in South America in São Paulo, Brazil. The full-year program begins early in the summer and continues through the following June. Students enroll at the Universidade de São Paulo in Brazil. For information on the São Paulo program, consult Dr. Van den Dool or the Overseas Studies Program office. For credits in these and other programs abroad, consult your advisor.

INTENSIVE SUMMER PROGRAM
Stanford University offers first-year intensive language study in Spanish during the summer. For further information, consult Dr. Haro.

TEACHING CREDENTIALS
For information concerning the requirements for teaching credentials, see the "School of Education" section of this bulletin and the Credentials Administrator, School of Education.

COURSES FOR BILINGUAL STUDENTS
The department offers a series of second- and third-year 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 bilingual courses.

HONORS PROGRAM
Spanish and Portuguese majors in their junior year with a letter grade indicator of "B+" or better in all major courses may apply to the Honors program. Students should submit an "Application for Honors Program" and a proposal outline by the end of Winter Quarter of the junior year. Each Honors student must be accepted by a faculty member who serves as Honors advisor. Candidates write an Honors essay of 20 to 25 pages. Work on the essay normally begins in the Spring Quarter of the junior year and must be completed by the end of the third week of March of the senior year. Consult the undergraduate secretary for more information.

PROFICIENCY CERTIFICATION
Advanced students are strongly encouraged to qualify by examination for the Language Proficiency Notation which is certified on the graduation transcript. For further information, contact Dr. Haro.

GRADUATE PROGRAMS
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. 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; Spanish 306, Introduction to Literary Theory or an equivalent course; two 200 or above level courses in Latin American literature and two 200 or above level courses in Peninsular literature; reading knowledge of one foreign language other than Spanish (preferably Portuguese); and a long research paper written in consultation with a faculty advisor.

In addition, students may take approved courses in related fields such as linguistics, modern thought, classics, comparative literature, philosophy, history of art, and education. Students planning a career in language teaching may also take part in the University’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.

DOCTOR OF PHILOSOPHY
The requirements of the Ph.D. are: (1) 90 units of graduate level course work; units com-
completed toward the A.M. degree can be counted for the Ph.D.; (2) Spanish 201 and 202, Advanced Grammar and Composition; 301, Methods of Teaching Spanish; and 306, Introduction to Literary Theory and Criticism or equivalent courses must be included; (3) a reading knowledge of Portuguese and one other foreign language; (4) the qualifying paper, the comprehensive and the University oral examinations, as described below; (5) the teaching of at least three courses in the department; (6) the writing of a dissertation. For basic residency and candidacy requirements, see the "Advanced Degrees" section in this bulletin. (For further information, consult the department's Graduate Student Handbook.)

Newly admitted students are required to take a proficiency examination in Spanish during the first week of the quarter. This examination will be reviewed by the Director of the Language Program to determine the degree of the student's previous preparation. The student will be required to remedy deficiencies indicated by this examination before a teaching assignment will be awarded.

In consultation with the advisor, students will select one major field of study from the following: (1) Spanish Medieval Literature, (2) Spanish Literature of the Golden Age, (3) Modern Spanish Literature, (4) Brazilian Literature, (5) Spanish American Literature to Independence, (6) Spanish American Literature of the 19th and 20th centuries, (7) Chicano Literature. 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) Spanish American Literature of the Colonial Period, (7) Spanish American Literature from Independence, (8) Chicano Literature, (9) Literary Theory.

At least four courses must be taken in the major field of study. At least two courses must be taken in each secondary area. Students whose major field is in Latin American literature must choose one minor in Peninsular literature and vice versa. One secondary area of concentration may be taken outside the department in consultation with the advisor.

In addition to departmental course offerings, students are encouraged, in consultation with their advisor, to take relevant courses in other departments and programs such as the Graduate Program in Humanities, Comparative Literature, Modern Thought and Literature, Feminist Studies, or History. Normally, not more than 25 units are taken outside the department.

In preparation for teaching, Ph.D. candidates must take Spanish 301, Methods of Teaching Spanish, 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 term paper of approximately 20 pages on the first day of the Autumn Quarter of their second year.

After receiving approval of the qualifying paper, students concentrate on the major field of study. All course requirements are completed usually by the end of the third year of study. Early in the fourth year, students take a written comprehensive examination on their major field and secondary areas. This examination is based on a comprehensive list of readings which integrates major and secondary topics in both Peninsular and Latin American Studies. At this time, students also hand in a research paper to be evaluated by the faculty. For further details, consult the Graduate Student Handbook.

A University oral examination is required, usually one or two quarters after taking the comprehensive examination. This examination will cover plans for the dissertation based on a prospectus approved by the advisor.

The candidate should file a formal application for candidacy, as prescribed by the University, no later than the end of the second year. As early as possible, Ph.D. candidates will be expected to find a topic requiring extensive original research and to choose a member of the department as their 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 admission to candidacy. 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.

JOINT Ph.D. PROGRAMS

The Department of Spanish and Portuguese participates in the Graduate Program in Humanities leading to a joint Ph.D. degree in Spanish and Humanities. For a description of that program see the "Humanities Special Programs' section in this bulletin.
Additional courses in literature that may be of interest to graduate students in Spanish may be found in the “Comparative Literature” and “Modern Thought and Literature” sections in this bulletin.

Students who choose a minor in Comparative Literature or Modern Thought and Literature should consult with the chairs of these programs.

COURSES

OVERVIEW

1. First- and Second Year-Spanish (1-99)
   - Culture (130B-132B)
   - Literature (140-199)
2. Intermediate Courses (100-199)
   - Culture (130B-132B)
   - Literature (140-199)
3. General Courses (given in English)
4. Courses for Advanced Undergraduates and Graduates (200-299)
   - Advanced Language and Linguistics (200-209)
   - Peninsular Literature (210-245)
   - Genre Survey Courses (121-132)
   - Medieval and Golden Age Literatures (214-235)
   - Modern and Contemporary Literatures (236-245)
   - Latin American Literature (246-279)
   - Genres and Literary Movements (246-259)
   - National Literatures (260-275)
   - Individual Authors (276-279)
   - Chicano Literature (280-289)
   - Special Topics (290-298)
   - Individual Work (299)
5. 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)
6. Portuguese Program (1-399)
   - Language (1-199)
   - Portuguese Literature (210-245)
   - Brazilian Literature (246-279)
   - Graduate Seminars (300-399)

All courses are taught in Spanish or Portuguese unless otherwise noted.

SPANISH LANGUAGE PROGRAM

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. Students who have passed the AP exams with a 4 or 5 are exempted from the test, but must register in third year courses in order not to lose their AP credit. For courses 11B, 12B, and 13B, see the special section for bilingual students. (No auditors permitted in language courses.)
100. Advanced Conversation—Prerequisite: 13 or equivalent. Given Pass/No Credit only. (May be counted only once for the major.)
3 units, Aut, Win, Spr (Staff) MWF

110. Elementary Conversation for Graduate Students—(See 10.)

FOR BILINGUAL STUDENTS

The following courses are designed to meet the specific linguistic and cultural needs of the bilingual student. See also the 130 sequence.

11B,12B,13B. Second-Year Spanish for Bilingual Students—Refinement of Spanish for bilingual students. Series for bilingual students of Hispanic background and others with equivalent language skills who wish to refine their command of the language and to enlarge their vocabulary. Short readings by and about Chicanos and other Hispanics in the U.S. constitute the basis of appropriate grammar review. Slides, tapes, videos, and films. (DR:2; entire sequence must be completed).
5 units, Aut, Win, Spr (Staff) MTWTh

162B. Chicano Literature: Creative Writing for Bilingual Students—(Same as English 162B.) Basic creative writing in which students are encouraged to draw from their bicultural, bilingual experience. Knowledge of Spanish and familiarity with barrio dialects essential. (Not open to graduate students or freshmen.)
3 units, Aut (Islas) TTh

SPECIAL

15. Reading Spanish—Intensive course designed for those seeking to fulfill the University requirement of a reading knowledge of Spanish. Students must earn at least a letter grade indicator of "B."
3 units, Spr (Staff)

20. Second-Year Intensive Spanish—A proficiency-oriented accelerated course recommended for students with previous training (four to five years of high school Spanish or the equivalent) whose progress would best be served by intensive study. Meets daily for two hours.
3 units, Win (Staff) MTWThF

21M/121M. Spanish for Medical Personnel—(Same as Health Research and Policy 280.) Geared to achieving a practical, rapid, and immediately useful command of spoken Spanish. Covers such topics as the human body, hospital procedures, diagnostics, food, and essential phrases for on-the-spot reference when dealing with Spanish-speaking patients.
3 units, Aut (Staff)

22M/122M. Spanish for Medical Personnel—(Same as Health Research and Policy 281.) Continuation of 21M. Prerequisite: 21M or equivalent.
3 units, Win (Staff)

23M/123M. Spanish for Medical Personnel—(Same as Health Research and Policy 282.) Continuation of 22M. Prerequisite: 22M or equivalent.
3 units, Spr (Staff)

99. Individual Work—Cannot be taken as a substitute for any of the regularly scheduled language courses.
1-5 units (Staff) by arrangement

CULTURAL READINGS

These courses 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.

Readings and topics for conversation and composition begin with a focus on Spain, the Mexican-Chicano, Puertorriqueño and Cubano heritages, and expand to include socio-cultural and historical material from Latin America. The aim of this sequence is to develop a critical perspective on issues affecting a bilingual-bicultural reality. Prerequisite: 13 or permission of instructor. For special courses in Chicano literature and history, see courses numbered 250-289.

130B,131B,132B. Cultural Readings—Art, current events, folklore, history, language, and literature of Spain (130B), Mexico and the Hispanic Southwest (131B), and of Spanish America (132B). Lectures supplemented by slides, movies, tapes, and occasional field trips. For non-majors, bilingual students, and others
interested in the culture of Spanish speakers. Need not be taken in sequence.

130B. Spanish Cultural Readings—(DR:2)
3-5 units, Aut (Haro)

131B. Mexican and Chicano Cultural Readings—(DR:2)
3-5 units, Win (Staff)

132B. Hispanic American Cultural Readings—(DR:2)
3-5 units, Spr (Staff)

LITERATURE
These courses emphasize a broad perspective on Hispanic literature and provide an introduction to literary studies. Prerequisite: 13 or equivalent.

140. Introduction to Methods of Literary Analysis—For students with little or no background in literary analysis. Introduces basic terminology of literary theory and a variety of critical approaches to literature through textual analysis. Emphasis varies with instructor, but teaches students to read, write, and think about literature. Prerequisite: 13 or equivalent. (DR:2)
3-5 units, Aut (Ybarra-Frausto)

150-151. Spanish Literature—The basic introduction to Spanish Peninsular literature. Sequence deals with major works from several periods and genres preparing for more specialized 200 level courses. Need not be taken in sequence. Content varies each year. Prerequisite: 13 or equivalent.

150. Spanish Literature I—The spirit of Spain in its literature. A study of Medieval and Golden Age masterpieces that establish and reflect Spain's unique identity (Christians, Jews, Moors) and create its tradition. Close reading of El libro de buen amor, Poema del Cid, La Celestina, Lazarillo de Tormes, El Burlador de Sevilla, Cervantes, Góngora, Lope de Vega, Calderón. (DR:2)
3-5 units, Win (Martin)

151. Spanish Literature II—Figures and representative works of Spanish literature from the 1830's to the 1930's: Larra, Espronceda, Bécquer, Galdós, Unamuno, Valle-Inclán, Machado, and Lorca. Emphasis on a close reading of texts in relation to the "problem of Spain" within the democratic tradition of Spanish liberalism. (DR:2)
3-5 units, Spr (Ybarra-Frausto)

155. The Spanish Republic, the Civil War, and the Aftermath—The significance of the Civil War for Spanish, European, and world history; the International Brigades. The effect of war on the literary and cultural life of the country and the response of writers from Spain (Machado, Lorca, Alberti) and Latin America (Neruda, Guílén, Vallejo). A survey of literary protest during the Franco regime by such figures as Alonso, Aleixandre, Cela, Santos and Goitisoló.
3-5 units (Predmore) alternate years, given 1989-90

160-161. Spanish American Literature—Basic introduction to Spanish American literature with major works from several periods and genres. Prepares the student for more specialized 200 level courses. Need not be taken in sequence. Content varies each year. Prerequisite: 13 or equivalent.

160. Spanish American Literature I—Major themes, writers, and major cultural debates. Novels, poems, essays, and periodicals from Latin America. (DR:2*).
3-5 units, Win (Corral)

161. Spanish American Literature II—Continuing 160, focuses on literary periodicals to examine an emerging cultural debate. (DR:2*)
3-5 units, Spr (Ybarra-Frausto)

3-5 units, Spr (Ruffinelli)

180. Undergraduate Winter Colloquium: Life and Literature in the Spanish Golden Age—A socio-historical study of daily life in Golden Age Spain with accompanying analysis of its depiction in literature. Emphasis on literary and social themes: the Academy, poetic competitions and literary rivalries, the comedia and other mass entertainments; the concept of honor, education, fashion, gastronomy, travel, the new world, the Church and the Inquisition, mysticism, minorities, women writers and early feminism, court life, and picaresque. (DR:2)
3-5 units, Win (Martin)

199. Individual Work—Open only to majors in Spanish, or with special permission.
1-12 units (Staff) by arrangement

GENERAL
These courses 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. Need not be taken in sequence. Open to all students.

135. Introduction to Chicano Life and Culture—(Same as Anthropology 110.) Interdisciplinary focus on the history and culture of Mexican Americans during the 19th and 20th cen-
turies. Historical perspectives are balanced with anthropological and literary views on the cultural patterns of Mexicans in the U.S. Students interact with three different Chicano faculty from three disciplines. Readings: historical texts, novels, poems and ethnographies. (DR.5) 3-5 units, not given 1989-89

162A. Contemporary Chicano Literature — (Same as English 162A.) An intensive examination of Chicano and Mexican American prose writers from 1959 to the present. 5 units (Islas) not given 1988-89

FOR ADVANCED UNDERGRADUATES AND GRADUATES
ADVANCED LANGUAGE AND LINGUISTICS

201. Advanced Grammar—Problems of grammar at an advanced level. 3 units, Aut (Martin)

202. Advanced Composition—Workshop on syntax and style. 3 units, Win (Haro)

205. History of the Spanish Language — The historical development of Spanish from Vulgar Latin. Combined with close readings of Old Spanish poetic and prose texts. 3-5 units, alternate years, given 1989-90

208/308. Latin American Sociolinguistics and Dialectology— (Same as Linguistics 156/256.) The social and regional diversity of language in Latin America. Regional dialect of Spanish and Portuguese; origins of dialectal difference. Non-standard varieties; social class differentiation of language use. Language contact and multilingualism. African and Amerindian influences on Spanish and Portuguese. Creolization. 3-4 units, Aut (Guy)

PENINSULAR LITERATURE

210. Studies in Medieval Literature—Spanish literature produced between 1000 and 1500. Focus is on the major works and history of the period. Readings: Poema de Mio Cid, El libro de Buen Amor, and La Celestina. 3-5 units, Win (Zahareas)

211. La Celestina. 3-5 units

214. The Spanish Golden Age. 3-5 units

216/316. Don Quijote I: The Historical Function of Madness—Don Quijote in relation to the principal literary traditions and cultural forces of the European Renaissance. 3-5 units, Win (Zahareas)

217/317. Don Quijote II—Continuation of 216. 3-5 units, not given 1988-89

219. Introduction to 19th-Century Spanish Literature—Representative literary figures of 19th-century Spain: Larra, Espronceda, Zorrilla, Becquer, and Galdós. Major directions in modern lyric poetry and in the modern realist novel are studied against the background of Napoleonic invasions, loss of overseas colonies, two Carlist civil wars, and frustrated attempts to establish the First Spanish Republic. Attention to close textual analysis. 3-5 units, Aut (Predmore)

220. Introduction to 20th-Century Spanish Literature—The first three decades of the 20th century. Works of Unamuno, Valle-Inclán, Baroja, Azorín, A. Machado, and Lorca. Major historical themes concerning the Disaster of 1898, the social and political conditions (“oligarqua y caciquismo”) of Restoration Spain (1875-1930), Carlism, civil war, and the rise of the Second Spanish Republic. Close reading and analysis of literary texts, involving aspects of ideology and literary structure. 3-5 units, Win (Predmore)

226. The Sonnet in Hispanic Literature—The structure of the sonnet and its history since Santillana in the 15th century. 3-5 units

227. Lyric Poetry in the Renaissance and the Baroque—Major Spanish poets of the 16th and 17th centuries. 3-5 units

LATIN AMERICAN LITERATURE

240. First Images of America in Colonial Prose—The European and indigenous views of “America” on discovery and initial contact; “fiction/history”; the noble savage, the mestizo, the semiotics of quests, and utopianism/materialism. 3-5 units, Aut (Corral)

241. Afro-Hispanic Cultural Worlds: An Introduction—(Same as African and Afro-American Studies 241.) The literature and thought of Black Latin American writers in the Spanish-speaking Americas and Brazil. An introduction to the popular syncretic cultures of these interesting but little known worlds. Reading in Spanish, Portuguese, and in English translations. 3-5 units, Spr (Wynter)

248. The Caribbean-Americas: An Introduction to Their Literature, Thought, and Cultural Worlds—(Same as African and Afro-American Studies 248, English 262G.) The literature, thought, and popular cultures of the Caribbean
Basin within the context of an overview of its multiple cultural and linguistic worlds.

3-5 units. Aut (González)


3-5 units (Ybarra-Frausto) not given 1988-89

252. Theory of Literature and Culture in Latin America—Analysis of themes and problems occurring in Latin American critical writings: acculturation and transculturation, eurocentrism or autonomy, historical periods and genres, literature nomenclature and the concept of America.

3-5 units, Win (Ruffinelli)

255. Methodology of Reading Poetry: César Vallejo—An analysis of the works of the Peruvian poet Vallejo as part of the process of modernization in Latin American literature.

3-5 units (Ruffinelli) given 1989-90

257. Magic Realism and the Latin American Short Story.

3-5 units

258. Contemporary Latin American Short Story—A variety of younger short story writers from Mexico, Central and South America.

3-5 units, Spr (Ruffinelli)

259. The Short Novel as Genre in Latin America—Los de Abajo and the avant-garde short novels of the 20's and 30's, the reception of works by Bombal, Onetti, Sábató, García Marquez, Pacheco, and other contemporary authors.

3-5 units, Spr (Corral)

260. A New Literary Genre: Testimony—Latin American literature and politics viewed in the light of a new narrative genre in the works of Rodolfo Walsh, Omar Cabezas, Elena Poniatowska, and others.

3-5 units (Ruffinelli) given 1989-90

266. Culture, Authoritarianism, and Resistance in Latin America—Latin American cultural production under the restrictive conditions imposed by authoritarian military regimes of the 1970's and 80's, especially in Brazil and the Southern Cone. Readings on the language of authoritarianism, the legitimation of state violence, and artistic forms of resistance including poetry, testimonio, film. Reading knowledge of Spanish required. In English.

5 units (Pratt) alternate years, given 1989-90

CHICANO STUDIES

280. Introduction to Chicano Literature—Selected works by major Chicano writers of the 20th century, including poetry, fiction, and drama. Questions of genre and textual interpretation emphasizing the socio-historical and cultural context of Chicano literature.

3-5 units (Ybarra-Frausto) given 1989-90

289. Chicano Creative Writing Workshop — Prerequisite: Knowledge of Spanish.

5 units

SPECIAL TOPICS

296. Western Views of the Non-West Through the Literature of Travel—The western traveler as cross-cultural mediator and interpreter in precolonial and neo-colonial settings; the ideological appropriation and "normalization" of alien contexts as related to developments in world politics and economy, notably European expansion. Readings on the Spanish Conquest of America, British exploration in Africa, the "re-opening" of China, and works by contemporary travelers: Graham Greene, V. Naipaul, S. Naipaul, Paul Theroux, Isak Dinesen, etc. In English.

3-5 units (Pratt) given 1989-90

299. Individual Work—May be repeated for credit. Open to undergraduates or graduates majoring or minoring in Spanish.

1-12 units, any quarter (Staff) by arrangement

GRADUATE SEMINARS

Open to undergraduates with consent of instructor.

301. Methods of Teaching Spanish—(Same as Education 292.) Analysis and discussion of second language theory on teaching and learning, classroom practices, and Spanish instructional materials.

3-5 units, Spr (Haro)

306. Introduction to Literary Theory and Criticism—Discussion of major currents in contemporary criticism. Topics and readings vary each year. In English.

4-5 units (Pratt) given 1989-90

310. Discourse and Ideology—Creation of meaning as a social process, ways in which ideology is produced, reproduced, and transformed in linguistic interaction, whether and how American competence models can interlock with theories that see language as constituting social reality and self. Readings on the concept of socially determined meaning, discursive practices in the French tradition, British empirical analyses, American sociolinguistics. In English.

4-5 units (Pratt)
336. Modern Spanish Poetry: Antonio Machado, Juan Ramón Jiménez, F. García Lorca—Detailed study of the principal poetic works of three major 20th-century poets in the context of Restoration Spain (1871-1930), and against the background of the democratic tradition of Spanish liberalism. Emphasis on close stylistic analysis and such concepts as Generation of 1898, Modernism, Krausism, pure poetry, and symbolic system. 3-5 units (Fredmore) not given 1988-89

340. Ramón del Valle-Inclán—The evolution of the major works of Valle-Inclán from the Sonatas to Tirano Banderas, including the Comedias bárbaras and three of the “esperpentos” against the background of Restoration Spain. Emphasis on Valle as a major force in aesthetic innovation and social criticism. 3-5 units (Predmore) given 1989-90

352. Interdisciplinary Graduate Seminar: Chicano Culture—(Same as English 363.) How literary texts reflect and interpret aspects of the Mexican-American experience. Texts included within the intellectual tradition of the U.S. and Mexico are analyzed from this dual perspective. 3-5 units, Spr (Islas, Ybarra-Frausto)

353. Onda y Escritura en México—Main lines in the development of literary production in Mexico since 1968. Examination of the aesthetic and textual practices of writers identified with “La Onda” (José Agustín, Gustavo Saenz, García Saldoña Parmenides), etc. Analysis of key works by the younger generation of writers (Luis Zapata, Armand Ramírez, Cristina Pacheco) in this socio-historical context. 3-5 units (Ybarra-Frausto) given 1989-90

355. Seminar on Contemporary Spanish American Poetry: Pablo Neruda—Study of Pablo Neruda’s Canto General emphasizing the historical and social background of Latin America in mid-century. 3-5 units, Spr (Alegria)

356. Latin American Literature of the Colonial Period—Study of crónicas, epic poetry, missionary theater, and Baroque literature by Spanish American-born writers. 3-5 units (Corral) given 1989-90

358. Latin American Writings in the 19th Century II. 3-5 units

359. Rubén Darío and the Poetics of Modernismo—The modernista period and the revolutionary poetic forms of Darío respond to traditional and foreign sources. Darío’s influence on the Generation of ’98 and innovative Latin American writers foreshadows the avant-garde movements. 3-5 units, Aut (Gicovate)

360. Research Seminar: Latin American Women Writers of the 19th Century—Workshop to give advanced graduate students experience in primary research on women, literature, and culture. Assignments focus on a research paper and annotated bibliography. 5 units, Win (Pratt)

361. Latin American Women Writers, 1900-1945—Major female poets, novelists, essayists; Storni, Ibarbourou, de la Parra and Mistral, in dialogue with major male writers of the same period. Issues of gender and gender symbolization in relation to regionalist, vanguardists, and feminist movements. 5 units (Pratt) given 1989-90

362. Latin American Women Writers, 1945 to Present. 5 units (Pratt)

365. The Latin American Novel: Julio Cortázar—Rayuela and other novels. 3-5 units, Win (Ruffinelli)

368. The Narratives of Augusto Monterroso—The works of Monterroso, which flout conventional generic rules for short story, essay, fable, fictitious biography, and reportage, are examined within the framework of canonicity in Spanish American literature. 3-5 units, Spr (Corral)

390. Humor in Hispanic Literature—Manifestations of humor in Peninsula literature from medieval times to the present. Comic poetry is discussed; emphasis is on prose. Primary texts analyzed in the light of theoretical works (Bakhtin, Foucault, Bergson, Colie, Levin) to establish a poetics of Hispanic humor. 3-5 units, Aut (Martin)

391. Humor in Latin American Literature—Satire and other comic forms of literature as a political force for reform in 19th- and 20th-century Latin American writings. 3-5 units (Ruffinelli) given 1989-90

395. Puerto Rican Literature—The main currents, aesthetic and ideological, of Puerto Rican literature during the 20th century, emphasizing the novel, short story, and the relationship between literary production and historical context. 3-5 units, Aut (González)

399. Individual Work—Exclusively for graduate students in Spanish engaged in special work. 1-12 units, any quarter (Staff) by arrangement
INTRODUCTORY

1. First-Year Portuguese (1st Quarter)—A proficiency-oriented introductory course emphasizing speaking and oral comprehension. 5 units, Aut (Van den Dool) MTWThF plus language laboratory

1A. Accelerated First-Year Portuguese (1st Quarter)—An accelerated proficiency-oriented course recommended for students with background in a Romance language. Equivalent to the first half of the regular first-year sequence. 5 units, Win (Van den Dool) MTWThF plus language laboratory

2. First-Year Portuguese (2nd Quarter)—Continuation of 1, with additional development of reading and writing skills. Prerequisite: 1 or equivalent. 5 units, Win (Van den Dool) MTWThF plus language laboratory

2A. Accelerated First-Year Portuguese (2nd Quarter)—Continuation of 1A. Equivalent to the second half of the regular first-year sequence. 5 units, Spr (Van den Dool) MTWThF plus language laboratory

3. First-Year Portuguese (3rd Quarter)—Continuation of 2, with additional cultural and/or literary readings. Prerequisite: 2 or equivalent. 5 units, Spr (Van den Dool) MTWThF plus language laboratory

5. Intensive First-Year Portuguese—Emphasis on proficiency in listening, comprehension, speaking, reading and writing, and presentation of various cultural aspects. Meets daily for two hours; language laboratory practice required. Recommended as preparation for study and travel abroad. Equivalent to Portuguese 1 and 2. No auditors permitted. 9 units, Spr (Van den Dool) MTWThF plus language laboratory

10/110. Elementary Conversation—Conversation practice as a supplement to 2 and 3. Prerequisite: 2 or equivalent. Given Pass/No Credit only. 2 units, Win, Spr (Staff) TTh

11. Second-Year Portuguese (1st Quarter)—Emphasis on reading, discussion, and composition. Grammar review included. Prerequisite: 2 or equivalent. 4-5 units, Aut (Van den Dool) MTWThF

12. Second-Year Portuguese (2nd Quarter)—Continuation of 11. Prerequisite: 11 or equivalent. 4-5 units, Win (Van den Dool) MTWThF

13. Second-Year Portuguese (3rd Quarter)—Continuation of 12. Prerequisite: 12 or equivalent. 4-5 units, Spr (Van den Dool) MTWThF

100. Advanced Portuguese Conversation—Given Pass/No Credit only. May be counted only once for the major. Prerequisite: 12 or equivalent. 3 units, Spr (Van den Dool) MWF

110. Elementary Conversation for Graduate Students—Given Pass/No Credit only. 1-5 units (Staff) by arrangement

130. Brazilian Cultural Readings and Composition—Readings on a variety of aspects of Brazilian life and culture (literature, history, art, current events, and institutions). Students who have completed the second-year language sequence (or have equivalent knowledge) may enroll for 5 units and write weekly compositions. 3-5 units, Win (Van den Dool) MWF

199. Individual Work—Consent of instructor required. Prerequisite: 13 or equivalent. 1-5 units (Staff) by arrangement

ADVANCED Undergraduate and Graduate

240. Portuguese Literature. 3-5 units

267. Brazilian Literature I—Major works of Brazilian fiction from Machado de Assis to the contemporary scene. 3-5 units, Aut (Van Den Dool)

271. Brazil in Film and Fiction—Brazil, a complex society in a period of rapid change, is characterized by regional, racial, class, and gender differences. Conflicting images presented in film and fiction include cannibalism, colonialism, life in the backlands, religious
EMERITI: Theodore W. Anderson, Rosedith Sitgreaves, Charles Stein
Chairman: Jerome H. Friedman
Professors: Byron W. Brown (Biostatistics), Thomas M. Cover, Persi Diaconis (on leave), Bradley Efron, Jerome H. Friedman, M. Vernon Johns, T. L. Lai, Gerald J. Lieberman, Lincoln E. Moses, Ingram Olkin, Lawrence A. Shepp, David Siegmund, Herbert Solomon, Patrick Suppes, Paul Switzer
Associate Professor: Iain M. Johnstone (on leave)
Assistant Professors: Anindita Adhikari, Thomas DiCiccio, Art B. Owen, Joseph P. Romano, Anne G. Sheehy
Courtesy Professors: Helena Kraemer, David P. Rogosa

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, P. Suppes), Electrical Engineering (T. Cover), Health Research and Policy (B. W. Brown, B. Efron, L. E. Moses), Geology (P. Switzer), Operations Research (G. J. Lieberman), Stanford Linear Accelerator (Persi Diaconis, Jerome Friedman).

The research activities of the department reflect an interest in both applied, and theoretical statistics and probability. There are workshops in biology-medicine and in environmental factors in health. The department offers a special master's program in Data Analysis and Statistical Computing.

In addition to courses for statistics majors at the undergraduate or graduate level, the department offers a number of service courses designed for students in other departments. These tend to emphasize the application of statistical techniques rather than their 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.

Located within the Statistics Department, the Laboratory for Computational Statistics (LCS) is a well-equipped center for research in statistical computing. Included among the facilities are a Chromatics CGC 7900 workstation, a Symbolics 3600 LISP machine, a Silicon Graphics Iris 1400 graphic workstation, and several state-of-the-art peripheral devices for graphic output. In addition to these facilities, the department maintains its own VAX/750 computer for use in general research and teaching. The Mathematical Sciences Library serves the Statistics Department jointly with the Mathematics and Computer Science Departments.

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.

GRADUATE PROGRAMS

MASTER OF SCIENCE

The department requires that the student take 42 units of work from offerings in the Statistics Department or from authorized courses in other departments. If advanced sta-
Statistical courses are included in the program, the total number of units may be reduced. A thesis is not required.

Each student will normally fulfill the following requirements for the Master of Science degree:

1. Statistics 116, 200, 217, 218. Courses previously taken may be waived, in which case they must be replaced by other approved courses.
2. Mathematics 103 or 113 and Computer Science 106A. 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, 209, 210, 227, 228.
4. Additional units to complete the requirements chosen from offerings in the Statistics Department or from authorized courses in other departments. At least half of the units taken for the M.S. degree must be from offerings in the Statistics Department.

There is sufficient flexibility to accommodate students with interests in applications to operations research, social sciences, engineering, computing, business, economics, and health.

Students with a strong mathematical background who may wish to go on to a Ph.D. in Statistics should consider applying directly to the Ph.D. program.

A 2.75 letter grade indicator will be required for all statistics courses which are taken for an M.S. degree. All courses which are offered for letter grades must be taken for letter grades.

The program normally takes one calendar year to complete.

DOCTOR OF PHILOSOPHY

Students with strong undergraduate mathematics backgrounds are encouraged to apply for the Ph.D. in Statistics. The department offers about 10 graduate fellowships and assistantships each year to incoming doctoral students. Students are also strongly encouraged to apply for external fellowships. The doctoral program normally takes four years after a bachelor’s or master’s degree. Applicants for the Ph.D. program are required to take the General Test and the Subject 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 1. For details concerning this test see the “Guide to Graduate Admission.”

The specific course and examination requirements for the Ph.D. are given below. In addition, students are encouraged to avail themselves of the advanced course offerings which may vary from year to year, as well as advanced courses related to statistical topics which may be offered in other departments.
Probability and Statistics—Statistics 230A, B, 233A,B,C, 236A,B,C, and 317-318. These courses provide familiarity with the mathematical theory of probability, stochastic processes, and the major topics 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, or Statistical Complexity. Ph.D. students are encouraged to take as many advanced topics courses as can be fitted into the program of studies.

Mathematics—Mathematics 206A (or equivalent) and one of the following alternatives: (1) two 200-level quarter courses in mathematics, or (2) 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 letter grade indicator 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.

Examinations—In addition to course examinations, two written qualifying examinations in probability and statistics are given at the end of the first year—an elementary examination 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 understanding of the basic course work. They are designed to serve as prognoses of the student's chances of success in the program. After completion of these courses the University oral examination will be taken. Normally this should take place after some progress has been made on the dissertation, but at least eight months before the dissertation is finished. At the examination the student will offer a presentation introducing and discussing the dissertation project. The student will be examined in depth on the dissertation topic and should be able to convince the committee that the dissertation topic is a viable one.

Experience—All candidates for the Ph.D. in Statistics are required to enroll in research, consulting, and computer programming. In addition, all candidates for the Ph.D. in Statistics are required to serve as a teaching assistant in the department for at least four quarters.

Ph.D. 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 40-42 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 10-12 units can be made up by the student by including in the M.S. program courses from his or her own field which are related to statistics or applications of statistics.

COURSES

INTRODUCTORY

Introductory courses for general students with an interest in the problems of descriptive statistics and statistical inference are: Statistics 40, 60, 61, 70. These courses have no mathematical prerequisites; Statistics 40, 60 are approved for the Mathematical Science distribution requirement for undergraduates. Statistics 40 covers discrete probability theory, game theory, decision theory, and applications to 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 110, 116, 200, 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 200, which deals with statistical theory, or by 217 and 218, which deal with stochastic processes. The sequence 116, 200 is a basic one-year course in mathematical statistics; the sequence 116, 217, 218 is a basic one-year course in probability theory.

40. Chance and Strategy—(Graduate students enroll in 140.) Precalculus for nonmathematical students in probability theory and game theory. Permutations and combinations, conditional probability, expectation, two-person games, risk and minimax theory, simple gambling, etc. (DR:6)

3 units, Aut (DiCiccio) MWF 11

40. Introduction to Statistical Methods I—(Graduate students enroll in 160.) 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 pack-
ages are used. Students cannot receive credit for both Statistics 60 and Psychology 60. (DR:6)

5 units, Aut, Win (Adhikari) MTWThF 1:15
Spr (DiCiccio) MTWThF 1:15
Sum (Staff) MTWThF 1:15

61. Introduction to Statistical Methods II—
(Graduate students enroll in 161.) Chi-square tests, analysis of variance, regression, correlation, nonparametrics, sample surveys, elementary design of experiments. Prerequisite: 60 or consent of instructor.

5 units, Win (Switzer) MWF 1:15

70. Biostatistics—(Enroll in Health Policy and Research 202.) Statistical reasoning and basic methods. Applications to biology and medicine. Prerequisite: High school algebra.

3 units, Win (Brown)

110. Statistical Methods in Engineering and the Physical Sciences—A first course in applied statistics for engineers and physical scientists. Topics: descriptive statistics, point and interval estimation, tests of hypotheses, nonparametric methods, curve fitting by least squares, analysis of variance, elementary experimental design. Prerequisites: 116 or equivalent, and one year of calculus. (DR:6)

4 units, Aut (Sheehy) MTWTh 11
Sum (Staff) MTWThF 9


4 units, Win (Sheehy) MTWTh 10


3 or 4 units, Aut (Romano) MTWThF 10
Spr (Sheehy) MTWTh 10
Sum (Staff) MTWThF 2:15

140. Chance and Strategy—(See 40.) For graduate students.

3 units, Aut (DiCiccio) MWF 11

152. Introduction to Operations Research I—
(Enroll in Engineering 62.) 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. Prerequisite: Mathematics 43 or consent of instructor.

4 units, Aut (Staff)

153. Introduction to Operations Research II—

4 units, Win (Lieberman)

160. Introduction to Statistical Methods I—
(See 60.) For graduate students.

5 units, Aut, Win (Adhikari) MTWThF 1:15
Spr (DiCiccio) MTWThF 1:15
Sum (Staff) MTWThF 1:15

161. Introduction to Statistical Methods II—
(See 61. For graduate students.)

5 units, Win (Switzer) MWF 1:15

199. Independent Study — For undergraduates.

(Staff) by arrangement

200. Introduction to Statistical Inference—Modern statistical concepts and procedures derived from a mathematical framework. Statistical inference, decision theory; point and interval estimation, tests of hypotheses; Neyman-Pearson theory, Bayesian analysis; maximum likelihood, large-sample theory. Prerequisite: 116.

4 or 5 units, Aut (Lai) MTWF 11
Win (Seigmund) MTWF 11

CONTINUATION

Courses in this category have been designed for particular use in applications. Generally, they have introductory statistics or probability as prerequisites.

Prerequisites: 116 and Mathematics 113 or 103, or equivalent.

3 units, Win (Romano) MTWThF 2:15

201B. Data Analysis II—Classification and discriminant analysis. Dimensionality reduction. Principal components, factor analysis, multidimensional scaling. Cluster Analysis. Treatment of missing values. Analysis of categorical data. Topics are discussed from the point of their application. Emphasis is conceptual rather than theoretical understanding. Prerequisite: 201A or equivalent.

3 units, Spr (Romano) MWF 2:15

203. Introduction to Regression Models and the Analysis of Variance—The most widely used statistical techniques; interpretation of observational data and empirical model building. Topics: simple and multiple linear regression, nonlinear regression, analysis of residuals and model selection, design of one-way and two-way factorial experiments, fixed effects and random effects models. Prerequisite: 200 or 201A.

3 units, Aut (Sheehy) MWF 1:15

204. Sampling from Human Populations—The theory of sampling from finite populations. Simple random sampling, stratified sampling, cluster sampling, efficiency of various designs, nonresponse models; emphasis on applications. Prerequisite: A basic course in statistics (61, 110, or 200).

3 units, alternate years, given 1989-90

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: 200 or concurrent registration in 200.

3 units, alternate years, given 1989-90

206. Applied Multivariate Analysis—Introduction to statistical analysis of several quantitative measurements on each observational unit. Emphasis on concepts, methods, computation, interpretation. Examples from economics, education, geology, psychology. Topics: multiple regression, multivariate analysis of variance, principal components, factor analysis, canonical correlations. Prerequisites: 200 or 201A. (Concurrent registration in 200 is permitted.)

3 units, Aut (Olkin) MWF 8:30-10

207. Introduction to Time Series Analysis—Time series models used in economics, engineering, physics, geology, etc. Trend fitting, autoregressive schemes, moving average models, periodograms, second order stationary processes, spectral analysis. Prerequisites: 116 and a basic course in statistics (200 or 201A).

3 units, Win (DiCiccio) MWF 3:15

209. Quantitative Methods and Their Application to Public Policy—(Same as Public Policy 105.) Applications of statistical methods, rather than methodology per se. Topics: risk assessment in the evaluation of biohazards and medical techniques and technologies; comparisons of information-gathering techniques—surveys, experiments, or simulation studies; methods of expressing and evaluating uncertainty; and the interpretation of quantitative techniques of data analysis—regression. Prerequisites: 60 and 61.

5 units, Spr (Moses) MTWThF 3:15


3 units, Win (Lai) MWF 10

218. Introduction to Stochastic Processes—Renewal theory, point processes emphasizing the Poisson process. Also, Wiener and Gaussian processes, and second order processes. Prerequisite: 217.

3 units, Win (Siegmund) MWF 2:15


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


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

251. Stochastic Models in Operations Research—(Enroll in Operations Research 251.) Introduction to stochastic modeling. Directed to students who anticipate doing project work in government or industry which involves stochas-
3 units, Spr (Lieberman)
Sum (Staff)

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, or PASCAL; 217 or the equivalent.
3 units, Spr (Glynn)
Sum (Staff)

299. Literature of Statistics—Intensive study of literature of any special topic, usually culminating in the preparation and presentation of reports upon topics studied. (Staff) by arrangement 
PRIMARILY FOR DOCTORAL STUDENTS

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 (Lai) MWF 10
230B. 3 units, Win (Adhikari) MWF 10
230C. 3 units, Spr (Adhikari) MWF 10

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. Prerequisites: 200 and Mathematics 103 or 113, or consent of instructor.
233A. 3 units, Aut (Owen) MWF 2:15
233B. 3 units, Win (Owen) MWF 2:15
233C. 3 units, Spr (Owen) MWF 2:15

236A,B,C. Theoretical Statistics—Decision theory; minimax and Bayes solutions, the concepts of admismissibility 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: 200.
236A. 3 units, Aut (Johns) MWF 11
236B. 3 units, Win (Johns) MWF 11
236C. 3 units, Spr (Johns) MWF 11

240. Linear Programming—(Enroll in Operations Research 240.) 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)
Sum (Staff)

3 units, Aut (Eaves)

260A,B,C. Workshop in Biostatistics—Applications of statistical techniques to current problems in medical science. Primarily for doctoral students in statistics. Enrollment for more than 2 units of credit involves extra reading or consulting and requires permission of the instructor.
260A. 1-5 units, Aut (Brown, Efron, Moses) Th 1:15-3:05
260B. 1-5 units, Win (Brown, Efron, Moses) Th 1:15-3:05
260C. 1-5 units, Spr (Brown, Efron, Moses) Th 1:15-3:05

266A,B,C. Workshop in Statistical Consulting—Provides Ph.D. students with a broad base of skills that are required of practicing statistical consultants, and exposure to a wide range of statistical applications. Students participate as consultants in the drop-in consulting service operated by the department. Seminar provides supervised experience in short term consulting. Prerequisites: Course work in applied statistics or data analysis, and permission of the instructor. No previous consulting experience is necessary.
266A. 1-3 units, Aut (Staff) by arrangement
266B. 1-3 units, Win (Staff) by arrangement
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, Aut (DiCiccio) MWF 3:15

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: 236A, B, C.

3 units, alternate years, given 1989-90

336. Decision Theory and Statistical Inference—Minimax theorem, admissibility and complete class theorem, formulation of statistical decision problems, sufficient statistics, testing hypotheses, estimation, comparison of experiments, and sequential problems.

3 units, alternate years, given 1989-90


3 units, Win (Lai) MWF 11


3 units, alternate years, given 1989-90

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, etc.

3 units, given 1989-90

352. Spatial Statistics—Summary statistics, probability models, smoothing and interpolation, classification, sampling design, applications to remote sensing and environmental monitoring.

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

354. Bootstrap and Resampling Methodology—Resampling methods in statistics: bootstrap, jackknife, cross-validation, permutation and
randomization techniques. General asymptotic theory. Relevant mathematical tools, Edgeworth expansions and empirical processes, methods are developed. Survey of recent literature.

3 units, Win (Romano) MWF 3:15


3 units, given 1989-90


3 units, Spr (Iglehart)


3 units, Win (Glynn)


3 units, given 1989-90


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

399. Research—Research work as distinguished from independent study of nonresearch character listed in 199 and 299.
(Staff) by arrangement

PROGRAM IN STRUCTURED LIBERAL EDUCATION

Emeritus: (Professor) John Goheen (Philosophy)
Director and Professor: Mark Mancall (History)
Lecturers: George Cattermole, Suzanne Greenberg, Kenneth Peter, Amy Sims, Robert Watson
Coordinator: Suzanne Greenberg

The Program in Structured Liberal Education (SLE) is designed specifically for freshmen interested in an integrated and interdisciplinary approach to the liberal arts and sciences. The program emphasizes intellectual rigor and individualized contact between faculty and students. SLE has three basic purposes: to present a coherent program of instruction; to develop students' ability to ask effective questions of texts, teachers, the culture, and themselves; and to develop students' intellectual skills in logical reasoning, critical reading, expository writing, and group discussions.

SLE stresses inquiry, criticism, and a tolerance for ambiguity. Neither the faculty nor the curriculum provides "ready-to-serve" answers to the questions being dealt with, rather, SLE encourages a sense of intellectual challenge, student initiative, and originality.

APPLICATION

Freshmen should apply during the summer preceding the academic year in which they will enroll.

SLE is designed as a three-quarter sequence, and all students applying should be willing to make a commitment for the entire program, although a student can withdraw from the program at any time.

Correspondence regarding the program should be addressed to Program in Structured Liberal Education, Florence Moore Hall, Stanford University, Stanford, California 94305.

COURSES

SLE is a demanding program, which consumes approximately 60% of the average academic workload first-year students usually carry. Each quarter deals with a separate period
of Western culture in the form of a 9-unit course. Autumn Quarter concentrates on the Hebrews and their Bible, and the Greeks from Homer through Aristotle; Winter Quarter focuses on the Renaissance through the Scientific Revolution and the Enlightenment; and Spring Quarter discusses the modern world. Completion of the SLE Program satisfies the Western Culture Requirement (DR:1), the Literature and Fine Arts Requirement (DR:2), the Philosophical, Social and Religious Thought Requirement (DR:3), and the Writing Requirement.

91. 9 units, Aut (Staff) TWTh 3:15-5 and TWTh 7-9 p.m.
92. 9 units, Win (Staff) TWTh 3:15-5 and TWTh 7-9 p.m.
93. 9 units, Spr (Staff) TWTh 3:15-5 and TWTh 7-9 p.m.

PROGRAM IN SYMBOLIC SYSTEMS

Chairman: Jon Barwise (Philosophy)
Program Committee: John Etchemendy (Philosophy, on leave), Martin Kay (Linguistics), Helen Nissenbaum (Program Coordinator), P. Stanley Peters (Linguistics), Stuart Reges (Computer Science), David Rumelhart (Psychology), Yoav Shoham (Computer Science), Terry Winograd (Computer Science)
Affiliated Faculty: Joan Bresnan (Linguistics), Herbert H. Clark (Psychology), Solomon Feferman (Mathematics and Philosophy), James Greeno (Education), Roy Jones (Computer Science), John McCarthy (Computer Science), Nils J. Nilsson (Computer Science), Michael Pavel (Psychology), John Perry Philosophy), Paul Rosenbloom (on leave), Ivan A. Sag (Linguistics), Barbara Tversky (Psychology), Tom Wasow (Linguistics and Philosophy)
Affiliated Consulting Faculty: Phil Cohen (Linguistics), Joseph Halpern (Computer Science), Pat Hayes (Computer Science), David Israel (Philosophy), Ron Kaplan (Linguistics), Lauri Karttunen (Linguistics), Roy Perrault (Philosophy), Stan Rosenchein (Computer Science), Brian Smith (Philosophy), Annie Zaenen (Linguistics)

STATEMENT OF PURPOSE

Computer systems, robots, and people are all examples of symbolic systems, agents that use language to represent the world around them so as to communicate and generally act intelligent-ly in the world. The notions of symbol, representation, information, and action are at the heart of the study of symbolic systems. This common core of notions arises in a variety of fields including artificial intelligence, computer science, cognitive psychology, linguistics, philosophy, and symbolic logic. In recent years though, a new discipline has begun to emerge from research collaborations across these traditional disciplines, addressing questions like the following: In what ways are computers and computer languages like humans and their languages? What would it take to build a computer that thinks, or that could understand and communicate in a human language?

The Symbolic Systems Program offers students the opportunity to focus on these issues in their course of studies. Its majors are required to take courses in the Departments of Computer Science, Linguistics, Philosophy, and Psychology, as well as courses designed specifically for the program. Its goal is to prepare students with the vocabulary, theoretical background, and technical skills to understand and participate in contemporary interdisciplinary research into questions about language, information, and intelligence—both human and machine. The curriculum offers a combination of traditional humanistic approaches to these questions as well as a training and familiarity with exciting contemporary developments in the science and technology of computation.

A degree in Symbolic Systems prepares the student for advanced training in the interdisciplinary study of language and information, or for post-graduate study in any of the contributing disciplines. It would also be excellent preparation for employment in the industrial sector immediately after graduation.

UNDERGRADUATE PROGRAM

BACHELOR OF SCIENCE

The program leads to a Bachelor of Science in Symbolic Systems. The curriculum is aimed at providing students with a core of concepts and techniques from computer science, linguistics, logic, philosophy, and cognitive psychology, drawing on faculty and courses from these and other departments.

Symbolic Systems majors must complete a common core of required courses plus a concentration consisting of four or five additional courses. The core requirements are:

1. Cognition —
   a) Psychology 106, Introduction to Cognitive Psychology

2. Computation and Artificial Intelligence —
b) Computer Science 106C, Theoretical Foundations of Computer Science. (Students interested in a more rigorous introduction to computer science may substitute Computer Science 109A,B, Introduction to Computer Science.)

c) Computer Science 107, Programming Paradigms.

d) Computer Science 221, Introduction to Artificial Intelligence.

3. Foundations —
   a) Philosophy 80, Mind, Matter, and Meaning.
   b) Philosophy 186, Philosophy of Mind or Philosophy 180, Philosophy of Language.

4. Language —
   a) Linguistics 120, Introduction to Syntax.
   b) Linguistics 130, Introduction to Semantics and Pragmatics. (Students may substitute Linguistics 220A,B, Syntactic Theory, and Linguistics 230, Semantics and Pragmatics, in place of 120 and 130 by consent of advisor and usually limited to students in the natural language concentration. If this option is chosen the concentration requires only four additional courses.)

5. Logic —
   a) Philosophy 160A, First-Order Logic.
   b) Philosophy 160B, Computability and Logic or Computer Science 154, Introduction to Automata and Complexity Theory.

6. Mathematics —
   a) Two courses on mathematical topics other than calculus.
      1) One course involving an introduction to basic mathematical techniques, with applications. Examples of suitable courses are: Philosophy 159, Math 103, Math 109.
      2) A second, more advanced mathematical concepts course of a more theoretical nature, involving the systematic development of some part of mathematics. Examples of suitable courses are Math 120, 162; Statistics 110, 115, 116; Computer Science 260; Philosophy 160B.

Other courses may be substituted for the suggested ones with the approval of the program coordinator.

Students may select their concentrations from the list below, or design their own concentrations in consultation with their advisers.

Artificial Intelligence
Cognition
Computation
Logic
Natural Language
Philosophical Foundations

The program offers only an undergraduate degree. An Honors option is available, which requires the student to complete an Honors project under his or her advisor’s supervision.

**COURSES**

**CORE**

80. Mind, Matter, and Meaning—(Enroll in Philosophy 80.) A writing focus course.
   5 units, Aut (Zalta)
   Spr (Perry)

105. Introduction to Cognitive Psychology—(Enroll in Psychology 106.)
   4 units, Win (B. Tversky)

106B. Programming Abstractions—(Enroll in Computer Science 106B.)
   5 units, Aut (Fisher)
   Win, Spr (Staff)

106C. Theoretical Foundations of Computer Science—(Enroll in Computer Science 106C.)
   5 units, Aut, Win, Spr (Staff)

106X. Programming Methodology and Abstractions (Accelerated)—(Enroll in Computer Science 106X.)
   5 units, Aut, Win, Spr (Staff)

109A,B. Introduction to Computer Science—(Enroll in Computer Science 109A,B.)
   109A. 4 units, Aut (Reid)
   Win (Gorin)

   109B. 4 units, Win (Reid)
   Spr (Gorin)

120. Introduction to Syntax—(Enroll in Linguistics 120.)
   4 units, Win (Sells)

130. Introduction to Semantics and Pragmatics—(Enroll in Linguistics 130.)
   4 units, Spr (Sells)

154. Introduction to Automata and Complexity Theory—(Enroll in Computer Science 154.)
   4 units, Win (Ullman)
   Spr (Staff)

160A. First Order Logic—(Same as Philosophy 160A.)
   4 units, Win (Devlin) MWF 9

160B. Computability and Logic—(Enroll in Philosophy 160B.)
   4 units, Spr (Devlin)

180. Philosophy of Language—(Enroll in Philosophy 180.)
   4 units, Spr (Zalta)

196. Philosophy of Mind—(Enroll in Philosophy 186.)
   4 units, Spr (Dretske)
220A,B. Syntactic Theory—(Enroll in Linguistics 220A,B.)
4 units, Aut, Win (Mohanon, Wasow)

221. Introduction to Artificial Intelligence—
(Enroll in Computer Science 221.)
3 units, Aut, Spr (Staff)

230. Semantics and Pragmatics—(Enroll in Linguistics 230.)
4 units, Spr (Peters)

SYMBOLIC SYSTEMS

1/101. Introduction to Information and Intelligence—(Graduate students register for 101.)
A weekly series of exploratory self-contained lectures. Notions of symbol, representation, information, and action from the perspectives of artificial intelligence, linguistics, logic, philosophy, and psychology. The study of computer systems, robots, and people; agents that use language to represent the world around them to communicate and act intelligently. Videotaped.
1 unit, any quarter

2. Problems of Intelligence, Information, and Learning—(Same as Education 120X.)
Introduction to studies of intelligent reasoning, knowledge, understanding, representation, and meaning. Results of computational, linguistic, philosophical, and psychological research discussed and compared. Relevance of the material to instruction and learning.
3 units, Aut (Greeno) MWF 1:15

100. Computers and Ethics—A philosophical analysis of ethical issues in the use of computers. An introduction to ethical theories and concepts, showing application to moral questions concerning the use of computers. Should programs be owned? Do computers violate our right to privacy? Does one have a responsibility for computer errors that result in harm to others? Can an intelligent machine have moral responsibility? Should computers control nuclear weapons?
3 units, Spr (Nissenbaum) TTh 3:15-4:30

101. Introduction to Information and Intelligence—(Same as 1.) For graduate students.

150. Computational Linguistics—Introduction to computing for linguists emphasizing good programming style. Data and functional abstraction, procedural and declarative formulations, deterministic and nondeterministic algorithms, computational complexity, and fundamental processes in the lexicon, phonology, morphology, and syntax. The programming language used is Lisp or Prolog (Lisp in 1988-89).
4 units, Aut (Kay)

190. Senior Honors Tutorial.
1-5 units, any quarter (Staff) by arrangement

191. Honors Seminar—Senior year.
2 units, any quarter (Staff) by arrangement

195. Microcomputer Programming Project—Students develop software illustrating concepts from symbolic systems. Project ideas are generated by faculty or by students, i.e., projects that produce software useful in departmental courses. Projects of up to 9 units are under faculty direction. Prerequisites: Computer Science 106X or equivalent and approval of basic proposal for software by course instructor, with the advice of department staff. Recommended: Familiarity with Macintosh, IBM-PC, or other microcomputer or Computer Science 193.
3-5 units, any quarter (Staff) by arrangement

196. Independent Study—Independent work under the supervision of a faculty member.
1-15 units, any quarter (Staff) by arrangement

PROGRAM ON URBAN STUDIES

Director: Leonard Ortolano (Professor of Civil Engineering)
Chairman: Paul Turner
The Committee on Urban Studies: Albert Camarillo (Associate Professor of History, on leave), Steven Gorelick (Associate Professor of Applied Earth Sciences), Irwin Remson (Professor of Applied Earth Sciences), Nancy Tuma (Professor of Sociology, on leave), Paul Turner (Associate Professor of Art), Sylvia Yanagisako (Associate Professor of Anthropology, on leave)
Lecturers for Adjunct Courses: Gerald Gast, Susan Goltsman, Arlen Gregorio, Daniel Iacofano, David Morrell, Jayant Sataye, George Sipel, Frederic Stout

Urban Studies brings together students, faculty, and outside specialists who are concerned with the people and problems of cities. The program stresses two basic themes: developing a critical understanding of how cities evolve and shape urban life, and developing the practical and analytical tools which can help improve the quality of life. Urban Studies enables undergraduates to examine urban problems through a number of disciplinary lenses and to address these problems in a practical way.

The Urban Studies major examines the city within the broader context of a liberal arts education. It treats urbanism as an interdisciplinary field and encourages students to inquire crit-
ically into both the nature of the urban environment and techniques used to modify that environment.

The major prepares students for a variety of careers and advanced academic pursuits. Graduates from the Program on Urban Studies have established careers in urban planning, public management, policy analysis, real estate development, architecture, environmental planning, and design. Many have obtained graduate degrees in urban planning, architecture or urban design from universities across the country including UC-Berkeley, Harvard, and MIT. Still others have opted to undertake joint degrees, for example, a masters in planning or policy analysis with a degree in business or law.

UNDERGRADUATE PROGRAMS

All students majoring in Urban Studies must complete the Urban Studies Core. Those who wish to specialize in either urban planning or architecture and urban design may complete their majors by meeting the appropriate Option Requirements. Students who wish to concentrate in a different area must complete the Urban Studies Core and design the remaining units (to bring the total to 60 units) with an academic advisor who is a member of the Academic Council. The self-designed portion of the major should concentrate on a particular area of analysis such as health care or education. It should include only courses at the 100-level, and it must be approved by a subcommittee of the Committee on Urban Studies. Proposals for the self-designed proposal portion of the major focusing on an area other than urban planning or architecture and urban design should include a course list and description of how the courses fit together to meet the student’s educational objectives. Proposals must be submitted to the program prior to the completion of the second quarter of the student’s junior year and will not be accepted after that time.

URBAN STUDIES CORE (33-37 units)

Urban Studies majors should take 110, Introduction to Urban Studies, before the end of the Autumn Quarter of their junior year. This course is a preprerequisite to the following core courses: Art 280, Utopia and Reality in Modern Urban Planning; Urban Studies 130, Urban Politics; and 131, Managing Local Government.

110. Introduction to Urban Studies, and 120. Utopia and Reality in Modern Urban Planning.
141. Race, Ethnicity, and Gender in American Urban Society: History and Public Policy.

URBAN PLANNING

The courses required for the Urban Planning option introduce students to the techniques and approaches of city and regional planners and provide them with the backgrounds they will need to enter graduate programs in urban planning. A course applying economics to the solution of urban problems provides a key element to this option. In addition, students are required to study the methods of land use planning and techniques to control the use of land. Because urban planners rely heavily on statistics and computers in doing their analyses, the major requires an introduction to each of these subjects.

See departmental listings for course information.

PREREQUISITE COURSES (10 units)

Course No. and Subject Units
Economics 1. Elementary Economics 5
Economics 51. Economic Analysis I 5

MAJOR REQUIREMENTS (25-27 units)

Course No. and Subject Units
Applied Earth Science 130.
Civil Engineering 234. Land Use Planning and Control 3
Computer Science 105A. Introduction to Computers 4
Applied Microeconomics—select one of the following: Economics 145, 150, 155; Civil Engineering 221.
Statistics—select one of the following: Statistics 60, 110; Sociology 182; Psychology 60 or 153.

RESTRICTED ELECTIVES

Courses selected from the Urban Studies Core, from any offered by the Program on Urban Studies, or from those listed below to bring the total to 60 units (not including Economics 1 and Economics 51).

Course No. and Subject Units
Applied Earth Sciences 131.
Environmental Earth Sciences II 5
Applied Earth Sciences 132.
Environmental Earth Sciences III 5
ARCHITECTURE AND URBAN DESIGN

The option in Architecture and Urban Design provides strong preparation for subsequent graduate study in architecture and urban design. Viewed together with the Urban Studies Core, the courses required for the Architecture and Urban Design option allow the student to explore design in the context of architectural and urban history and in response to human needs, social concerns, and cultural values. The required courses focus on drawing and design skills and on the history of architecture. Two of the design courses are sequenced (Art 60 and 160). Students who are considering professional study in architecture are advised to take, in addition to the required courses, a year of calculus and introductory courses in mechanics.

See departmental listings for course information.

PREREQUISITE COURSES (3 units)

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art 40. Basic Drawing</td>
<td>3</td>
</tr>
<tr>
<td>Art 60. Basic Design</td>
<td>3</td>
</tr>
</tbody>
</table>

REQUIRED COURSES TO COMPLETE THE MAJOR (23-27 units)

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art 140. Drawing I</td>
<td>3</td>
</tr>
<tr>
<td>Art 160K or 160L. Design I—Intermediate Design</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical Engineering 101. Visual Thinking</td>
<td>3</td>
</tr>
<tr>
<td>At least two courses on the history of architecture (or architecture and art) offered by the Department of Art (100 level or above).</td>
<td></td>
</tr>
</tbody>
</table>

RESTRICTED ELECTIVES

Courses selected from the Urban Studies Core, from any offered by the Program on Urban Studies, from any 100-level course offered by the Art Department in drawing, painting, sculpture, printmaking or design, or from those listed below to bring the total to 60 units (not including Art 40 and Art 60).

<table>
<thead>
<tr>
<th>Course No. and Subject</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Engineering 180. Elementary Structural Analysis</td>
<td>4</td>
</tr>
<tr>
<td>Engineering 11. Mechanics of Materials</td>
<td>4</td>
</tr>
</tbody>
</table>

RECOMMENDED ADDITIONAL STUDY

Students considering professional study in architecture note that architecture schools typically require applicants to submit a portfolio of work in the visual arts or design as part of the admissions process. In addition, many graduate schools of architecture require calculus and physics as conditions for admission. Such students are strongly advised to take:

HONORS PROGRAM

The Honors program offers qualified students an opportunity to conduct independent research, and to write a thesis of superior quality summarizing the results of their research. The program grants Honors at graduation to those students who have successfully completed a thesis of Honors quality, attained a 3.5 letter grade indicator in their major, and who have successfully completed all the course requirements for their major. Students may obtain details regarding application, admission and Honors procedures from the Office of the Program on Urban Studies, 126 Encina Commons.

COURSES

Further descriptions and details of current adjunct courses are available prior to each quarter from the program offices and are listed in each quarter’s Time Schedule.

110. Introduction to Urban Studies—Cities and the process of urbanization. The various disciplinary approaches to urban studies, history, geography, sociology, economics, and politics, and the interdisciplinary perspectives that are inherent in the practice of urban planning, urban design, urban public administration, and urban public policy formation.

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

115. Seminar: Utopia and Reality in Modern Urban Planning—(Enroll in Art 280.) The origins of the contemporary urban situation emphasizing the city as a cultural phenomenon. Interdisciplinary methodology focuses on key interrelationships: between the city as an economic machine and the city as a human community; between the city’s architectural form and its social and political functions; between the perceptions/descriptions of the city characteristic of statistical analysis and those common to literature, art, and film; between the short term projections of policy analysis and the
visions of urban futurists. Prerequisite: 110 (for Urban Studies majors only).
4 units, Win (Turner, Stout) W 1:15-3:05

120. Economics of Urban Problems—(Enroll in Economics 148.) Application of theoretical analysis of the location, form, and economic structure of cities to public policy issues in poverty, employment, education, housing, urban transportation, and the local public sector. Prerequisite: 51.
5 units, not given 1988-89

130. Urban Politics—(Graduate students enroll in 230.) The political process in urban areas. Topics: historical development, environment, and structure of politics, the policy-making process, the interface between politics and administration, politics as craft, citizens and the political process, and politics at the intergovernmental level. Emphasis on practical application using the expertise of former and current elected/appointed public officials.
4 units, Spr (Sipel, Gregorio) T 3:15-5:05 plus periodic Th 3-4

131. Managing Local Government—(Graduate students enroll in 231.) Urban administration using the urban executive as a focal point. Topics: the mission and structure of government; policymaking processes in urban government; the respective roles of legislators and administrators; and the role and function of the city manager. The manager's role as a "change agent" vis-a-vis contemporary urban problems: productivity, declining resources, housing, and transportation. Prominent elected and appointed officials from the area guest lecture. Prerequisite: 110 (for Urban Studies majors only).
4 units (Sipel) alternate years, given 1989-90

132. Politics and Public Policy—(Enroll in Political Science 101P, Public Policy 101.) The domestic policy-making process, emphasizing how elected officials, bureaucrats, and interest groups shape governmental policies in various areas including tax policy, environmental policy, and social-welfare policy, given their goals and available tactics. How public policies are formulated and implemented. The results of this process using equity and efficiency criteria. Prerequisite: Political Science 10.
4-5 units, Spr (Brady) MW 1:15-3:05
Sum (Moe) TWTThF 10

134. Managing Urban and Environmental Conflicts — Workshop teaching techniques for involving clients, users, communities, and consultants in the environmental planning and design process. Through case studies and a quarter-long project involving a campus or local community group, students develop, plan, and manage a participatory decision-making process having some urban environmental focus. Topics: process management; data-gathering methods for public involvements such as community surveys, workshops, and facilitation graphics; group dynamics and process design; theories of leadership effectiveness; environmental mediation and conflict management; visual simulations and other public involvement media.
5 units, Aut (Goltsman, Tacofano) Th 2:15-5:05

141. Race and Ethnicity in American Cities — History and Public Policy — (Enroll in History 162A.) Compares urban histories of the nation's two largest minority groups, and the predominant themes which characterize the history of Chicanos, Puerto Ricans, and Blacks in American cities from 1870-1980. Topics: formation and development of ghettos and barrios, urban occupational structure and stratification, racial attitudes and institutional responses to the presence of racial minorities, ethnic community and political organizations, and family structure and the role of women in the household.
4 units (Camarillo) not given 1988-89

143. Undergraduate Colloquium: Race and Ethnicity in American Cities — History and Public Policy — (Enroll in History 262A.)
5 units (Camarillo) not given 1988-89

144. Topics in the Social and Political Transformation of American Cities, 1800-1980 — (Enroll in History 255B.) Competing theories of power and social change in the study of urban America in the 19th and 20th centuries. Linking of current issues of immigration, migration, homelessness, and neighborhood redevelopment to the long-term structural patterns in the creation and undoing of ethnic and racial urban communities. The urban transformation of women's work and lives, reform movements, geographic and economic mobility, the urban labor market, class formation, and the structure and distribution of power among the various social and political groups and classes in the city.
5 units, Win (Ethington) MW 1:15

150. Urban Sociology — (Enroll in Sociology 150.) Over the last 200 years the scale of the ecological communities in which people are embedded has increased more rapidly than the psychological communities with which people identify themselves, and the political communities within which they are governed. Explores all three kinds of communities and the impact of the disparity between the scales on the ability of people to govern themselves.
3-5 units (Staff) by arrangement

151. Urban Growth and Change — (Enroll in Sociology 154.) Cities and towns changing: in density, composition, and internal organiz-
tion. The causes and consequence of changes. The processes of change in a city as a whole; processes of change in a subarea of a city (in a neighborhood). The consequences of these changes for individuals, families, organized groups, and voluntary associations, firms, and public institutions.

5 units (Tuma) alternate years, given 1989-90

152. Poverty and Public Policy—(Enroll in Sociology 105.) Why large scale poverty persist in America and what are the effects of poverty on the individual? Lectures, class discussions, and individual projects explore the facts, myths, and theories.

3-5 units (Tuma) given 1989-90

153. Organizations and Public Policy—(Enroll in Sociology 166H.) The concepts and methods for analyzing the influence of organizations on the setting and implementation of public policy. The varying conceptions of organizations as corporate actors and as social contexts. The roles of organizations in relation to public policy as decision makers and problem solvers, as change agents, and as clients. Prerequisite: Industrial Engineering 160 or Sociology 160.

3 units, Win (Scott) MWF 9

160. Urban Problems in Anthropological Perspective—(Enroll in Anthropology 146.) Issues from current urban problems examined from the cross-cultural perspective of anthropology. Topics: the social consequences of growing; rural-urban migration; changing family and kinship patterns; urban ethnic communities and inter-ethnic relations; urban poverty and stratification; and crime. Implications for urban planning and social policy.

5 units, Spr (Klimt) MWF

161. Women in Cities: A Cross-cultural Perspective—(Enroll in Anthropology 145, Feminist Studies 142.) Women’s experiences in cities throughout the world and the determinants of the similarities and differences in those experiences. A series of hypotheses and key concepts that have emerged primarily from research in North America and Western Europe evaluated in light of research on women in Latin America, Asian, and African cities. Topics: women and urban migration, changing forms of the sexual division of labor, changing family and kinship structures, prostitution, and the political activism.

5 units (Yanagisako) alternate years, given 1989-90

162. Rural Urbanization and Social Change—(Enroll in Anthropology 147.) Rural-to-urban migration as indicator and consequence of social change. Models of migration processes: impact of policies in sending and receiving notions; motive and adaptive strategies of migrants; significance of emigration for peasant villages. Case studies from Africa, Latin American, Asia, and Europe.

3 units (Siegel) not given 1988-89

163. Ethnographic Monitoring of Rapid Change I—(Enroll in Anthropology 192A.) Seminar-practicum of the anthropological and empirical study of processes of rapid or sudden change such as technological innovation (tele-microelectronic, biotechnical, materials-science, etc.) and ecological crisis, a precipitous economic downturn, or a fundamental shift in political or managerial control, where such change is judged likely to produce serious impacts on human well-being. Students, alone or with a team, receive training and tutorial guidance in using appropriately adapted ethnographic techniques to carry out a fieldwork project in a local community or institution. The resulting paper assesses implications of findings for theory, public policy, and/or educational programs. Open to all graduate students and to undergraduates contemplating Honors thesis. Recommended: 138/238, previous social science interviewing background helpful. Enrollment limited to 50.

3-5 units (Textor) not given 1988-89

165. Inter- and Intra-Ethnic Variation in Urban Vernacular English—(Enroll in Linguistics 153.) The literature on ethnic vernaculars in urban settings, concentrating on modern sociolinguistic studies of black and white vernaculars in New York City, Philadelphia, Detroit, Washington D.C., Atlanta, Los Angeles, and London. Recent research findings that urban black and white vernaculars are diverging is compared with new research in the local (East Palo Alto) community. Students innovate local research on their own. Implications for linguistics, the social sciences, and urban policy.

4 units (Rickford) alternate years, given 1989-90

170. Introduction to Urban Design—(Undergraduates enroll in Art 168A; graduates enroll in Urban Studies 270.) Urban design in theory and practice. Important theoretical ideas of city form and image, from historical principles inherited from the cities of Western Europe to late 20th-century models exemplified by Los Angeles and the sunbelt cities. Case studies examine urban design examples, projects and controversies in North America, and abroad. Workshops analyze the image and physical characteristics of San Francisco neighborhoods. A 5-week term urban design problem summarizes
principles in the readings, seminars, and workshops.

5 units, Win (Gast) T 10-12 and 7-9 p.m.
plus two required Sat. workshops

171. Urban Design Studio—(Undergraduates enroll in Art 168B; graduates enroll in Urban Studies 271.) A 10-week comprehensive urban design project taken from a current problem in San Francisco. A systematic understanding of the urban design process and problem-solving methods. Graphic, diagrammatic, and other visual tools of analysis and communication are used in the study project. Recommended: 170. Enrollment limited to 14.

5 units, Spr (Gast) TTh 7-10
plus one required Sat. workshop

172. Environmental Psychology in Urban Design—Seminar emphasizing critical reading and discussion of environment/behavior literature; and a workshop training students in environmental research procedures. The major theories and methods of environmental psychology and their application to the fields of architecture, urban planning, and design. Topics: ecological psychology, behaviorism, phenomenology, environmental symbolism, psychology of place, personal space and personalizations, workspaces, public/private institutions, neighborhoods and communities, and environmental assessment.

5 units (Goldtsman, Iacofano) alternate years, given 1989-90

180. Introduction to Urban Planning—(Enroll in Civil Engineering 130.) The nature of urbanization and evolution to urban forms; conceptual modeling of urban growth and decay; the rationale for steps in the planning process and basic studies of plan formulation; estimating requirements for commercial, industrial, and residential land uses; zoning, growth control, and other techniques of plan implementation; and the application of the planning process to typical problems of community growth and development.

3 units, Win (Staff) by arrangement

181. Environmental Planning—(Enroll in Civil Engineering 171, VTSS 183.) Alternative strategies for air and water quality management; environmental impact assessment requirements; interactions between land use, physical infrastructure, and environmental quality; forecasting and evaluation of environmental effects; survey of techniques for assessing visual, biological, noise, air quality, and water quality impacts. Recommended: One year of college mathematics and Civil Engineering 170.

4 units, Win (Ortolano) TTh 1:15-2:30

182. Land Use Planning and Control—(Graduate students enroll in Civil Engineering 234.) Theory and practice of contemporary and newly emerging methods in the planning and control of development, and the protection of the environment. Current practices, their origin and evolution, and the relation between land use planning and environmental protection. Emphasis on the regulatory and permitting process with examples of actual projects in urban and suburban/rural settings. Guest speakers from public, private, and conservation organizations. Students carry out case studies or investigations commensurate with standing.

3 units, Aut (Staff) TTh 9-10:30


3 units, Spr (Staff)

184. Facility Siting—(Enroll in Civil Engineering 239.) The underlying reasons for inherent conflicts in facilities needed by society but which are locally unwanted: landfills, hazardous waste sites, energy facilities. Siting techniques: constraint mapping, optimization procedures, and decision analysis. Appropriate public and private roles, new planning strategies including environmental dispute resolution, and the relationship between regional and site-specific concerns.

3 units, Aut (Morell) M 3:15-6:05

188. Infrastructure Planning in Developing Countries—(Enroll in Civil Engineering 231.) 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 (Staff) by arrangement

190. Seminar on Planning and Design Professions—Informal luncheon seminar on vocational possibilities in urban planning, urban design, and architecture. Bay Area professionals lecture and respond to questions concerning the nature of their day-to-day work, impressions of the field in general, and academic background recommended for that career. One session devoted to graduate school admissions and the degree relevant to these fields.

1 unit, Win (Staff) T 12-2
WESTERN CULTURE PROGRAM

Chairman, Western Culture Program Committee: Paul Robinson (Professor of History)

The Western Culture Requirement is part of the system of Distribution Requirements instituted in 1980-81. Since 1980, entering 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. Although the eight courses that constitute the Western Culture Program are sponsored by different departments and programs, they share a core of readings, insuring that all students will be exposed to certain great works.

The sequences have different formats, but in addition to the core readings they share another important feature. Each sequence provides at least two hours per week of small group instruction with an experienced teacher—often a regular member of the Stanford faculty.

Students are strongly encouraged to fulfill the Western Culture Requirement during the freshman year; however, some students may choose to defer it. 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. The following courses are available in 1988-89 and are organized to accommodate all entering freshmen and transfer students. Every effort will be made to assign students to the specific courses that they elect, but it is not possible to place all students in the courses they list as first choice.

COURSES

STRUCTURED LIBERAL EDUCATION

Track Chairman: Mark Mancall (Professor of History)

The program in Structured Liberal Education is also designated as a Western Culture sequence. For details, see the "Program in Structured Liberal Education" section in this bulletin.

GREAT WORKS OF WESTERN CULTURE

Track Chairman: Ronald Rebholz (Professor of English)

Students meet for four hours per week in classes of 16 or fewer to discuss great works of philosophy, religion, imaginative literature, history, and science. These discussions are led by faculty and instructors drawn from a variety of departmental and disciplinary backgrounds. Once a week a lecture by an outstanding scholar helps interpret these works by placing them in their historical and intellectual context.

1. The Ancient World—Writings from Hebrew, Greek, Roman, and early Christian cultures. (DR:1; three-quarter sequence)
   5 units, Aut (Staff)

2. From the Middle Ages to the Enlightenment—Works of imaginative literature and religious (Christian and Islamic), philosophical, and scientific writings of the Medieval, Renaissance, Reformation, and Enlightenment periods of Western history. (DR:1; three-quarter sequence)
   5 units, Win (Staff)

3. From the Enlightenment to the Present—Major political treatises, works of imaginative literature, and scientific works from the late 18th through the 20th centuries. (DR:1; three-quarter sequence)
   5 units, Spr (Staff)

EUROPE: FROM THE MIDDLE AGES TO THE PRESENT

Track Chairman: James Sheehan (Professor of History)

(Enroll in History 1,2,3.) This sequence explores the relationship between literary and philosophical texts and political, social, and economic developments in Europe since late antiquity. The focus is on the origins and decline of Medieval Europe, 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 in small discussion sections (17 or fewer) led by postdoctoral fellows. (DR:1; three-quarter sequence)

WESTERN THOUGHT AND LITERATURE

Track Chairman: Paul Robinson (Professor of History)

(Enroll in Humanities 61,62,63.) This sequence, offered by Humanities Special Programs, has been taught at Stanford continuously for more than 40 years. It emphasizes the interconnection of literature, the arts, philosophy, and social thought in shaping the Western cultural traditions from the ancient to the contemporary world. Three lectures per week are given by regular faculty from various departments; students also attend one two-hour discussion seminar per week led by postdoctoral lecturers or advanced doctoral candidates in the Humanities Program. (DR:1; three-quarter sequence)

5 units, Aut, Win, Spr, MTW 9 plus section

WESTERN CULTURE AND TECHNOLOGY

Track Chairman: Paul S. Seaver (Professor of History)

(Enroll in Values, Technology, Science, and Society 1,2,3.) This sequence, designed and taught by the interdisciplinary faculty of the VTSS Program, treats science and technology in their interaction with philosophy, literature, and the other domains in which human creativity unfolds across history. The course does not focus narrowly on technology, but views technical ideas and artifacts as essential parts of our common cultural heritage. The track begins with the prehistoric world and traces the inter-connections between intellectual, material, and societal values into the age of computers, nuclear weapons, and recombinant-DNA. Autumn Quarter: the cultures of antiquity—Greece and Rome, Egypt, Palestine, and China. Winter Quarter: the Chinese origin, Islamic transmission, and European exploitation of technical ideas in the Middle Ages, Renaissance, and Enlightenment. Spring Quarter: the Industrial Revolution through to the present. Readings from the great works of philosophy, science, literature, and politics. (DR:1; three-quarter sequence)

5 units, Aut, Win, Spr, MTW 11 plus section

LITERATURE AND THE ARTS IN WESTERN CULTURE

Track Chair: Charles Fifer (Professor of English)

(Enroll in English 7,8,9.)—This sequence emphasizes literature and the creative imagination as part of the Western tradition. Lectures explore literature in its cultural context and include sessions on art, music, and drama. Students meet three times weekly for lectures and once weekly in two-hour seminar discussion groups. The course moves chronologically from antiquity to the present day, setting works in their original historical and intellectual perspective. Besides developing critical and analytical skills, this course stresses the techniques and practices of good writing. Seminar instructors are experienced writing teachers, and student essays receive close attention. Students who elect other courses to satisfy the Writing Requirement are eligible to request this Western Culture track for the usual 5 units per quarter. Priority goes to those who take this track to fulfill both the Western Culture requirement and the Writing Requirement simultaneously. These students meet their seminar instructors concurrently in additional class sessions and conferences other than those described above, taking the sequence for 8 units during Autumn and Winter Quarters, and 5 units during Spring Quarter. (The total is the same as if the requirements were fulfilled separately.) Students who have satisfied the Writing Requirement by Advanced Placement also have priority; they receive 5 units of credit each
quarter toward fulfillment of the Western Culture requirement. (DR:1; three-quarter sequence)

7. Antiquity and the Middle Ages—Begins with the Hebrew Bible and continues to the dawn of the Renaissance, covering Homer, Sappho, Sophocles, Plato, the Beowulf poet, Dante, Marie de France, Boccaccio, and Chaucer.

8 units, Aut (Steidle, Staff) MTW 10 plus sections


8 units, Win (Bebholz, Staff) MTW 10 plus sections


5 units, Spr (Polhemus, Staff) MTW 10 plus sections

SPECIAL PROGRAMS

PROGRAM FOR INDIVIDUALLY DESIGNED MAJORS

This program is intended for undergraduates who are interested in pursuing an area of scholarly inquiry which falls outside the purview of an established academic department or program of the University. It permits intellectually coherent majors designed by the students themselves, with the assistance of faculty members of their choice. While the Individually Designed Major program is not an Honors program, the governing committee encourages each participating student to consider an Honors project as a culminating experience of the major. Any student in good academic standing is free to participate. Information about proposal procedures, and the procedure for an Honors project, is available at the Undergraduate Advising Center, Sweet Hall, first floor.

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 Dean's Advisory Committee on Individually Designed Majors and the Undergraduate Advising Center.

The committee acts in lieu of a regular department of the University. This role involves certifying the scholarly merit of the program and includes the obligation to consider, approve, and recommend changes in each proposed major.

In carrying out its role, the committee reserves the right to reject proposals which in its opinion lack scholarly merit or which are not clearly interdisciplinary. Occasionally, the committee must reject a proposal which, though of considerable academic merit, requires resources not available at Stanford. The committee also reserves the right to recommend additions to each student's faculty advisory group.

THE PROPOSAL

Detailed written procedures and advice about the preparation of the proposal are available from the Undergraduate Advising Center, (Sweet Hall, first floor; telephone 415 723-2426), where a UAC advisor is available to discuss your proposal with you.

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 all three advisors giving separate appraisals of the academic viability of the proposed major.

All members of the student's advisory group must be members of the Academic Council at
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 specific requirements. The criteria for approval of proposals submitted to the Program Committee for Individually Designed Majors include the following:

1. Each major shall consist of at least 60 units, all in courses at or above the 100 level (or their equivalent);
2. A maximum of 15 units of these 60 may be taken on a Pass/No Credit basis.
3. A maximum of 5 units of these 60 may be taken in individual study or directed reading.
4. The proposed major must constitute a coherent academic program which fulfills the student's objectives and achieves a clear academic goal.
5. The proposed major must be comparable in quality and in academic rigor to degrees obtained by students in other degree-granting programs offered at Stanford.
6. The proposed major must achieve both breadth and depth within the academic discipline(s), involve interdisciplinary study, and be compatible with a liberal arts education.
7. The proposed major must not duplicate, or be achievable through, a major already offered by another degree-granting program or department.
8. Students must present evidence that demonstrates their ability to do independent work.
9. Students proposing individually designed majors must have at least three full quarters undergraduate work remaining at Stanford after the date of which the proposal is approved by the committee.

These specific requirements are in addition to the general guidelines discussed under "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.

INNOVATIVE ACADEMIC COURSES (IAC)

Director: Margo Horn

Innovative Academic Courses (IAC) introduce alternative topics and methods into the standard University curriculum and, through SWOPSI, link students' academic experience to social and political activism. IAC encourages faculty and students to introduce experimental courses and develop alternative approaches to learning. These courses do not fulfill any Distribution Requirements, but do count as units toward graduation. IAC courses are selected and approved by the program's Accreditation Committee. They include three types of offerings: Freshman-Sophomore Seminars, SWOPSI (Stanford Workshops on Political and Social Issues), and Undergraduate Special courses (UGS).

REGISTRATION

All Freshman-Sophomore Seminars, SWOPSI workshops, and Undergraduate Special courses are listed in the IAC Program Catalog, available each quarter during advanced registration through the residences, at the Registrar's office, and at the IAC office, 124 Sweet Hall. Enrollment of individual students in all courses is determined by the Registrar's class lists. (Sign-ups are handled in accord with the regular University system of alphabetical rotation on regular advance registration or class list sign-up days at the location established by the Registrar.)

GRADES

Grades in these courses are given in the normal manner, with the Pass/No credit option available on the instructor's approval.

COURSE PROPOSALS

A proposal for an Undergraduate Special or SWOPSI course may be initiated by a student, staff member, faculty member, or a member of the community. The proposed instructor should submit, for review by the IAC Accreditation Committee, a proposal using forms available at the program office, 124 Sweet Hall, including:
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 a 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 IAC Accreditation Committee 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.

Proposals are due by the fifth week of the quarter preceding the one in which the proposed course is to be offered.

FRESHMAN-SOPHOMORE SEMINAR PROGRAMS

Freshman-Sophomore Seminars bring together small groups of students early in the undergraduate years to investigate a well-defined issue under the guidance of a faculty member, usually a professor in one of the University's graduate departments or professional schools. The seminars introduce students to research and scholarship that rarely finds its way into introductory courses.

Approximately 15 seminars will be offered in 1988-89; each seminar will have 8 to 12 students.

ADMISSION PROCEDURES

Enrollment is limited to freshmen and sophomores. Seminar offerings are announced each Autumn Quarter in Approaching Stanford II, in Approaching the Sophomore Year, as well as in the IAC Program Catalog (see above). Students sign up for seminars on class-list sign-up days.

Inquiries may be directed to the Innovative Academic Courses office, Sweet Hall.

SWOPSI (STANFORD WORKSHOPS ON POLITICAL AND SOCIAL ISSUES)

SWOPSI was 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 students, faculty, and staff; each course is sponsored by a faculty member. The program offers credit for approximately nine workshops each quarter. SWOPSI classes are small; enrollments of 8 to 15 students per instructor allow for personal contact between students and instructors and for a high level of 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. For example, one workshop developed a solid waste recycling plan for the campus. In other workshops, students have worked in a school for children with learning disabilities, on a rape crisis hotline, and at the Stanford Women's Center. 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. Public events such as symposia or film series are frequently generated by workshops; SWOPSI also sponsors or co-sponsors public events that deal with political or social topics of interest to the Stanford community.

SWOPSI takes an interdisciplinary approach to problem solving, gives students a substantial voice in the conduct of workshops, and encourages cooperative group work. Workshops are open to both undergraduates and graduates, as well as to 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 or in exploring possible SWOPSI sponsorship of a public event should contact the IAC office at (415) 723-4305. For registration, see above.

UNDERGRADUATE SPECIAL COURSES

Undergraduate Special (UGS) courses widen the range of options open to undergraduate students by encouraging innovation in subjects
and methods, and introducing experimental and interdisciplinary courses. UGS provides settings for testing new course ideas and approaches to unusual subjects. Recent UGS courses include Political Theories of Sexuality, Chicano Poetries, and Critical Thinking and the Media. Like SWOPSI, instructors may be students, faculty, staff, and community members.

PUBLIC SERVICE CENTER

The Public Service Center serves as the focal point for students, faculty, and staff interested in public and community service. Through the Public Service Opportunities Clearinghouse, it maintains, coordinates, and lists volunteer, internship, and action research opportunities for undergraduate and graduate students in the Bay Area, nationally, and internationally. Students seeking credit for academic work based on public service internships or community sponsored research projects will be assisted by staff in identifying a faculty member who might supervise and accredit their work. It is the responsibility of students to take the initiative; credit is arranged in the same manner as individual study.

The center also houses and supports the Stanford Volunteer Network, Stanford in Government, the Stanford International Development Organization, and the You Can Make A Difference Conference; all are student organizations designed to assist students interested in public service in the San Francisco Bay Area, Sacramento, Washington, D.C., and in the international development field. It administers the Public Service Summer and John Gardner Fellowship programs, both designed to provide financial support to students undertaking public service work, and the Local Government Internship Program which places Stanford students in paid internships in municipal offices in San Mateo County. Students work with the Ravenswood School District to offer supplemental academic tutoring and athletic training to elementary school students. The center also sponsors conferences and workshops.

Students interested in public and community service internships, action research, volunteer work, and fellowships should visit the Public Service Center at Owen House or call (415) 723-0992.

CENTER FOR TEACHING AND LEARNING

Director: Michele Marincovich

The services of the Center for Teaching and Learning are divided into two broad categories—those for undergraduate and graduate students in the areas of study skills, reading rate improvement, and tutoring in academic subjects, and those for teaching assistants and faculty in the areas of teaching evaluation and improvement.

SERVICES TO UNDERGRADUATES AND GRADUATES

At some point in their studies here, many students find that they need to sharpen their study skills. CTL can help through programs and coursework designed to improve students' ability to read with speed and comprehension, study efficiently, and learn material more effectively. Free tutoring is also available to undergraduates in most subjects; to arrange it, undergraduate students should drop by CTL and request a trained tutor. Students interested in and qualified for tutoring others can also take courses in tutoring techniques from CTL. CTL offices are located on the first floor of Sweet Hall, (415) 723-1326, and are open from 8:30-12 and 1-5 Monday through Friday.

SERVICES TO FACULTY AND TEACHING ASSISTANTS

Since 1975, CTL has provided the Stanford community with services and resources on effective teaching. Its aims are several: to identify and involve successful teachers who are willing to share their talents with others; to provide those who are seeking to improve their teaching with the means to do so; to acquaint the Stanford community with important innovations and new technologies for teaching; to prepare inexperienced teachers for their responsibilities; and to expand awareness of the role of teaching at research universities and to increase its rewards.

Goals are realized through a variety of continuing programs: videotaping and consultation; small group evaluation; workshops and lectures; coursework for foreign TAs in association with the Linguistics Department; a handbook on teaching and a library of teaching materials; an annual orientation; and by working with individuals, groups, and departments on their specific needs. If you are currently teach-
ing or will teach in the future, you are encouraged to drop by the CTL offices on the first floor of Sweet Hall and acquaint yourself with the activities. Further details are also available in CTL's teaching handbook and in the CTL brochure, both available by calling (415) 723-1326.

CTL offers non-credit lectures and workshops throughout the year on topics related to teaching and public speaking. Handouts, videotapes, and readings on these topics are also available without charge. To be regularly informed regarding these offerings, call (415) 723-1326.

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COURSES

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., 101 instead of 1) for a limited number of units. They will be expected to complete additional work.

1. Learning Strategies—Time management, self-management, notetaking, techniques for understanding and remembering what is read, concentration and memory, mapping, how to prepare for and take exams, flexible problem solving strategies, relaxation techniques and other strategies for dealing with test anxiety, and library research.
   1-2 units, Aut, Win, Spr (Wanat)

4. Reading Rate Improvement—Aims to double students' reading rate without loss of comprehension and to improve their skills of critical analysis. Students learn to better understand and remember what they read in textbooks, articles, and essays in the sciences, humanities, and social sciences, and develop flexibility in reading speed which enables them to vary reading rate according to familiarity, difficulty, and purpose.
   1 unit, Aut, Win, Spr (Wanat)

8. Critical Reading and Writing—(Same as English 1ID.) Focuses on reading and writing. Students meet four times weekly in class and once in tutorial.
   3 units, Sum (Staff)

118. Practical Speech Communication—A practical approach to the art of speech communication. Examines speech at the informal level, looking at impromptu and anecdotal communication. Emphasis is then on developing skills in various speech types: exposition, entertainment, argumentation, and persuasion. In addition to reading a basic textbook, students sharpen skills with the aid of videotape, texts of famous speeches, and participation in a final dinner program of speeches. In learning about the art of speaking, students will evaluate presentations by others. Letter grades or pass/no credit.
   3 units (Wagstaffe) T 7-10 p.m.

120. Peer Tutoring: Math and the Sciences—Provides training for those who wish to be paid tutors through CTL. Includes readings; discussion of tutoring techniques such as listening skills, probing skills, approaches to problem solving, and feedback techniques; videotapes. Short individual and group projects required. New tutors may begin work after 2-3 weeks in the class.
   1 unit, Aut, Win, Spr (Gordon)

121. Peer Tutoring: Humanities and the Social Sciences—Format same as 120, but content designed for tutors in the humanities and social sciences.
   1 unit, Aut, Win, Spr (Gordon)

UNDERGRADUATE RESEARCH OPPORTUNITIES (URO)

Director: Laura S. Selznick

The Undergraduate Research Opportunities Program (URO) seeks to combine two of Stanford's greatest strengths: the eminence of its research faculty and excellence in undergraduate education. URO encourages students to work independently on projects with faculty, and thus to participate directly in Stanford's research community.

There are two principal formats in which the collaboration is established. Faculty members may list ongoing research projects in which undergraduates can become involved. Undergraduates may design their own individual projects and pursue them under the sponsorship of an individual faculty member. The URO staff directs students to departments with established research programs, advertises opportunities submitted by individual faculty, and helps to develop opportunities.

Faculty who have participated in this program since 1974 have found enthusiastic and energetic assistants, made better progress in research, and freed up time for more specialized work. Students have appreciated the direct con-
tact with faculty, immersion in a topic of mutual interest, and the unique learning opportunity that research provides.

LISTING RESEARCH

Faculty members with ongoing research programs are encouraged to identify a piece of their project which is appropriate to undergraduate competencies and to list it through URO. (Purely menial or mechanical projects are not appropriate.) The researcher should state very clearly the nature of the position, requisite background and qualification, and the expected time commitment. Determination of credit appropriate to each project is left to the researcher and the student. The formula generally used is three hours of intellectual work per week per academic unit. (On the average, students have received 3 units of credit per quarter in exchange for a commitment of 10 hours per week.)

RESOURCE FILES

Students can obtain free computer accounts to access two data bases designed to facilitate undergraduate research projects. The Odyssey and Faculty Interests files are available through Folio, the computer processor which includes Socrates, the on-line library catalog. Odyssey lists openings for student research assistance on faculty research projects (as well as public service opportunities from the Public Service Center and internships from the Career Planning and Placement Center). The Faculty Interests File contains information about the research interests of individual Stanford faculty across the University. Students can use faculty interest information in identifying potential sponsors for projects of their own design or in seeking advice about a particular discipline.

FUNDING AVAILABLE

The Fund for Undergraduates' Research is administered by URO and available exclusively to Stanford undergraduates. The deadlines for major grants (up to $2,500) for 1988-89 are Friday, April 7 for projects in social sciences and natural sciences and Monday, May 1 for projects in humanities and creative arts.

Small grants ($500 maximum) are awarded each quarter. The deadlines for 1988-89 are November 4, February 10, and April 7.

Major grants differ from small grants in the scope of the project proposed rather than the level of reimbursement requested. Major and small grants are restricted to supplies and expenses associated with research. Major grants are awarded once a year, during Spring Quarter, to as many as 40 students whose projects reflect the highest level of creativity and independence and the greatest promise for exciting results. The faculty sponsor of each winning major grant project receives an unrestricted professional expense grant of $500. Major grants for students on financial aid may sometimes include funds to replace summer earning expectations.

Research grants have been made possible by the generosity of donors to Stanford. Lane Grants are unrestricted as to area of exploration. Golden Grants fund work in humanities and creative arts. Other designated grant funds include Culley Grants for Undergraduate Opportunities in Music and Dwight Grants for research in physics and applied physics.

The URO office has information on applications and criteria.

SUMMER HUMANITIES INSTITUTE

Each summer URO sponsors an eight-week Summer Humanities Institute. This residentially-based program offers the opportunity for undergraduates (especially sophomores and juniors) to participate in a small group seminar and to work closely with a faculty member in the humanities. Previous institute topics have included Black English and Writers and Politics of the Two Germanics. Tuition for the institute is subsidized with scholarships available for room and board.

Students interested in research, and faculty with projects to list, should contact the program at 122 Sweet Hall or call 723-3828.

STANFORD PROGRAM IN WASHINGTON, D.C.

Director: David Danelski

The University offers 13-week "stretch quarters" (early September to December or late March to July) in residence at the Stanford facility in Washington, D.C. The program will enable highly-qualified undergraduates to work and study in the nation's capital. In addition to allowing students to draw on the city's unique culture and educational resources, the program will expose students to public service and encourage them to assume leadership roles in solving contemporary world problems.

The centerpiece of the student's educational experience is an internship. Students serve as interns at such institutions and agencies as the Senate, the House of Representatives, the Supreme Court, Office of Management and Budget, the Security and Exchange Commis-
sion, the National Gallery, and the National Institutes of Health.

In addition to the internship, students must, also complete an academic course of study consisting of (1) a theme tutorial which brings together a small cluster of students with related internships in regularly scheduled guided discussions, 5 units, and (2) a weekly policy seminar addressing the broader issues encountered by policymakers, 5 units. Students also have the option of writing a major paper for 3-5 units of credit.

A Stanford faculty member supervises the academic program in Washington. Experts drawn from government or Washington policy research institutions will act as tutors. They will direct the theme tutorials and assist the program director in monitoring the internships and the major paper.

The program is designed for students in their junior year or the first part of their senior year, but sophomores with relevant course preparation may also apply. Applications must be completed two quarters in advance.

For Autumn Quarter participation apply during early Winter Quarter the year prior.

For Spring Quarter participation apply during early Autumn Quarter.

Students interested in the program should visit the Public Service Center at Owen House to pick up a brochure or call for information, (415) 723-0992.

COURSES


5 units, Aut, Spr (Danelski) T 4-6 p.m., W 7-9 p.m.
Emertiti: (Professors) Jack H. Friedenthal, J. Myron Jacobstein, J. Keith Mann, John H. Merryman, Howard Williams

Dean: Paul A. Brest

Associate Deans: Robert Weisberg, Thomas McBride, John Gilliland

Assistant Dean: Sally M. Dickson


Associate Professors: Ellen Borgersen (on leave Autumn), Janet M. Cooper, Henry T. Greely (on leave Autumn), Barton H. Thompson (on leave Spring)

Assistant Professor: Barbara H. Fried


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 the full School of Law curriculum, see the School of Law Bulletin.) The school is on a two-term academic calendar. Autumn Term classes begin on September 8, 1988. Spring Term classes begin on January 23, 1989. Spring Term ends on May 31, 1989.

COURSES

GRADUATE

The following courses are open to qualified graduate students of other departments of the University upon permission of the instructor:

236. Art and the Law—The range of problems that arise at the intersection of law and the visual arts (painting, sculpture, and graphic art) including: the protection of works of art in time of war, occupation, and civil strife; the international traffic in stolen and smuggled cultural treasures; censorship, criticism, selection, and artistic freedom; copyright, moral right, and the proceeds right; art forgery, fakes, and consumer protection in the visual arts; legal relations between artists, dealers, museums, collectors, and auction houses; tax and estate problems of artists and collectors; legal services for artists; artnapping and insurance; legal problems of art museums, etc.

3 term units, Spr (Merryman, Elsen)

244. Issues in Child Custody—(Same as Psychology 351.) How information from psychology and other behavioral sciences can be utilized in the development of legal policies regarding child custody decisions. Identifies research projects that provide new data relevant to policymakers and on ways various disciplines cooperate to improve the process by which child custody decisions are made. Seminar limited to 20 graduate and law students. Admission by consent of the instructor.

2 term units or 3 quarter units, Aut (Wald, Maccoby) W 3:20-6:20

307. Law and Behavioral Science—The implications of psychological research and theory for law and legal processes. Issues: the notions of responsibility and intention; the reasonable man; insanity; group processes and their effects on juries; stereotyping and arrest; eyewitness testimony; the social psychology of institutions.

2 term units (Rosenhan) not given 1988-89
316. Law in Radically Different Cultures—
(Same as Anthropology 157, Political Science 182L; graduates enroll in Anthropology 257.)
American law as a benchmark to examine comparative issues in the law of the Peoples' Republic of China (Eastern law), Republic of Egypt (religious law), and Botswana (traditional law) to identify the historical, philosophical, social, and cultural factors which contribute to the development of different attitudes and practices regarding law. Issues: the passing on of status and property rights—especially at death, the punishment of embezzlement, 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. Non-law students enroll for 2 quarter units in winter and 3 quarter units in spring. First class meeting January 23.

3 term units or 5 quarter units, Spr (Wald) W 3:15-5:45

325. Interdisciplinary Seminar in Decision, Conflict and Risk—
(Same as Business 694, Economics 386, Operations Research 366, Psychology 283.) Addresses problems of decision making, risk analysis, conflict resolution and negotiation from normative and descriptive perspectives.

2 term units, Spr (Mnookin) T 4-5:30

327. Jury Decision Making—
(Same as Psychology 355.) Seminar examining the psychological processes regulating jury decision-making. The cognitive aspects of a presentation (the amount of information that can be retained and processed), story, and construal processes. The social psychological aspects of group decision-making. Preparations for trial, including trial simulations, voir dire, and juror selection. Limited to law and graduate students who have permission of the instructor.

2 term units, Aut (Rosenhan, Stublarec) T 3:20-5:20

329. Psychopathology and Mental Health Law—
(Same as Psychology 353.) The literature on severe psychopathology focusing 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. Also, law and practice in commitment and conservatorship, issues and case law in right to treatment, patients' rights, informed consent, assessment of malpractice and psychosurgery.

3 term units (Rosenhan) not given 1988-89

337. Public Policy Towards Abused and Neglected Children—
(Same as Education 379X.) Standards that are, and should be, used in defining child abuse and neglect and evaluating means of state intervention to protect such children. Role of various professionals, doctors, lawyers, mental health experts, police, and social workers in dealing with the problems of child abuse and neglect. Types of research currently being done and identification of new research directions. Seminar limited to 20 graduate and law students and meets for 15 weeks under the school's semester system. Permission of the instructor required.

3 term units or 5 qtr. units, Spr (Wald) W 3:15-5:45

345. Psychology and the Law Proseminar—
(Same as Psychology 225.) Current Stanford research on psychologal issues designed to acquaint faculty and students in the Psychology/Law program with each other's current research and with contemporary issues in the field. Topics may include the role of social science experts in legal decision making, eyewitness identification, jury behavior, psychological assumptions in evidence law, the insanity defense, and others, depending upon the interests of the participants. Prerequisites: Law student or graduate standing in psychology or postdoctoral fellow, and consent of instructor.

2 term units or 3 quarter units, Aut (Rosenhan) Th 2:15-4:45

NONPROFESSIONAL

The following 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.

106. Introduction to American Law—
(Same as American Studies 179, Political Science 182F.) Introduction to American law for undergraduates, dealing with the structure of the American legal system, including the courts; American legal culture; the legal profession and its social role; the scope and reach of the legal system; the background and impact of legal regulation; the relationship between the American legal system and American Society in general.

5 units, Aut (Friedman) MTWTh 9

149. Freedom of the Press—
Introduces nonlaw students to the issues surrounding government regulation of the mass media. Emphasis on libel and invasion of privacy, the role of media in covering elections and criminal prosecution, and issues involving state secrets. The problems of confidential sources, of gaining access to information, and of special regulation of broadcasting. Decisions of the Supreme Court involving First Amendment issues. Prerequisites:
Limited enrollment, mandatory preregistration, junior standing or above. Not open to undergraduate communication majors.

4 units, Spr (Franklin) MWF 11-12:20

150. Regulation, Welfare, and Public Policy—Objectives: to develop an understanding of the role administrative agencies are playing in the resolution of major issues of socioeconomic conflict; and to explore the practical and theoretical limitations of the administrative process as a tool for implementing social change. The impact of various constituencies in shaping administrative policy in product safety and environmental protection. The role of the courts in controlling administrative discretion.

4 units (Rabin) not given 1988-89
The 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, Stanford had designed its 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 length of the curriculum may vary as the individual's needs dictate. Students develop study plans that take into consideration their academic background, particular strengths, and career objectives.

Since 1984, Stanford has required all students to complete a formal curriculum in the basic medical sciences and to have formal clinical experience in medicine, surgery, pediatrics, gynecology-obstetrics, and psychiatry. The minimal requirement for the M.D. degree is satisfactory completion of 13 quarters of academic work. Stanford offers the option to take additional quarters at a nominal fee. The time students spend in medical school is a function of their background and their degree of involvement in research and outside course work.

There is a wide variety of opportunity for students at Stanford who wish to study subject areas in the preclinical and clinical disciplines in depth. Students with strong interests in careers in medical research are urged to investigate opportunities available under the auspices of the Medical Scientist Training Program (MSTP). This program provides an opportunity for a limited number of students to pursue an individualized program of research and course work leading to both the M.D. and Ph.D. degrees. The estimated time for completion of the program is six years. Students interested in participating in the MSTP will be asked to provide supplemental information relevant to their research background and will be considered for entry into the MSTP at the time of their application to the Stanford University School of 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.

Provided an applicant to the 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 records. The general requirements for admission are in the Stanford School of Medicine bulletin. For application materials write: Chairman, Committee on Admission, Stanford University School of Medicine, Stanford, California 94305.

**BIOCHEMISTRY**

*Emeritus: (Professor) Arthur Kornberg*
*Chairman: David S. Hogness*
*Associate Professor: Douglas L. Brutlag*
*Assistant Professors: Patrick O. Brown, Robert S. Fuller, Mark A. Krasnow, Suzanne R. Pfeffer*

The Department of Biochemistry is part of the Graduate Division of the University and a department of the School of Medicine. 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, and in cell biology, equivalent to the core series offered by the Department of Biological Sciences.

Advanced courses in more specialized areas are offered 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 replication and recombination, 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 Biochemis-
Those applying should have at least a baccalaureate degree in cell and developmental biology. Applicants should have completed a career in biochemical research and teaching to be considered for admission to the Ph.D. program. Those interested should directly apply to the Department of Biochemistry. Applicants should contact the department for further information.

**GRADUATE PROGRAM DOCTOR OF PHILOSOPHY**

The Department of Biochemistry offers a Ph.D. program which begins in the Autumn Quarter of each year. The program 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. Prerequisites: Organic chemistry, cell biology (equivalent to Biology 41). Qualifying examinations are required. Students must pass these examinations before starting research.

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 should apply directly to the Department of Biochemistry for admission to the Ph.D. program. Applicants must 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, and analytical, organic, inorganic, and physical chemistry. The department is especially interested in those applicants who have research experience in biology or chemistry. Students must submit an application, including transcripts and letters of recommendation, by January 1. Applications are available from the department beginning September 1. Applicants will be notified by April 1 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 should complete an application for a National Science Foundation and Howard Hughes Medical Institute Predoctoral Traineeship. Students are usually provided with financial support adequate to meet their normal expenses. In addition, Stanford tuition costs will be paid by the department.

All applicants for admission to the department 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; 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**

**BIOCHEMISTRY 659**

200. Biochemical Structure, Metabolism, and Energetics—The structure and function of biochemical molecules, enzyme kinetics and mechanisms, bioenergetics, pathways of intermediary metabolism, and membrane structure and function. Alternative lectures dealing with special topics also presented. Prerequisites: Organic chemistry, cell biology (equivalent to Biology 41).

5 units. Win (Baldwin, Fuller, Kaiser, Kornberg, Lehman, Pfeffer) MTWThF
201. Advanced Molecular Biology—Lectures on recent information about rapidly developing frontiers in polynucleotide metabolism and its control, chromosome structure and function, transcription and translation, hormone action, and virus biochemistry. Prerequisite: 200 and an understanding of basic molecular biology.

5 units, Spr (Berg, Brown, Brutlag, Davis, Hogness, Krasnow, Kornberg) MTWThF 11

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: 200, 201, or equivalents, and consent of instructor.

4 units, Win (Pfeffer)

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. Computer Applications in Molecular Biology—(Same as Medical Information Sciences 231.) Recombinant DNA and rapid DNA sequencing methods, and symbolic computation. Computer methods are used at all steps during a cloning/sequencing project, including the planning stages, sequencing, and analyzing biological sequence information. Hands-on use of a variety of software tools for analyzing DNA protein and RNA sequences, and review and evaluation of the relative benefits of each including microcomputer methods, timesharing methods, and communications between microcomputer and mainframes. Homework assignments and completion of a research project. Registration limited to 40 with consent of the instructor.

3 units, Win (Brutlag)

221. The Teaching of Biochemistry—To be taken by all students as teaching assistants in 200, 201, or 217. Emphasizes practical experience in teaching on a one-to-one basis, and problem set design and analysis. Familiarization with current lecture and text material is expected, along with evaluations of class papers and examinations. Prerequisite: Enrollment in the Biochemistry Ph.D. program.

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

299. Research.

1-15 units, any quarter (Staff) by arrangement

399. Research and Special Advanced Work—Prerequisite: Consent of instructor. Must register by section numbers by arrangement with faculty.

1-18 units, any quarter

CELL BIOLOGY

Chairman: Roger D. Kornberg
Professors: Roger D. Kornberg, Michael Levitt, James A. Spudich, Lubert Stryer
Assistant Professor: Peter Parham
Lecturer: Patricia Cross

The department offers opportunities for course work and research in cell biology. Courses fall in three categories: (1) Molecular Biology of the Cell, an intensive, one-quarter course that treats the emerging discipline of cell biology from a molecular standpoint and that is intended for advanced undergraduates, graduate students, and medical students; (2) a series of one-quarter courses that treat special topics of great current interest in cell biology at an advanced level; and (3) Structure of Cells and Tissues, a one-quarter course tailored to the needs of medical students that includes both lectures on structure-function relationships of mammalian cells and tissues, and a laboratory on medical histology.

The emphasis of research in the department is on understanding fundamental cellular processes in terms of the structure and function of organelles and molecular assemblies. Techniques used include standard methods of biochemistry, genetic engineering, and cell culture, as well as image processing and three-dimensional reconstruction from electron micrographs, x-ray and electron diffraction, fluorescence microscopy, nanosecond fluorescence spectroscopy, and microinjection of cells and nuclei. The department owns and operates a computing center equipped with the most advanced time-sharing and color graphics systems for data analysis and molecular modeling.

The graduate program in Cell Biology leads to the Ph.D. degree. The department also participates in the Medical Scientists Training Program in which individuals are candidates for both the Ph.D. and M.D. degrees.

The graduate program is intended to prepare students for careers as independent investigators in cell and molecular biology. The principal requirement of a Ph.D. degree is the completion of research constituting an original and significant contribution to the advancement of knowledge. In addition, students are required to enroll in the series of special topics courses taught by the faculty of the department. Finally, students gain teaching experience by assisting in the one-quarter course, Molecular Biology of the Cell.
Applicants to the program should have a bachelor's degree and should have completed at least a year of course work in mathematics, physics, organic chemistry, physical chemistry, and biology. Application forms must be received by the department before January 1 for notification by April 15. Application to the National Science Foundation for fellowship support is also encouraged. Remission of fees and a personal stipend are available to graduate students in the department. Prospective applicants should write to the Department of Cell Biology for further information.

Current topics of research in the department lie in the areas of gene expression and molecular genetic analysis of protein structure, cell motility, signal transduction, and cell-cell interaction.

COURSES

200. Molecular Biology of the Cell—The molecular basis of cell function. Themes: storage and expression of genetic information, protein targeting, exocytosis and endocytosis, cell surface interactions, cell motility, and the cytoskeleton, and signal transduction. The three-dimensional architecture and dynamics of biological macromolecules and supramolecular assemblies in relation to their biological function. Experimental techniques discussed include electron microscopy, x-ray diffraction, site-directed mutagenesis, immunocytochemistry, and reconstitution of functional assemblies. Four lectures and one discussion section per week. Prerequisite: Knowledge of introductory biochemistry.

5 units (Staff) given 1989-90

201, 202. Advanced Immunology—(Same as Immunology 201, 202, Microbiology and Immunology 211, 212.) Lecture (201) and student presentation (202) featuring current problems in immunology; for graduate and advanced undergraduate students. Topics: genetics and structure/function relationships of antibodies, T-cell receptors, MHC antigens; differentiation and activation; cellular regulation of immune responses; autoimmunity and other problems in clinical immunology. Prerequisites: Biochemistry, basic immunology, consent of instructor (for undergraduates). 201 is a prerequisite for 202.

201. 3 units, Win (Davis, Parham) MWF 10
202. 3 units, Spr (Davis, Parham) Th 3:15-5:05

211. Structure of Cells and Tissues—The structural organization of tissues in relation to their function. Topics: light and electron microscopy; epithelia, muscle, connective tissue, bone and cartilage, blood, cardiovascular system, lymphoid tissue, nervous tissue, skin, endocrine, exocrine, gastrointestinal, respiratory, urinary, female and male genital systems, and the ear and eye. Three lectures, two laboratories, and one review session per week.

7 units, Aut (Cross, Staff)

222. Signal Transduction Mechanisms—Molecular mechanisms of transduction of sensory and hormonal stimuli by prokaryotes and eukaryotes. Topics: bacterial chemotaxis and phototaxis; vision in invertebrates and vertebrates; olfaction; and hormonal actions mediated by G-proteins such as the adenylate cyclase cascade and the phosphoinositide cascade; molecular evolution of transducing proteins. The structure and interplay of receptors, enzymes, and ion channels mediating these processes. Experimental approaches include gene cloning and site-specific mutagenesis, isolation and reconstitution of functional transducing assemblies, and patch clamping and other electrophysiological methods. Recurring motifs of excitation and adaptation, and transduction and their evolution are emphasized.

3 units, Win (Stryer)

224. Electron Crystallography—Three-dimensional structure analysis of ordered arrays of biological molecules by electron microscopy and image processing. Techniques of 3-D image reconstruction using 2-D crystals and objects possessing helical symmetry. Topics: principles of image formation, methods of specimen preservation, Fourier averaging, rotational filtering, and symmetry relationships. The application of these techniques in elucidating the structure of membrane proteins, cytoskeletal filaments and cellular organelles illustrated by detailed examination of selected examples. Prerequisite: Knowledge of basic biochemistry and cell biology.

3 units (Staff) given 1989-90

225. Cell Motility—The molecular basis of cell movements and change of cell shape. The mechanism of interaction of actin and myosin in the conversion of chemical energy derived from ATP hydrolysis into mechanical energy of movement. Also, the regulation of motile assemblies and their evolution. A variety of experimental approaches elucidate the molecular basis of cell motility: genetic analyses, DNA cloning, immunocytochemical localization, isolation of proteins, reconstitution of functional assemblies, spectroscopic approaches, x-ray diffraction, and electron microscopy. Current literature is critically analyzed. Shows how a complex cellular process is analyzed and understood at the molecular level by the use of a wide range of biochemical, biophysical, and molecular genetic techniques. Prerequisite: Knowledge of basic biochemistry and cell biology.

3 units, Spr (Spudich)
225. Protein and Nucleic Acid Structure, Dynamics, and Engineering—The availability of three-dimensional atomic structures of proteins and nucleic acids allows interpretation of biological processes based on the physical and chemical properties of these molecules. Crystallographic studies: structural themes exemplified by local chain conformation, secondary structure, domains, families of folds, protein folding and thermodynamic stability. How these structures move is considered by combining results of experiment with theoretical molecular dynamics simulations. Enzyme catalysis is described in these terms. How these structures can be changed to engineer novel molecules from the experimental and predictive aspects; use of interactive computer graphics programs to illustrate problems. Systems include protein-nucleic acid complexes and antibody-antigen interactions. Prerequisite: Knowledge of basic biochemistry and cell biology. 

3 units, Aut (Levitt)

229. The Eukaryote Chromosome—Principles of chromosome structure and function. Topics: the structure, dynamics, and topological forms of DNA; units and hierarchies of DNA coiling in chromosomes; centromeres, telomeres, and the basis of chromosome maintenance and sorting in mitosis; the mechanism of gene activation, with regard to enhancer, promoter, and terminator sequences; the basis of sequence-specific protein-DNA interaction; organization and assembly of the cell nucleus. Prerequisite: Knowledge of basic biochemistry and cell biology.

3 units (Kornberg) given 1989-90

260. Supervised Study—Research or advanced tutorial for undergraduates.

1-18 units, any quarter (Staff)

299. Directed Reading.

1-18 units, any quarter (Staff)

399. Individual Research.

1-18 units, any quarter (Staff)

DIAGNOSTIC RADIOLOGY AND NUCLEAR MEDICINE

Emeriti: (Professors) Henry H. Jones, Frederic N. Silverman
Acting Chairman: Ronald A. Castellino
Associate Professors: Dieter R. Enzmann, Barton Lane, F. Graham Sommer, Stuart W. Young, Tien-Wen Weidmann
Assistant Professors: Robert L. De La Paz, John Drace, Sheila Moore, Matilde Nino-Murica, George Segall, Ralph L. Smathers, Allan Wright
Professors of Radiology (Clinical): William H. Marshall, Jr., Bruce R. Parker
Associate Professor of Radiology (Clinical): Barton Lane
Acting Associate Professor: Gerhard Wittich
Acting Assistant Professors: Michael Marks, Susan Marks

Although the Department of Diagnostic Radiology and Nuclear Medicine 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. Undergraduate students may also arrange individual research projects under the supervision of the department's faculty.

This discipline focuses on the use of radiation, ultrasound, and magnetic resonance as diagnostic, therapeutic, and research tools. The fundamental and applied research within the department reflects this broad spectrum as it relates to anatomy, pathology, physiology, and interventional procedures.

Courses offered by the department which are open to undergraduate and postgraduate students are listed below.

COURSES

101. Selected Readings in Radiology Research.

Aut, Win, Spr (Staff) by arrangement

208. Experimental Nuclear Medicine—Computer applications in medicine, particularly the use of radioisotopes as tracers. Recommended: Some knowledge of physiology and calculus.

Spr (Goris) by arrangement

299. Research.

any quarter (Staff) by arrangement
GENETICS

Chairman: L.L. Cavalli-Sforza
Associate Professor: Michele P. Calos

GRADUATE PROGRAMS

The Department of Genetics offers programs of study and broad-based research training in genetics and related fields of molecular, cellular, and developmental biology leading to the Ph.D. degree. In addition, a limited number of M.D. candidates can combine research training in the department 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 the conceptual and experimental tools required by modern geneticists to approach biomedical problems of fundamental or clinical importance. Former trainees currently hold positions at leading universities and research institutions around the world, and in a variety of private industries.

Although the program provides formal course work as well as informal seminars and lectures, the emphasis is on laboratory research involving close interaction between each student and his or her faculty advisor. At the same time, the program is designed to prepare the student for a career as an independent scientist. The principal subject areas for research training include molecular and cellular genetics, developmental genetics, medical genetics, and immunogenetics. There are also special opportunities for the application of advanced instrumentation and extensive computer capabilities to certain specialized research problems, including cell detection and sorting, and aspects of human biochemical and population genetics. Interdisciplinary programs can be arranged with the faculty of other departments in the Medical Center in such fields as clinical genetics, pharmacogenetics, prenatal diagnosis, development, and immunology.

Ordinarily, students select their area of research specialization after they have explored the various scientific opportunities available in the department by rotation through the laboratories of some of the faculty. The usual course of study for the Ph.D. involves four to five years of graduate work, most of which is spent on the students' dissertation research. When the interests of an incoming student are well defined at the time of admission, the student can be placed with a faculty preceptor soon after admission. Commonly, a formal dissertation proposal is submitted by the student following a qualifying examination given in the second year of study. Student progress is followed by a faculty preceptor and an advisory committee.

A grant from the U.S. National Institute of Health provides major support for the graduate training program in the Department of Genetics. Students who are U.S. citizens or who hold permanent resident visas are eligible to receive support from this source. Other student support can be provided by departmental funds. Support for the research programs carried out in the laboratories of department faculty is derived mostly from federal grant funds and by funds from other non-profit granting agencies. Some faculty research funds are also available for student support. Information about individual fellowship support can be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue N.W., Washington, D.C. 20418, and prospective students are encouraged to apply for such support.

For further information on the availability of the following courses, consult the quarterly Time Schedule, or inquire at the department office. Additional courses in or related to genetics are included in the listings of the Departments of Biological Sciences, Biochemistry, Cell Biology, and Microbiology and Immunology.

For basic University requirements for the Ph.D. degree, see the 'Degrees' section of this bulletin.

COURSES

201, 202. Human Genetics—Theoretical and experimental basis for modern genetics emphasizing human and medical genetics in their molecular, chromosomal, cellular, developmental, and population aspects.

201. 3 units, Win (Calos, Cavalli-Sforza, Cohen, Ganesan, Herzenberg) MWF 9
202. 22 units, Spr (Calos, Cavalli-Sforza, Cohen, Ganesan, Herzenberg) TTh 10

requisites: Algebra, elementary statistics, basic genetics.

3 units (Cavalli-Sforza) alternate years, given 1989-90

249. Advanced Genetics—Principles and modern methods of chromosomes and their influence on development and evolution. Gene transfer and recombination in pro and eukaryotic systems. Biochemical basis of certain inherited diseases. Important advances in molecular genetics and biochemistry. Intended for graduated students, medical students and advanced undergraduates with good knowledge of biochemistry, biology, and basic genetics.

3 units, Aut (Ganesan) alternate years, not given 1989-90

260. Supervised Study—Prerequisite: Consent of instructor.

any quarter (Staff) by arrangement

270. Genetics Seminar—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

HEALTH RESEARCH AND POLICY

Chairman: Byron Wm. Brown, Jr.

Director of Master's Program: John P. Bunker


Clinical Associate Professors: Sheldon S. King, Roland S. Merchant, Sr.

Participating Faculty: Alain C. Enthoven (Graduate School of Business), June A. Flora (Communication), James F. Fries (Medicine), Halsted R. Holman (Medicine), Ronald A. Howard (Engineering Economic Systems), Nathan Macoby (Communication), Kenneth Melmon (Medicine), Rudolf H. Moos (Psychiatry), W. Richard Scott (Sociology), Edward H. Shortliffe (Computer Science and Medicine), Harold C. Sox, Jr. (Medicine), Carl Thoresen (Education), Amos N. Tversky (Psychology), Ernie Young (Chaplaincy Service)

The Department of Health Research and Policy includes three divisions:

1) The division of Biostatistics deals with scientific methodology in the medical sciences, with particular emphasis upon the use of statistical techniques;

2) The division of Epidemiology provides training and experience in the application of epidemiologic methods to the study of diseases of unknown etiology. It is concerned also with problems of health and disease in human populations in all parts of the world and with efforts toward improving levels of health;

3) The division of Health Services Research is concerned with many aspects of health policy analysis in the public and private sectors. The department, and each division, offer courses in their areas of specialization. These are listed in the current Stanford University School of Medicine bulletin.

MASTER OF SCIENCE PROGRAM

The master's degree program in Health Services Research (M.S. in H.S.R.) is designed to complement training in the medical and social sciences in preparation for careers in health services or health policy; for example, careers in medicine and nursing, in which responsibilities in administration and health policy are anticipated, and careers in health policy analysis in government, consulting firms, health planning agencies, education, business, or the law. The program provides specialized training in selected areas of health care policy and other health-related topics, in research methodology, and in the application of these skills to a specific research problem. Coursework requirements, based on an individually-designed multidisciplinary curriculum, allow students to design a program of study suited to their individual backgrounds and interests.

Applications will be considered from persons in the following categories:

1. Medical students interested in problems of health care delivery and policy who seek additional training in the applied social sciences. Medical students who intend to pursue careers involving administration may wish to consider coursework in the Graduate School of Business.

2. Graduate students in other academic disciplines, such as communication, sociology, political science, economics, education, engineering, and business, who want additional expertise in the application of social science research methods to issues in health care.


Students already admitted to a degree program who wish to be admitted to the Master of Science in Health Services Research program
must submit an "Application for Additional Degree," available from the Department of Health Research and Policy in the School of Medicine.

In order to receive the Master of Science degree in Health Services Research, students are expected to demonstrate competence in three broad areas, participate in a core seminar, and complete a University thesis. A total of 45 units is required to complete the program, approximately half in coursework and half in research (and not less than 15 units in each). Normally, this requires three quarters of work, but it can be spread over a longer period of time if the student is working concurrently toward another graduate degree. Of the 45 units, 36 must be counted only toward the H.S.R. degree. The remaining 9 units may be double-counted to meet other degree requirements.

For additional information, address inquiries to the Program Administrator, Department of Health Research and Policy, School of Medicine, Stanford University, Stanford, California 94305.

**COURSES**

220. Social Controversy and Policy Analysis in Medicine—(Same as Human Biology 40.) The goals: understand the role and limits of health care and prevention in achieving and maintaining health; develop a working knowledge of the organization, financing, and regulation of health care in the U.S.; learn to plan and carry out analyses of problems in health policy, and assess the validity of analyses carried out by others; to understand the logical basis of clinical decision-making, especially clinical decision-making under uncertainty and the resulting implications for policy.

4 units, Spr (Bunker) MWF 11

256. Economics of Health and Medical Care—(Same as Economics 156/256; graduate students enroll in 256.) Empirical, institutional, and theoretical analysis of problems of health and medical care. Topics: measurement, valuation, and determinants of health; physicians, hospitals, and the drug industry; financing and organization of medical care; public policy issues. Open to graduate students and undergraduates (juniors, seniors) with training in microeconomics and some background in statistics or mathematics. Prerequisite: 51 or permission of instructor.

5 units, Spr (Fuchs)

270. International Health—Discussion on world distribution of selected diseases and health problems; international organizations and control programs; environmental, social, and economic factors in relation to health, particularly in developing countries; and comparative health care systems in poor and wealthy countries. Also, preparation for work and experience abroad. Prerequisite: Consent of instructor.

2-4 units, Spr (Basch) Th 1:15-3:05

279. Management of Hospitals and Other Health Care Institutions—The administrative aspects of health care institutions. Organizational elements of hospitals, administration, financial issues and problems, hospital departmental relationships, quality of patient care, principal external pressures (governmental and nongovernmental), consumerism, and community influence.

3 units, Win (King, Merchant) Th 3:15-6:05

283. Core Seminar—Presentation of thesis research in progress. Open to HSR masters candidates only.

1 unit, Aut, Win, Spr (Bunker)

284. Research Seminar—Invited guests present current research. Credit available to HSR masters candidates only.

1 unit, Aut, Win, Spr (Bunker) alternate M 3:30-5:30

391. Political Economy of Health Care—(Same as Business 431.) The financial and public policy context in which the health care system operates, and the issues in public policy controlling it in the public expenditure. The issues: financing and organization for delivery of health care in the U.S., 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. Not open to undergraduates.

4 units, Aut (Enthoven) MF 8-10

392. Cost-Benefit Analysis in Health Care—(Same as Business 432.) How do you do cost-benefit analysis when the "output" is difficult or impossible to measure? Study and discussion of the main literature on the principles of cost-benefit analysis applied to health care. A critical review of actual studies. Emphasis on insights into the art of practical application. Not open to undergraduates.

4 units, Spr (Enthoven) MF 8-10
MEDICAL INFORMATION SCIENCE PROGRAM

Committee: Edward H. Shortliffe, Chairman and Program Director (Associate Professor of Medicine and by courtesy, Computer Science); Mark A. Musen (Assistant Professor of Medicine); Richard L. Popp, (Professor of Medicine); Allen K. Ream, (Associate Professor of Anesthesia); Gio C. M. Wiederhold, (Associate Professor of Medicine, Research, and Computer Science, Research). 

Co-Director: Lawrence M. Fagan (Medical Computer Science)

Participating Faculty and Staff:
The faculty members in the program are drawn from the departments listed below. Opportunities for research are not limited to the specific faculty and departments listed.

Anesthesia: John P. Bunker (Professor), David M. Gaba (Assistant Professor), Allen K. Ream (Associate Professor)

Biochemistry: Douglas L. Brutlag (Associate Professor)

Business, School of: Alain C. Enthoven (Professor)

Computer Science: Thomas O. Binford (Professor), Edward A. Feigenbaum (Professor), Michael L. Genesereth (Associate Professor), Edward H. Shortliffe (Associate Professor), Gio Wiederhold (Associate Professor)

Economics: Victor R. Fuchs (Professor)

Education, School of: Lee S. Shulman (Professor), Richard E. Snow (Professor)

Electrical Engineering: Albert Macovski (Professor), Gio Wiederhold (Associate Professor)

Engineering-Economic Systems: Samuel Holtzman (Consulting Assistant Professor), Ronald A. Howard (Professor), Ross D. Shachter (Assistant Professor), Edison Tse (Associate Professor)

Health Research and Policy: Byron W. Brown, Jr. (Professor), John P. Bunker (Professor)

Genetics: Stanley N. Cohen (Professor)

Medicine: Terrance Blaschke (Associate Professor), Robert W. Carlson (Assistant Professor), Gregory F. Cooper (Research Associate), Lawrence M. Fagan (Senior Research Associate), James F. Fries (Associate Professor), Alan M. Garber (Assistant Professor), Charlotte Jacobs (Associate Professor), Laurence Kedes (Professor), Mark A. Musen (Assistant Professor), Richard L. Popp (Professor), Edward H. Shortliffe (Associate Professor)

Obstetrics and Gynecology: Emmet J. Lamb (Professor)

Pathology: Howard H. Sussman (Professor)

Psychology: Amos N. Tversky (Professor)

Radiology: Dieter Enzmann (Associate Professor), Leslie M. Zatz (Professor)

Statistics and Biostatistics: Byron W. Brown, Jr. (Professor)

Surgery: Michael Eliastam (Associate Professor), Adam Seiver (Clinical Instructor)

This interdisciplinary program was created in response to a recognized need for well-trained researchers and academic leaders in the expanding field of medical information sciences (medical informatics).

Stanford University’s extensive computing facilities are described under the “Computer Science” section in this bulletin. In addition, the Medical Information Sciences Program has many personal computers plus a network or Hewlett-Packard and Xerox 1100 series professional workstations. These high performance machines are available for coursework and research projects by trainees in the program.

GRADUATE PROGRAMS

The Medical Information Sciences Program is an interdepartmental program that offers instruction and research opportunities leading to M.S. and Ph.D. degrees in Medical Information Sciences. All students are required to complete the core curriculum requirements outlined below. Students who fail to maintain a 3.0 letter grade indicator in a category of the core curriculum (see categories listed below) will be expected to pass a comprehensive exam in that area before the graduate degree will be granted. In addition, all degree candidates must pass an oral examination that tests the student’s ability to integrate the various components of the curriculum and to relate them to the overall field of Medical Information Sciences (MIS). The program’s master’s degrees are intended as terminal professional degrees.

Although most students will be expected to comply with the basic program of study outlined here, special arrangements can be made for those with unusual needs or those simu-
CORE CURRICULUM

All students are expected to participate regularly in the MIS Journal Club (201) and Colloquia (200). In addition, all students are expected to fulfill requirements in the following five categories:

1. Medicine (7-21 units): The student is expected to acquire a basic knowledge of human physiology, anatomy, and disease. Required are Human Biology III (Human Physiology) or the Clinical Physiology series (Physiology 200-204). Also required are Clinical Diagnosis (MIS 202) and Introduction to Clinical Environments (MIS 205).

2. Computer Science (11 units): The student is expected to acquire a knowledge of the use of computers, computer organization, programming, and symbolic systems. It is assumed that students will have had prior computing experience at least equivalent to Computer Science (CS) 109 A/B. All students are required to take a minimum of 11 units of courses in the Computer Science Department. If similar courses have not been taken previously, these units must be CS 110, 161, and 221. With the exception of CS 110, all other courses applied to the degree requirements must be numbered 137 or higher.

3. Decision Making (10-12 units): Students will be expected to learn basic probability theory, Bayesian statistics, decision analysis techniques, and experimental design techniques. It is assumed that students will have had a prior course in statistics at least equivalent to Statistics 60. Required courses are Psychology 252 (Statistical Analysis of Data); Statistics 116 (Theory of Probability) or Engineering-Economic Systems (EES) 221 (Probabilistic Analysis); and EES 231 (Decision Analysis).

4. Medical Computer Science (9 units): All students are expected to acquire a general knowledge of the state-of-the-art and future frontiers for medical computer science. Required courses are MIS 210 (Computer Applications in Medicine), 211A (Computer-Assisted Medical Decision Making), and 211B (Project Course).

5. Health Policy/Social Issues (5-7 units): Candidates will be expected to be familiar with key issues regarding public health policy, financing, ethics, and legal topics. Students are expected to take Health Research and Policy (HRP) 200 (Health and Society). A second course may be selected from among HRP 220/Human Biology 40 (Public Decision Making Regarding Human Health), Symbolic Systems 100 (Computers and Ethics), or any other advanced course in Health Policy/Social Issues proposed by the student and approved by the MIS advisor.

Note that the core curriculum generally entails a minimum of 42 units of coursework, but can require substantially more or less depending upon the courses selected and the previous training of the student. The varying backgrounds of students are well recognized and no one will be required to take courses in an area in which he or she has already been adequately trained; under such circumstances, students will be permitted to skip courses or substitute more advanced work. Students will design appropriate programs for their interests with the assistance and approval of their MIS advisor.

MASTER OF SCIENCE

This degree is designed for individuals who wish to undertake in-depth study of medical informatics. The University's basic requirements for the master's degree are discussed in the "Degrees" section in this bulletin. Normally a student will spend two years in the program and will implement and document a substantial project during the second year. The first year will involve acquiring the fundamental concepts and tools through coursework and research project involvement. Graduates of this program will be prepared to contribute creatively to basic or applied projects in medical information science.

PROGRAM REQUIREMENTS

Programs of at least 54 units that meet the following guidelines will normally be approved:

1. Completion of the core curriculum.
2. A minimum of 9 additional units composed of courses in Computer Science numbered 137 or higher, courses in Engineering-Economic Systems or Operations Research numbered greater than 200, or one of Psychology 256 or 260.
3. Electives: Additional courses to bring total to 54 or more units.

MASTER OF SCIENCE (SPECIAL PROGRAM)

This special program is designed as postdoctoral training for individuals with established research credentials who may wish to acquaint themselves broadly with the field of Medical Information Sciences, emphasizing formal coursework. Candidates will be required to complete the core curriculum and to supplement coursework with approved electives to
obtain a total of 42 units. A research project is encouraged but not required. Candidates will be permitted to complete the program in no less than four quarters. Students in this program will be drawn from applicants with doctoral degrees in medicine, computer science, decision theory, or related fields; for example, an academic physician on sabbatical might wish to undertake this program of study. The degree is designed to allow its graduates to complement their area of primary academic or research activity by providing them with a heightened ability to work effectively in collaborative research projects.

DOCTOR OF PHILOSOPHY

Individuals wishing to prepare themselves for careers as independent researchers in medical information science should apply for admission to the doctoral program. The University's basic requirements for the doctorate (residence, dissertation, examination, etc.) are discussed in the "Degrees" section in this bulletin. The following are additional requirements imposed by the MIS Interdisciplinary Committee:

1. A student should plan and successfully complete a coherent program of study including the core curriculum, oral examination, and additional requirements for the master's program. In addition, doctoral candidates will be expected to complete two additional courses totaling at least 6 additional units of advanced coursework (see categories under (2) of the master's program requirements). The master's requirements, including the oral examination, should be completed by the end of the second year in the program (six quarters of study, excluding summers). Doctoral students are generally advanced to Ph.D. candidacy after completing the oral examination. A student's advisor has primary responsibility for the adequacy of the program, which will be regularly reviewed by the Graduate Study Committee of the MIS Program.

2. To remain in the Ph.D. program, each student must retain a letter grade indicator (LGI) as outlined from the master's programs above, and must pass a comprehensive exam covering introductory level graduate material in any curriculum category in which he or she fails to attain an LGI of 3.0. The student must fulfill these requirements and apply for admission to candidacy for the Ph.D. by the end of six quarters of study (excluding summers).

3. By the end of nine quarters (excluding summers), each student must orally present a thesis proposal to a dissertation committee that will generally include at least one member of the Graduate Study Committee of the MIS Program. The committee will determine whether the student's general knowledge of the field, and the details of the planned thesis, are sufficient to justify proceeding with the dissertation.

4. As part of the training for the Ph.D., each student is required to complete 2 units of teaching assistant service in MIS courses, 1 unit (10 hours per week for one quarter) being required during the first two years as evidence of satisfactory progress toward the degree.

5. The most important requirement for the Ph.D. degree is the dissertation. Prior to the oral dissertation proposal and defense, each student must secure the agreement of a member of the program faculty to act as dissertation advisor. In some cases, the advisor need not be an active member of the MIS program faculty.

6. No oral examination will be required upon completion of the dissertation. The oral defense of the dissertation proposal satisfies the University oral examination requirement.

7. The student is expected to demonstrate an ability to present scholarly material orally and will present his or her research in a lecture at a formal seminar.

8. The student is expected to demonstrate an ability to present scholarly material in concise written form as well. Each student will be required to write a paper suitable for publication, usually discussing his or her doctoral research project. This paper must be approved by the student's advisor as suitable for submission to a refereed journal before the doctoral degree will be conferred.

9. The dissertation must be accepted by a reading committee composed of the principal dissertation advisor, a second member of the program faculty, and a third member chosen from anywhere within the University. The principal advisor and at least one of the other committee members must be Academic Council members.

COURSES

200. Medical Information Sciences Colloquium—Series of colloquia, offered by program faculty, students, and occasional guest lecturers. Credit available only to students in an MIS degree program. (May be taken no more than three times for credit.)

1 unit, Aut, Win, Spr, Th 2-3

201. Medical Information Sciences Journal Club—Journal club for all students and several faculty. Participants report on recent relevant articles from the Medical Information Science literature. Credit available only to students in an
MIS degree program. (May be taken no more than 3 times for credit.)

1 unit, Aut, Win, Spr, T 2-3

202. Clinical Diagnosis—Specifically designed for the learning of techniques of interviewing and symptom analysis by the study of a variety of common and well-defined clinical entities by role-playing in a problem-solving setting. No final exam. Available only to students in an MIS degree program.

2 units, by arrangement

205. Introduction to Clinical Environments—For students who are not enrolled in the M.D. program or do not have an M.D. degree. One half day per week is spent becoming familiar with a variety of clinical settings at Stanford Medical Center and the Veterans Administration Medical Center. Selected faculty members introduce assigned students to the medical wards, outpatient clinics, emergency room, operating room, intensive care unit, psychiatry ward, and rehabilitation ward. Meeting time is adjusted to suit the student's class schedule. Available only to students in a MIS degree program.

1 unit, by arrangement

208. Computer-assisted Literature Searching—(Same as Medicine 225.) The techniques involved in the use of several major online databases relevant to clinical medicine. MEDLINE, CANCERLIT, and TOXLINE are emphasized. The course meets the training requirement for access to the National Library of Medicine's system. Students are eligible to apply for their own passwords upon successful completion. Available only to medical students and graduate students in the School of Medicine.

1 unit, Aut, Spr (Lenon) by arrangement

210. Computer Applications in Medicine—(Same as Computer Science 270.) Medical computer science activities in research and applied environments. Topics: office systems, hospital information systems, medical databases, laboratory systems, image analysis, EKG analysis, history taking, library systems, multiphasic health testing, medical computer-aided instruction.

3 units, Aut (Pagan, Shortliffe) TTh 3:15-4:15

211A. Computer-Assisted Medical Decision Making—(Same as Computer Science 271A.) Medical decision making techniques and methods for their implementation in decision support systems. Bayesian statistics, decision analysis, and artificial intelligence (expert systems).

3 units, Win (Shortliffe) TTh 3:15-4:15

211B. Computer-Assisted Medical Decision Making—(Same as Computer Science 271B.) For students who have completed 211A and wish to implement some of those ideas in a computer project. Computer programming required in most projects. Prerequisite: 211A.

3 units, Spr (Cooper, Fagan) TTh 3:15-4:15

229. Seminar on Rule-Based Expert Systems—(Same as Computer Science 524.) A historical perspective and technical understanding of the last decade's research on rule-based expert systems in the Knowledge Systems Laboratory, and its relationship to similar research directions for the late 1980's. Emphasis is on an analysis of the research lessons of MYCIN and related projects in the KSL, the strengths and limitations of the rule-based approach to knowledge representation, and the way in which artificial intelligence (AI) research evolves as new ideas and concepts are discovered. Prerequisites: At least one course in AI and familiarity with LISP.

2 units, Spr (Shortliffe, Musen) W 3:30-5

231. Computer Applications in Molecular Biology—(Same as Biochemistry 218.) Recombinant DNA and rapid DNA sequencing methods, and symbolic computation. Computer methods are used at all steps during a cloning/sequencing project, including the planning stages, sequencing, and analyzing biological sequence information. Hands-on use of a variety of software tools for analyzing DNA protein and RNA sequences, and review and evaluation of the relative benefits of each including microcomputer methods, timesharing methods, and communications between microcomputer and mainframes. Homework assignments and completion of a research project. Registration limited to 40 with consent of the instructor.

3 units, Win (Brutlag)

235. Medical Decision Analysis—(Same as Engineering-Economics Systems 235, Computer Science 371.) The use of decision analysis in medical practice. Student teams analyze specific clinical decision problems as a term project. Topics: the decision-making role of patients and physicians, medical preference models, assessing decision models in a clinical context, medical ethics, and designing and using automated medical decision tools. Prerequisite: Engineering-Economics Systems 31 or 231, or equivalent. No formal medical background is required.

4 units, Spr (Holtzman, Matheson) MWF 3:15-4:30

299. Directed Reading and Research—For students wishing to receive credit for research time.

any quarter, by arrangement
MICROBIOLOGY AND IMMUNOLOGY

Emeriti: (Professors) Sidney Raffel, Carlton E. Schwerdt, Bruce A. D. Stocker; (Adjunct Professors) Monroe D. Eaton, Esther M. Lederberg

Chairman: Hugh O. McDevitt
Professors: Stanley Falkow, Hugh O. McDevitt, Leon T. Rosenberg
Associate Professors: Mark M. Davis, Harry B. Greenberg, Abdul Matin, Robert J. Roantree, Gary K. Schoolnik
Assistant Professors: John C. Boothroyd, Edward S. Mocarski, Kasturi Haldar, Peter O'Hanley, Lucy S. Tompkins
Associate Professor (Research): Thomas E. Hamm/Professor (Teaching): John P. Steward

The Department of Microbiology and Immunology offers programs leading to degrees of Bachelor of Science and Ph.D. (On rare occasions, a Master of Science may be awarded—see below.) 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; molecular and genetic studies of the immune system; structure and function of animal viruses, and molecular biology of parasites.

UNDERGRADUATE PROGRAM

BACHELOR OF SCIENCE

Requirements include: Mathematics, including calculus, 9 units; Biological Sciences, 15 units; Chemistry, 20 units (Chemistry 31, 33, 35, 36, 131, 135, or equivalent); Physics, 12 units. Specific course requirements are the following: Microbiology and Immunology 101, 102, 103, 203, 204, and 206; Biochemistry 200.

Students in this program can arrange to take units in 199, Undergraduate Research. For outstanding research, a student may be awarded a degree with departmental Honors.

GRADUATE PROGRAM

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 degrees 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, including some experience in biochemistry and molecular biology, and chemistry. 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 1.

An applicant must file a report of scores on the general tests and the subject test (normally in biology, but where appropriate in some other subject, e.g., chemistry) of the Graduate Record Examination (GRE). It is strongly recommended that the GRE be taken in October so that scores will be available when applications are evaluated.

The policy of the department is that entering predoctoral students be supported. The department can provide only a small number of assistantships and traineeships. Applicants are encouraged to apply for predoctoral fellowships such as those from the National Science Foundation.

Program for Graduate Study—The degree of Doctor of Philosophy requires coursework and independent research demonstrating an individual's creative, scholastic, and intellectual abilities. Upon entering the department, each student meets with his/her designated supervisor and together they design the basic timetable for completion of the degree requirements. Typically, this will consist of first identifying gaps in the student's undergraduate education and determining which courses should be taken. Then, a tentative plan will be made of which laboratories will be worked in during the two required rotations (each lasting 1-2 quarters). During their graduate study in the department, each student will also take six upper level (200-series) courses, at least three of which should be in this department, the other three of which may be in one of the many departments at Stanford with overlapping interests; e.g., Biochemistry, Biological Sciences, Cell Biology, Chemistry, Computer Science, Genetics, Health Research and Policy, and Pathology.

In the Autumn Quarter of the second year, each student will take the written qualifying
exams which ensure that a comprehensive understanding of the basic subject areas of microbiology and immunology have been attained. In the Winter Quarter of the second year, an oral exam will be taken based on a written research proposal prepared by the student, the subject of which will be other than the intended thesis project. This will test the creative intellect of the student. Based on these two exams, the student will be admitted to candidacy. Teaching experience and training are part of the graduate curriculum. All graduate students are required to act as teaching assistants for at least two quarters as part of their program.

COURSES

101. General Microbiology—Lecture-laboratory introduction to the biology of bacteria, bacteriophages, and animal viruses. Coverage: bacterial anatomy, genetics, and physiology, antibiotic action, immunology, and host-parasite relationships. Prerequisites: Chemistry 31, 33, and 35. Recommended; Biological Sciences 31.

5 units, Aut (Roantree) MWF 1:15
lab MWF 2:15-4:05

102. Principles of Immunology—An introduction to immune responses in vertebrates. Also, immune-like reactions in nonvertebrate animals and in plants and bacteria.

3 units, Win (Rosenberg) TTh 1:15

103. Undergraduate Medical Microbiology—Lecture covering the principles of pathogenic microbiology in more breadth and depth than in 101. Topics: host-parasite relationships as they pertain to bacterial, viral, and parasitologic infections, their diagnosis, treatment, and prevention. Prerequisite: 101 or equivalent.

3 units, Spr (Roantree, Falkow, Mickelsen) MWF 1:15

198A-F. Undergraduate Directed Reading—Prerequisite: Consent of instructor.
15 units maximum, any quarter (Staff) by arrangement

200. Immunology—(Same as Pathology 220.) Immunology as related to medicine is emphasized. Principally for medical, graduate, and advanced undergraduate students. Prerequisites: Basic principles of genetics and introductory courses in biochemistry and histology.

3 units, Spr (Rosenberg, McDevitt, Weissman) MWF 10

200A. Problem Solving in Immunology—(Same as Pathology 220A.) Provides direct experience in understanding immunology, using problems. Each week 3-5 problems are to be corrected and discussed. Corequisite: Simultaneous enrollment in 200.

1 unit, Spr (Rosenberg, McDevitt, Weissman) by arrangement

202. Medical Microbiology—Lectures and laboratory demonstrations covering the fundamentals of pathogenic microbiology, emphasizing bacteria and animal viruses. Also, some aspects of immunology, laboratory diagnosis, and preventive measures. Limited to medical students and graduate students who have the consent of the instructor.

6 units, Aut (Falkow, Greenberg, Mocarski, Schoolnik, Tompkins) TTh 1:15-3:05 F 9-10:50

203. Bacterial Physiology and Ecology—For graduate and advanced undergraduate students. Bacterial nutrition and growth kinetics; bacterial phenotype during nutrient-limited growth; structure and function; terminal energy-yielding pathways (aerobic and anaerobic respiratory chains, proton translocation, oxidative phosphorylation, nutrient transport); and special bacterial groups or processes. Prerequisites: Biological Sciences 31, 32, and 33.

3 units, Win (Matin) MWF 1:15

204. Bacterial Genetics—Lectures on inheritance in bacteria. Prerequisites: 101 and Biological Sciences 31, or equivalents.

3 units, Win (Matin) MWF 1:15

206. Animal Viruses—For graduate and advanced undergraduate students. Lectures on the molecular biology of virus replication emphasizing the host-virus interaction. Prerequisites: 101 or 202, Biochemistry 200, or consent of instructor. Recommended: Biological Sciences 213 and Biochemistry 201.

3 units, Aut (Mocarski) MWF 3:15
207. Pathogenesis of Infectious Diseases—Emphasis: provide an understanding of the molecular mechanisms employed by microorganisms to bring about the infection of animal and human hosts. Formal instruction plus class discussion of recent literature pertaining to microbial pathogenicity, and normal and acquired host surface mechanisms. Prerequisite: Consent of instructor. Sign-up list requested.

2 units (Falkow) alternate years, given 1989-90

208. Topics in Virology—In depth discussion of current literature in a topical area of the molecular biology of viruses. Student participation in presentations required. Prerequisite: 206. May be taken repeatedly.

1 unit, Win (Mocarski) M 10

209. Molecular Parasitology—An advanced seminar on the molecular biology of parasites, especially protozoa. Topics: antigenic variation, molecular cloning of protective antigens, gene amplification, kinetoplast DNA and host-parasite interactions. Recommended: A background in parasitology, e.g., Health Research and Policy 204. Prerequisite: Biochemistry 201 or consent of instructor.

2 units Win (Boothroyd) Th 3:15-5:05

211, 212. Advanced Immunology—(Same as Cell Biology 201, 202, Immunology 201, 202.) Lecture and student presentation featuring current problems in immunology; for graduate and advanced undergraduate students. Topics: genetics and structure/function relationships of antibodies, T-cell receptors, MHC antigens; accessory molecules; lymphocyte differentiation and activation; cellular regulation of immune responses; autoimmunity and other problems in clinical immunology. Prerequisites: Biochemistry, basic immunology, consent of instructor (for undergraduates). 201 is a prerequisite for 202.

211. 3 units, Win (Davis, Parham) MWF 10
212. 3 units, Spr (Davis, Parham) Th 3:15-5:05

270. Seminar—Reports, discussions on selected topics by departmental speakers.

1 unit, Aut, Win, Spr (Staff) W 12

299. Directed Reading—Prerequisite: Consent of instructor.

18 units maximum, any quarter (Staff) by arrangement

MOLECULAR AND CELLULAR PHYSIOLOGY

Emeritus: (Professor) Frederick A. Fuhrman
Chairman: Richard Tsien
Professors: Julian M. Davidson, Roy H. Maffly, Eugene D. Robin (jointly with medicine)

Courtesy Professor: Jeffrey J. Wine

Courtesy Associate Professors: William T. Clusin, Allen D. Cooper

Courtesy Assistant Professors: Andrew R. Hoffman, Timothy Meyer

Courtesy Professor (Research): David M. Maurice

Courtesy Professor (Clinical): Mark G. Perlroth

Consulting Associate Professor: Noel Thompson

Senior Research Associate: Erla R. Smith

GRADUATE PROGRAMS

The Department of Molecular and Cellular Physiology offers required and elective courses for students in the School of Medicine, and is open also to other qualified students with the consent of the instructor. Training of medical, graduate, and postdoctoral students is available. The department offers the Ph.D. degree, but not the master’s or bachelor’s degrees.

DOCTOR OF PHILOSOPHY

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 (general and subject test in Biology) on the Graduate Record Examination as part of the application.

The total course of study is expected to occupy four or more years, including three summers. Required courses for all students are: Biochemistry 200 and 201, Neurobiology 200, Pharmacology 201 and 202, Biostatistics 202, and Molecular and Cellular Physiology 200, 201, 202, 203, and 204. Students may take additional courses selected from departmental or extradepartmental offerings. This will be arranged by agreement between the student and the faculty supervisor.

At present the chief research interests of the department are in behavioral physiology, cell and respiratory physiology, reproductive phys-
iology, and neuroendocrinology. 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 or third year in residence as a graduate student, each Ph.D. candidate will be given an oral comprehensive examination. The examination may be taken only after all course work has been completed to the required standard. Students will undertake individual research studies as early as possible after consultation with their preceptor.

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

There are no departmental training grants for graduate student support. Research assistantships may be available through individual preceptor research grants. Graduate students who are also medical students are eligible for financial aid from the Office of Student Affairs, Stanford School of Medicine.

In general, graduate students must expect to find the majority of their financial support outside the University.

COURSES

199. Undergraduate Research—Investigation sponsored by individual faculty members, available to undergraduates, hours and units arranged in consultation. Fields of research open to students include behavioral physiology and neuroendocrinology.

any quarter (Staff) by arrangement

200. Physiology: Cardiovascular—Offered jointly with the Department of Medicine. Lectures, clinical presentations, and laboratory demonstrations of normal and disordered human cardiovascular physiology. Final exam given. Prerequisite: An understanding of general biochemistry.

6 units, Aut (Perlroth) MW 10-11:50, TTh 11-11:50

201-202. Physiology: 201-Endocrine, 202-Gastrointestinal—Offered jointly with the Department of Medicine. Lectures, clinical presentations, and demonstrations on normal and disordered function in the endocrine and gastrointestinal systems. Final exams given. Prerequisite: An understanding of general biochemistry.

6 units (201, 4 units; 202, 2 units), Win (Endocrinology: Hoffman; Gastrointestinal: Cooper) MWF 9-10:50

203-204. Physiology: 203-Renal, 204-Respiratory—Offered jointly with the Department of Medicine. Lectures, clinical presentations, and demonstrations on normal and disordered function in the respiratory, renal, fluid and electrolyte, and acid-base systems. Final exam given. Prerequisite: An understanding of general biochemistry.

6 units (203, 3 units; 204, 3 units) Spr (Renal: Maffly, Meyer; Respiratory: Robin) MWF 8-9:30

210. Neuroendocrine Physiology of Sex—Lectures and discussions on physiological mechanisms involved in sexual and reproductive function of animals and humans. Hormonal factors and their relationships to the nervous system emphasized.

2 units (Davidson) not given 1988-89

211. Thoracic and Abdominal Anatomy and Physiology—Intended for students who, because of their studies, require a knowledge of human anatomy and physiology as it relates to the thorax and abdomen but who will not be taking the mainline medical anatomy and physiology courses. Emphasis on the major organs and vessels in these body compartments. Lectures and dissections.

3 units, Win (Thompson) TTh 4:15-5:30

212. Human Sexuality in Medicine—A multidisciplinary survey of physiological and psychosocial determinants of sexual behavior, basic concepts, and clinical approaches to diagnosis and therapy of sexual dysfunction, and related topics such as sexual differentiation and sexually transmitted disease.

2 units, Win (Davidson) M 4:15-6:05

213. Special Topics in Physiology—A seminar of guided reading and discussion in introductory and advanced physiological topics agreed upon by an individual instructor and interested students. Prerequisite: Consent of instructor. (Staff) by arrangement

219. Advances in Physiological Research—A seminar presenting current research topics in physiology. Speakers are Stanford scientists and guest lecturers. Meets alternate weeks.

1 unit, Aut, Spr (Davidson) T 4:15

299. Directed Reading—Prerequisite: Consent of instructor.

any quarter (Staff) by arrangement

399. Advanced Research—Investigation sponsored by individual faculty members undertaken by interested, qualified medical or graduate students. The fields of research include endocrinology, neuroendocrinology, central
nervous system function, reproductive physiology, cybernetics (systems analysis and instrumental techniques).

any quarter (Staff) by arrangement

**NEUROBIOLOGY**

Chairman: Uel J. McMahan
Professors: Denis A. Baylor, Uel J. McMahan, Eric M. Shooter
Associate Professors: Eric I Knudsen, William T. Newsome, Carla J Shatz
Assistant Professors: Richard Aldrich, J. H. Pate Skene

**GRADUATE PROGRAMS**

Graduate students in the Department of Neurobiology 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 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; structure, function and development of auditory and visual systems; integrative mechanisms and regeneration in the central and peripheral nervous system; the biochemistry of neurotransmitters; and neuronal growth and differentiation.

**COURSES**

The 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.

199. Directed Reading (Undergraduate)—Prerequisite: Consent of instructor.
   any quarter (Staff) by arrangement

200. The Nervous System—The 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. Coherent framework is a preparation for neurology, neuropathology and clinical medicine, and advanced work in neurobiology. Lectures and neuroanatomy laboratories, frequent, informal seminars with students in small groups, and demonstrations. Neuroanatomy and neurobiology components must be taken together. Final exam. No limitation.
   9 units, Win (Aldrich, Baylor, Knudsen, McMahan, Newsome, Shatz, Shooter, Skene) M 1:15-3:05, T 9-10, W 1:15-5:15, Th 9-10, F 1:15-3:05

216. Membrane Biophysics Seminar—For students who have some previous background in neurobiology and who are curious about the basic mechanisms of signalling in nerve cells. A reading and discussing of original research papers, emphasizing concepts, quantitative analysis of experimental results, and critical evaluation of evidence. Topics: gating mechanisms in voltage- and sensitive- and chemosensitive ionic channels and ionic mechanisms in sensory transduction. Student presentations and small group discussions.
   3 units, Aut (Aldrich, Baylor)

270. Neurobiology Seminar—Prerequisite: Consent of instructor.
   any quarter (Staff) by arrangement

299. Directed Reading—Prerequisite: Consent of instructor.
   any quarter (Staff) by arrangement

   (Staff)

**PATHOLOGY**

Emeriti: (Professors): Bruno Gerstl, David Glick, Lelland J. Rather; (Clinical Professors) Donald L. Alcott, Lysia K. Forno
Chairman: Klaus G. Bensch
Associate Professors: Margaret E. Billingham, Gerald R. Crabtree, Edgar G. Engleman, Richard K. Sibley, Jeffrey L. Sklar, Roger A. Warnke
Professor (Research): Lawrence F. Eng
Associate Professor (Research): Teresa S. F. Wang
Professors (Clinical): Dikran S. Horoupian, Jon C. Kosek
Associate Professor (Clinical): Michael R. Hendrickson
Lecturer: Glen B. Haydon
Acting Assistant Professors: William C. Pitts, Donald P. Regula
Clinical Professors: John T. Differding, Seth L. Haber, Mahendra Ranchod
Clinical Associate Professors: Robert W. R. Archibald, Stephen S. Chen, Maie K. Herrick, A. Paul Miller
Physician Specialists and Clinical Assistant Professors: P. Joanne Cornbleet, Barbara M. Egbert, Susan A. Calel
Clinical Assistant Professors: Robert M. Cardelli, Meredith Halks-Miller, Paul L. Herrmann, Steven C. Quay, Jon C. Ross, Charles T. Uyeda, Peter Windhorst
Clinical Instructor: Louis J. Picker
Research Associates: Claudia Benike, Peggy Bradshaw, Naomi Galili, Shantharaj Gowda, Debra Hiraki, James Lipka, Robert C. Penhallow, Barry S. Stein, David F. H. Zhou

PROGRAMS OF STUDY

The Department of Pathology offers a sequence of basic courses in general pathology and special pathology, including 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 four 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 normal 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 clinical-pathological correlations, with a primary emphasis 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, molecular cytogenetics, 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, immunology and genetics of the human major histocompatibility complex, developmental and cellular immunology, tumor immunology, viral leukemogenesis, fundamental studies of the AIDS virus and its effects on the immune system, and a variety of clinical-pathological studies with particular emphasis on disease of the cardiovascular and lymphoreticular systems. Research training in all of these areas is available at the present time for qualified medical and graduate students by individual arrangement with the appropriate faculty member.

COURSES

205. Clinical-Pathological Correlations—Correlation of clinical histories with surgical and autopsy material, including microscopy. Maximum 12, minimum 5 students.
1 unit, Aut, Win (Kosek, Fajardo, Forno, Chen, Rouse, Egbert) MF 3:15-5:15

207. Principles of Electron Microscopy—Seminars on basic optics, specimen as an optical device, nature of image contrast, image detection and interpretation, related photographic principles, specimen preparation and requirements, fixation, embedding, microtomy, staining, and some special techniques.
1 unit, Spr (Haydon) by arrangement

208. Interpretation of Electron Micrographs—Seminar on principles of electron optical image formation as applied to the interpretation of biological ultrastructure. Development of the wave mechanic description of the various sources of contrast in the electron microscope image.
1 unit, Spr (Haydon) by arrangement

213. Gross Autopsy Pathology Laboratory—Students examine and discuss unfixed dissected organs from current autopsies and correlate morphologic findings with the clinical history. Students are encouraged to view postmortem examinations and (alone or in a small group) may participate in one postmortem examination with the assistance of residents and staff, and
present the case to class. Prerequisite: Currently taking or previously completed 230B or C.
2 units (an additional unit for participation in a postmortem examination)

Aut (Bensch, Regula, Staff) W 12:30-2:30
Win (Bensch, Regula, Staff) T 12:30-2:30

220. Immunology—(Same as Microbiology and Immunology 200.) Immunology as related to medicine is emphasized. Principally for medical, graduate, and advance undergraduate students. Prerequisites: Basic principles of genetics and introductory courses in biochemistry (equivalent to 200-201) and histology.
3 units, Spr (Weissman, Rosenberg, McDevitt) MWF 10

220A. Problem Solving in Immunology—(Same as Microbiology and Immunology 200A.) Provides direct experience in understanding immunology using problems. Three to five problems are corrected and discussed weekly. Prerequisite: Simultaneous enrollment in 220 or Microbiology and Immunology 200.
1 unit, Spr (Weissman, Rosenberg, McDevitt) by arrangement

230A, B, C. General and Special Pathology—A three-quarter introduction to general principles in general pathology followed by a detailed pathology of human disease based on disordered structure and function of individual organ systems (special pathology). Lecture and laboratory discussion groups. Examination after A and B and final examination. Course Director: Dr. C. Lombard. Advisors: Drs. R. Kempson and K. Bensch.

230A. General and Special Pathology.
6 units, Spr (Butcher, Rouse, Staff) MWF 1:15-3:15

230B. Special Pathology.
6 units, Aut (Lombard, Horoupian, Staff) MW 11-12 TTh 9-11

230C. Special Pathology.
6 units, Win (Hendrickson, Staff) MW 11-12 TTh 9-11

281. Practical Introduction to Electron Microscopic Techniques—Laboratory providing, through tutorial direction in the completion of two products, basic familiarity with the major technical problems encountered in the preparation of biological material for electron microscopy. Prerequisite: A basic understanding of electron microscopy.
1-4 units, Aut, Win, Spr (Haydon) by arrangement

290. Research in Experimental Neuropathology—Introduction to research methods in experimental neuropathology for students interested in a long-term project in this area. Participation in neuropathology research under the close supervision of a staff member in neuropathology. Facilities available include electron microscopy, tissue culture, neurochemistry and immunocytochemistry with antibody and molecular probes. Prerequisite: Consent of instructor.
1-18 units, Spr (Eng, Forno)

299. DNA Repair and Mutagenesis—(Same as Biological Sciences 205, Radiation Oncology 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: Biological Sciences 31 or 41, or consent of instructor.
3 units, Spr (Hanawalt, Friedberg, K. Smith) TTh 1:15, alternate years, not given 1989-90

299. Directed Reading—Prerequisite: Consent of faculty member.
1-18 units, any quarter (Staff) by arrangement

399. Research—The department faculty are involved in active research programs at the Stanford Medical Center. Students interested in research at the molecular, cellular, and clinical-pathologic levels are encouraged to seek out faculty advisors. The department is fully equipped for all modern research and maintains an active and vigorous postdoctoral research training program. Prerequisite: Consent of the instructor.
1-18 units, any quarter (Staff) by arrangement

PHARMACOLOGY

Emeriti: (Professors) Robert H. Dreisbach, Sumner M. Kalman
Chairman: Tag E. Mansour
Professors: Avram Goldstein, Dora B. Goldstein, Tag E. Mansour, James P. Whitlock, Jr.
Associate Professors: Terrence Blaschke (jointly with Medicine), Helen M. Blau, Howard Schulman
Assistant Professors: Stuart E. Leff, Richard A. Roth
Professors (by courtesy): Kenneth Melmon, Ferid Murad
Associate Professor (by courtesy): Brian Hoffman
Assistant Professors (by courtesy): Phyllis Gardner, Stephen Peroutka
GRADUATE PROGRAMS

The department presents two basic courses in contemporary pharmacology (201 and 202) and advanced courses open to qualified medical and other graduate students.

A program of study and research training leads to the Ph.D. degree. Postdoctoral research training is available to those 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. Teaching experience is an integral part of the Ph.D. curriculum and is required for the degree.

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; biotransformation of xenobiotics; mechanisms of multi-drug resistance; molecular biology of differentiation and development including post-transcriptional RNA processing events, molecular parasitology, regulation of ion channels in T-cell activation; biochemical basis for control of synaptic functions; drug metabolism and toxicology; and biochemical mechanisms associated with drug addiction and tolerance.

Students desiring to become candidates for advanced degrees should consult the general University regulations regarding such degrees, as summarized in the 'Degrees' section in this bulletin. Further information can be obtained from the department. Consult the Time Schedule for additional advanced courses.

COURSES

BASIC

Pharmacology 201 and its continuation, 202, 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.

201. Pharmacology—Lecture on the principles of pharmacology and the major drug groups used in medicine. Topics: the drug-receptor interaction; kinetic aspects of drug absorption, distribution and elimination; drug metabolism; hormones; toxicology; chemo-therapeutic agents; antibiotics; antiparasitic drugs; and the antitumor agents. Emphasis on the mechanisms of action of drugs in relation to their use in man. Prerequisite: Biochemistry.
5 units, Aut (Staff) MTWTh 8 F 11

202. Pharmacology—Continuation of 201. Major drug groups include those affecting the central nervous system, the peripheral nervous system, the cardiovascular system, and the kidney. 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. Also, problems of drug abuse.
5 units, Win (Staff) MTWTh 8 F 11

ADVANCED

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.

203. Basic Principles in Therapeutics—(Same as Medicine 202.) Clinically relevant presentations on the pharmacological basis of therapeutics. Considers various pharmacological, physiological, and pathological factors involved in qualitative and quantitative decisions about drug therapy.
2 units, Win (Blaschke) TTh 11-12

221. Molecular and Biochemical Aspects of Chemical Carcinogenesis—Topics: causes of cancer, initiation and promotion, carcinogen metabolism, oncogenes, growth factors, tumor cell heterogeneity, cellular responses to DNA damage, carcinogen detection, and quantitative risk assessment.
2 units, Aut (Whitlock) by arrangement
Frontiers of Pharmacology: Biogenic Amine Receptors — Lectures and discussions on the localization, characterization, and control of different biogenic amine receptors. Emphasis on biochemical and molecular aspects of these receptors in vertebrate and invertebrate animals. Weekly lecture and group analysis of assigned papers. Prerequisite: Biochemistry 200 or equivalent.

2 units, Spr (Mansour) by arrangement

270. Research Seminar — Weekly seminars by outside speakers on current research in pharmacology. Seminars are reviewed and discussed in a separate conference with a member of the faculty.

2 units, Aut, Win, Spr (Staff) Th 4:15-6:05 F 12-1

270. Tutorial Program — Primarily for graduate students in pharmacology. Guided readings in the literature of any area of pharmacology. A critical review paper may be required.

any quarter (Staff) by arrangement

299. Directed Reading.

any quarter (Staff) by arrangement

399. Research.

any quarter (Staff) by arrangement

REGULARLY OFFERED, BUT NOT DURING 1988-89


5 units (Schulman, Ringold, Roth)

216. Opiates, Opioid Peptides, and Opioid Receptors — Lectures emphasizing recent research developments and relating events at the molecular level to physiological and pharmacological phenomena.

2 units (D. Goldstein)

219. Scientific Communication — The techniques of scientific writing and lecturing. Students write several papers, present material orally, and evaluate the work of others with respect to clarity and efficient transfer of information.

2 units (D. Goldstein)

231. Regulation of Gene Expression in Differentiation and Development — Model biological systems for the study of differentiation and development are analyzed at a cellular and molecular level. A lecture and student discussion on recent research developments.

2 units (Blau)
plasms of hyperthermia alone and in combination with irradiation and/or cancer drugs.

Courses offered by the department which are open to undergraduate and postgraduate students are listed below.

**COURSES**

101. Selected Readings in Radiation Biology.  
*Aut, Win, Spr (Staff) by arrangement*

154. Biosocial Aspects of Cancer—(Same as Human Biology 154.) Aspects of cancer as a biological phenomenon and as a clinical, emotional, and societal problem. Diagnosis and treatment of human neoplasms, their psychosocial and economic impact, organization of cancer care and research. Emphasis on the specific control mechanisms operative *in vitro* and/or *in vivo* and delineation of their influence in an attempt to characterize the differences between normal and malignant growth.  
*4 units (Hirst, Staff)*  
*Alternate years, given 1989-90*

202. The Basic Science of Radiation Therapy—Primarily for residents or fellows in the Radiation Therapy division training program; open to medical or postgraduate students. Focus is on the basic biological processes underlying the treatment of malignant disease by radiation. Prerequisites: Some familiarity with cell biology and physiology, and consent of instructor.  
*4 units, Aut, Win, Spr (Brown) Th 8*

205. DNA Repair and Mutagenesis—(Same as Biological Sciences 205, Pathology 292.) 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 31 or 41, or consent of instructor.  
*3 units, Spr (Hanawalt, Freidberg, Smith)*  
*TTh 1:15, alternate years, not given 1989-90*

299. Directed Reading.  
*Any quarter (Staff) by arrangement*

399. Research.  
*Any quarter (Staff) by arrangement*
Vice Provost and Dean of Graduate Studies: Elizabeth C. Traugott
Associate Deans of Graduate Studies: Cecilia P. Burciaga, Karlene N. Dickey
Director of Bechtel International Center: John Pearson

The Vice Provost and Dean of Graduate Studies is generally responsible for policy concerning graduate instruction within the University. In particular, the Dean oversees admission to graduate standing, supervises the assignment of graduate fellowships, research and teaching assistantships, administers regulations for advanced degrees that have been established by the Academic Council or the Committee on Graduate Studies, oversees the fulfilling of University degree requirements for advanced degrees, develops policy for graduate affirmative action and for the support of foreign students, and works for the improvement of graduate study at Stanford and for the welfare of graduate students.

The Dean of Graduate Studies is responsible for the following curricular programs: Biophysics, Cancer Biology, the Graduate Division Special Program, Immunology, Neurosciences, and Scientific Computing and Computational Mathematics.

Three independent research centers report to the Dean of Graduate Studies: the Stanford Center for Chicano Research, the Institute for Research on Women and Gender, and the Stanford Humanities Center.

INTERDISCIPLINARY PROGRAMS AND COMMITTEES

BIOPHYSICS PROGRAM

Committee on Biophysics: Steven G. Boxer, Chairman (Professor of Chemistry); Robert Baldwin (Professor of Biochemistry); Oleg Jardetzky (Professor of Pharmacology); Michael Levitt (Professor of Cell Biology); Harden M. McConnell (Professor of Chemistry); Robert D. Simoni (Professor of Biological Sciences)

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.

GRADUATE PROGRAM

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) IXChemistry 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, at discretion of the advising committee.
6. 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. dissertation as the result of independent investigation and
expressing a contribution to knowledge in the field of biophysics.

9. 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 macromolecular structure and intermolecular interactions, physical methods for characterizing proteins, and nucleic acids. Open to qualified advanced students upon consent of instructor.

4 units, Win (Simoni, Staff) TTh 10-12

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, or consent of instructor.

3 units, Aut (Jardetzky) by arrangement

300. Research.
(Staff) by arrangement

350. Seminar in Biophysics—Presentation of current research projects and topical literature by faculty, graduate students, and visiting speakers. All graduate students in Biophysics are expected to participate.

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

Biophysics courses in related departments:
Applied Physics 130; Biochemistry 214; Cell Biology 225, 227, 228, 229; Chemistry 251, 287, 289, 291, 297; Neurobiology 216.

Other recommended courses:
Biological Sciences 205, 211, 222H, 230, 252; Biochemistry 200, 201; Cell Biology 211, 224; Chemistry 271, 273, 275, 277; Physics 170, 171, 230, 231, 232.

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 specialty and are subject to the core requirements specified below. The degree offered is the Ph.D. in Cancer Biology. Basic University requirements for the Ph.D. are described under the “Degrees” section in this bulletin.

GRADUATE PROGRAM

DOCTOR OF PHILOSOPHY

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. During the first year in the program, each student is required to constitute a three person Advising Committee which will assist him/her with the development of an appropriate program of courses and provide advice and consultation on thesis-related research. The appointment of this committee is normally carried out in consultation with the student’s research preceptor, who will chair the Advising Committee.

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. General Biochemistry and Advanced Molecular Biology.
b) Pathology 230A. General Pathology.

3. Each student must take at least 12 units of additional courses that are offered by four or more different Stanford faculty members. Course work to be taken will be determined in consultation with each student's Advising Committee.

4. Successful completion of a comprehensive qualifying examination in Cancer Biology is required for admission to Ph.D. candidacy. This examination must be completed prior to the end of the second full year of study in the program. The examination is set by the Advising Committee and consists of two parts. The first is a written examination that covers materials relevant to Cancer Biology and to the special research interests of the individual student. The second is an oral presentation to the Advising Committee of Dissertation Research or proposed dissertation research. The advising committee shall be presented with a brief written description of this research prior to the oral examination.

5. The presentation of a Ph.D. dissertation as the result of independent investigation and constituting a contribution to knowledge in the area of cancer biology.

6. 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. The oral examination will be conducted by a Dissertation Reading Committee.

**COURSES**

241, 242, 243. Molecular and Cellular Aspects of Cancer Biology—A three quarter course covering: cancer cell biology, carcinogenesis, and fundamental principles of therapy. It gives a comprehensive view of the major, relevant scientific bases, and advances in areas directly relating to the understanding and control of neoplastic growth. Organized and coordinated by Professor Friedberg.

- 241. 3 units, Aut (Staff) TTh 4:15-5:35
- 242. 3 units, Win (Staff) TTh 4:15-5:35
- 243. 3 units, Spr (Staff) TTh 4:15-5:35

251, 252, 253. Special Topics in Cancer Biology—Full quarter courses or half-quarter mini-courses given by different lecturers. Covers topics of major importance in cancer research. Units given proportionately.

- 251. Aut (Staff) TTh 4:15-5:35
- 252. Win (Staff) TTh 4:15-5:35
- 253. Spr (Staff) TTh 4:15-5:35

299. Research—All students registered for the Ph.D. must register for this course as soon as they begin dissertation-related research work.

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**GRADUATE DIVISION SPECIAL PROGRAM**

The Graduate Division Special Program is designed for students who have demonstrated outstanding academic performance in a doctoral program at Stanford and who are interested in an interdisciplinary Ph.D. degree which cannot reasonably be completed in an existing graduate department or interdisciplinary program. It is administered by the Committee on Graduate Studies (CGS) through a standing subcommittee and appointed by the CGS chair which reviews proposals and makes recommendations on admission to CGS.

The eligibility criteria for application to the Graduate Special Program are: completion of a minimum of two quarters in a Stanford Ph.D. program, completion of no more than three years of graduate study at Stanford, completion of all departmental or program requirements (including qualifying examinations which normally are completed within the time of enrollment in the Ph.D. program) and admission to candidacy for the Ph.D. degree if beyond the second year of graduate study.

The applicant is responsible for obtaining the agreement of at least four faculty members to serve on a supervisory committee. The principal advisor must be an Academic Council member, and at least two of the committee members must be tenured faculty. In accordance with the nature of the program, members of the committee should represent at least two departments of the University.

The deadline for applications is the second week of the quarter in which review is requested. The application includes a succinct statement of the dissertation topic, describing and justifying the field of inquiry, its interdisciplinary nature, and why it cannot be completed within an extant department or program. A title for the program should be selected that does not include the name of any department or graduate program at Stanford. The applicant should also describe his/her preparation in the subjects relevant to the proposal and the reasons for wishing to pursue the field of inquiry.

If approved, the student submits a Petition to Change Major and enrolls as a Graduate Special
doctoral student in the field designated on the proposal. Any subsequent changes in the program or the composition of the supervisory committee must be approved by the Graduate Special Subcommittee.

Each student in a Graduate Special program must have the agreement of a graduate department or program to provide the administrative support and services normally available to its doctoral students. This department is usually the student's previous department or that of the principal adviser. The home department is not obliged to provide financial support or to monitor academic progress.

Students registering for special research under the guidance of their committee or for the Ph.D. dissertation should use the following course numbers:

**COURSES**

400. Research.
   by arrangement

   by arrangement

**IMMUNOLOGY PROGRAM**

**Director:** Patricia P. Jones (Associate Professor of Biological Sciences)

**Committee on Immunology:** Mark M. Davis (Associate Professor of Microbiology and Immunology), C. Garrison Fathman (Associate Professor of Medicine/Immunology), Leonard A. Herzenberg (Professor of Genetics), Hugh O. McDevitt (Professor of Microbiology and Immunology, Medicine/Immunology), Jane R. Parnes (Assistant Professor of Medicine/Immunology), Irving Weissman (Professor of Pathology)

**Participating Faculty:**

**Biological Sciences:** Patricia P. Jones (Associate Professor)

**Cell Biology:** Peter Parham (Associate Professor)

**Chemistry:** Harden M. McConnell (Professor)

**Genetics:** Leonard A. Herzenberg (Professor)

**Medicine/Immunology:** C. Garrison Fathman (Associate Professor), Hugh O. McDevitt (Professor), Jane R. Parnes (Assistant Professor), Samuel Strober (Professor)

**Medicine/Oncology:** Ronald Levy (Associate Professor)

**Microbiology and Immunology:** Mark M. Davis (Associate Professor), Hugh O. McDevitt (Professor), Leon T. Rosenberg (Professor)

**Neurology:** Lawrence Steinman (Associate Professor)

**Pathology:** Eugene C. Butcher (Assistant Professor), Gerald R. Crabtree (Associate Professor), Edgar G. Engleman (Associate Professor), F. Carl Grunet (Associate Professor), Robert V. Rouse (Assistant Professor), Jeffrey L. Sklar (Associate Professor), Roger A. Warnke (Associate Professor), Irving L. Weissman (Professor)

**Pediatrics:** Alan M. Krensky (Assistant Professor), Dale T. Umetsu (Assistant Professor)

**GRADUATE PROGRAM**

**DOCTOR OF PHILOSOPHY**

The Immunology Program is an interdepartmental program which offers instruction and research opportunities leading to a Ph.D. in Immunology. The goal of the program is to develop young investigators who will have a solid foundation in basic biomedical sciences and who will carry out innovative research in immunology. The program features a flexible selection of courses and seminars to enrich students' backgrounds, combined with extensive research training in the laboratories of the 22 participating immunology faculty.

Students applying to the program in Immunology should have an undergraduate major in biological sciences; majors in other sciences may be acceptable if the applicants have had sufficient coursework in biology. Formal application should be made through the Graduate Admissions Office by January 15. Applications will be evaluated by the Immunology Pre-doctoral Committee based on scores on the GRE exams (including the subject test in either biology or chemistry), which should be taken by the October test date; grades; evidence of prior research experience in biological sciences; letters of recommendation, including letters from research sponsor(s); and commitment to a career in biomedical research. Interested Stanford medical students are welcome to apply to the program; they should contact the Program Director.

Students admitted to the program are offered financial support covering full tuition and a living stipend. Applicants are urged to apply for independent fellowships such as from the National Science Foundation and the Howard Hughes Medical Institute. Fellowship applications are due in November of the year prior to matriculation in the graduate program. Because of the small number of funded slots, students who have been awarded an outside fellowship will have an improved chance of acceptance into the program.

On matriculation, each student will be assigned an advisor from the Immunology Predoctoral Committee, who will assist in selecting courses and laboratory rotations in the first year
and in choosing a laboratory for the thesis research. Once a thesis advisor has been selected, a dissertation committee consisting of at least three immunology faculty, including the thesis advisor and a member of the Immunology Pre-doctoral Committee, will be constituted to guide the student during the thesis research. The student must meet with the dissertation committee at least once a year.

Candidates for Ph.D. degrees at Stanford must satisfactorily complete a three-year program of study that includes 72 units of graduate coursework and research and nine full-tuition quarters of residency. At least 3 units must be taken with each of four different Stanford faculty members. For further information on University requirements, see the "Degrees" section in this bulletin.

The requirements for the Ph.D. degree in Immunology include the following:

1. Training in biology and cognate disciplines equivalent to that provided by the undergraduate biology major at Stanford.

2. Completion of the following courses (or their equivalents from undergraduate work):
   a) Basic immunology (Biology 230 or Microbiology and Immunology 200)
   b) Advanced immunology (Immunology 201, 202)
   c) Biochemistry, graduate level (Biochemistry 200, 201)
   d) Cell biology, graduate level (Cell Biology 200)
   e) Basic genetics (Genetics 201, 202)
   f) Statistics (Biology 141 or Health Research and Policy 202)

3. Elective courses as agreed upon by student and his/her advisor and advisory committee. Electives may be chosen from graduate courses and seminars in the following departments or programs: Biochemistry, Biological Sciences, Biophysics, Cancer Biology, Cell Biology, Genetics, Microbiology and Immunology, Pathology, Pharmacology.

4. Completion in the first year of three one-quarter rotations of research in immunology laboratories (this requirement may be waived under certain circumstances, requiring approval of the Immunology Pre-doctoral Committee).

5. Teaching assistantships in two immunology courses, at least one of which should be completed by the end of the second year.

6. For admission to candidacy, students must complete three requirements by the end of their second year. A comprehensive written examination in immunology and related biomedical sciences must be completed satisfactorily by the end of Autumn Quarter of the second year. A research proposal on a subject other than the student's own research must be written by the end of Winter Quarter. Finally, students must prepare and defend a research proposal on their thesis research by the end of Spring Quarter of the second year. Administration and evaluation of these requirements is the responsibility of the student's dissertation committee.

7. Participation (through regular attendance and oral presentation) in one of the immunology journal clubs for at least the first two years. Students are also expected to attend the Wednesday afternoon immunology seminars and the annual Stanford Immunology Retreat.

8. Passing of the University oral examination on the thesis research, 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 candidate will present his/her research.

9. The completion of a Ph.D. dissertation, resulting from independent investigation and constituting a contribution to knowledge in the area of immunology.

**COURSES**

**BIOLOGICAL SCIENCES**

230. Topics in Immunology—Introduction to the basic elements of the immune system: structure and functions of antibody molecules; cellular basis of immunity and its regulation; molecular biology of antigen recognition structures; genetics of autoimmunity and disease susceptibility. For graduate and advanced undergraduate students. Prerequisite (for undergraduates): Biology Core or consent of instructor.

4 units (Jones) not given 1988-89

335. Seminar in Immunobiology and Immunogenetics—Literature review of current topics in immunology. Prerequisites: Introductory immunology course and consent of instructor (for undergraduates). Biology Core or consent of instructor.

1-3 units, Aut, Win Spr (Jones)

**IMMUNOLOGY**

201, 202. Advanced Immunology—(Same as Cell Biology 201, 202, Microbiology and Immunology 211, 212.) Lecture (201) and student presentation (202) featuring current problems in immunology; for graduate and advanced undergraduate students. Topics: genetics and structure/function relationships of antibodies, T-cell receptors, MHC antigens; accessory molecules; lymphocyte differentiation and activation; cellular regulation of immune responses; autoimmunity and other problems in clinical immunology. Prerequisites: Biochemistry, basic
immunology, consent of instructor (for undergraduates). 201 is a prerequisite for 202.

201. 3 units, Win (Davis, Parham) MWF 10
202. 3 units, Spr (Davis, Parham) Th 3:15-5:05

290. Teaching of Immunology—Practical experience in teaching by serving as a teaching assistant in an immunology course. (Staff) by arrangement

300. Research—Research for graduate students in the Ph.D. Program in Immunology: 1-15 units (Staff) by arrangement

MICROBIOLOGY AND IMMUNOLOGY

200. Immunology—(Same as Pathology 220.) Immunology as related to medicine is emphasized. Principally for medical, graduate, and advanced undergraduate students. Prerequisites: Basic principles of genetics and introductory courses in biochemistry and histology. 3 units, Spr (Rosenberg, McDevitt, Weissman) MWF 10

200A. Problem Solving in Immunology—(Same as Pathology 220A.) Problems provide direct experience in understanding immunology. Each week three to five problems are corrected and discussed. Co-requisite: Simultaneous enrollment in 200. 1 unit, Spr (Rosenberg, McDevitt, Weissman) by arrangement

NEUROSCIENCES PROGRAM

Chairman: U. J. McMahan (Professor of Neurobiology)

Committee: Richard W. Aldrich (Assistant Professor of Neurobiology), Jack D. Barchas (Professor of Psychiatry and Behavioral Sciences), Helen Blau (Associate Professor of Pharmacology), Stephen Feroutka (Assistant Professor of Neurology), David A. Prince (Professor of Neurology), Richard H. Scheller (Associate Professor of Biological Sciences), Howard Schulman (Associate Professor of Pharmacology), Robert Sapolsky (Assistant Professor of Biological Sciences), Brian Wandell (Associate Professor of Psychology), Student Members: Sascha du Lac, Chuck Socle

Participating Faculty:
Anesthesia: Joan E. Kendig (Associate Professor of Biology in Anesthesia), Mervyn Maze (Assistant Professor of Anesthesia)
Biological Sciences: William F. Gilly (Assistant Professor), H. Craig Heller (Associate Professor), Robert Sapolsky (Assistant Professor), Richard H. Scheller (Associate Professor), Stuart Thompson (Associate Professor)

Cell Biology: Lubert Stryer (Winger Professor)
Mechanical Engineering: Felix Zajac (Professor)
Molecular and Cellular Physiology: Julian M. Davidson (Professor)

Neurobiology: Richard Aldrich (Assistant Professor), Denis A. Baylor (Professor), Eric I. Knudsen (Assistant Professor), U. J. McMahan (Professor and Chairman), William T. Newsome (Associate Professor), Carla J. Shatz (Associate Professor), Eric M. Shooter (Professor), J. H. Pate Skene (Assistant Professor)

Neurology: Dennis Choi (Assistant Professor), Arnold Kriegstein (Assistant Professor), Istvan Mody (Assistant Professor), Stephen Pernutka (Assistant Professor), David A. Prince (Professor and Chairman), Marion E. Smith (Professor, Research), Lawrence Steinman (Associate Professor), Michael Weinrich (Assistant Professor)

Pathology: Lawrence F. Eng (Professor, Research)

Pharmacology: Helen Blau (Associate Professor), Stuart Leff (Assistant Professor), Howard Schulman (Associate Professor)

Psychiatry and Behavioral Science: Jack D. Barchas (Nancy Friend Pritzker Professor), Roland D. Ciaranello (Professor), William C. Dement (Professor), Seymour Levine (Professor), John Madden (Assistant Professor), Kazuhiko Tatimoto (Associate Professor, Research), Dona Wong (Assistant Professor)

Psychology: Brian Wandell (Associate Professor), Jeffrey J. Wine (Professor)

Surgery: Michael F. Marmor (Associate Professor)

GRADUATE PROGRAM

DOCTOR OF PHILOSOPHY

The Neurosciences Program is an interdepartmental program which offers instruction and research opportunities leading to a Ph.D. in Neurosciences. The program is administratively under the aegis of the Dean of Graduate Studies. 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. Formal application should be made through the Graduate Admissions Office which will submit completed applications to the Neurosciences Ph.D. Program Admissions Committee. January 1 is the deadline for receipt
in the University's Graduate Admissions Office of applications with all supporting material. A supplemental application (which can be obtained from the Neurosciences Program Office, M.S.O.B., Rm. X207, Stanford University 94305-6114) must be submitted to the Neurosciences office by January 1.

Applicants are encouraged to familiarize themselves with the research interests of the faculty and to indicate their preferences clearly 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). Students are also required to take at least five advanced neuroscience courses offered by several participating departments. At least one course must be taken in each of the five following categories: (1) Integrative and Behavioral Neurosciences, (2) Membrane Excitability, (3) Neuronal Communication, (4) Developmental Neuroscience, and (5) Clinical Neuroscience.

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. dissertation 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.

**COURSES**

The course selections of individual departments participating in the Neurosciences Program should also be consulted for complete offerings.

**BIOLOGICAL SCIENCES**

222H. Ionic Channels in Natural and Model Membranes: Single Channel Techniques—An advanced treatment of membranes physiology and several modern experimental techniques. Emphasis on the regulation of ionic channels. Laboratory work concentrates on patch clamp methods applied to native nerve and muscle cells, nerve cell lines, and ion channels reconstituted in artificial bilayers. Offered to graduate students and advanced undergraduates. Taught at Hopkins Marine Station. Apply to Hopkins. 6 units, Sum (Gilly, S. Thompson)

254. Cellular and Molecular Neurobiology—The function of the nervous system at the cellular and molecular level. Membrane biophysics, synaptic transmission, biochemistry and molecular genetics of neuronal function, and their relationship to behavior and learning. 4 units (Scheller) not given 1988-89

263. Human Behavioral Biology—Biological bases of normal and abnormal human behavior are used to train students in approaching complex behaviors in a multidisciplinary way. Introduces relevant disciplines: sociobiology, ethology, neuroscience, and endocrinology. Integrates these disparate approaches in examining behaviors: aggression, sexual behavior, language use, mental illness. 4 units (Sapolsky) not given 1988-89

264. Animal Behavior: Neurobiological Aspects—(Same as Psychology 147.) Ethological studies of behavior emphasizing understanding physiological substrates of simple behavior. Prerequisites: Psychology 107 or equivalent, and elementary biology. 4 units (Fernald) not given 1988-89

**HUMAN BIOLOGY**

196. Advanced Neurochemistry Seminar—For those with a prior background in neurochemistry. Topics decided by the students and the instructor, and taken from the areas of current importance and activity in neurochemistry. Through judicious selection of topics and articles, it will be at the cutting edge of neuroscience and offer a unique opportunity to watch the progress of a rapidly moving field. Emphasis on critical reading and evaluation of current literature, and coherent presentation of topic material. Prerequisites: Permission of the instructor plus either 167 or Biochemistry 200 and Neurobiology 200. 3 units, Spr (Ciaranello)

**MECHANICAL ENGINEERING**

252. Neuromuscular Biomechanics—Engineering mechanics applied to coordination of the human neuromuscular system including:
mechanical properties and models of muscle and tendon; dynamics and models of limbs that consist of single- and multi-joint muscles originating and inserting on a multi-segmented skeleton; application to sports and rehabilitation such as posture, walking, jumping, and cycling.

3 units, Spr (Zajac) TTh 8-9:15

**MOLECULAR AND CELLULAR PHYSIOLOGY**

210. Neuroendocrine Physiology of Sex—Lectures and discussions on physiological mechanisms involved in sexual and reproductive function of animals and humans. Hormonal factors and their relationships to the nervous system emphasized.

2 units, Win (Davidson) TTh 4:15-5:30

212. Human Sexuality in Medicine—A multidisciplinary survey of physiological and psychosocial determinants of sexual behavior, basic concepts, and clinical approaches to diagnosis and therapy of sexual dysfunction and related topics such as sexual differentiation and sexually transmitted disease.

2 units, Win (Davidson)

**NEUROBIOLOGY**

200. The Nervous System—The 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. Presents a coherent framework as a preparation for neurology, neuropathology, and clinical medicine, and for more advanced work in neurobiology. Lectures and neuroanatomy laboratories, frequent informal seminars with students in small groups, and demonstrations. The neuroanatomy and neurobiology components must be taken together. Final exam given. No limitation.

9 units, Win (Aldrich, Baylor, Knudsen, McMahan, Newsome, Shatz, Shooter, Skene)

212. Neurochemistry—Advanced seminar reading course dealing in detail with the biochemistry of neurons and synaptic transmission. Topics: neurotransmitter metabolism, neurohormones and peptides, nerve growth factor and regeneration. Emphasis on the study of original papers and on student presentations. Prerequisite: Neurobiology 200 or equivalent.

3 units, (Shooter, Skene) not given 1988-89

216. Membrane Biophysics Seminar—For students who have some background in neurobiology and are curious about the basic mechanisms of signalling in nerve cells. Topics are covered by reading and discussion of original research papers. Emphasis on concepts, quantitative analysis or experimental results, and critical evaluation of evidence. Topics: gating mechanisms in voltage-sensitive and chemosensitive ionic channels and ionic mechanisms in sensory transduction. Student presentations and small group discussions.

3 units, Aut (Aldrich, Baylor)

217. Formation of the Synapse—Seminar evaluating current views on the sequence of steps and mechanisms involved in synapse formation. Emphasis is on the neuromuscular synapse; its development in the embryo and its regeneration in the adult. Students read original articles, summarize them in writing, and present the summaries for discussion.

3 units (McMahan) not given 1988-89

**NEUROLOGY**

204. Physiology of Mammalian Central Nervous System—Laboratory for advanced students interested in neurological sciences. Introduction to a variety of techniques used in current research in the physiology of mammalian central nervous systems. Limited to 8 students. Prerequisite: Consent of instructors.

4 units, Spr (Mody) by arrangement

205. Clinical Neuroscience—Case demonstrations of selected disorders; discussion of the pathophysiological basis of the disorder; presentation of the basic principles underlying modern diagnostic and therapeutic management; and a discussion of recent research advances for each disease entity. Final exam given. Sign-up list requested.

2 units, Win (Kriegstein, Staff)

**NEUROSCIENCES**

300. Neurosciences Journal Club—Students and faculty select and present for critical discussion articles from current journals.

1 unit, Aut, Win, Spr (Aldrich, Staff)

**PHARMACOLOGY**

202. Medical Pharmacology—Major drug groups include the drugs affecting the central
nervous system, and drugs affecting the peripheral nervous system, the cardiovascular system, and the kidney. 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 considered.

5 units, Win (D. Goldstein, Schulman)


5 units (Schulman, Roth, Ringold) not given 1988-89

219. Scientific Communication—The techniques of scientific writing and lecturing. Students write several papers, present material orally, and evaluate the work of others with respect to clarity and efficient transfer of information. No undergraduates.

2 units (D. Goldstein) not given 1988-89

231. Regulation of Gene Expression in Differentiation and Development—The regulation of gene expression during differentiation and development at a cellular and molecular level emphasizing approaches to resolving the mechanisms underlying different steps in mammalian neuromuscular development. This is a lecture and student discussion of recent research developments.

2 units (Blau) not given 1988-89

PSYCHIATRY

248. Neuropeptides and Hormones—Laboratory/seminar focused on basic techniques of peptide chemistry. Experimental approaches studying neuropeptides and peptide hormones include: extraction and purification, structural determination, chemical synthesis, various assays including bioassay, radioimmunoassay and chemical assay. Students use HPLC instrument, protein sequencer, amino acid analyzer, and peptide synthesizer.

1 unit, Aut, Spr (Tatemoto)

252. Neurobiological Substrates in Experimental Psychopathology—Lectures and discussions addressing animal model systems relevant to biological psychiatry. Emphasis on experimental paradigms pertinent to affective disorders including models of stress psychopathology; anxiety, coping, and learned helplessness. The biological processes subserving a particular model system are analyzed and its potential implications to the human condition explored.

3 units (Madden) not given 1988-89
GRADUATE PROGRAMS
MASTER OF SCIENCE

A candidate is required to complete a program of 45 units of courses numbered 100 or greater, of which at least 18 must be at the 200 level or above. At least 36 of these units must be graded units, passed with a letter grade indicator of 3.0 ("B") or better. The core curriculum is common to all degrees offered by the program but is adapted according to the interests and prior education of the student. Deviations from the core curriculum must be justified in writing and approved by the student's advisor and the SC/CM Committee. Courses that are waived rather than taken may not be counted towards the master's degree. The student is expected to fulfill credit requirements in each of the categories listed below.

CORE CURRICULUM

1. **Mathematics** (15-18 units)—Each student is required to take Math 220 A,B,C. Nine additional units in mathematics are required: at least 6 units must be at the 200 level. Suggested courses are the following: Math 135, 173, 224, 230A,B,C, 256A,B,C, 270, 274. Other courses can be taken with the consent of the advisor and the SC/CM Committee. Each student is encouraged to take those courses which are most suitable to his/her area of specialization.

2. **Numerical Analysis** (9-12 units)—The student is required to take Computer Science (CS) 237 A,B,C and 3 units of one of the advanced courses in numerical analysis: CS 335, 339; Mechanical Engineering (ME) 235A,B,C.

3. **Computer Science** (6-9 units)—The student can take a selection of courses from the following: CS 108A,B, 212, 248, 260. This must include a course at the 200 level.

4. **Application area** (9 units)—The student must take a focused program in an applications area such as fluid mechanics, operations research, or statistics. Courses must be at the 200 level or higher and the program of concentration must be approved by the advisor and committee. The following courses would be acceptable candidates: ME 251A,B, 269; Aero and Astro (AA) 210A,B, 214A,B,C; Civil Engineering (CE) 210A,B; Electrical Engineering (EE) 363, 364, 365, 378A,B.

5. **Seminar** (1 unit)—Each student is required to regularly attend the Scientific Computing/Computational Mathematics seminar for one quarter. The seminar is held weekly during the academic year.

SCIENTIFIC COMPUTING AND COMPUTATIONAL MATHEMATICS

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 program requirements:

1. A student must plan and successfully complete a coherent program of study covering the basic areas of Scientific Computing and Computational Mathematics. This program must at least satisfy the requirements for the M.S. degree in SC/CM. It is important that the student be able to exhibit depth in some area of applications. The student's advisor has the primary responsibility for the adequacy of the program, which must meet the approval of the SC/CM Committee.

2. To be admitted to candidacy for the Ph.D. degree, a student must have successfully completed 27 units of graduate courses (200 level and above) with at least a letter grade indicator of "B." In addition, a student must pass a qualifying examination. This examination will cover basic courses in mathematics, numerical analysis, and computer science as described in the Master's of Science Degree program. Students who have obtained the master's degree in another program must satisfy the candidacy requirement within one year of entering the program.

3. Beyond the requirements for candidacy, the student must complete a focused course of study of at least 48 units. The program should be designed to develop a deep, focused background in the research area to be pursued in the dissertation. Approval of the program must be obtained from the SC/CM Committee.

4. In addition, the student must have an adequate knowledge of a coherent area of application and must complete at least 12 units in that area.

5. The most important requirement for the doctorate is the dissertation. Within a reasonable period after passing the qualifying examination, the student must obtain the agreement of a faculty member to be the dissertation advisor. A reading committee must be selected before the student is admitted to Terminal Graduate Registration (TGR), and this committee should be frequently consulted by the student before the University oral. Upon completion of a substantial portion of the dissertation, the student must pass a University oral examination in defense of the dissertation.
CENTERS

STANFORD CENTER FOR CHICANO RESEARCH

Director: Renato Rosaldo
Associate Director: Armando Valdez

The Stanford Center for Chicano Research (SCCR), is a research unit designed to conduct original research on urban Chicanos in American society. The four major areas of SCCR research are: demography, communications, education, and health. SCCR engages in collaborative research with other private and public institutions, sponsors research colloquia and other public forums, and publishes research findings that significantly contribute to knowledge about Chicanos.

STANFORD HUMANITIES CENTER

Director: Bliss Carnochan
Associate Director: Morton Sosna

The purpose of the Stanford Humanities Center is to promote humanistic research and education at Stanford and nationally. Its programs include: (1) fellowships for advanced research by faculty (from Stanford and other institutions) and by Stanford graduate students; (2) public presentation, through lectures, colloquia, conferences and publications, of new work in the humanities, especially work of an interdisciplinary nature.

The center provides fellowships for at least six Stanford Faculty Fellows (internal fellows), about eight Faculty Fellows from other universities (external fellows), and about eight Stanford Graduate Fellows. All Fellows are in residence during the academic year and meet regularly.

Faculty Fellows of the center, selected on the basis of an open competition, not only pursue their own research but contribute to the intellectual life of the Stanford community by giving departmental courses or by leading other activities. The courses given by Fellows in 1988-89 are shown below:

COURSES

American Studies 218. Sport in American Culture.
5 units, Win (Corn) MW 1:15-3:05

Anthropology 287H. Popular Culture and Rites of Subordination in Colonized Societies—(Same as Latin American Studies 287H.)
5 units, Spr (Abercrombie)

Drama 351C. Brecht in Africa.
5 units, Spr (Richards) TTh 10-12

English 261. Ritual Content in the Works of West Indian Writers.
5 units, Win (Ismond) MW 3:15-5:05

English 265. Knowing the Holocaust: Psychoanalytic and Literary Perspectives—(Same as Psychology 180B.)
5 units, Spr (Auerhahn) T 3:15-6:05

History 223/323. Intellectual and Cultural History of Eastern Europe in the 19th and 20th Centuries.
5 units, Spr (Gluck) Th 2:15-4:05

Linguistics 258. Topics in Sociolinguistics—(Same as Anthropology 245H.)
Win (Yankah)

3 units, Aut (Code, Moravcsik) Th 3:15-5:05

INSTITUTE FOR RESEARCH ON WOMEN AND GENDER

Director: Deborah Rhode (Professor of Law)
Associate Director: Sherri Matteo

During the last decade, research on women and gender has had a profound effect on the social sciences and the humanities. Since its founding in 1974, the Institute for Research on Women and Gender (formerly the Center for Research on Women) has been a leading force in this conceptual revolution.

The Institute's primary mission is to support scholarship on subjects related to women and gender and to organize educational programs that will communicate these findings to a broader public. By bringing together faculty, graduate students, and members of the community, the Institute seeks to stimulate a more informed analysis of issues concerning gender.

Institute projects span a wide range of disciplines but rest on certain shared premises: that gender is a vital category of analysis for contemporary scholarship and policy-making, and that the experiences of women as individuals and as a group can best be understood within their historical, social, and cultural contexts. The Institute sponsors interdisciplinary research seminars, and conferences that examine gender issues in areas such as education, employment,
law, literature, art, health care, and family structures.

Participants in these projects are:

1. **Stanford Faculty**—Faculty who present and share the results of their research at the Institute while maintaining their appointments in their own departments. Faculty receive help in seeking funds for future projects. Institute-affiliated faculty also participate in the Faculty Seminars on Feminist Theory. Over 60 faculty members have been associated with the Institute.

2. **Graduate Students**—Stanford graduate students work as research assistants and administrative interns at the Institute, and have ongoing opportunities for interchange among colleagues and faculty. Through the Institute, they can obtain exposure to the most advanced thinking in gender-related scholarship. A few small stipends are available each year to support graduate research.

3. **Undergraduate Students**—Research projects undertaken at the Institute by Stanford faculty can provide undergraduate research opportunities for students. Available research possibilities are listed through Undergraduate Research Opportunities. Determination of credit is left to the researcher and the student within guidelines established by the appropriate department. Courses are not offered through the Institute, but within academic departments. Course information may be located under the "Feminist Studies" section and other departments in this bulletin.

4. **Visiting Scholars**—About half a dozen scholars affiliated with other universities are in residence each year. While engaged in their own gender-related research, they bring new intellectual concerns to the Institute and help develop national and international networks of scholarly interchange.

5. **Affiliated Scholars**—Approximately 20 local Bay Area scholars working independently without other academic affiliation are selected for two-year renewable terms. This innovative program makes it possible for scholars with advanced degrees, who are not Stanford faculty members, to pursue their own research on women and gender through association with Stanford scholars.

6. **Institute Associates**—Institute Associates are individuals and corporate sponsors who provide financial support to the Institute and help extend its research and educational activities to the broader public. Associates attend Institute lectures and organize seminars designed to transmit the new scholarship on women and gender to the surrounding community.
INDEPENDENT RESEARCH LABORATORIES, CENTERS, AND INSTITUTES

Vice Provost and Dean of Research: Robert L. Byer
Associate Dean of Research: Patricia L. Devaney

Independent research laboratories, centers, and institutes are units in which multi-disciplines are involved and which extend beyond the scope of any one of the organized schools of the University.

The independent laboratories and institutes reporting to the Vice Provost and Dean of Research are: Center for Economic Policy Research, Center for Materials Research, Institute of International Studies, Hansen Laboratory of Physics (including Ginzton Lab and High Energy Physics Lab), Institute for Mathematical Studies in the Social Sciences (including Center for the Study of Language and Information), International Strategic Institute at Stanford, and Stanford Synchrotron Radiation Laboratory. The Stanford Synchrotron Radiation Laboratory is a national research facility supported by the Department of Energy and National Institute of Health.

The Stanford Linear Accelerator Center, which reports to the President and Provost, is independently operated under a contract with the Department of Energy.

Following is a description of the activities of each of these organizations including the research activities and, where applicable, courses offered.

CENTER FOR ECONOMIC POLICY RESEARCH

Director: Michael J. Boskin (Professor of Economics)
Deputy Director: Ed Steinmueller (Research Associate)

As its primary mission, the Center for Economic Policy Research (CEPR) fosters a rational and informed approach to economic policy. CEPR pursues four interrelated goals in support of this mission: (1) stimulating graduate student and faculty research on economic policy issues of continuing importance to the American people; (2) communicating its findings broadly; (3) building a community of scholars conducting research on policy issues; and (4) linking the policy community at Stanford with decision makers from business, government, and academia.

CEPR is a University-wide activity, involving individuals from most schools and many departments. Affiliated faculty and students maintain appointments in their home departments while working on CEPR activities.

Through its General Research Program, CEPR fosters policy research initiatives that look to newly developing or recurring issues in the public policy arena. This program provides seed money funding for start-up projects. Proposals are particularly encouraged from junior faculty and from faculty members changing their areas of research to address policy issues.

In addition, CEPR actively encourages policy research in five programs: Technology and Economic Growth, directed by Nathan Rosenberg of Economics and co-directed by consulting Professor of Economics Ralph Landau; Tax and Budget Policy Program (TAX), chaired by Michael Boskin and John Shoven of Economics; Energy, Natural Resources, and the Environment Program, chaired by Alan Manne of Operations Research and James Sweeney of Engineering-Economic Systems; High Technology Impact Program (HTIP), chaired by Timothy Bresnahan and Paul David of Economics; and Program in Regulatory Policy, led by a committee consisting of Chairman Roger Noll (Economics), David Baron (Graduate School of Business), John Ferejohn (Political Science), and A. Mitchell Polinsky (Law School).

CEPR conducts workshops, conferences, and other events designed to improve the flow of economic policy information among people from a wide variety of institutional and professional backgrounds.

CEPR does not offer any courses for academic credit, admit students, or award degrees.

W. W. HANSEN LABORATORIES OF PHYSICS

Director (HEPL): Mason Yearian
Director (Ginzton Lab): Anthony Siegman
Associate Director: Marshall O'Neill
Assistant Director: Robert Strena
The Hansen Laboratories consist of two distinct programs: the High Energy Physics Laboratory (HEPL), and the Edward L. Ginzton Laboratory.

HEPL is engaged in basic research in high energy physics, astrophysics, accelerator physics, and low temperature physics which currently includes experiments involving superconducting accelerators, a gyroseismometry satellite, gravity waves, gamma ray and x-ray detection in space, and free electron lasers.

The Ginzton Laboratory houses a number of Electrical Engineering and Applied Physics faculty and graduate students, who are engaged in research on quantum electronics and lasers, fiber optics, acoustics and nondestructive testing, and superconducting materials and electronics.

INTERNATIONAL STRATEGIC INSTITUTE AT STANFORD (ISIS)

Chairman: John W. Lewis
Associate Chairman: Nancy Okimoto

The Northeast Asia-United States Forum on International Policy and the Center for International Security and Arms Control together constitute the International Strategic Institute at Stanford and share offices located at 320 Galvez Street.

The Northeast Asia-United States Forum on International Policy is co-directed by John Lewis, William Haas Professor of Chinese Politics, and Daniel Okimoto, Associate Professor, Political Science. The forum serves as a focal point at Stanford for research, training, and exchange activities related to international policy issues involving the United States, China, and Japan. Some 60 faculty members throughout the University are forum members. The forum’s programs have in residence each year a group of visiting fellows and graduate student research assistants. Current research includes projects on U.S.-Japan developments in science and technology, China’s emerging role in the Asian-Pacific region, and strategic issues. The forum is co-sponsor, with the Overseas Studies Program, of the new Stanford Center in Japan, at Kyoto. Forum research activities will be organized at both the Kyoto and Stanford campuses.

The Center for International Security and Arms control is co-directed by Sidney Drell, Deputy Director and Professor, Stanford Linear Accelerator Center, and John Lewis, Professor, Political Science. The center expanded in 1983 from the Arms Control and Disarmament Program, established in the early 1970s. Faculty from business, engineering communication, history, political science, law, medicine, and the Stanford Linear Accelerator Center, and specialists from outside the University comprise the membership of the center. Members work collectively on research, training, and outreach related to arms control and international security. Center faculty and staff work closely with forum faculty and staff on Asian-Pacific security relations.

The training efforts of the center include a sequence of undergraduate courses taught under the auspices of the Political Science Department (Arms Control and Disarmament, Political Science 138A,B, and D) and an annual program of visiting fellowships at the pre- and postdoctoral levels. The fellowship program brings four to six fellows to the center each year from the United States and abroad. In addition, a program for science fellows, initiated in 1983, brings midcareer scientists to the center for training in the technical and political aspects of arms control and international security.

THE INSTITUTE OF INTERNATIONAL STUDIES

The Institute of International Studies (IIS) was established in 1958 as a means of coordinating Stanford’s numerous activities in the fields of international, comparative, and regional studies. Its mission is to promote excellence in teaching, research, and public service in these fields. It supports the scholarly community at Stanford by strengthening existing programs in international studies, aiding in the formation of new programs, and stimulating the development of an international perspective in subject matter not traditionally regarded as international.

IIS provides the University with a means of planning, financing, stimulating, and coordinating activities and programs in the international field. It is continuously and closely involved in the support of Stanford’s foreign area and language programs and a variety of major research programs as well. IIS raises and administers funds from government, 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, graduate student exchanges, and appointment of new faculty members and international visiting professors.

The operations of IIS are University-wide and involve faculty members in the Schools of
INDEPENDENT RESEARCH LABS, CENTERS, AND INSTITUTES

Humanities and Sciences, Law, Business, and Education. One of its goals is to develop coherent multi-disciplinary, regional, and cross-regional teaching and research programs. Its relations with departments in the social sciences and humanities are especially close, but it also seeks to develop new programmatic relationships with departments in science, engineering, and the professional schools. IIS also cooperates with international studies programs and activities at the Hoover Institution on War, Revolution, and Peace.

In the sphere of public service, IIS 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 projects on China, Japan, Africa, and Latin America, which are organized within the Stanford Program on International and Cross-cultural Education (SPICE).

The institute also administers on behalf of two consortia of major universities, the Inter-University Center for Japanese Language Studies in Japan 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.

While IIS does make a limited number of academic faculty appointments, it neither offers courses nor confers degrees. These academic functions are performed by the schools, departments, and programs associated with the Institute.

IIS is administered by a Director, a Deputy Director and an Associate Director for Administration who work with a small administrative and secretarial staff. Its offices are located in the GSB Littlefield Center, lower level, telephone (415) 723-4581.

PROGRAMS

AREA STUDIES

Stanford has five interdisciplinary language and area programs: African Studies, East Asian Studies, Latin American Studies, European Studies, and Russian and East European 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 five 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. For course information, see listings under the "School of Humanities and Sciences" section in this bulletin.

UNDERGRADUATE

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 in the "International Relations Program" in the School of Humanities and Sciences section of this bulletin.

INTER-UNIVERSITY PROGRAM FOR CHINESE LANGUAGE STUDIES IN TAIPEI

The Inter-University Program (IUP) for Chinese Language Studies in Taipei, Taiwan, was established in September 1963. It is sponsored by 10 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 the 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 write to the attention of IUP at:
Institute of International Studies
Littlefield Center, Room 14
Stanford University
Stanford, California 94305-5031

INTER-UNIVERSITY CENTER FOR JAPANESE LANGUAGE STUDIES IN JAPAN

The Inter-University Center for Japanese Language Studies in Tokyo, Japan, is a cooperative enterprise of 12 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 Japan 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 established by their home institutions.

The academic year at the center is equivalent to three full quarters, beginning in early September. Any student may apply for admission provided that he or she: (1) 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; (2) will have successfully completed prior to attendance a minimum of two years of Japanese or its equivalent at the college level; and (3) 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 the attention of IUC at:
MATERIALS RESEARCH 695
Institute of International Studies
Littlefield Center, Room 14
Stanford University
Stanford, California 94305-5013

CENTER FOR MATERIALS RESEARCH (CMR)

Director: T. H. Geballe
Co-Directors: G. E. Brown, Jr., S. B. Hagstrom
Technical Director: G. B. Ansell
Director, Crystal Science Division: R. S. Feigelson
Affiliated Faculty: Currently 80 members from the following departments: Aeronautics and Astronautics, Applied Earth Sciences, Applied Physics, Chemical Engineering, Chemistry, Civil Engineering, Electrical Engineering, Geology, Materials Science and Engineering, Mechanical Engineering, Physics, Hansen Laboratories, and the Stanford Synchrotron Radiation Laboratory

The Stanford University Center for Materials Research (CMR), located in the McCullough Building, is one of 14 university laboratories throughout the United States supported by the Division of Materials Research of the National Science Foundation under its Materials Research Laboratory (MRL) Program.

The purpose of the MRL Program is to support major central research facilities, to provide seed money for funding junior faculty or provide initial funding for established faculty who are changing research fields, and to support coherent multi-investigator projects in major thrust areas requiring expertise in two or more materials-related disciplines—so-called "thrust" research.

To fulfill these goals CMR operates extensive materials characterization facilities and, at the present time, sponsors 14 seed programs and four multi-investigator, multi-discipline thrust programs. CMR's professional staff also conducts research programs in crystal synthesis and vapor phase synthesis.
IMSSS is a research institute primarily funded by gifts, government grants, and contracts. It was founded in 1959. The current major emphases are on research in computer-assisted instruction, mathematical economics, and situated language. The staff includes research associates, graduate student research assistants, programmers, and faculty.

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 electron and positron beams at energies up to 50 GeV. Polarized electron beams can be produced with polarization of 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 are available. A complement of large research instruments available for use with the accelerator includes three magnetic spectrometers capable of analyzing momenta up to 1.6, 8, and 20 GeV/c.

An electron-positron storage ring facility (SPEAR) is engaged in a full research program with colliding beams each of energy up to 3.7 GeV. The SPEAR facility was used in the discovery of the psi particle for which the 1976 Nobel Prize in physics was awarded, and for the discovery of the tau lepton, for which the 1983 Wolfe Prize was awarded. At SPEAR, experiments will continue using the Mark III detector, constructed by SLAC and collaborating universities.

A second major facility at the center is PEP, a large colliding beam storage ring, a collaborative effort between SLAC and Lawrence Berkeley Laboratory. Construction began in 1976 and was finished early in 1980. Particle physics experiments using the ring began later in that year. PEP consists of a single positron-electron ring hexagonally shaped and 2200 meters in circumference. Collisions between positrons and electrons at beam energies up to 15 GeV yield center-of-mass interaction energies up to 30 GeV, making PEP one of the most powerful instruments of its kind in the world. PEP is the third storage ring to be constructed at Stanford. The first physics results obtained by the high energy colliding-beam technique came from experiments performed on the 500-MeV Princeton-Stanford electron-electron rings in 1965 at the Hansen Laboratory. PEP has six interaction regions, five of which can house major particle experiments.

A new colliding beam facility under construction at SLAC since October 1983, began operating in 1988. Called the SLAC Linear Collider (SLC), this machine will reach well beyond PEP to center-of-mass energies up to 100 GeV where the recently discovered Zo, the neutral mediator of the weak interaction, can be pro-
duced. In addition to its utility as a particle physics vehicle, the SLC is a pioneering embodiment of a new colliding-beam technique which continues Stanford's leading role in developing these techniques.

SLAC 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 1988, physicists from more than 100 other institutions have had research programs accepted for execution at the center. The faculty of the center leads a group of some 150 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 has dealt with almost all areas of elementary particle physics at high energies. In recent years, the principal emphasis has shifted from fixed-target experiments to 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.

SYNCHROTRON RADIATION LABORATORY

STANFORD SYNCHROTRON RADIATION LABORATORY (SSRL)

Director: A. Bienenstock
Deputy Director: H. Winick
Associate Directors: G. Brown, R. Gould, K. Hodgson, I. Lindau, P. Pianetta, H. Wiedemann

The Stanford Synchrotron Radiation Laboratory (SSRL) is a national research facility supported by the Department of Energy and the National Institutes of Health for the utilization of synchrotron radiation for research in the natural sciences, medicine, and engineering. Synchrotron radiation is electromagnetic radiation emitted by relativistic charged particles curving in magnetic fields. SSRL has 23 experimental ports on the storage rings SPEAR and PEP located at SLAC. The radiation emitted from these rings extends from the infrared to 100 keV x-rays with intensity 1000 to a million times that available from conventional sources. The radiation is used for studies of fundamental properties of matter as well as studies of technological interest. Among types of experimental studies being performed are; x-ray absorption, spectroscopy, x-ray diffraction, atomic physics, x-ray fluorescence analysis, photoemission, photoelectron diffraction, non-invasive angiography, x-ray lithography, x-ray microscopy, and time-resolved fluorescence spectroscopy.

Accelerator physics and development of advanced sources of synchrotron radiation are major interests of the laboratory. SSRL is interdisciplinary with students from the following Stanford departments actively pursuing degrees: Applied Physics, Chemical Engineering, Chemistry, Electrical Engineering, Geology, Materials Science, Medicine, and Physics.

Students interested in working at the facility should contact a member of the affiliated faculty or one of the associate directors.
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 publication on political, economic, social, and educational change in the 20th century.

The library includes one of the largest private archives in the United States, and has outstanding area collections on Africa, East Asia, Eastern Europe, Russia and the Soviet Union, Latin America, the Middle East, North America, and Western Europe.
Holdings include government documents, files of newspapers and serials, manuscripts, memoirs, diaries and personal papers of men and women who have played significant roles in the events of this century, the 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, educators, political scientists, and sociologists. The International Studies Program, the Domestic Studies Program, and the National Security Affairs Program publish basic research, documentary studies, and current public policy analyses.

Notable long-term research in progress in the International Studies Program includes the areas of African colonialism, post-Mao China, the international communist movement, non-Russian nationalities in the Soviet Union, Latin America, and the United States, and the role of education in development abroad. Research on the last subject has been enhanced by the establishment of the Paul and Jean Hanna Collection on the Role of Education in 20th-Century Society. Richard F. Staar is coordinator of the International Studies Program.

The Domestic Studies Program sponsors scholarship on social, economic, and policy issues in the United States. The program carries out both basic and applied research in the social sciences and brings into focus broad policy issues in such vital areas as fiscal policy and budget reform. Political economy and public choice, welfare and regulatory reform, as well as other domestic policy concerns. Edward Lazear coordinates the program.

The National Security Affairs Program was significantly expanded four years ago. Many of the scholars in the program combine theoretical knowledge with practical experience at high levels of government service. They have served, or are serving, in such agencies as the National Security Council, the Arms Control and Disarmament Agency, the Department of State, and the Department of Defense. Their knowledge and expertise place them in a unique position to analyze the strategic, political, ideological, and economic challenges confronting the United States in today's bipolar world. The program, which is interdisciplinary in nature, is coordinated by senior fellow Dennis L. Bark.

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. The National Peace and Public Affairs Program, for example, provides about 14 scholars annually with the opportunity to pursue advanced postdoctoral research. Thomas H. Henriksen coordinates the National Fellows Program.

The Institution also maintains a publications program. In addition to books published by the Hoover Institution Press, research results are disseminated through seminars, conferences, journal articles, lectures, testimony, and the news media.

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 E. Hall on a joint appointment with the Economics Department; senior fellow Seymour Martin Lipset on joint appointment as the Caroline S. G. Munro Professor of Political Science and with the Sociology Department; senior fellow James G. March on joint appointment as the Fred H. Merrill Professor of Management with the Graduate School of Business; and with the Departments of Political Science and Sociology and, by courtesy, Education; senior fellow John A. Ferejohn on joint appointment with the Political Science Department; senior fellow Henry S. Rowen on joint appointment as the first Edward B. Rust Professor of Public Policy and Management at the Graduate School of Business; Professor Thomas F. McCurdy in Economics is a senior fellow; senior research fellow Kenneth E. Scott on joint appointment as Ralph M. Parsons Professor of Law and Business in the Law School; senior research fellow Mauro Capelletti on joint appointment with the Law School; senior research fellow Joseph Berger on joint appointment as chair of the Sociology Department; Professors Kenneth J. Arrow and Michael Boskin in Economics; Peter Duus in History; Heinz Eulau and Robert E. Ward in Political Science; Nancy B. Tuma, in Sociology is a senior fellow (by courtesy); East Asian curator Ramon H. Myers is adjunct professor at the Food Research Institute and acting professor in the History Department; senior fellow Bruce Bueno de Mesquita is professor (by courtesy); senior research fellow Larry Diamond is assistant professor (by courtesy) in the Sociology Department; research fellow Fu-mei C. Chen is a lecturer at the Law School; and deputy archivist Robert Hessen teaches in the Graduate School of Business.

In addition, Peter J. Duignan, who is the
Institution's curator on Africa, serves as a 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 Institution's East Asian library collects research materials in the Chinese and Japanese languages for all of Stanford University.

Hoover scholars have received many awards and distinctions. Associated with the Hoover Institution are six Nobel laureates, two recipients of the National Medal of Freedom, two recipients of the National Medal of Science, 17 fellows or foreign honorary members of the American Academy of Arts and Sciences, 11 fellows of the American Association for the Advancement of Science, six members of the National Academy of Sciences, four members of the National Academy of Education, and five members of the American Philosophical Society.

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 pavilion displays selected archival and library materials for the public.

**UNIVERSITY LIBRARIES**

**Emeriti:** William P. Allan (Curator for English and American Literature); 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); Jennette E. Hitchcock (Chief Catalog Librarian); Anna Hoen (Reference Librarian, Lane Medical Library); J. Myron Jacobstein (Law Librarian); Paul J. Kann (Curator for Romance Languages); Susan V. Lenkey (Rare Books Librarian); Clara S. Manson (Chief Librarian, Lane Medical Library); Charlotte W. Mercado (Assistant Chief for Monograph Cataloging); Jack Plotkin (Chief Circulation Librarian); Marion Smith (Director, J. Hugh Jackson Library, Graduate School of Business); Grace Stillson (Assistant Chief, Catalog Department);

**University Libraries**

**Director:** David C. Weber

**Director for Administrative Services:** Bruce A. Jones

**Director for Technical Services:** Cynthia I. Gozzi

**Director for Instruction and Research:** Vacant

**Collection Development Officer:** Michael T. Ryan

**Library Development Officer:** Anne-Marie Littenberg

**Department Chiefs:** Anthony M. Angiletta (General Reference); Barbara Celone (Humanities and Social Science Libraries); Vacant (Acquisition); Tamara Frost (Catalog); Eleanor Goodchild (Science), Susan J. Schoell (Personnel); Joan K. Krasner (Access Services); Susan Perry (Meyer); Jerry C. Persons (Systems); Victoria Reich (Serials); Michael T. Ryan (Special Collections and University Archives); Roberto Trujillo (Foreign Languages and Area Collections); Win-Shin Chiang (Government Documents)

**Branch Librarians:** Alan Baldrige (Hopkins Marine Station); Barbara Celone (Cubberley Education); Charlotte Derksen (Branner Earth Sciences); Eleanor Goodchild (Engineering); Rebecca Lasher (Mathematical and Computer Sciences); Henry Lawood (Physics); Charles C. Milford (Food Research Institute); Karen Nagy (Music); Alexander Ross (Art and Architecture); Joseph G. Wible (Swain Chemistry and Chemical Engineering, Acting and Falconer Biology)

**Curators—Collection Development Program:**

James M. Breedlove (Latin American Collections); Peter R. Frank (Germanic Collections); Eleanor Goodchild (Science Collections); James Knox (U.S. and British History Collections); William McPheron (English and American Literature Collections); Roxanne L. Nilan (University Archives); Mary Jane Parrine (Romance Language and Humanities Collections); Alexander Ross (Art and Architecture Collections); Roberto Trujillo (Mexican American Collection); Anthony M. Angiletta (Social Science Collections); Wojciech Zalewski (Slavic and East European Collections)

**Curators—Honorary:** Samuel I. Barchas (History of Science); W. Conyers Herring (Physics Collection); William R. Moran (Archive of Recorded Sound); Margaret V. Sowers (Map Collections); Samuel Stark (Theater collection); Charles J. Tannenbaum (Exhibits)

**Hoover Institution**

See "Hoover Institution" listing in this bulletin.

**J. Hugh Jackson Library, Graduate School of Business**

**Director:** Bela Gallo

**Assistant Director/Head Technical Services Librarian:** Robert E. Mayer
The Libraries of Stanford University sponsor a variety of instructional activities 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 specialities. Other types of instructional aid include tours, audio-visual presentations, and lectures to classes at the instructor's request.

Numerous library publications are prepared to inform and instruct library users. The most general and basic of these are the guide series entitled "Guides to the Stanford University Libraries," 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 included in the Stanford University Bulletin Information.

The formal courses listed below are intended to serve those students for whom a more extended study of bibliographic organization is useful.

**COURSES**

**Art 236. Art History Bibliography and Library Methods—**An introduction to important reference works in art and architectural history. 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 (Ross) alternate years, given 1989-90

**English 313. Colloquium on Research Methods and Materials for the Study of Modern Literature—**Some prevalent methods of inquiry into the post-Enlightenment British and American Literature, accompanied by analysis of the library resources that enable and facilitate them. Emphasis on interdisciplinary approaches that literalize the text's cultural occasion. Study of short works representative of major period and national circumstances focuses discussion of different models of contextual criticism. Topics: the genesis, production, and distribution to texts; the reconstruction of their original semantic, ideological, and literary environments; and the competing philosophies of editing them.

3 units, Spr (McPherson)

**French and Italian 397. Colloquium on Research Methods in French and Italian Studies—**Acquaints graduate students with general and specialized resources for French and Italian studies. Emphasis on overall strategy for research, but provides an opportunity to explore bibliographical sources in the particular fields of interest to each student.

3 units, Aut (Parrine)

**Latin American Studies 260. Colloquium on Latin American Bibliography—**Directed to the needs of beginning graduate students. Acquaint them with the principal resources for Latin American studies in the humanities and social sciences and teaches the mechanics of utilizing the bibliographic data available for the study of Latin America.

3 units, Aut (Breedlove)

**Medical Information Sciences 208. Computer-assisted Literature Searching—**(Same as Medicine 225.) See course description listed under those departments.

**Music 200. Music Bibliography—**Survey of essential research resources and methods of information retrieval for music. Introduction to the use of local, institutional, and network resources. Practical experience in evaluation and use of dictionaries, encyclopedias, bibliographies, discographies, indexes, and catalogs. Guest presentations related to resources and programs of the Music Department.

3 units, Aut (Nagy)

**Slavic 184. Introduction to Slavic Bibliography—**Historical and evaluative analysis of Slavic bibliographic and research tools emphasizing Russian and Soviet materials. Application of bibliographic search methodology. Final bibliographic project required. Reading knowledge of Russian required, another Slavic language helpful.

3 units, Aut (Zalewski)
INFORMATION RESOURCES

Vice President for Information Resources:
Robert L. Street

Information Resources (IR) combines responsibilities for academic and administrative computing, allowing common management of Stanford's computing resources. This includes facilitating the acquisition and availability of hardware and software and the development of computing expertise. The organization provides the support services necessary to maintain and promote Stanford's leadership in campus-wide academic information and data resources, academic and administrative computing, computer networking, and telecommunications. Further, IR works with the Stanford University Libraries to develop plans and initiatives for communications, electronic scholarship, and automated systems.


ACADEMIC INFORMATION RESOURCES (AIR)

Director: Ralph E. Gorin

Academic Information Resources supports the students, faculty, and staff of the University in their computer-related endeavors by providing widespread, convenient access to computing resources, consulting, training programs, and computing documentation. In addition, AIR develops new computing technologies and transfers these technologies (and other appropriate technologies) throughout the campus. Further descriptions of some of the services that AIR provides follow. For more information, contact AIR, Sweet Hall, third floor, (415) 723-1055.

AIR operates the academic computer center, which provides interactive computing to Stanford students and faculty in support of instruction and unsponsored research. The AIR computers include three DECSYSTEM-20's and a Systems Concept's SC30-M (collectively referred to as the Tragedies) running the TOPS-20 Operating System; an IBM 4381 (called Watson) running the VM/CMS Interactive Timesharing System; and a VAX8800 (called Portia) running ULTRIX, a version of UNIX™. Terminals connected to these computers are located in Sweet Hall (second floor) and in Tresidder Union. Various campus locations have terminals attached to SUNet (the Stanford University Network) that can access the AIR computers. There are also several projects, sponsored jointly by Residential Education, the Computer Science Department, and AIR, providing terminals (and personal computers) in particular student residences.

Interactive services available on AIR systems include several text editors and programming languages such as Pascal, FORTRAN, Basic, Lisp, APL, and statistical packages such as SPSS-X, BMDP, and Minitab. The NAG and IMSL subroutines are also available. In addition, SAS is available on the IBM 4381. Access to the Data Center 3090 vector processor for numerically-intensive computing may also be arranged.

Use of the AIR mainframe computers is available without charge to students and faculty. The publications racks located on the second and third floors of Sweet Hall contain instructions on how to obtain an account. An AIR student consultant is usually available on the second floor of Sweet Hall and at the Tresidder Union location.

Besides mainframe computing services, AIR provides computing advice and information to students, faculty, and academic staff. In that role, AIR offers technical consulting and advice about computing at Stanford (ranging from microcomputers to the various mainframe computers on campus). AIR also tests and evaluates computer systems and software, produces informational and instructional computing publications, and helps administer clusters of microcomputers located in Stanford libraries and other buildings on campus (including some of the residences). In addition, AIR develops software tools that allow Stanford faculty, with minimum intervention by computer programmers, to create innovative instructional applications on computers. Tools such as these are made available to professors in the course development laboratories located on the ground floor of Sweet Hall.

COURSES

AIR offers short, non-credit orientation classes the first two weeks of each quarter. These classes provide the new user with an overview of the various AIR computers and of the programs, editors, and utilities available as outlined below. Class schedules are available at the beginning of each quarter in the publications racks on the second and third floors of Sweet Hall.

Instruction and Research Information Serv-
ices (IRIS), a division of AIR, also offers alternatives for learning about computers and their use: courses open to the academic community or, by arrangement to interested groups from departments or schools; seminars on current topics; and tutorial materials designed for independent study. For more information about these alternatives, contact the AIR/IRIS office, Sweet Hall, Third Floor, (415) 723-1055.

Other non-credit classes in computing are offered by the Stanford Data Center. For credit classes in programming are offered by the Computer Science Department.

**EMACS Introduction**—An introduction to EMACS, the screen-oriented test editor on the Tragedies and Portia.
  - 0 units, Aut, Win, Spr, Sum

**TOPS-20 Intro-Class**—An introduction to the TOPS-20 operating system on the Tragedies. Topics: opening an account, basic commands, directories, files, and on-line help.
  - 0 units, Aut, Win, Spr, Sum

**UNIX**—Introduction—An introduction to the UNIX operating system on Portia. Topics: opening an account, file system organization, useful system commands, an overview of the various text editors, and basic concepts necessary for the use and enjoyment of the UNIX environment.
  - 0 units, Aut, Win, Spr, Sum

**VM/CMS Introduction**—Provides the minimum instruction necessary to get started in VM/CMS (the operating system on Watson). Topics: logging on, basic file manipulation, electronic mail, basic CMS, and XEDIT (a text editor) commands.
  - 0 units, Aut, Win, Spr, Sum

**VM/CMS Intermediate**—Covers the introductory and intermediate commands for XEDIT, a text editor on Watson, advance mail commands, and other topics. For those who know the basics of VM/CMS and XEDIT and would like to learn additional commands to improve their skills.
  - 0 units, Aut, Win, Spr, Sum

**Introduction to Statistical Packages Using VM/CMS**—Provides the minimum instruction necessary to begin using the following stastical packages: SAS, SPSS-X Minitab, and BMDP. For those who have a working knowledge of the VM/CMS operating knowledge system and little or no knowledge of the packages mentioned above.
  - 0 units, Aut, by arrangement

**LIBRARY INFORMATION SYSTEMS**

IR is responsible for providing the information technology necessary to maintain the Stanford University Libraries' collection of scholarly resources. The Library Information Systems division works with the Libraries in the areas of communications, electronic scholarship, and automated systems. For more information about the Stanford University Libraries, see the "Libraries" section in this bulletin.

**NETWORKING AND COMMUNICATIONS SYSTEMS**

Director: William H. Yundt.

Networking and Communications Systems provides technical advice and counsel to faculty, students, and staff on their data, video, and voice networking needs. Networking and Communications Systems operates both a University-wide computer and video network, SUNet, which connects all major academic buildings and student dormitories, and the campus telephone system. This division identifies network standards, evaluates products, and provides the hardware and software that allow departmental networks to access SUNet services, including electronic mail, file transfer, the sharing of expensive resources, and video communications for instructional television and image retrieval. SUNet also offers connections to off-campus networks, including access to outside supercomputing facilities. The division offers seminars on local and cross-campus networks, publications and consulting services. For more information, contact Networking and Communications Systems, (415) 723-3909.

**STANFORD DATA CENTER**

Director: John R. Sack

Stanford Data Center supports the institutional processes of the University and the Hospital by providing them with highly reliable data processing, graphics, and printing technologies, both centralized and decentralized. The center supports local systems, offering consultation services, and services based on the Data Center's mainframe computer. More specifically, the center helps departments and pro-
grams to effectively acquire, develop, and use these technologies for managing information. The Data Center also handles all campus mail services.

In Forsythe Hall, the center operates an IBM 3090-300E, and provides many machine and staff services to the Stanford community. Public terminals at Forsythe and other easily accessible campus locations are available. The center also maintains connections for Stanford to national networks such as Tymnet and Telenet.

Computer based services include: screen text editing (WYLBUR) and formatting (SCRIPT) programs for preparing reports, letters, data, and theses; SPIRES, the Stanford-developed data base management system; Prism, the online collection of Stanford administrative files and services; and Folio, a system which provides on-line access to Stanford's academic and institutional data resources such as Socrates, the on-line library catalog.

The Data Center has an extensive master library of application-specific computer routines encompassing statistical, data analysis, and other data processing functions, including SAS®, SPSS®, and BMDP®. Extensive data files are available on a variety of subjects. Programming languages for use in interactive and/or batch mode include APL, Assembler H, COBOL, FORTRAN, Pascal, and PL/I. Many other software packages that run under the IBM MVS-XA operating system are also available. Other services include high speed page printers; support for local laser printers; CONTACT/EMS™ an electronic mail handling system; and micro-mainframe linkage using the Samson™ file transfer software.

The courses and seminars described below are offered to help clients learn to use the facilities and services independently. The courses are non-credit but do require registration through the center. Some are orientation seminars to introduce you to the Data Center. Others are beginning-level courses in the use of computers (including microcomputers) for functions such as text editing or information retrieval. Others are more advanced seminars. Most courses are free, but there is a charge for some micro-computer courses. For current information on places, times, and fees, see the quarterly Class Schedule, available at the Data Center Information Desk in Forsythe Hall, (415) 723-4392. The Class Schedule is also available on-line (DOC#SCHEDULE PUBLIC).

### COURSES

#### INTRODUCTORY SEMINARS

42. DOS in Depth—Introduces Disk Operating System (DOS) commands useful when setting up and using an IBM PC or compatible hard disk computer system. Topics: creating and manipulating disk directories; the role of the AUTOEXEC.BAT file; how to create a custom batch file menu system; using pipes and filters to re-direct output; and how to control the DOS environment through AUTOEXEC.BAT and CONFIG.SYS file changes. Use of EDLIN, the DOS line editor, to create and modify text files.

0 units, Aut, Win, Spr, Sum

48. Introduction to the IBM-Style Computer and DOS—A general introduction to the IBM PC and compatible computers, covering fundamental computing information and Disk Operating System (DOS) commands. Concepts relating to files, drives, and directories. Commands to manipulate files and format diskettes. Distinguish program and data files and use DOS commands that diagnose problems. Optional hands-on session after this class.

0 units, Aut, Win, Spr, Sum

81. Introduction to Macintosh—An overview of Macintosh terminology and concepts designed for those with little or no computer experience. Topics: how to use the Macintosh operating system, types of configurations of Macintosh equipment, and file management. Demonstrations include MacWrite, MacPaint and how to communicate with the Data Center using MacSamson.

0 units, Aut, Win, Spr, Sum

82. Making Pages Pretty: A Guide to Graphics and Publishing Software for the Macintosh—The strengths and special features of various "draw," "paint," "illustration," and "desktop publishing" programs for the Macintosh. Provides the insight to make intelligent choices among packages. For novice Macintosh users, and or experienced users. Merging text and graphics on the Mac, an overview. Topics: how "paint" and "draw" programs work, "illustration" programs, other graphics programs, scanners, imaging programs, ClipArt, ways to create charts, graphs, etc, ways to create illustrations, how "page makeup" programs work; page makeup vs. word processing programs; ways to create signs, posters, flyers; ways to create newsletters; ways to create longer documents.

0 units, Aut, Win, Spr, Sum

88. Mac In Depth—How to use Apple's new MultiFinder, Font/DA Mover, Desk Accessories in depth; connect to other computers, printers, organize files with HFS, and more.

0 units, Aut, Win, Spr, Sum
1. WYLBUR Basics—For new users of the Data Center mainframe computer system and the WYLBUR text editor. Hands-on session to create, edit, save, and mail messages.
0 units, Aut, Win, Spr, Sum

2. WordPerfect for the IBM PC—Word Processing for the novice involved in the preparation of frequently modified documents and reports, and lengthy reports, papers, and manuscripts. The fundamentals of word processing and the special features of WordPerfect software.
0 units, Aut, Win, Spr, Sum

3. Advanced WYLBUR Editing—Hands-on session for reviewing and expanding WYLBUR text editing skills. How to work with more than one file at a time, merge files and text, make multiple changes to files and modify, replace, and insert text quickly using line mode WYLBUR. Advanced printing options, special effects on your screen such as flashing, bold, and underlined text. Routing printed output to a U.S. or on-campus mail address, etc.
0 units, Aut, Win, Spr, Sum

4. WYLBUR for Statistical and Programming Applications—Batch programs, such as SAS, SPSS, Script/GML or Fortran, and the components necessary to use them. Emphasis on library management, file format for batch data, running jobs, file protection, transferring files from microcomputers, logon EXEC files, and command retry. The differences between Edit Format and LRECL and card formats, and how to send consulting questions and suggestions online.

5. Introduction to MultiMate Advantage II—The basic capabilities of MultiMate, a word processing software program for microcomputers. Write, edit, store, and print documents. Focus is on MultiMate’s editing functions (inserting, deleting, moving, copying, and replacing text) and modifications of the document’s format.
0 units, Aut, Win, Spr, Sum

6. Introduction to Macintosh WORD—Fundamentals of basic editing, formatting text, printing, and saving work using WORD. How to use sophisticated formatting features, Page Preview, and printing options. Practice with spell checking and glossary functions.
0 units, Aut, Win, Spr, Sum

65. Advanced WORD for the Macintosh—Advanced techniques covering style sheets, paragraph and section formatting, and form letters. Generate tables of contents, indexes, open windows, and use selected keyboard options, etc.
0 units, Aut, Win, Spr, Sum

69. Advanced MultiMate Advantage II—If you are comfortable with the basic MultiMate skills, this takes you into more advanced knowledge of the program. Topics: key procedures, libraries, merge print, and other advanced features.
0 units, Win, Spr, Sum

86. Document Formatting Using Generalized Markup Language (GML)—Generalized Markup Language (GML) is an extension to the SCRIPT text-formatting program. Topics: how simple labels (“tags”) indicate major parts and headings of any document to simplify laying out a report or publication; introduces several basic document layouts used with GML; and the type, styles, and printers available for the various layouts.
0 units, Aut, Win, Spr

99. Advanced WordPerfect—For the experienced user involved in general office typing, in the preparation of frequently modified documents and reports, and in preparation of lengthy reports, papers, and manuscripts. Advanced formatting, block functions, headers, footers, centering; working with columns, math functions, searching and replacing, merging documents, working with more than one document at a time, using line draw, and customizing WordPerfect.
0 units, Aut, Win, Spr, Sum

DATA BASE MANAGEMENT

5. Intermediate DataEase—For those with a basic understanding of DataEase (see 55) who are developing data base applications to automate record-keeping tasks on a microcomputer.
0 units, Aut, Win, Spr, Sum

6. SPIRES Concepts and Facilities—SPIRES, is a unified approach to storing, retrieving, and processing information which enables you to
develop a small database; design, create, and enter data; and maintain and use files. Topics: discussion of data bases and SPIRES, and of the components necessary to design and create a data base.

0 units, Aut, Win, Spr, Sum

7. Introduction to SPIRES—Enables you to "find your way around" a SPIRES data base, a unified approach to storing, retrieving, and processing information. Search for information, add new data, modify material, and generate simple reports. Emphasizes the searching capabilities of SPIRES. Also, methods for adding, modifying, and removing information, and creating simple reports.

0 units, Aut, Win, Spr, Sum

30. SPIRES for Programmers—Self-study course containing approximately 15 sections of in-depth SPIRES programming instruction. Extensive reading in the SPIRES documentation with homework corrected and reviewed by Data Center staff. Following the completion of each section, one-on-one consultation with the instructor is available to review the unit's contents and the homework responses. Contact the Information Desk in Forsythe Hall for further information.

0 units, Aut, Win, Spr, Sum

46. Reporting in SPIRES—Using data stored in SPIRES data bases for users who need to create reports. The SPIRES facilities used for ad hoc report writing emphasizing the REPORT format and the REPORT DEFINER. Topics: the selection and sequencing of material (records), ways of displaying values, use of element or structure filters and dynamic elements, and considerations of efficiency and convenience. Advanced report writing techniques include page formatting, group summaries, and SPISORT.

0 units, Aut, Win, Spr, Sum

51. Accelerated EXCEL for the Lotus 1-2-3 User—For Macintosh users who are experienced with Lotus 1-2-3 but have little or no Macintosh EXCEL knowledge. Experienced EXCEL users may also benefit. Spreadsheet basics familiarize students with the EXCEL interface. Advanced spreadsheet manipulations, and tips and techniques for optimizing spreadsheet operations.

0 units, Win, Sum

55. Introduction to DataEase—How to use the basic functions and features of Data Ease, a data base management system for microcomputers. How to define forms, add, view, modify, and delete information in a data base, define and run simple and complex reports, and set up and use relationships between multiple files. Topics emphasize form definition and changes, record entry and changes, reports, relationships between files, data base maintenance, and system administration. Also, sharing information with other systems and customizing DataEase with menus.

0 units, Aut, Win, Spr, Sum

STATISTICAL AND PROGRAMMING APPLICATIONS

14. SPSS-X Overview—How to use commercially available SPSS-X (Statistical Package for the Social Sciences, extended version) to enter data, create, and merge system files; write codes to transform and create variables; and run elementary statistical procedures on the mainframe computer. SPSS-X is an integrated system of computer routines used for the analysis, presentation, and management of data for individuals with little or no programming experience. Data and file manipulation tools are part of the software. Also, methods to prepare data for analysis.

0 units, Aut, Spr

15. SAS Overview—How to use the commercially available SAS (Statistical Analysis System) to enter data, write codes to transform and create variables, and run elementary statistical procedures on the mainframe. Some advanced data step applications. How to prepare data for analysis. Oriented to those with programming knowledge.

0 units, Aut, Win, Spr, Sum

70. JCL for Statistical Packages on the Data Center Mainframe—Learn to use the JCL (Job Control Language) necessary to read and write files using SPSS-X and SAS. How to submit jobs and examine output critically. Introduction to batch processing on the 3090. Instructions for coding JOB, EXEC (execution) and DD (data definition) statements, and explanations of their linkage to the statistical software. Tape and disk storage issues and the relative merits of SAS versus SPSS-X.

0 units, Aut, Win, Spr, Sum

84. EXEC Files—The basics of writing simple exec files. Topics: the exec file environment; simple exec files; use of variables, expressions and functions in exec files; use of program flow control in exec files (e.g., IF-ELSE, WHILE REPEAT, and CASES statements); use or input-output statements (e.g., READ, WRITE statements); the structure of more complex exec files; and exec file debugging: extended exec files.

0 units, Aut

85. Advanced EXEC Files—For those involved
in writing production who want to learn advanced exec file techniques. Topics: the structure of production execs; exec procedures and argument passing; error and attention control within execs; scanning input string; variables of extended scope; use of multiple active files within exec files; and other advanced topics. Advanced extended exec features are covered.

0 units, Aut

87. Using Vector FORTRAN and Special Subroutine Libraries at the Data Center—How to take advantage of the Vector facility and special subroutines using FORTRAN in batch mode or the Data Center's mainframe. Large computer-intensive jobs can be modified to execute 90% faster than similar non-vector programs. Overview of special subroutine programs, basic JCL, accessing output, and vectorization techniques.

0 units, Aut

Advanced extended exec features are covered.

40 units, Aut

88. Regression and ANOVA in SAS™—Choosing SAS procedures for specific options and lowest cost. Linear models. The statistical implications of PROCs GLM, ANOVA, and REG; their similarities and differences; and research design issues. First session: research design or statistics questions. Second session: user topics.

0 units, Win, Spr

GRAPHICS

47. SAS/GRAPH™—on the IBM 3090—How to use SAS/GRAPH, a sophisticated graphics system, to produce full color graphs, charts, and maps on the Data Center mainframe computer. SAS/GRAPH basics, focusing on general bivariate plotting, Mapping, contour plots, and three-dimensional plotting.

0 units, Aut, Win

75. Getting Started with PageMaker—How to design and lay out a simple publication, newsletter or flyer using Aldus' PageMaker software on the Macintosh computer. The process of creating a simple publication on the Macintosh, the initial design decisions, the physical layout using PageMaker, and printing on a laser printer or PostScript typesetter.

0 units, Win, Spr

76. Fine Tuning Your PageMaker Publications—How to use advanced PageMaker features to make publications sharp. Topics: review of basic PageMaker techniques, more about column guide and master pages, ways of gridding the page, page number markers, using paragraph/hyphenation controls, using word and letter-spacing controls. Kerning, using tab/indent controls, creating tabbed tables vs. using text blocks, creating special effects, special logos, drop caps, runarounds, special graphics techniques, basic design principles.

0 units, Win, Sum

83. Create Your Flyer with MacDraw—Enhance written and oral presentations by creating presentation graphics on the Macintosh, using the tools available in MacWrite, MacPaint, and MacDraw. Focus is on the MacDraw program for the Macintosh; also MacPaint and MacWrite. Combines text and graphics to create flyers, charts, newsletters, and graphs. The skills are applicable to all other Macintosh graphics programs; some are discussed.

0 units, Win, Spr, Sum

SPREADSHEETS

49. Introduction to Macintosh EXCEL Spreadsheets—Designed for those new to EXCEL and to electronic spreadsheets. Briefly reviews Macintosh basics and how to perform calculations, create a worksheet, adjust column width, align text, format numbers, fill cells, and save and print your work.

0 units, Win, Spr

50. Introduction to Macintosh EXCEL Data Bases, Charts, and Macros—For users familiar with spreadsheet basics on the Macintosh. Organize lists of information, find information in an EXCEL data base, analyze data using "what-if" analysis and data base statistics; create charts that represent spreadsheet data and use macros to automate commonly used keystrokes.

0 units, Win, Spr

56. Building LOTUS 1-2-3 Spreadsheets—Hands-on introductory course on fundamentals of creating simple electronic spreadsheet models using LOTUS 1-2-3 on IBM PC/XT. Develops basic spreadsheet skills, entering and formatting data, creating and editing formulas, and building simple financial models for conducting "what if" analysis. Experience in printing SIMPLE reports.

0 units, Win, Spr

57. Creating LOTUS 1-2-3 Graphs—An introduction to LOTUS 1-2-3 PrintGraph on the IBM PC or compatible computer. Emphasis is on learning to enter and format data, create and
edit formula, and build simple financial models for conducting “what-if” analysis. Produce graphs and print simple reports.

0 units, Aut, Win, Sum, Spr

58. Working With Lotus 1-2-3 Data Base Commands—Designed for sophisticated Lotus 1-2-3 users using the IBM PC/XT spreadsheet as a data base management tool. Emphasis is on developing data base skills and techniques such as SORTing data on one of two keys; using DATA QUERY to locate and extract information from a complex spreadsheet model; constructing and using the DATA TABLE capabilities of Lotus 1-2-3; as well as STATISTICAL FUNCTIONS.

0 units, Aut, Win, Sum, Spr

66. Introduction to LOTUS 1-2-3 MACROS—Using IBM PC/XT, build simple KEYSTROKE MACROS to automate redundant processes, such as setting up and printing a report. How to build more complex BRANCHING MACROS that allow you to modularize repetitive tasks; write CUSTOM MENU MACROS which provide custom user interface to the LOTUS environment.

0 units, Aut, Win, Spr, Sum

67. Lotus 1-2-3 Tips and Tricks—For the experienced spreadsheet person who wants to refresh advanced Lotus skills and learn new ones. Techniques for building formulas for mixed cell references, lookup tables, function, “what-if” analysis, how to create a frequency distribution analysis, etc.

0 units, Win, Sum

68. Advanced LOTUS 1-2-3 MACROS—A continuation of “Introduction to LOTUS 1-2-3 Macros.” Build macros which are INTERACTIVE, CONDITIONAL, MODULAR, and include COUNTERS and passable PARAMETERS. Create a custom user interface for the LOTUS environment based on the needs of those for whom you are developing the spreadsheet.

0 units, Aut, Win, Spr, Sum

COMMUNICATIONS NETWORKS

20. Using Electronic Mail—How to read and send electronic mail on the Data Center mainframe computer. Introduces basic concepts of electronic mail. Topics: how to send, receive, file and retrieve, and how to “tickle” mail. Addressing messages by personal name, distribution lists, and an automatic answering feature. Focus is on electronic mail systems on the Data Center mainframe computer. Connections to other mail networks.

0 units, Aut, Win, Spr, Sum

24. Fundamentals of Data Communications—New communications terminologies, components of various systems, and basic trouble analysis and identification to assist vendors in repair. Topics: equipment selection, short and long distance transmission, the role of the data switch (which routes your communication to the desired destination), basic voice communications, and multiplexing (setting up data lines to concentrate data from several lines into one). Reference to networks and their functions including SUNet and other interbuilding LAN’s, various transmission media (copper, coax, and fiber optic), and benefits and hazards of the recent phone deregulation. For new entrants into the data communications arena and those interested in a general understanding of data communications.

0 units, Aut, Spr

44. Introduction to Samson IP—How to use the Samson/IP program, a file transfer and terminal emulation program for IBM PC-style computers connected to the SUNet network. Lecture/demonstration with hands-on practice in starting terminal sessions, printing and logging files and sessions, transferring files between the Data Center and common microcomputer software packages, transferring files between the PC and other SUNet hosts, and using the WHOIS and FINGER commands for directory and account information.

0 units, Aut, Win, Spr, Sum

45. Introduction to Samson Using the IBM PC—Samson is a terminal emulation and file transfer program for the IBM PC to use a PC or compatible as a DEC VT100-type terminal and transfer files between the Data Center and the PC. Using a PC as a terminal, printing and saving terminal sessions, transferring text and binary files, and transferring files between WYLBUR on the Data Center and microcomputer word processors.

0 units, Aut, Win, Spr, Sum

93. Introduction to Samson Using the Macintosh—Samson is a terminal emulation and file transfer program available on the Macintosh as a DEC VT100-type terminal and transfer file between the Data Center and the Macintosh. Using the Macintosh as a terminal, transferring text and binary files, and transferring text files between WYLBUR and MacWrite or MicroSoft Word.

0 units, Aut, Win, Spr, Sum
UNDERGRADUATE  
INTER-SCHOOL PROGRAM  

PROGRAM IN VALUES, TECHNOLOGY, SCIENCE, AND SOCIETY

Emeriti: (Professors) Eric Hutchinson (Chemistry), Walter G. Vincenti (Aeronautics and Astronautics)

Chairman: James L. Adams  
Associate Chairman: Robert E. McGinn  
Director, Western Culture Sequence: Paul S. Seaver  
Director, Honors Committee: Joseph J. Corn  
Professors: Herbert Abrams (Radiology), James L. Adams (Industrial Engineering and Engineering Management), Barton J. Bernstein (History), Sidney Drell (SLAC), Alexander L. Fetter (Physics), Edwin M. Good (Religious Studies, on leave, 1988-89), Alex Inkeles (Sociology, on leave 1988-89), Stephen J. Kline (Mechanical Engineering), John McCarthy (Computer Science), Leonard Ortolano (Civil Engineering), Robert Osserman (Mathematics), Nathan Rosenberg (Economics), Paul S. Seaver (History), Bernard Seigel (Anthropology), Robert B. Textor (Anthropology)

Associate Professor: Peter Galison (History of Science, Philosophy, and Physics)  
Assistant Professors: Paul Adler (Industrial Engineering and Engineering Management), Clifford I. Nass (Communications)  
Professors (Teaching): Gilbert Masters (Civil Engineering), Robert E. McGinn (Industrial Engineering and Engineering Management, and VTSS)

Senior Lecturers: Joseph J. Corn (History, American Studies, and VTSS), Barry Katz (Mechanical Engineering and VTSS)  
Lecturers: Lois Becker (VTSS), Iain Boal (VTSS), Naushad Forbes (VTSS), David Horn (VTSS), Barry Katz (VTSS), Thomas McBride (Law), Theodore Postol (VTSS)  
Consulting Professor: Richard Mechan (VTSS)

Technology and science are activities of pivotal importance in modern life, intimately bound up with industrial society's evolving character, problems, and potentials. If scientific and technological pursuits are to enhance human well-being, they and their effects on society and the individual must be better understood by non-technical professionals and ordinary citizens, as well as by engineers and scientists. Issues of professional ethics and social responsibility confront practicing engineers and scientists. At the same time, lawyers, public officials, and business people are increasingly called upon to make decisions for which a basic understanding of modern technology or science, related ethical, social, and environmental impacts is essential. Ordinary citizens, moreover, are being asked with increasing frequency to pass judgement on controversial matters of public policy related to science and technology. These circumstances require a new form of liberal education adequate to the technical character of the contemporary era.

The Program in Values, Technology, Science, and Society (VTSS) is an interdisciplinary enterprise aimed at enhancing the student's understanding of the nature and significance of technology and science in modern industrial society. Achieving this understanding requires critical analysis of the interplay of science and technology with human values and worldviews, social organizations and institutions, and broader cultural and environmental contexts. Hence, VTSS courses study science and technology in society from a wide variety of perspectives in the humanities and social sciences. The program's purpose requires some basic understanding of technology and science. Thus, general courses providing technical literacy are also included among the VTSS offerings, and as requirements in some program curricula.

GENERAL INFORMATION

VTSS courses may be used, individually or in integrated groups, for various purposes:
1. To satisfy University Distribution Requirements.
2. To satisfy the VTSS requirement of the School of Engineering.
3. To comprise parts of student-designed concentrations required for majors in Humanities Special Programs or Human Biology.
4. To satisfy the requirements of the VTSS Honors Program complementing any standard major (see below).
5. To satisfy requirements for majors in VTSS (see below).
6. To obtain general education.

VTSS courses will be particularly valuable for undergraduates planning further study in graduate professional schools (e.g., business, education, engineering, law, journalism, medicine) and for students wishing to relate the specialized knowledge of their major fields to broader technology- and science-related aspects of modern society and culture.
UNDERGRADUATE INTER-SCHOOL PROGRAM

WALTER G. VINCENTI PRIZE

An annual prize is awarded to the author of the best student essay written in VTSS 1, 2, 3. This prize honors Professor Walter G. Vincenti, historian of technology, founding member, and first chairman of the VTSS Program.

UNDERGRADUATE PROGRAMS

Degree programs in VTSS are interdisciplinary curricula devoted to understanding the nature and significance of technology and science in modern society. All majors will analyze phenomena of science and technology in society from philosophical, ethical, aesthetic, historical, economic and other social scientific perspectives. Students pursuing the A.B. degree will, in addition, study a technical field in sufficient depth to obtain a grasp of basic concepts and methods and will complete a concentration on a science-and-technology-in-society-related theme, sub-area, or problem. Those seeking the B.S. degree will complete the equivalent of approximately one full year of courses in technology, science, and mathematics. The particular courses chosen will partly reflect the student's special interest in the field of science and technology in society. The requirements for the bachelor's degrees in VTSS are as follows:

BACHELOR OF ARTS

1. VTSS Core (8 courses)
   a) Overall VTSS Perspectives (VTSS 101)
   b) Economics Perspective (VTSS 107)
   c) Philosophical and Ethical Perspectives (VTSS 110)
   d) Aesthetic Perspective (VTSS 115)
   e) Historical Perspective (VTSS 121 and 125 or 126)
   f) Social Science Perspectives (one of VTSS 150, 155, 159, 161, or 162)
   g) Senior Seminar (VTSS 200)

2. Technical Literacy (5 courses)
   a) Computer literacy, normally demonstrated by successfully completing Computer Science 106A, its equivalent, or any computer science course with 106A as a prerequisite.
   b) Science or engineering literacy demonstrated by:
      1) completing a four-course "sequence" (minimum of 12 units) in one field of engineering or science (samples available in the VTSS office), or
      2) completing the program's technical literacy sequence (VTSS 51, 52, 53) and one other complementary technical course chosen in consultation with the Program Chair or Associate Chair.

3. Thematic Concentration (at least 5 courses above the introductory level totaling a minimum of 20 units), organized around a science-and-technology-in-society-related theme, problem, or sub-area. The VTSS Policy Committee has certified the following topics as suitable Thematic Concentrations for the VTSS A.B. degree: aesthetics, development, environment, history and philosophy of science, history of science and technology, industrial organizations, public policy (including innovation policy), social change, war and peace, and work.

4. Senior Paper, an original 20-25 page paper for VTSS 200 on a subject related to the student's Thematic Concentration or Technical Depth. Descriptions of certified A.B. Thematic Concentration topics and their respective course lists are available in the VTSS office. A student selecting one of the certified topics may include one or more courses not on the corresponding list if such courses are germane to the concentration and meet the student's special interests. The above certified topics notwithstanding, the student may elect to design her or his own A.B. Thematic Concentration topic and course package and secure the program's approval. See the Associate Chairman for details.

BACHELOR OF SCIENCE

The student pursuing the B.S. degree shall complete the VTSS Core and a package of at least 50 units of technical courses designed to impart not only an understanding of but an ability to work with, basic concepts of engineering and science. While courses comprising part of this component may reflect the student's interest in one or more science- or technology-related social problems, all courses in it must be in engineering, science, or the mathematical sciences. Introductory courses in mathematics or physics (e.g., Mathematics 19 or Physics 19) will not normally be countable as parts of the technical component.

The B.S. candidate will follow one of the following two models as guidelines for fulfilling this minimum 50-unit requirement:

1. "Focused depth": at least 24 units in a single field of science or engineering, with the remaining units, except for at most two standalone courses, grouped in clusters of at least three courses each in other fields of science or engineering, e.g., eight industrial engineering, three physics, three mathematics, and three computer science courses, and one course each in electrical engineering and chemistry.

2. "Focused breadth": at least 24 units in two fields of science or engineering, with the remaining units, except for at most two standalone courses, grouped in clusters of at least three courses each in other fields of science or engineering, e.g., eight industrial engineering, three physics, three mathematics, and three computer science courses, and one course each in electrical engineering and chemistry.
2. "Clustered depth": 50 units comprised of clusters of at least 5 courses each in different fields of science or engineering, with at most two stand-alone courses, e.g., physics, chemistry, electrical engineering, and computer science courses, and one course each in industrial engineering and earth sciences.

It is strongly recommended that B.S. majors complete Computer Science 106A, a course equivalent to it, or a computer science course having 106A as a prerequisite.

HONORS PROGRAM

As distinguished from VTSS majors, the VTSS Honors Program is intended to complement study in any conventional major. The Honors program will be of particular interest to two categories of students. Students majoring in some field of science or engineering or in the pre-medical curriculum may feel a need to complement their technical studies with courses which focus on the ethical, social, and cultural aspects of modern technology and science. Students in the humanities or social sciences may wish to enrich their studies by acquiring an understanding of how science and technology have influenced ideas and developments in their respective major fields.

ADMISSION

The Honors program is open to students majoring in any field. Interested students should make serious inquiries about the Honors program no later than Autumn Quarter of the junior year and declare their intentions to pursue Honors in VTSS by the beginning of Spring Quarter of the same year. At an appropriate time, typically during Spring Quarter of the junior year, each student intending to pursue Honors will submit a two-page description of rationale for the research project he or she proposes to carry out to the VTSS Honors Committee for approval.

REQUIREMENTS

1. Introductory Course: VTSS 101
2. Philosophical and Ethical Perspectives: VTSS 110
3. Historical Perspective: one of VTSS 107, 121, 125, or 126
4. Social Science Perspective: one of VTSS 150, 155, 159, 161, 162
5. Senior Seminar: VTSS 200
6. Honors Project: An original critical essay or investigative project on a VTSS topic of general importance (10-12 units; normally 2 units Spring Quarter, junior year; 5 units Autumn Quarter, senior year; 5 units Winter Quarter, senior year). Past Honors projects are on file in the VTSS library, room 371.

VALUES, TECHNOLOGY, SCIENCE AND SOCIETY

To earn Honors, the project must be completed with a letter grade indicator (LGI) of at least "B". The student must also achieve an LGI of at least 3.3 in the courses taken to satisfy requirements 1-5 above. If these requirements are met, the designation "Honors Program in Values, Technology, Science, and Society" will be affixed to the student's permanent record and appear in the commencement program.

COURSES

WESTERN CULTURE SEQUENCE

1. The Ancient World—Technology and culture in the ancient societies of the Near East, China, Greece, and Rome.
   5 units, Aut (Katz, Staff) MTW 11, two-hour section by arrangement
2. The Pre-Modern World—The diverse influences that shaped the culture of the Middle Ages, Renaissance, and Enlightenment. Chinese origins, Islamic transmission, and European exploitation of scientific and technological ideas.
   5 units, Win (Seaver, Katz, Staff) MTW 11 two-hour section by arrangement
   5 units, Spr (Corn, Katz, Staff) MTW 11 two-hour section by arrangement

TECHNICAL LITERACY SEQUENCE

1. The Nature of Technology, Mathematics, and Science—Integrated three-quarter sequence enhancing one's ability to think quantitatively and to understand the character and interrelationships of technology, mathematics, and science. Treats quantitative questions that confront people intending to comprehend and influence contemporary society. Basic concepts include conservation laws, energy, entropy, equilibrium, feedback, probability, reliability, symmetry, uncertainty. Topics: sources of problems, nature of invention and discovery, experiment vs. theory, societal concerns. (DR:6, 7, and 8 when all three courses completed.)
   3 units each quarter, Aut, Win, Spr (Adams, Fetter, Osserman) MWF 1:15
101. Science, Technology, and Contemporary Society—Key social, cultural, and values issues associated with scientific and technological developments in contemporary life, focusing on the U.S. in the 1980's. Topics: nature and the relationship of science and technology; influence of scientific and technological developments on social institutions (work, leisure, community), groups (women, children, the elderly) values and world views (progress, materialism, religious fundamentalism); societal influences on science and technology (regulation, legislation, litigation); effects of the organization of research on the ideals and practice of science and technology (objectivity, fraud, Kuhnian paradigms, and revolutions); science, technology, and the fabric of everyday life in traditional ascetic and modern affluent cultures; roles of science and technology in economic growth and competitiveness; science, technology, and the arts in the 20th century; and science- and technology-based value conflicts and political disputes (public participation in decision-making and aid for Third World development). (DR:5)

4-5 units, Aut (McGinn) MW 2:15-4:05
two-hour section by arrangement

107. Technology and Modern Industrial Society—(Same as Economics 113.) The interplay of technology and the process of economic development from 1750 to the present. Topics: the origins of industrialism, industrialization in 19th-century Britain and the U.S., factors affecting the rate and direction of technological change and diffusion, technology and the growth of large-scale organization, the spread of industrialization to less-developed countries, late-comers to industrialization (the cases of Japan and the U.S.S.R.), the growth and slowdown in mature industrial countries, and present concerns and future prospects (the influence of technology on employment, civilian "spillovers" from military R&D spending, and coping with technological change). (DR:5)

4 units, Win (Rosenberg)

110. Philosophical and Ethical Issues in Public Policy—Philosophical and ethical issues in science- and technology-related public policy conflicts. Develops the capacity for rigorous critical analysis of complex, value-laden policy disputes. Topics: the natures of ethics and morality; the natures and rationales for liberty, justice, and human rights; and the analysis of case studies illustrating the use (and abuse) of these concepts in recent and current policy disputes. Cases from: biomedicine (abortion, euthanasia, in vitro fertilization, pre-determination of sex of offspring, and genetic testing); environmental affairs (endangered species, wilderness and landmark preservation, coastal development, noise, and high-rise proliferation); work policy (privacy, "whistle-blowing", worker participation); and international relations (warfare, food and development aid, immigration, and repatriation of artistic patrimony). (DR:3)

5 units, Win (McGinn) MW 2:15-3:30 plus two-hour section by arrangement

115. Technology and Aesthetics—The aesthetic dimension of technology in the modern world and in history. The role of subjective factors in technological and scientific problem-solving and in the response of users and observers to technological phenomena. Analysis of such concepts as beauty, elegance, quality, appropriateness, and function as they apply to specific works of technology and science. Technology as art and art as technology. Attention to improving the ability to analyze the "fit" of technological products to individual needs and cultural values. Case studies of personal computers, building, machines, weapons, structures, and networks.

4-5 units, Aut (Adams, Katz) MW 2:15-4:05

121. History of Technology, 1500-1918—(Same as History 115, History of Science 121.) The interplay of technological change and social and cultural developments from the late Middle Ages to WW I. Focus is on Europe and the U.S., with attention to contemporary technological developments in the non-Western world and to the consequences there of western technologies. Topics: the mechanization and the labor process, the changing relationship of technology to science, the industrialization of warfare, technology and imperialism, and the cultural implications of new communications technologies. Discussion section mandatory for majors. (DR:5)

4-units, Win (J. Corn) TWTTh 10 plus optional section Th 3:15-5:05

125. The Scientific Revolution—(Same as History 139, History of Science 145, Philosophy 145.) Social, intellectual, and institutional background of the 17th-century period that established modern science. Theories of matter and motion, Descartes, Galileo, Bacon, Boyle, and Newton. Historical controversies: Yates thesis on hermeticism and magic; Merton on Protestantism and science; Hessen on the economic basis of scientific change. Readings from era texts and modern historical studies. Considers various interpretations of the revolution and what is meant by science and revolution. (DR:3)

5 units, Aut (Galison) TTh 11-12:15

126. History and Philosophy of 20th-Century Physics—(Same as Philosophy 168, History
20th-century physics. Late 19th-century reduc-tionist world-views leading to special and gen-eral relativity. Einstein's response. How did early workers in quantum mechanics attack the wave-particle duality? The problem of scientific realism in quantum mechanics. Nuclear fission, the bomb, and growth of large-scale experimental high-energy physics. What is meant by "uni-fied" field theories in contemporary physics? Readings: scientific, historical, and philosophi-cal texts. (DR:3)

5 units, Win (Galison) TTh 11-12:15

200. Senior Seminar—Weekly research semin-ar for senior VTSS majors and Honors stu-dents. Analysis of advanced level works in the VTSS field and preparation of a senior paper in area of the student's concentration. Prere-quisite: Senior standing and four VTSS core courses, or permission of the instructor.

4 units, Win (Clayton)

APPLICABLE TO CORE REQUIREMENTS

To satisfy the science part of the Historical Perspectives Requirement (see "Undergraduate Programs" section above), students select one of the following five courses:

150. Legal and Political Perspectives on Biology and Technology—(Same as Human Biology 125.) How legislatures, courts, and regulatory agencies deal with contemporary issues related to biology and technology. Issues: computers and privacy; carcinogens and legislation; tobacco and the law; risk-benefit analysis and politics; the workplace issues of equal pay and job safety; and government and corporate accountability in a time of rapid technological and scientific change. Introduction to the work-ings of law, politics, and regulation. Emphasis on research. Find data, library and live, analyze it, understand how the government works and why interests compete, and use the skills of written and oral presentation to educate and persuade. Limited to 40 students.

4 units, Spr (McBride) TTh 3:15-4:45

155. Social Structure of World Society—(Same as Sociology 152, Education 231.) Sociological analysis of human society on a world-wide basis. Competing models of the emerging world order and its dynamics. 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. (DR:5)

5 units (Inkeles) given 1989-90

159. Sociocultural Implications of High Tech-nology—(Same as Anthropology 138/238.) Lecture/discussion in cultural process terms on the development, diffusion, and utilization of tech-nology—"high" technology developed around Stanford, e.g., biogenetics, microelectronic information technology, and superconductors. Ways such technological innovations enable or drive profound changes in other parts of a sociocultural system (e.g., its symbolic, values, and belief patterns, and its social and economic organization). Types of unintended human damage such innovations have sometimes pro-duced. Implications for appropriate technologi-cal design and for public and educational policy. Includes anthropological case studies from non-Western cultures at various evolutionary levels of sociotechnical complexity, and a unit on modern Japan. Guest lecturers include local tech-nologists, venture capitalists, and political activ-ists. Open to all graduate students and undergraduates contemplating Honors theses. (DR: 5)

5 units, Aut (Textor) MWF 1:15-2:45

161. Anthropology of Development—(Same as Anthropology 149.) A history of anthropology in development projects from the Colonial Period through WW II. The involvement of anthropologists at the community level, e.g., Vicos, Administration of Pacific Trust Territo-ries; intervention in development projects and disillussionment with same, "Camelot"; the "trickle-down" paradigm, e.g., the Green Revo-lution; the "Bottom-up" paradigm, anthropolo-gists in AID, local systems analysis, including on the farm research, small-scale fisheries, the rationality of peasant producers, and a consider-ation of comparative research on diet, nutrition, and forms of exchange (implications of change from subsistence production to produc-tion for the market). Extensive use of case stud-ies. Lecture-seminar format.

5 units, Win (Siegel)

162. Communication, Technology, and Soci-ety—(Same as Communications 169/269.) The intellectual tools for analyzing the ques-tion: Does technology drive societal change or does society drive technological change: How technology is related to psychological, social, economic, cultural, and political systems. Focuses on information and information-pro cessing technologies since 1850.

4 units, Spr (Nass)

OTHER OFFERINGS

106. The Nature of Technology in Modern Soci-ety—(Same as Engineering 221.) Develop-ment of unified consideration of technology, science, society, and human values. Basic pat-terns underlying the physical bases of human
societies. Systems covering areas of major human concern and the disciplines that study them. The world views of technology, science, and other disciplines, and the problems and advantages associated with combining them. Necessary routes to better connect science and technology with society and values and suggested agenda for clarification of unresolved conflicts and for the provision of a better basis for cooperative interdisciplinary work. The bases of cooperation in groups. (DR:5)

4 units, Spr (Kline) TTh 1:15 and section by arrangement


4 units, Spr (Meehan) TTh 9-10:50

116. Technology and Aggression—The role of technology, military and civil, in human conflict; psychological and sociological theories of aggression; origins of organized violence and changing relationship between specific technological innovations and warfare in history; role of automobile, television, and other civil technologies in promoting aggressiveness in advanced industrial societies.

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

140. Science, Technology, and Soviet Society—(Same as History 219/419) History of science and technology in Soviet economy, society, culture, and ideology, including "Red" experts, purges, the Lysenko affair, space research, and technology transfer. The politics of Soviet scientific community, and information in a closed society. The social context of the scientific community, including the prestige, benefits, and reponsibilities of careers in science. The images of science and technology in Marxist philosophy, Soviet ideology, and popular culture.

3 units, Aut (Becker) TH 3:15-5:05

141. Tools of Persuasion: Propaganda and the History of Technologies of Communication—Seminar on development of the classic instruments of propaganda, press, poster, public address systems, film, radio and television, as case studies of the embedding of values in human artifacts. The linguistic, social, and psychological dimensions of propaganda characterized as the discourse of domination. Role of the techniques of persuasion in popular culture, international conflict, and politics. Field trips to poster collection and Coit Tower mural; video analysis of film and TV footage.

3-4 units, Spr (Boal) M 2:15-4:05

144. Technology and the Body—(Same as Anthropology 160) Interplay of medical and biological techniques, cultural categories, and politics of the human body. Topics: the role of techniques in the definitions of the body, sexuality, life, death, normality and pathology; the relations between the body and the "social body" in 19th- and 20th-century Europe and America; and cultural problems raised by new medical practices associated with the generation and termination of life. Readings include primary sources and works by social historians and cultural anthropologists. Open to advanced undergraduates and graduates.

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

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: the human drive to understand and control nature, and 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. Prerequisite: At least one course in chemistry or biology, or consent of instructor. Limited enrollment. (DR:3)

4 units (Clayton) given 1989-90

148. Neurosciences, Technology, and Values—(Same as History of Science 159) Historically based discussion of the neurosciences in relation to the concept of human personality. Emphasis on the emergence of modern views of the structure and function of the brain, related diagnostic and psychotherapeutic technologies, and the implications of these developments for human values. Limited enrollment; consent of instructor.

4 units, Spr (Clayton) MWF 1:15-2:05

149. Technology and National Security—The technology of strategic nuclear armaments and their implications for the present and future security of the U.S. and its allies. Nuclear weapons and their effects; long-range delivery systems; their survivability and accuracy; and strategic reconnaissance and early warning systems. Analysis of: strategic stability; verification
of compliance with arms control agreements, and the relation of strategic defense and nuclear deterrence. (DR:8)

3 units, Spr (Postol, Drell)

156. Accidental or Unintentional Nuclear War—Seminar on the likelihood of nuclear war occurring through accident, miscalculation, misunderstanding, or inadvertence. Analysis of past accidents in world's nuclear weapons systems, the impact of false alerts, human fallibility; systems fallibility reflecting command and control and component failure, the security of nuclear fuel and weapons, terrorism and potential theft by non-state actors, the nature of decision making in crises, and the synergy between accidents and crisis. Mechanisms of risk reduction, anticipatory planning, crisis prevention and management, and the means of translating such measures from theory to practice. Limited enrollment. Prerequisite: 154A.

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

157. Technology and American Culture—(Same as American Studies 221, History 252.) Examination of technology as a cultural phenomenon in 19th- and 20th-century America. Themes: technology as a secular religion, ideologies of anti-technological and technological utopianism, technology-centered rituals and celebrations, cultures surrounding particular technologies, and technology in popular culture.

5 units, Spr (J. Corn) T 3:15-5:05

158. Material Culture—(Same as American Studies 217, History 251S.) An introduction to the study of culture through three-dimensional objects. The artifacts of the built environment in the U.S. over the last 100 years.

5 units (J. Corn) given 1989-90

160. Technological Opportunities for Humanity—Opportunities for new technologies in daily life based on present science. Criteria for technological advances to be useful and wanted by individuals. Obstacles to the implementation and use of the different kinds of technologies. Products vs. systems. Disparities between what people want and use and what is thought to be good. Technology in fiction, especially science fiction. Futurism. Anti-technological attitudes and movements. The technologies include computers, transportation of goods and people, medicine, utilities, space travel.

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

164. America and the "Bomb": Politics, Diplomacy, and Culture in the Nuclear World, 1939-Present—(Same as History 163, History of Science 163.) Issues of nuclear weapons emphasizing early development, use on Japan in 1945, military planning and diplomatic leverage and threats, efforts at disarmament and arms control, the H-bomb decision and tactical weapons, disputes over nuclear testing and fallout, the development of deterrence and its critics, the roles of scientists and the strategy community, and various peace movements.

4-5 units, Spr (Bernstein) MTWThF 1:15

165. Technology and Musical Expression—Interrelations between music-making technologies and the music written for them in Western classical music from the 18th century to the present. (DR:2 or DR:8)

4 units, Spr (Staff)

166. Innovation—The nature, processes, and management of research and development in industrial societies. Sociotechnical systems as the physical basis of society. The creation of abundant societies and the rise of R&D in the final quarter of the 19th century in the U.S. and Germany. Conventional linear model and improved chain-linked model. Comparison of scientific (reductionist) view with the consistent view needed in innovation; operational consequences. Japanese and U.S. styles of innovation and their cultural bases. Modes of institutionalizing R&D. Barriers to innovation, and countervailing forces. Revolutionary and evolutionary innovation in small and large companies. Effects of management style on the development of group cooperation. Effects of industry and product life cycle. Government role in innovation.

3 units, Win (Kline) TTh 1:15 plus section T or Th 2:15-4:05

167. The Early Nuclear Age: Diplomacy, Politics, and Culture, 1939-1953—(Same as History 270A.) An intensive colloquium exploring in discussion and in papers major problems of the early nuclear age and emphasizing the careful analysis of arguments and sources. Major issues: why the A-bombs were used; their effects on U.S.-Soviet relations and on American culture; the roles and self-conceptions of scientists during and after WWII; the emergence of strategic thought; psychological literature on denial and survivorship; and the decisions for the H-bomb. Students may take an additional 5 units and write a research paper. Prerequisite: consent of instructor.

5 or 10 units, Spr (Bernstein) W 1:15-3:30

169. Development and Technology in the Third World—Seminar on the relationship between technology and industrial development from technical, social, and economic perspectives. Technology in developing countries and in newly industrializing countries (India, Brazil, Mexico, and Korea), including transfer of tech-
nology, "appropriate" technology, factors affecting choice of technology, technological capability, and the relationship between technology and culture. Limited enrollment. Open to all.
4 units, Spr (Forbes) TTh 1:15-3:05

170. Work, Technology, and Society—(Same as Industrial Engineering 107.) Work in contemporary Western society as influenced by rapid technological innovation. Causes and consequences of the current radical transformation of work and attitudes and policy proposals that have emerged as ways of grappling with resultant problems. After historical and philosophical background, major focus is on contemporary issues: new technology at the workplace; related organizational changes; "technological unemployment"; the "global factory", plant closures, and worker retraining; the changing structure and status of the workforce; the decline of manufacturing and the demise of unions; women and work; New Technology Agreements; workplace ethics; innovative work policies, and the future of work. The interplay of work and society is focused on contemporary America; contrasts drawn with the corresponding situations in Italy, Mexico, and Japan. (DR: 5)
4 units, Spr (McGinn) TTh 2:15-4:05

172. Automation and Work—(Same as Industrial Engineering 272.) A combination of theoretical reflection on and pragmatic analysis of the implementation of new technologies. Topics: human resource management in technology-intensive environments, skill and organizational impacts of advanced technologies (numerical control, word processing, CAD), technology and industrial relations, Taylorism and new job design approaches, etc. Emphasis on current issues; some historical background. Enrollment limited and at discretion of instructor. Open to seniors and graduate students only.
4 units (Adkr) given 1989-90

190A, B, C. Honors Project—Project for students in VTSS Honors Program

190A. Submission of Proposal.
2 units, Spr (Staff) by arrangement

190B. Continued Study and Writing.
5 units, Aut (Staff) by arrangement

190C. Final Work on Project.
5 units, Win (Staff) by arrangement

3-5 units, Aut, Win, Spr (Staff) by arrangement

199. Individual Work.
1-5 units, Aut, Win, Spr (Staff) by arrangement

210. Ethics and Technology—Intensive seminar on selected ethical issues raised by developments in science and technology. Issues: human reproduction, genetic testing and therapy, war and weaponry, computers and other privacy-related technologies, and moral obligations of technical professionals. Prerequisite: 110 or one course in ethics (e.g., Philosophy 20) or permission of the instructor. Limited enrollment.
4 units, Spr (McGinn) W 3:15-5:05

250A. Practicum in Ethnographic Futures Research I—(Same as Anthropology 269A, Education 212A.) The rationale and guidance in the practice of Ethnographic Futures Research (EFR), a method for eliciting from a sample of interviewees, in scenario form, their perceived and preferred middle-range sociocultural visions of alternative futures for their society or organization. EFR (1) complements other methods for studying both extant values and ongoing change processes; (2) augments conventional approaches to public and educational policy; and (3) provides an educational experience for both interviewer and interviewee. The focus is on alternative futures enabled or driven by high technology, with reference to Stanford, viewed as a sociocultural entity.
3-5 units, Win (Textor) W 7-10 p.m.

250B. Practicum in Ethnographic Futures Research II—(Same as Anthropology 269B, Education 212B.) Continuation of 250A for those who require additional time and guidance, especially in writing up research results for publication.
3-5 units, Spr (Textor) W 7-10 p.m.

259. Seminar on Technology in Culture—(Same as Anthropology 268.) Anthropologists treat technology as an aspect of a sociocultural system and study its dynamic relationship with other aspects, e.g., ecological adaptation strategies, social and political structure, economic routines and reward systems, value orientations, world views, and symbolic forms. Seminar explores a variety of social science theories and models. Enrollment limited to 15; preference given to graduates in the social sciences and undergraduate majors in VTSS. Prerequisite: 159.
3-5 units, Win (Textor)

CROSS-LISTED

127. History of Biological Thought—(Same as History of Science 62, Philosophy 62, History 116A.) A survey from ancient times to the present treating the growth and changing nature of biological thought in historical context as represented through classic controversies: theological vs. mechanistic explanations, vitalism, reductionism, the units and levels of biological
organization, the origins of life, development, inheritance, and evolution.

4 units, Aut (Lenoir) MWF 11

128. The Rise of Scientific Medicine — (Same as History of Science 154, History 133A.) The intellectual, social, and institutional dimensions of the rise of scientific medicine in the 19th century. How did medicine become "scientific" in the 19th century? What differences did it make to the physician? Why did scientific medicine displace other approaches to medicine? Focus is on developments in France, Germany, and England from 1750 to 1912 and U.S. from 1890-1912. The development of experimental physiology and biomedical technology and their claimed contributions to the medical revolution of the 19th century. The concrete relationships of scientific developments in physiology, pharmacology, and bacteriology to changes in medical practice and therapy. The patterns of professionalization of medicine in different national contexts. Were the forces driving the professionalization of medicine in these contexts the same or different? How the institutional structure of the medical profession differed according to its local context.

4 units, Spr (Lenoir) MWF 9

130. The Darwinian Revolution — (Same as History 152, History of Science 152, Human Biology 152, Philosophy 152.) The conceptual developments leading to the establishment of the major unifying paradigm of biological science, the theory of evolution by natural selection. Biological thought before Darwin, 1750 to 1836. The formation of Darwin's thought in terms of its broader intellectual and social context; attention to Origin of the Species. The difficulties the theory had to overcome and their resolution in the union of evolutionary biology and population genetics.

4 units, Win (Lenoir) MWF 9

134. Science/Technology Relationship: Historical Problems — (Same as History of Science 134, History 115A.) Seminar on the development of science/technology relationships in rhetoric and practice, from early 19th-century organizations for the advancement of science in Germany, Great Britain, and the U.S. to the creation of the postwar concept of "basic research", and from chemical research underlying the dye industry to quantum electronics. Identifies the mutual influences of rhetoric and practice, and of science and technology.

4 units, Spr (Hevly) TTh 11-12:15

138. The Sociology of Scientific Knowledge — (Same as Anthropology 158, History of Science 155, Philosophy 155, History 133B, Sociology 140.) Some of the classical problems in the sociology of knowledge as represented in the writings of Marx, Durkheim, and Mannheim. Recent work in the social construction of scientific knowledge. Emphasis on recent studies in the historical sociology of experimental science and laboratory practice. Using case studies and drawing on anthropological approaches in the works of Mary Douglas, Pierre Bourdieu, etc., a theory of practice and a critique of historically situated practical reasons is explored as the foundation for the sociology of scientific knowledge.

4 units, Spr (Lenoir) MWF 11

143. Peace Studies — (Same as History 154, Political Science 133, Psychology 142, Sociology 108.) Theoretical approaches to war and peace; peace and the modern state; and morality and peacemaking. Topics: conceptions of conflict and cooperation, the processes of conflict resolution, the creation of enemies, the connections between war and the development of the modern state, the policies of deterrence, conflicts between peace and justice, the moral conduct of nations, the activities of peace movements, types of pacifism and anti-war sentiment, and the relationships of war and peace to the economy and to educational institutions.

5 units, Spr (Drekmeter, Ross, Moses, Bernstein) TTh 2:15-4:05

154A. Arms Control and Disarmament — (Same as Political Science 138A.) Introductory survey of international security relations since 1945, revolutionary development of nuclear weapons, arms competition, and efforts at arms control and disarmament in post-WW II period. Political, technological and conceptual problems of national security policies and arms control stressed. Analyses of strategic military doctrines and negotiations on strategic and regional military forces, including SALT, START, INF, and space-based weapons. 154A is a prerequisite to 154B.

5 units, Win (Holloway) MTWThF 1:15

163. Specialized Workshop: Science Writing — (Same as Communication 177B/277B.) Aimed at both science and communications students. Writing projects cover the range of science and medical fields. Organization, structure, and writing style for lay and professional audiences. Discussions of relationships between scientists and the media.

4 units, Spr (Leuenstein)

175 A, B. Modern Architecture I, II — (Enroll in Art 175A, B.) A two-quarter tracing of 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.

4 units, Win, Spr (Turner)

177. Photographs as Historical Documents—(Same as Art 231A, American Studies 220.) Methods, problems, and practice of "reading" photographs as historical evidence. The history of photography and theories of photograph interpretation, followed by development of an individual research project and writing of major essay.

5 units, Aut (J. Corn, W. Corn) TTh 3:15-5:05


3 units, Aut (Winograd) MWF 10

181. Problem Solving—(Same as Industrial Engineering 201, Engineering 190.) Problem solving emphasizing problem definition, creativity, and the interpersonal and organizational factors that influence thinking. Common blocks to problem solving and methods of dealing with them. The advantages of integrating various problem solving strategies through the use of reading, abstracted problem situations, and projects. Open to all undergraduates and graduates.

3 units, Spr (Adams) MW 2:15-4:05

182. Environmental Science and Technology—(Same as Civil Engineering 170.) An introduction to the causes, effects, and methods of controlling environmental degradation. Emphasis on problems associated with water resource development and water pollution; air pollution, population; and environmental effects of energy consumption. For science and nonscience majors.

3 units, Aut (Masters) MWF 8

183. Environmental Planning—(Same as Civil Engineering 171.) Alternative strategies for air and water quality management; environmental impact assessment requirements, interactions between land use, physical infrastructure, and environmental quality; forecasting and evaluating environmental effects; survey of techniques for assessing visual, biological, noise, air quality, and water quality impacts. Open to all students. Recommended: One year of college mathematics and Civil Engineering 170.

4 units, Win (Ortolano) Th 1:15-2:30

STATEMENTS OF NONDISCRIMINATORY POLICY

Stanford University admits students of either sex and any race, color, religion, sexual orientation, 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, religion, sexual orientation, 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, Senior 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 Regulation should contact Ms. Mahoney at (415) 723-1550.

REHABILITATION ACT OF 1973

In its programs, activities, and employment, Stanford University does not discriminate on the basis of handicap. An Affirmative Action Officer, has been appointed 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 Regulation should contact the Affirmative Action Officer at (415) 723-3484.
Following is a guide to Stanford publications of general interest. Requests for these publications and other information about Stanford should be addressed to specific offices at Stanford University, Stanford, CA 94305.

Admissions information and applications can be obtained from the Office of Undergraduate Admissions and the Office of Graduate Admissions.

Financial aid information for both undergraduate and graduate students is available from the Financial Aids Office.

Students from other countries may contact the appropriate Admissions Office for Information for Prospective Graduate (or Undergraduate) Applicants from Other Countries; Bechtel International Center also provides helpful information to the international community.

Stanford University Bulletins of general interest (Courses and Degrees, Information, Summer Session) are available through the Registrar's Catalog Mailing Services. Individual departments, Hopkins Marine Station, School of Law, School of Medicine, Graduate School of Business, School of Education, and School of Engineering may be contacted directly for more specific information.

The quarterly Time Schedule may be obtained at the Information Window in the Office of the Registrar.

Minority students—undergraduate and graduate, and their opportunities and experiences at Stanford, are addressed in special publications directed to American Indians, Blacks, Chicanos, and Puerto Ricans. The Office of Undergraduate Admissions and the Office of Graduate Admissions will respond to requests for the appropriate publication.

Library guides, facts, maps, and borrowing regulations are available at service desks of all Stanford libraries.

Maps and visitors' guides can be obtained at the Visitors' Information Office in Memorial Court, at the Stanford Bookstore, or by writing to the Office of Public Affairs.

Other publications of interest:


Campus Report, the weekly faculty staff newspaper (includes events calendar and employment opportunities), available at many pickup sites on campus and from Stanford News Service.

Conference Planning at Stanford, available at the Conference Office.


Faculty/Staff Directory, on sale at Stanford Bookstore.

Guidebook for Graduate Students, an introduction to offices and people who serve graduate students, available at the Office of the Dean of Student Affairs and at the Office of Graduate Studies.

Life Off the Farm, a guide to off-campus goods, services and activities, available at the Office of Residential Education and the Stanford Bookstore.

The Lively Arts at Stanford, season brochure of concerts and other performances, available at University Events and Services.


The Stanford Daily, the student newspaper, available at many pickup sites on campus and at the Daily office.


Stanford Today, a detailed description of undergraduate opportunities with a pictorial introduction to the undergraduate experience, available from the Office of Undergraduate Admissions.

Stanford Women in Science and Engineering, a booklet with information on graduate programs and careers, available at the Office of Graduate Studies.
COURSES CERTIFIED FOR 1988-89 AS FULFILLING THE UNDERGRADUATE DISTRIBUTION REQUIREMENTS

Information regarding the Distribution Requirements may be found in the "Degrees" section of this bulletin, p. 11-12. Included in the section is information regarding a petition process for students who believe they have strong reason to fulfill a requirement by substituting some alternative course for any certified listing.

The following courses have been certified as fulfilling the Distribution Requirements in 1988-89. The symbol (*) indicates courses in Areas 2-8 which also fulfill the Non-Western culture requirement.

NOTE 1—In order to satisfy particular Area Distribution Requirements with transfer work, the transfer course(s) must be substantially similar to those course(s) offered at Stanford which satisfy specific Distribution Requirement Area(s).

NOTE 2—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 noted below.

NOTE 3—Courses offered overseas during 1988-89 which satisfy Distribution Requirements are listed at the end of this section following Area 8.

NOTE 4—By way of standing exception, the Non-Western component of the Distribution Requirements may be satisfied by completing one course from among those approved for inclusion on a list of routine substitutes drawn up annually by the Dean of Undergraduate Studies, based on information provided by the departments and approved by the C-US Subcommittee on Distribution Requirements. These courses are listed at the end of the appendix.

AREA 1: WESTERN CULTURE

English 7, 8, 9; Literature and the Arts in Western Culture (entire sequence must be completed)

History 1, 2, 3; Europe from the Middle Ages to the Present (entire sequence must be completed)

Humanities 61, 62, 63; Western Thought and Literature (entire sequence must be completed)

Philosophy 5A, B, C; Ideas in Western Culture (entire sequence must be completed)

SLE 91, 92, 93; Program in Structured Liberal Education (entire sequence must be completed and thereby also satisfies Areas 2 and 3)

VTSS 1, 2, 3; Western Culture and Technology (entire sequence must be completed)

Western Culture 1, 2, 3; Great Works of Western Culture (entire sequence must be completed)

Western Culture 4, 5, 6; Europe and the Americas (entire sequence must be completed)

AREA 2: LITERATURE AND FINE ARTS

A) Courses typically taken either by non-majors or by people without special preparations.

Art 1; Introduction to Art

*Art 2; Ideas and Forms in Asian Art

Art 3; Introduction to the History of Architecture

Art 5; Introduction to Ancient Art

Art 10; Introduction to Art: Renaissance to Modern

*Art 20; Introduction to the Art of Asia: to 600 A.D.

*Art 21; Introduction to the Art of Asia: 7th-13th Centuries

*Art 22; Introduction to the Art of Asia: 14th Century to the Present

*Asian Languages 91; Traditional East Asian Civilization: China

*Asian Languages 131; Chinese Poetry in Translation

*Asian Languages 132; Chinese Fiction and Drama in Translation

*Asian Languages 133; Modern Chinese Literature in Translation

*Asian Languages 135; Japanese Drama in Translation

*Asian Languages 136; Japanese Poetry in Translation

*Asian Languages 138; Modern Japanese Literature in Translation

*Asian Languages 181; Japanese Women Writers Classics 11; Age of Heroes

Classics 12; Greek Tragedy: Aeschylus, Sophocles, Euripides

Classics 21; Romantic Comedy and Popular Fiction: Euripides to Shakespeare

Drama 2; Introduction to Theatrical Styles

Drama 50; Introduction to Drama

Drama 150N; Major Dramatic Texts I: Greek to Renaissance

Drama 151; Major Dramatic Texts II: Renaissance to Romantic

Drama 152N; Major Dramatic Texts III: Early Realistic to Present

Drama 154N; American Drama: 1920's to 1950's

Drama 155N; American Drama: 1960 to Present

Drama 156; American Women Playwrights
Drama 157N; Contemporary Black Playwrights
English 10/110; Masterpieces of English Literature I: Chaucer, Shakespeare, Milton and Their Contemporaries
English 11/111; Masterpieces of English Literature II: From the Enlightenment to the Modern Period
English 12/112; Masterpieces of American Literature
English 30/130; The Novel
English 50/150; Poetry and Poetics
English 164A; The Biblical Presence in Modern Poetry
German Studies 32A/132; Culture of Modernism in Austria and Germany
German Studies 60A; Introduction to Medieval Literature
German Studies 150; Introduction to German Literature
German Studies 153; Contemporary German Drama
German Studies 154; Modern Short Prose
Humanities 90; Introduction to the Humanities Honors Program
Italian 233; Dante's Divine Comedy
Music 1; Introduction to Music
Music 2A; The Symphony
Music 4A; The Music of J.S. Bach
Music 4C; The Music of Beethoven
Music 4D; The Operas of Mozart
Music 5A; Music in America
Music 21; Elements of Music I
Religious Studies 121; The Hebrew Bible
Slavic 145; Survey of Russian Literature in English Translation I: The Age of Experiment
Slavic 146; Survey of Russian Literature in English Translation II: The Novel and Beyond
Slavic 147; Survey of Russian Literature in English Translation After 1917: Invention of Tradition
Slavic 151; Fyodor Dostoevsky
Slavic 153; Leo Tolstoy
SLE 91, 92, 93; Structured Liberal Education
(eight sequence must be completed and thereby also satisfies Areas 1 and 3)
VTSS 165; Technology and Musical Expression

B) More advanced courses that can still be appropriate:
Art 100A; Ancient Art I
Art 100B; Ancient Art II
Art 100C; Ancient Art III: Roman Art
Art 105; Art and Architecture in Medieval France
Art 107; Medieval Architecture
Art 110A; Renaissance Art I
Art 110B; Renaissance Art II
Art 110C; Renaissance Art III
Art 115A; Artistic Culture in 17th Century Italy
Art 115B; 17th Century Art in the Low Countries: The Age of Rubens and Rembrandt
Art 116A; Monuments and Masterpieces of the Baroque Age
Art 120A; Modern Art I: Rococo to Revolution
Art 120B; Modern Art II: Romanticism and Naturalism
Art 120C; Modern Art III: Realism and Impressionism
Art 120D; Modern Art IV: Alternatives to Impressionism
Art 130; American Art and Culture: 1870-1860
Art 130A; American Art and Culture in the Gilded Age
Art 130B; Paris and NY: Transatlantic Exchange in Early Modernism
Art 130C; Culture in Crisis: American Art in the 1930's
Art 175A; Modern Architecture I
Art 175B; Modern Architecture II
Art 176; American Architecture and Urbanism
English 132; 19th Century English Novel
English 133; 20th Century English Novel
English 137; Development of the Short Story
English 161A; Afro-American Writing 1945-1970
English 161B; Afro-American Writing 1970 to the Present
English 173A, B, C (same as Drama 159A, B, C); Shakespeare

C) Courses where some foreign language preparation is necessary:
French 130; French Literature I: Middle Ages and Renaissance
French 131; French Literature II: 17th and 18th Centuries
French 132; French Literature III: 19th-20th Centuries
Italian 227; Italian Literature I: Middle Ages and the Renaissance
Italian 228; Italian Literature II: From Manicmic Through the Modern
Spanish 11B, 12B, 13B; Second-Year Spanish for Bilingual Students (entire sequence must be completed)
Spanish 130B; Spanish Cultural Readings
Spanish 131B; Mexican and Chicano Cultural Readings
Spanish 132B; Hispanic-American Cultural Readings and Composition
Spanish 140; Introduction to the Methods of Literary Analysis
Spanish 150; Spanish Literature I
Spanish 151; Spanish Literature II
Spanish 160; Spanish-American Literature I
Spanish 161; Spanish-American Literature II
Spanish 180; Daily Life and Literature in the Golden Age
AREA 3: PHILOSOPHICAL, SOCIAL, AND RELIGIOUS THOUGHT

Biological Sciences 114; Scientific Philosophy and Bioethics
Classics 3; Democracy and Imperialism
Classics 8; Political Philosophy in Classical Antiquity
Economics 120; The Marxian and Radical Tradition
French 217; Female Saints: The Rhetoric of Religious Perfection
German Studies 33A/133; Democracy, Protest, and Political Culture in German-speaking Europe

*History 21 (same as Anthropology 21); World Outside the West: Change and Tradition before the Age of European Imperialism (must be taken in sequence with History 22 to satisfy Area 3; taken independently, satisfies Area 5 and Non-Western Culture)

*History 22 (same as Anthropology 22, Political Science 22); World outside the West in the Age of European Imperialism (must be taken in sequence with History 21 to satisfy Area 3; taken independently, satisfies Area 5 and Non-Western Culture)

History 136B; European Thought in the 20th Century

*History 187A; The Middle East, 570-1718

History of Science 145 (same as History 139, Philosophy 145, VTSS 125); Scientific Revolution

History of Science 147; Science in the Enlightenment

History of Science 168 (same as History 139A, Philosophy 168, VTSS 126); History and Philosophy of 20th Century Physics

Humanities 90; Introduction to the Humanities Honors Program

Philosophy 10; God, Self, and World: Introduction to Philosophy

Philosophy 20; Introduction to Moral Theory

Philosophy 30; Introduction to Political Philosophy

*Philosophy 46/104 (same as Asian Languages 46, Religious Studies 55); Introduction to Chinese Thought

Philosophy 60 (same as History of Science 60); The Growth of Scientific Knowledge

Philosophy 100 (same as Classics 65); Greek Philosophy

Philosophy 102; Modern Philosophy, Descartes to Kant

Philosophy 138A (same as Classics 138A, History 138A, History of Science 138A); Introduction to Cosmology: The Ancient Period (when taken in sequence with 138B or 138C, also satisfies Area 6)

Philosophy 138B (same as Classics 138B, History 138B, History of Science 138B); Introduction to Cosmology: Middle Ages to Newton (when taken in sequence with 138A, also satisfies Area 6)

Philosophy 138C (same as Classics 138C, History 138C, History of Science 138C); Introduction to Cosmology: Newton to Einstein (when taken in sequence with 138A, also satisfies Area 6)

Religious Studies 1D; Religions of the East
Religious Studies 14; Introduction to Buddhism

*Religious Studies 18; Zen Buddhism

Religious Studies 23; Judaism

Religious Studies 24A; Christianity

Religious Studies 42; Philosophy of Religion

Religious Studies 65; Introduction to Christian Ethics

*Religious Studies 116; Japanese Buddhism

Religious Studies 126 (same as History 110); Age of the Reformation

Religious Studies 164 (same as Philosophy 174); The Morality of Peace and War

SLE 91, 92, 93; Structured Liberal Education (entire sequence must be completed and thereby also satisfies Areas 1 and 2)

Sociology 170; Classics of Modern Social Theory

VTSS 110; Philosophical and Ethical Issues in Public Policy

VTSS 145; Chemistry and the Life Sciences in Historical and Philosophical Perspective

AREA 4: HUMAN DEVELOPMENT, BEHAVIOR, AND LANGUAGE

*Anthropology 1/101; Social and Cultural Anthropology

*Anthropology 4 (same as Linguistics 4); Language and Culture

Anthropology 5 (same as Linguistics 5, Human Biology 113); Biology and the Evolution of Language

*Anthropology 165; Psychological Anthropology

Communication 170; Communication and Children

Computer Science 75 (same as Linguistics 35); Computers and Language

English 102; History of the English Language

German Studies 118/218 (same as Linguistics 176); Introduction to German Dialects

Human Biology 2B, 3B, 4B; Human Biology Core (entire sequence must be completed and thereby also satisfies Area 5)

Linguistics 1; Introduction to Linguistics

Linguistics 70; The Structure of English Words

Linguistics 73; Black English

Linguistics 120; Introduction to Syntax

Philosophy 180; Philosophy of Language

Psychology 1; General Psychology

Psychology 102; Perception

Psychology 106; Cognitive Psychology

Psychology 111; Developmental Psychology

Psychology 115; Social Development

Psychology 116 (same as Feminist Studies 126); Psychology of Women

Psychology 146 (same as Linguistics 145); Language and Thought
| Slavic Languages and Literatures 1, 2, 3; First Year Russian (entire sequence must be completed) |
| Sociology 5; Status, Friendship, and Social Pressure: An Experiential Approach |
| Sociology 120; Interpersonal Relations |
| Sociology 121; Introduction to Social Psychology |

**AREA 5: SOCIAL PROCESSES AND INSTITUTIONS**

- *African and Afro-American Studies 105 (same as Anthropology 105, History 149C); Introduction to African and Afro-American Studies*
- *African and Afro-American Studies 114; Core Seminar: Africa and the Black Diaspora*
- *Anthropology 1/101; Social and Cultural Anthropology*
- *Anthropology 3; Human Pre-History*
- *Anthropology 8; Introduction to China*
- *Anthropology 11 (same as Feminist Studies 140); Sex Roles and Society*
- *Anthropology 15/116; Anthropological Perspectives on American Culture*
- *Anthropology 102; Native Peoples of North America*
- *Anthropology 108; African Societies in a Changing World*
- *Anthropology 115; Peoples of Island Southeast Asia*
- *Anthropology 117; Traditional Chinese Society*
- *Anthropology 238 (same as VTSS 159); Sociocultural Implications of High Technology*
- *Asian Languages 92/192; Traditional East Asian Civilization: Japan*
- *Asian Languages 151; Survey of Chinese Archaeology*
- *Asian Languages 152 (same as History 195); Nomad Empires of Inner Asia*
- *Asian Languages 156 (same as History 192A); China from Earliest Times to the 9th Century*
- *Classics Art/Archaeology 14; Classical Athletics*
- *Classics Art/Archaeology 20; Introduction to Classic Archaeology*
- *Classics History 101 (same as History 101H); History of Greece*
- *Classics History 102 (same as History 102H); Greek and Roman History from Alexander to Caesar*
- *Classics History 103 (same as History 103H); History of the Roman Empire*
- *Classics History 107 (same as History 112A); Art, Religion, and Society in Late Antiquity: 284-717 A.D.*
- *Classics 117; Greek Religion and Society Communication 1; Mass Communication and Society*
- *Communication 140; History of American Journalism*
- *Economics 1; Elementary Economics*
- *Economics 51/51Q; Economic Analysis I*
- *Economics 122; The Theory of Capitalist Development*
- *Education 200; History of Education*

**APPENDIX**

- *Feminist Studies 101 (same as Anthropology 12); Introduction to Feminist Studies: Issues and Methods*
- *German Studies 31A/131; Central Europe: Geography, Institutions and Society*
- *History 21 (same as Anthropology 21); The World Outside the West; Change and Tradition Before the Age of European Imperialism (satisfies Area 5 and Non-Western Culture; when taken in sequence with History 22, also satisfies Area 3)*
- *History 22 (same as Anthropology 22, Political Science 22); The World Outside the West in the Age of European Imperialism (satisfies Area 5 and Non-Western Culture; when taken in sequence with History 21, also satisfies Area 3)*
- *History 109; The Age of the Renaissance*
- *History 120C; Russia in Revolution, 1861-1930*
- *History 142; Stuart England: The Making of a Revolution, 1603-1688*
- *History 148C; Africa in the 20th Century*
- *History 165A; 18th Century America*
- *History 165B; 19th Century America*
- *History 165C; The United States in the 20th Century*
- *History 172A; America Since 1945*
- *History 187B; The Modern Middle East: 1718-Present*
- *History 192B; China from the 9th to the 19th Centuries*
- *History 192C; Modern China 19th and 20th Centuries*
- *History 194A; Medieval and Early Modern Japan, 1336-1800*
- *History 194B; The Rise of Modern Japan*
- *Human Biology 1 (same as Anthropology 2); Genes, Culture, and Human Diversity*
- *Human Biology 2B, 3B, 4B; Human Biology Core (entire sequence must be completed and thereby also satisfies Area 4)*
- *Latin American Studies 80 (same as History 80, Anthropology 100); Culture, Politics and Society in Latin America*
- *Political Science 1; Major Issues of American Public Policy*
- *Political Science 10; American National Government*
- *Political Science 20; Introduction to Comparative Politics*
- *Political Science 25; Colonialism and Nationalism in the Third World*
- *Political Science 35; International Politics*
- *Political Science 111; Politics and State in Germany*
- *Political Science 113A; Politics and Development in Latin America*
- *Political Science 114A; Theoretical Approaches to Japanese Politics*
- *Political Science 114K; The Political Economy of Development*
### Political Science Courses

- **Political Science 115**: Politics in the People's Republic of China
- **Political Science 118**: Political Change in Sub-Saharan Africa
- **Political Science 118B**: Politics of Race and Class in Southern Africa
- **Political Science 119**: Socialism in Latin America
- **Political Science 119A** (same as History 123A): Soviet Politics and Society
- **Political Science 124**: Latin American Dependency
- **Political Science 132**: International Communism
- **Political Science 136** (same as History 122B): Soviet Foreign Policy
- **Political Science 139A**: Japanese Foreign Policy

### Sociology Courses

- **Sociology 1A, 1B, 1C**: Introduction to Sociology
- **Sociology 5**: Status, Friendship, and Social Pressure: An Experiential Approach
- **Sociology 120**: Interpersonal Relations
- **Sociology 121**: Introduction to Social Psychology
- **Sociology 130**: American Society in Film and Literature
- **Sociology 141**: Politics and Society
- **Sociology 144**: Social Inequality and Social Stratification
- **Sociology 145**: Race and Ethnic Relations
- **Sociology 152** (same as Education 231, VTSS 155): Social Structure and World Society
- **Sociology 156**: Sociology of Culture
- **Sociology 160**: Formal Organizations
- **Sociology 192** (same as Anthropology 110): Introduction to Chicano Life and Culture
- **VTSS 101, 102, 103**: Nature of Technology, Mathematics, and Science (entire sequence must be completed)

### Area 6: Mathematical Sciences

- **Mathematics 19**: Calculus and Analytical Geometry
- **Mathematics 20**: Calculus and Analytical Geometry
- **Mathematics 21**: Calculus and Analytical Geometry
- **Mathematics 41**: Calculus and Analytical Geometry
- **Mathematics 42**: Calculus and Analytical Geometry
- **Mathematics 43**: Calculus and Analytical Geometry
- **Mathematics 43H**: Honors Calculus and Analytical Geometry
- **Mathematics 44H**: Honors Calculus
- **Mathematics 45H**: Honors Advanced Calculus
- **Mathematics 103**: Matrix Theory and its Applications
- **Mathematics 113**: Linear Algebra and Matrix Theory
- **Philosophy 57/157**: Introduction to Logic
- **Philosophy 138A and 138B or 138C** (same as Classics 138A and 138B or 138C; History 138A and 138B or 138C; History of Science 138A and 138B or 138C) (138B and 138C are offered alternate years); Introduction to Cosmology (both courses must be completed to satisfy Area 6; taken independently, each course satisfies Area 3)
- **Philosophy 159**: Basic Concepts in Mathematical Logic
- **Psychology 60**: Statistical Methods
- **Statistics 40**: Chance and Strategy
- **Statistics 60**: Introduction to Statistical Methods
- **Statistics 110**: Statistical Methods in Engineering and the Physical Sciences
- **Statistics 116**: Theory of Probability

### Area 7: Natural Sciences

- **Anthropology 6**: Human Origins
- **Applied Physics 15**: The Nature of the Universe
- **Applied Physics 50**: Astronomy Laboratory and Observational Astronomy
- **Applied Physics 100**: Introduction to Observational Astronomy and Astronomy Laboratory
- **Biology 11**: Evolutionary Aspects
- **Biology 165**: Animal Behavior: Ecological and Evolutionary Aspects
- **Chemistry 1**: Chemistry and the World About Us
- **Chemistry 31**: Chemical Principles
- **Chemistry 33**: Structure and Reactivity
- **Geology 1**: Interpreting the Earth
- **Geology 2**: Earth History
- **Geology 150**: The Oceans: An Introduction to the Marine Environment
- **Human Biology 1** (same as Anthropology 2): Genes, Culture and Human Diversity
- **Human Biology 2A, 3A, 4A**: Human Biology Core (entire sequence must be completed)
- **Physics 11**: Symmetries of Nature
- **Physics 14**: Physics of Music
Physics 15; Cosmic Horizons
Physics 19; An Introduction to Physics (Physics for Poets)
Physics 21; Mechanics and Heat
Physics 23; Electricity and Optics
Physics 25; Modern Physics
Physics 51; Mechanics
Physics 53; Electricity and Magnetism
Physics 55; Light and Heat
Physics 57; Modern Physics
Physics 61; Advanced Freshman Physics
Physics 62; Advanced Freshman Physics
Physics 63; Advanced Freshman Physics
VTSS 51, 52, 53; Nature of Technology, Mathematics, and Science (entire sequence must be completed and thereby also satisfies Areas 6 and 7)

AREA 8: TECHNOLOGY AND APPLIED SCIENCE
Aeronautics and Astronautics 100; Introduction to Aeronautics and Astronautics
Applied Earth Sciences 1; Introduction to Earth Resources
Applied Earth Sciences 130; Environmental Earth Sciences I
Applied Physics 20; From Klystrons to Lasers: The Stanford Connection
Civil Engineering 170; Environmental Science and Technology
Civil Engineering 176; Small Scale Energy Systems
Computer Science 75 (same as Linguistics 35); Computers and Language
Computer Science 101; Computers: Their Nature, Use, and Impact (student must also have completed Computer Science 106, as taught before 9/1/85)
Computer Science 105A; Introduction to Computers
Computer Science 106A; Introduction to Software Engineering
Electrical Engineering 106; Planetary Exploration
Engineering-Economic Systems 31; Introduction to Decision Analysis
Engineering 10; Applied Mechanics - Statics
Engineering 12; Intermediate Dynamics
Engineering 30; Engineering Thermodynamics
Engineering 35; Automotive Technology
Engineering 40; Basic Electronics
Engineering 50 (same as Materials Science and Engineering 50); Introductory Science of Materials
Geophysics 4; Natural Hazards and Man
Operations Research 50/150; Models and Applications of Operations Research
Operations Research 152; Introduction to Operations Research I
Petroleum Engineering 103; Survey of the Energy Industries
Physics 105; Intermediate Physics Laboratory: Electronics

APPENDIX 725
Physics 145; Physics of Nuclear Weapons
VTSS 51, 52, 53; Nature of Technology, Mathematics, and Science (entire sequence must be completed and thereby also satisfies Areas 6 and 7)
VTSS 149; Technology and National Security
VTSS 165; Technology and Musical Expression

OVERSEAS STUDIES COURSES
NOTE—In the case of courses offered by faculty other than Academic Council members, no more than one course per quarter and no more than two courses overall may count toward the Distribution Requirements. This limitation does not apply to courses offered by faculty who are Academic Council members.

BERLIN

A) Courses taught by Non-Academic Council members:

AREA 2:
Overseas Studies Germany 117V (same as Art 173Y, VTSS 117V); Industrial Revolution and Its Impact on Art, Architecture, and Theory
Overseas Studies Germany 120X; New Ways of Seeing
Overseas Studies Germany 123X; German Art in the Weimar Republic and the Nazi Reich
Overseas Studies Germany 124X; German Art Since 1945
Overseas Studies Germany 129E; Modernism and Metropolis: Turn of the Century Culture in Berlin
Overseas Studies Germany 179B; Split Images: German Film Culture, East and West

AREA 5:
History 230B; Berlin: Its History, Politics and Culture
Overseas Studies Germany 2; Sexual Cultures: German and American
Overseas Studies Germany 135X (same as Political Science 135X); East-West Relations
Overseas Studies Germany 227V; Introduction to German History: Politics and Culture, 900-1870
Political Science 141X; The German Federal Republic in the International System

B) Courses taught by Academic Council members:

AREA 2:
Drama 158D; Weimar Culture: Theater, Film, Music, and Drama
Drama 258D; Theater and Politics: West and East Germany, Poland, and Czechoslovakia

AREA 8:
Engineering 50; Introductory Science of Materials
FLORENCE

A. Courses taught by Non-Academic Council members:

AREA 2:
Art 111A; Tuscan Art from Giotto to Leonardo
Art 111B; The High Renaissance and Mannerism in Florence, Rome and Venice

AREA 4:
Overseas Studies Florence 190I (same as History of Science 190I); Seeing and Measuring Human Differences

AREA 5:
Political Science 125X; Contemporary European Politics
Political Science 126X; Italian Political System Part I

B) Courses taught by Academic Council members:

AREA 2:
Classics History 109; Greek Civilization in Italy
Italian 233F; The Literature of the City: Dante's Commedia

AREA 5:
History 109V; The Age of the Renaissance
History 216V; The Structure of the City
Italian 257F; Discourse of the City
Political Science 121X (same as History 135V); The United States and Western Europe after WWII

KRAKOW

A. Courses taught by non-Academic Council members:

AREA 2:
Overseas Studies Krakow 190D (same as Drama 190D); Between Art and Politics: Special Topics in Polish Literature and Theater

B) Courses taught by Academic Council members:

OXFORD

A) Courses taught by Non-Academic Council members:

AREA 2:
Art 176X; History of English Architecture
Drama 158E; Contemporary British Theater

AREA 5:
Political Science 131X; The Political Economy of the European Economic Community
Political Science 132X (same as History 144V, International Relations Cluster A); The British Empire and Commonwealth
Political Science 138X; British Foreign Policy and International Relations, 1935-1985

TOURS

A) Courses taught by non-Academic Council members:

AREA 2:
French 101T; French Literature Survey: 17th Century
French 102T; French Literature Survey: 19th Century
French 103T; French Literature Survey: 20th Century

AREA 5:
Economics 127X; France and Europe and the Economic Crisis
Economics 128X; Contemporary Problems of Economic Growth
History 130V; Survey of French History: 1715 to the Present
History 132V; The Social History of Modern France: 1871 to the Present
Overseas Studies Tours 140X (same as Political Science 140X); France and the Third World
Political Science 111X; Contemporary French Politics
Political Science 120X; French Foreign Policy

B) Courses taught by Academic Council members:

AREA 2:
Overseas Studies Tours 11; L'Amerique: America in the French Imagination
Overseas Studies Tours 165Z (same as English 165Z); Living in the Past: The American Experience in Europe

UPPER-LEVEL COURSES
SATISFYING THE NON-WESTERN CULTURE DISTRIBUTION REQUIREMENT 1988-89

ANTHROPOLOGY

90. Theory of Social Anthropology
109. Women and Development in Africa (same as African and Afro-American Studies 175X, Education 175X, Feminist Studies 138)
112. National State and Ethno-political Indigenous Movements in Latin America (same as Latin American Studies 112)
118. Communist Chinese Society
123. Cultural Background of Japanese Economic Organization
164. Ecological Anthropology (same as Human Biology 134)

ART
128D. Architecture and Gardens of Japan
128E. Japanese Ceramics
229D. Seminar on Japanese Art
229J. Colloquium: Japanese Painting in the 18th Century

ASIAN LANGUAGES
230. Interpreting Classical Chinese Texts
241. Modern Chinese Literature I
242. Modern Chinese Literature II
243. Modern Chinese Literature III
250. Introduction to Kambun
251. Japanese Historical Texts
260. Introduction to Chinese Poetry
271. Traditional Chinese Fiction
280. Medieval Japanese Narrative and Dramatic Literature
296. Readings in Modern Japanese Literature

ECONOMICS
124. Japanese Economy

FOOD RESEARCH INSTITUTE
103. The World Food Economy (same as Economics 106)
121. Development and Population Interactions in the Third World (same as Economics 119)
136. Population Perspectives in the Third World (same as Economics 133, Human Biology 136, Sociology 153)
148. Economic Development in China (same as Economics 121)
218. Economic Development in Latin America (same as Economics 123)
250. Nutritional Problems of Developing Nations (same as Anthropology 250, Human Biology 110)
251. Food and Nutrition Strategies in Development

HISTORY
147B. The History of South Africa
149A. History of East Africa
177. Modern Latin America
179. The Historical Evolution of Mexico
183. Contemporary Latin American History
187C. Middle Eastern Women Through Film (same as Feminist Studies 120)
188A. Jewish History from the Biblical Period to the Arab Conquest
194. Early and Medieval Japan to 1336
194A. Medieval and Early Modern Japan, 1336-1800

195. Nomad Empires of Inner Asia
246. Undergraduate Colloquium: The New History of Africa
248A. The End of Slavery in Africa and the Americas
248D. Law in Colonial Africa
249A. Undergraduate Colloquium: Africa Since 1945
280. Undergraduate Colloquium: Modern Mexico
280A. The Economic Growth of Latin America
281. Undergraduate Colloquium: Contemporary Andean History
283A. Frontiers, Migration, and the Creation of New Societies in the New World
284A. Undergraduate Colloquium: National Identity in Latin America, 1890-1940
288. Palestine and the Arab-Israeli Conflict
290A. Japan Since 1945
298A. Visions of Utopia: Travellers to China
299. Undergraduate Colloquium: The Institutions of Medieval Japan

POLITICAL SCIENCE
139. Seminar: Chinese Foreign Policy
215. Japan's Political Economy
222. Decolonization in Asia and Africa 1940-1980

RELIGIOUS STUDIES
158A. Buddhism and the Feminine (same as Feminist Studies 149)
212. Interpreting Classical Chinese Texts
230A. Topics in Chan and Zen
236. Buddhist Meditation Texts
288. Life in the Light of Death: Cross-Cultural Perspectives

SPANISH AND PORTUGUESE
SPANISH
248. The Caribbean Americas: An Introduction to their Literature, Thought, and Culture (same as African and Afro-American Studies 248, English 162G)

PORTUGUESE
13. Brazilian Cultural Readings and Composition
267. Brazilian Literature: Modern Brazilian Fiction
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